Investor-Driven Corporate Finance: Evidence from Insurance Markets

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Abstract

This paper documents that bond investments of insurance companies transmit shocks from insurance markets to the real economy. Liquidity windfalls from household insurance purchases increase insurers' demand for corporate bonds. Exploiting the stylized fact that insurers persistently invest in a small subset of firms for identification, I show that these increases in bond demand raise bond prices and lower firms' funding costs. In response, firms issue more bonds and use the proceeds to fund real investment rather than equity payouts. Bond underwriters amplify the sensitivity of bond issuance to investor demand, consistent with them disseminating information. The results emphasize the importance of investors for corporate finance and investment dynamics.

Keywords: Corporate Finance, Corporate Bonds, Insurance, Real Effects.

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1 Introduction

Corporate bonds are an important source of finance for nonfinancial firms, accounting for more than half of their debt. However, surprisingly little is known about the impact of bond investors on the real economy, especially in comparison to the large literature on banks. In contrast to banks, investors interact with firms through capital markets. The traditional view is that capital markets are highly elastic (e.g., Modigliani and Miller, 1985). In this case, changes in some investors' demand are readily offset by arbitrageurs, muting potential effects on asset prices or firms' activities. However, this assumption is challenged by recent literature that documents investors' effect on asset prices (Koijen and Yogo, 2019; Vayanos and Vila, 2021) and firms' reaction to bond market conditions such as government bond supply (Greenwood et al., 2010; Ma, 2019). This paper asks whether changes in bond investor demand affect firms' financing and investment behavior.

Addressing this question is challenging because investors' decisions can correlate with firms' investment opportunities and, thus, conflate bond demand and supply. I overcome this challenge using granular data and institutional characteristics of insurance companies, which hold almost 40% of outstanding corporate bonds. The identification exploits the stylized fact that individual insurers persistently invest in a small subset of firms over time and plausibly exogenous liquidity windfalls in household insurance markets. The results reveal that insurers' bond investments transmit liquidity windfalls from household insurance markets to the real economy by affecting bond prices.

Specifically, there are three main findings. First, liquidity windfalls from changes in household insurance premiums increase insurers' bond purchases in the secondary market, which not only boosts secondary market prices but also lowers firms' funding costs in the primary market.[1] Second, firms opportunistically react to an increase in insurers' bond demand by issuing more bonds. This reaction is amplified when a firm's bond underwriters are well-connected with the insurers that are potential investors of the firm. Third, insurers' bond demand generates real effects, as it raises firms' investment through capital expenditures and acquisitions.

The results offer new insights into how investors, capital markets, and nonfinancial firms interact. They show that bond investors have a substantial impact on corporate finance and real investment and that this effect is driven by investors' price impact in an inelastic bond market. Therefore, my analysis sheds light on the potential implications of firms' increasing reliance on bond financing (Berg et al., 2020; Darmouni and Papoutsi, 2020), the capital market dominance of institutional investors, and the potential real effects of their investment preferences.[2]

I construct a rich data set that merges microlevel data on U.S. insurers' bond investments and underwriting business with granular information on U.S. nonfinancial firms. For each firm, I observe which insurers hold, purchase, or sell the firm's bonds and where insurers' customers are located. The empirical identification rests on two characteristics of insurers. First, I document that

[1] Insurance companies collect insurance premiums from customers to build up reserves for future claims. I document sizable variation in insurance premiums, which stems, e.g., from rising insurance demand after natural disasters.

[2] The share of U.S. nonfinancial firms' bond debt relative to total debt increased from below 40% in the 1980s to more than 55% in 2020 (see Figure IA.13). A total of 80% of corporate bonds were held by U.S. institutional investors (insurers, pension funds, and mutual or other funds) in 2020 (see Figure IA.14).

insurers increase their corporate bond investments when they collect more insurance premiums from households, i.e., when households purchase more insurance. This result is consistent with insurance premiums being insurers' main funding source. Second, insurers persistently invest in a similar set of firms over time: if insurers previously invested in a firm, they are 13 times more likely to purchase the firm's bonds. I call such insurers a firm's *potential investors.* Bond ownership is very fragmented, as an average firm has only 80 potential investors. Exploiting this fragmentation, I use the total household insurance premiums of a firm's potential investors to construct an instrumental variable for insurers' purchases of the firm's bonds. I geographically separate firms from insurance customers by considering only the insurance premiums paid by customers located outside the U.S. state in which a firm is located, which accounts for potential home bias in insurers' investments.[3]

The identification assumes that a firm's investment opportunities do not correlate with its potential investors' insurance premiums. Supporting this assumption, I document that insurers are *not* more likely to invest in firms that are more connected through geographic or social proximity or employment patterns. For example, insurers whose customers are in U.S. states with a strong car industry are not more likely to invest in car manufacturers than other insurers. This behavior suggests that insurers deploy diversified investment strategies and is consistent with their strong reliance on unaffiliated asset managers (Carelus, 2018). Furthermore, firm-by-insurer-level analyses show that the difference in bond purchases between insurers that are potential investors, especially those with high premium growth, and other insurers is not driven by unobserved firm-specific shocks.[4] These results suggest as-good-as-random matching of insurers and firms. To further strengthen the identification, in robustness analyses, I use natural disasters as shocks to life insurance demand, as these raise life insurers' premiums but not their outflows and, thereby, increase bond demand. Using this alternative identification strategy confirms the baseline results.

The main analysis proceeds in three steps. In the first set of results, I estimate the bond price impact of insurers' premium-driven bond purchases, starting with the secondary market. An increase in bond purchases of 1% of a firm's outstanding bond debt raises bond returns by 47 basis points (bps). This magnitude is more than twice the average bond transaction cost estimated in prior studies (e.g., O'Hara et al., 2018), suggesting that demand shocks amplify market frictions. The effect is highly significant and robust to the inclusion of controls for various determinants of bond returns, such as rating and maturity. Bond prices revert after roughly two quarters, consistent with the instrumental variable capturing nonfundamental bond demand shocks that are orthogonal to bond supply. If other market participants ("arbitrageurs") provided an unlimited and elastic supply of bonds, prices would not react to such shocks. Instead, insurers' significant price impact suggests the presence of limits of arbitrage, e.g., because arbitrageurs are constrained (Duffie, 2010; Gromb and Vayanos, 2010).

Turning to new bond issuances in the primary market, I find that insurers' bond demand

[3]In robustness checks, I additionally exclude premiums from a firm's neighboring states and a firm's supplier and customer locations.

[4]Persistence in insurers' bond portfolio is explained partly by time-invariant investment preferences over firm characteristics and information asymmetries, which may induce due diligence costs.

significantly reduces issuance yield spreads and, thus, firms' funding costs. Since insurers' bond purchases are almost entirely in the secondary market, this result shows that demand shocks in the secondary bond market spill over to the primary market.

In the second set of results, I investigate whether insurers' price impact motivates firms to alter their financing activities. Specifically, I compare firms that face large premium-driven bond purchases by insurers with other firms that face relatively smaller purchases. I document that firms issue significantly more bonds in response to insurers' bond purchases. The estimate suggests that \$1 increase in bond purchases raises firms' net bond issuance by \$6. For a one standard deviation increase in bond purchases, this effect corresponds to an increase by 15% of firms' bond debt. The large magnitude of this effect implies a substantial elasticity of firms' bond financing to insurers' bond demand, consistent with insurers' strong price impact. Supporting the identifying assumption, the inclusion of additional control variables (such as cash flow and market-to-book ratio) or granular fixed effects has a negligible impact on the estimated coefficients. In particular, the results are unaffected by the inclusion of controls for insurance prices and insurers' investment return, alleviating the concern that insurance premiums might capture changes in firm characteristics through insurers' investment performance (Knox and Sørensen, 2020). I also show that increases in insurers' premium-driven bond purchases raise bond issuance *relative* to commercial paper issuance of the same firm at the same time and with a similar magnitude.[5] This rules out any uniform firm-level shocks as an alternative explanation.

Previous literature debates whether managers have an informational advantage that enables them to exploit favorable market conditions (e.g., Jenter, 2005; Baker, 2009; Jenter et al., 2011). I propose a complementary channel: the underwriter channel, whereby bond underwriters disseminate information about investor demand.[6] To test this channel, I construct a measure of how strongly connected underwriters are with potential investors. For this purpose, I use information about the counterparties of insurers' bond purchases at the transaction level, which I merge with underwriters in Mergent FISD. I find that consistent with the underwriter channel, bond issuance reacts significantly more strongly to insurers' bond demand when underwriters are well connected with potential investors. This channel becomes stronger when information about investors is more difficult to gather, namely, when there are a large number of investors or investors are very dispersed. This finding emphasizes the role of underwriters in disseminating information about investors to firms.

In the final set of results, I show that insurers' bond demand affects corporate investment. Firms whose bonds are in higher demand experience larger asset growth and, in particular, tangible asset growth. This effect is fueled by both indirect investment (measured by acquisition expenditures) and direct investment (measured by capital expenditures). The estimate suggests that firms' total investment increases by roughly \$6 for each \$1 of bonds purchased, which implies that the additional

[5] Since insurers are barely active in the commercial paper market, insurer liquidity windfalls increase demand for bonds *relative* to that for commercial paper.

[6] Bond underwriters are investment banks that support firms' bond issuances. Part of underwriters' services is the bookbuilding process, during which they determine investors' demand.

funds raised by issuing more bonds are primarily used for investment. Two-thirds of this effect stem from acquisition expenditures and one-third from capital expenditures. The magnitude and significance are robust to inclusion of controls for various firm characteristics and granular fixed effects, e.g., at the state-by-industry-by-time level.

Previous literature stresses financial constraints, resulting from financing frictions that prevent firms from funding all desired investments, as an amplification mechanism for capital supply shocks (e.g., Holmstrom and Tirole, 1997; Baker et al., 2003b; Warusawitharana and Whited, 2016). To explore the role of such constraints in the transmission of insurers' bond demand, I use the size-age index from Hadlock and Pierce (2010) to classify firms as more constrained or less constrained. First, I find that the sensitivity of firms' bond issuance to insurers' bond purchases does *not* differ across more- and less-constrained firms. This suggests that opportunistic bond issuance is, at the margin, not driven by financial constraints but primarily by favorable funding conditions. Second, I provide evidence that the sensitivity of tangible asset growth and acquisition expenditures is larger for more constrained firms. This suggests that insurers' bond demand alleviates financing frictions; nonetheless, the effects are moderate in terms of magnitude and statistical significance, consistent with the fact that bond issuers are relatively unconstrained on average.

To explore whether my firm-level findings also hold at a broader level of aggregation, I aggregate insurers' bond purchases, potential investors' premiums, and firms' activities at the industry-by-region level. Similar to the baseline results, this analysis shows that insurers' instrumented bond purchases significantly raise corporate bond issuance and investment. The magnitude is similar to that at the firm level, which suggests that competition or agglomeration effects across firms are weak.

To further strengthen the identification, I exploit that natural disasters with a large number of fatalities raise life insurance customers' risk salience. As a result, an increase in disaster-related fatalities in insurance customers' locations raises life insurers' premiums but not their outflows, which results in an increase in corporate bond purchases. Analogously to my approach in the baseline analysis, I use life insurers' persistent investment universe to trace insurers' bond purchases to disaster-related fatalities. I isolate firms from the direct impact of disasters by excluding disasters in the state where a firm is located and neighboring states. I document that an increase in disaster-driven bond purchases boosts firms' bond issuance and investment to a similar extent as that estimated in the baseline analysis.

Related literature. This paper documents that insurers' bond investments transmit liquidity windfalls from household insurance markets to nonfinancial firms by affecting bond prices. Thereby, it contributes to understanding the role of capital market investors for the real economy.

My findings relate to the growing literature on how capital markets affect corporate finance. Previous work focuses primarily on variation in market conditions such as the government bond supply and its effect on corporate bond issuance (e.g., Baker et al., 2003a; Greenwood et al., 2010; Ma, 2019). Less attention has been paid to the role of individual bond investors in corporate decisions.[7] Prior studies document that investors' fire sales motivate firms to substitute bank loans for bonds (Massa and Zhang, 2021), that firms prepone bond issuance to refinance existing bonds when mutual funds are more likely to participate in new bond issuances (Zhu, 2021), and that they exhibit higher leverage when uncertainty about investors' capital supply is lower (Massa et al., 2013).[8] Extending this literature, I focus on positive investor demand shocks driven by liquidity windfalls and document their strong impact on firms' total bond debt and leverage as well as on their real investment. This evidence points to changes in investor demand as an important determinant of firms' capital structure and real economic activity. Moreover, whereas prior studies document that firms engage in arbitrage across financing sources when funding conditions change, e.g., repurchase equity when bond prices are high (Ma, 2019), I provide evidence that this effect is mostly absent and dominated by a strong effect on investment in response to positive investor demand shocks. This finding suggests that the origins of variation in firms' funding conditions are important for understanding how these affect firms' balance sheet.

Whereas this paper focuses on capital supply by bond markets, a related literature examines bank lending (e.g., Khwaja and Mian, 2008; Huber, 2018).[9] An important difference is that, while banks directly interact with firms, insurers purchase bonds mostly in the secondary market. Thus, the firm-level effects depend on insurers' price impact. Moreover, banks alleviate agency frictions by closely monitoring firms (Diamond, 1991; Rajan, 1992) and, thereby, at the margin, affect the most financially constrained firms (Holmstrom and Tirole, 1997; Chava and Purnanandam, 2011; Chodorow-Reich, 2014). In contrast, the absence of monitoring by capital market investors suggests that financial constraints are less relevant for the transmission of investor demand shocks to bond debt, consistent with my findings.

This paper also relates to an emerging literature on demand-based asset pricing. Koijen and Yogo (2019) propose an asset pricing model that emphasizes the role of investor demand in explaining variation in asset prices, applied to corporate bonds by (Bretscher et al., 2020) and (Yu, 2020). In a similar vein, the preferred habitat view of financial markets (Modigliani and Sutch, 1966; Vayanos and Vila, 2021) predicts that markets are segmented into investor clienteles and that shocks to these clienteles affect bond prices. Consistent with this prediction, my results provide evidence for segmentation across bond issuers through which investor liquidity shocks affect bond prices.[10] Extending evidence that investors impact asset prices, I find that the secondary market price impact also spills over to the primary market and that this spillover is sufficiently strong to affect firms' financing and investment activity. I show that the sensitivity of bond issuance is am-

[7] A large literature examines the impact of equity investors on corporate decisions (e.g., Frazzini and Lamont, 2008; Edmans et al., 2012; Hau and Lai, 2013). There are significant structural differences between equity and debt financing and markets. For example, aggregate debt issuance ($1.79 trillion) is 10 times larger than equity issuance ($171 billion) in an average year for U.S. nonfinancial firms in Compustat.

[8] Central banks have also been intervening in bond markets, with implications for firms' financing activities and investment (Foley-Fisher et al., 2016; Grosse-Rueschkamp et al., 2019; Pelizzon et al., 2021).

[9] Most closely related are Paravisini (2008) and Gilje et al. (2016), who document the impact of positive bank funding shocks on credit supply, and Becker (2007), who examines the impact of bank deposits on loan supply.

[10] It is straightforward to apply Vayanos and Vila (2021)'s model of segmentation across maturities to segmentation across bond issuers.

plified when underwriters are well connected with investors, contributing to an emerging literature on the interactions between underwriters, investors, and firms (Nikolova et al., 2020; Chakraborty and MacKinlay, 2020; Siani, 2021).

Moreover, my analysis contributes to understanding of the role of insurance companies in financial markets and the real economy. Related studies document that regulatory frictions (Becker and Ivashina, 2015; Becker et al., 2021) and financial constraints (Ge and Weisbach, 2020) affect insurers' investment behavior and asset prices (Ellul et al., 2011; Manconi et al., 2016; Greenwood and Vissing-Jorgensen, 2018; Girardi et al., 2021; Jansen, 2021; Liu et al., 2021). I show that liquidity windfalls in insurance markets raise insurers' bond demand and, thereby, propagate not only to financial markets but also to corporate investment decisions.[11] Thereby, my paper sheds light on how insurers' insurance and asset management businesses interact and on their relevance for the real economy.

2 Institutional background and conceptual framework

2.1 Insurance market

Insurers perform two roles. On the one hand, they insure households against risks, such as car accidents or mortality. For this purpose, they collect insurance premiums from customers and use these premiums to build reserves for potential future claims. Annual insurance premiums written by U.S. insurers were $1.7 trillion in 2019, accounting for 8% of U.S. GDP.[12] Reserves make up roughly 80% of insurers' liabilities, which highlights insurers' reliance on premiums as their main funding source (see Figure IA.15). On the other hand, insurers invest premiums in financial assets. The total financial assets of the U.S. insurance sector amount to $7.5 trillion, which underlines the importance of insurers as investors (Wong and Carelus, 2021).

The vast majority of the insurance business is property & casualty (P&C) insurance, which protects against property loss or damage and negligent acts, and life insurance, which includes annuities, that protect against longevity risk, and pure life insurance, which provides an insurance payment upon the death of the insured. Insurance premiums are primarily for personal (i.e., noncommercial) insurance and, within that category, especially for annuities and individual life insurance and homeowners and car insurance (see Figures IA.2 and IA.3).

U.S. insurance regulation is organized at the state level, with insurers required to be licensed in each state in which they are active. As a consequence, the insurance market is geographically fragmented. Half of all insurers are active in only 7 or fewer U.S. states.[13] Geographic fragmentation

[11]Complementary to my paper, Liu et al. (2021) examine municipal finance and investment in response to municipal bond fire sales by hurricane-exposed insurers.

[12]Insurance markets have a similar size in other advanced economies (Swiss Re, 2021). Insurers distinguish between *direct* premiums written, which is the actual cash flow from insurance customers, and *net* premiums written, which deduct reinsurance premiums. In this paper, if not noted otherwise, by *insurance premiums* I mean direct premiums written since these are not affected by insurers' (potentially endogenous) reinsurance policy.

[13]By *states*, I mean the 50 U.S. states, the District of Columbia, and the 5 U.S. territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and U.S. Virgin Islands). Figure IA.18 depicts the distribution of

is not concentrated among small insurers but instead among large insurers: when weighted by total premiums, the median insurer is active in only one state. Moreover, some insurers are also active outside the U.S., albeit to a negligible extent.[14]

Nearly 40% of insurers' financial assets are invested in corporate bonds (see Figure IA.15). Corporate bond holdings trace mostly to life insurers ($2.1 trillion) and to a relatively lower extent to P&C insurers ($0.4 billion), with these proportions driven by differences in size and investment strategies. Due to risk-based capital regulation, insurers have strong incentives to invest in high-quality assets (Becker and Ivashina, 2015; Becker et al., 2021). As a result, 90% of insurers' corporate bond holdings have an investment-grade rating (see Figure IA.16).

2.2 Corporate bond market

U.S. nonfinancial companies' corporate bond debt amounted to nearly $6 trillion as of 2019, corresponding to 27% of U.S. GDP.[15] The vast majority of corporate bonds are issued by investment grade borrowers, i.e., those with a credit rating at or above BBB- (Berg et al., 2020). The corporate bond market is an institutional market, with institutional investors holding approximately 80% of bonds outstanding.[16]

The secondary bond market is a bilateral ("over-the-counter" or OTC) market dominated by dealers that intermediate between end-investors. Previous literature has highlighted several financial frictions present in this market, such as search frictions (Friewald and Nagler, 2019) and dealer market power (e.g., O'Hara et al., 2018). Insurers maintain persistent relationships with dealers to mitigate search frictions (Hendershott et al., 2020).

In the primary bond market, bond underwriters intermediate between firms and investors. Underwriters communicate directly with investors, collect investors' orders, and support the firm in setting bond prices (for a description of the underwriting process, see Nikolova et al., 2020). Among all U.S. nonfinancial firms in Mergent FISD from 2010 to 2018, the average firm issues approximately two bonds per year with a total offering amount of $1 billion.

2.3 Conceptual framework

Building on theoretical models, e.g., by Stein (1996) and Baker et al. (2003b), I posit that non-fundamental investor demand can affect firms' activities under the following four conditions. First, characteristics other than asset prices must matter for investor demand. Consistent with this condition, I document that insurers have strong preferences to invest persistently in a similar set of firms over time. Thus, insurers are segmented into preferred habitats across firms, similar to the segmentation across bond maturities in Vayanos and Vila (2021).

the number of states that an insurer is active in.

[14] In an average quarter, 0.3% of total premiums are written in Canada and an additional 2% of total premiums in other countries.

[15] *Source:* Z.1 Financial Accounts of the United States.

[16] Institutional investors include insurers and pension, mutual, and other funds. These characteristics of corporate bond markets are similar in other jurisdictions, such as the Euro area and U.K. (Celik et al., 2020).

Second, potential arbitrageurs must be constrained in fully exploiting arbitrage opportunities, which implies that nonfundamental demand shocks affect asset prices. For example, Duffie et al. (2007) propose a model in which search-and-bargaining frictions imply that large investor demand shocks cause asset prices to deviate from their fundamental value and recover only slowly over time. Limited risk-bearing capacity (Gromb and Vayanos, 2002; Mitchell and Pulvino, 2012) and short-selling and borrowing constraints (Gromb and Vayanos, 2010) contribute to such limits of arbitrage.

Third, nonfundamental demand shocks must affect primary market prices. This condition is not trivial since insurers respond to an increase in insurance premiums by purchasing bonds almost entirely in the secondary market. Primary market participants may react to exploit arbitrage opportunities resulting from secondary market illiquidity or because they interpret demand shocks as news about firms' fundamentals.

Fourth, firms must be willing and able to opportunistically react to market conditions. Surveys suggest that firms' debt financing policies are affected by overall market conditions (Graham and Harvey, 2001). Additionally, I assemble anecdotal evidence from a large international nonfinancial firm and a bond underwriter that confirms that bond issuance is highly price-sensitive and that the time lag between the decision and completion of bond issuance is significantly less than 3 months and in the range of 1-2 days for frequent bond issuers. This is consistent with the data in Siani (2021), which shows that the time between issuance announcement and final pricing is 6 hours for a median bond issued by a nonfinancial U.S. firm.

My analysis provides empirical evidence that these conditions hold and that, as a consequence, nonfundamental investor demand affects firms' financing and real activities.

3 Data and descriptive statistics

I combine granular data on insurance companies and their bond investments with information on firm characteristics and bond prices. The followings sections provide an overview of the data. Detailed definitions and documentation are provided in Appendix A.

3.1 Insurer characteristics

Financial data for U.S. P&C and life insurers are from their statutory filings to the National Association of Insurance Commissioners (NAIC), obtained from S&P Global Market Intelligence. Schedule D of insurers' annual filings provides detailed information on end-of-year corporate bond holdings and all transactions within a given year at the insurer-security-transaction level. For example, I observe the bond acquisition and disposal date, par value, counterparty, coupon, maturity, and price paid for each acquisition. Combining this information, I reconstruct end-of-quarter holdings from 2009q4 to 2018q4. Changes in holdings can be due to actual transactions or other events such as bond redemptions or within-company transfers. I consider a bond to be actively purchased if the par value and actual cost of the bond acquisition are positive and the reported name of the seller does not indicate a transfer (is not reported as, e.g., a "portfolio transfer") or adjustment (is note reported as, e.g., a "record gain on bond"). Approximately 95% of reported bond acquisitions are thus flagged as actual purchases. In an average quarter, insurers in my sample purchase corporate bonds with a total par value of roughly $61 billion (see Figure IA.17).

From insurers' financial statements, I obtain information about their balance sheet, investment, and insurance activities and the state-level breakdown of direct premiums written (from Schedule T) from 2007q1 to 2018q4. I also retrieve the history of insurers' financial strength rating provided by A.M. Best. I drop insurers with negligible corporate bond investments or negligible noncommercial insurance business, defined as those with less than $100,000 invested in corporate bonds (at par) or noncommercial insurance premiums below $50,000 or below 10% of total premiums in the median quarter from 2009q4 to 2018q4, respectively. Additionally, I exclude inactive insurers by dropping observations without positive direct premiums written.

Table 1 provides summary statistics at the insurer-by-quarter level. The sample includes more than 1,400 insurers, with corporate bond holdings of $30 million and purchases of $1.2 million at the median.[17] Median insurance premiums written are $14 million, with wide variation across and within insurers.

I match insurers' corporate bond investment data to information about firms, i.e., bond issuers, from Capital IQ and Compustat, as outlined in Appendix A.2. A total of 74% of an insurer's bond holdings are matched to Capital IQ and Compustat in the median insurer-quarter (43% at the 5th percentile), and this matching probability is stable over time (see Figure IA.4). A median quarterly bond purchase is $1.1 million at the insurer-firm level, with wide variation across insurer-firm-quarter observations. The probability that a random insurer purchases a random firm's bonds is low, specifically it occurs in only 0.5% of insurer-by-firm-by-quarter observations, which is consistent with the substantial fragmentation of insurers across firms (see Section 4).

3.2 Firm characteristics

I obtain quarterly data from Compustat about U.S. firms' balance sheets and cash flows and from Capital IQ about their debt structure. Firms enter the sample if at least one insurer ever held bonds issued by the firm in the previous 8 quarters. Following the corporate finance literature, I exclude financial firms (SIC 6000-6999), utilities (SIC 4900-4999), and firms in public administration (SIC above 8999). I drop small firms (with median total assets below $1 million) and exclude observations when a firm's reported equity is below zero or exceeds the firm's total assets. To ensure the quality of the Capital IQ data, I require the total debt in Capital IQ to match the total debt in Compustat.

A key variable in my analysis is a firm's net bond issuance, which I compute as the relative change in corporate bond debt outstanding. I saturate the sample with a wide range of control variables that have been shown to capture firm-specific determinants of capital structure and real activities, such as cash flow and market-to-book ratio.

[17]Throughout the paper, I use the par value of bond holdings and transactions since it is unaffected by changes in bonds' market value or firms' fundamentals.

The final baseline sample includes more than 800 firms and spans from 2010q2 to 2018q4. Since all firms in the sample have access to the bond market, they are relatively large, with total assets of $4 billion at the median.[18] Bond debt ranges from 30% to 100% of total debt at the 5th and 95th percentiles, respectively. Insurers in my sample hold 23% of firms' outstanding bonds, and their quarterly purchases correspond to 1% of firms' bond debt, on average. This highlights the importance of insurers relative to other bond investors.

To explore firms' real economic activity, I examine their asset growth and change in tangible assets, defined as property, plant and equipment (PPE), based on firms' balance sheets, as well as their capital expenditures (i.e., direct investment) and acquisition expenditures (i.e., indirect investment), which are both cash flow variables. All variables are scaled by lagged total bond debt such that the coefficients can be compared across regressions.[19]

3.3 Bond characteristics and prices

To examine insurers' bond market impact, I merge the sample with data on bond characteristics, prices, and credit ratings, preferably using bonds' 9-digit CUSIP and, otherwise, their 6-digit CUSIP (which indicates the bond issuer). Bond characteristics, prices at issuance, and credit ratings are from Mergent FISD.[20] I calculate the offering yield spread as the difference between the offering yield and the contemporaneous yield on its nearest-maturity treasury bond.[21] I aggregate issuances to the firm-by-quarter level using the total offering amount and the offering amount-weighted average yield spread. The median offering amount is $650 million, and the median offering yield spread is 1.6% across all firm-by-quarter pairs with issuance activity.

I also retrieve information about bond underwriters from Mergent FISD, which are mostly investment banks. Due to the absence of a common identifier, I match underwriters from FISD with the counterparties in insurers' bond trades with a combination of fuzzy string merging and manual matching. I thereby create a uniquely detailed dataset about the investor-underwriter-firm network, which connects approximately 70% of insurers' corporate bond purchases to underwriters in FISD.[22] I define underwriter connectedness as the lagged share of corporate bonds purchased by potential investors from a firm's underwriters relative to all underwriters, denoted as %UW. It ranges from below 10% to 70%, highlighting the large heterogeneity in how connected underwriters

[18]To provide context on the external validity of my analysis, in Appendix A.5, I compare the cross-sectional distribution of firm characteristics in my sample with that of all firms in Compustat. They closely resemble each other, with the main difference being that firms in my sample are slightly larger and have higher leverage.

[19]The results are robust to scaling by lagged total assets.

[20]Credit ratings are issued by S&P, Moody's, or Fitch. Following Becker and Ivashina (2015), I use the minimum rating if two ratings are available and the middle rating if three ratings are available. Following the literature, in all bond market analyses, I drop Yankees, convertible, puttable, and asset-backed bonds, bonds in foreign currency, and bonds with a floating coupon or enhancement.

[21]When the offering yield is not available in FISD, I use the offering price and coupon information to impute yield. The imputed yields are almost identical to those available, suggesting that the imputation procedure is reliable.

[22]Counterparty names are missing for roughly 20% of insurers' bond purchases (in which case, the seller is reported as, e.g., "various") and thus cannot be matched to underwriters. To the best of my knowledge, the only other study that links insurers to underwriters in FISD is Nikolova et al. (2020), albeit without matching this information to firm characteristics.

are to investors (see Table IA.20).

Secondary market prices are retrieved from the Trade and Reporting Compliance Engine (TRACE), which records the near universe of U.S. secondary market corporate bond transactions. I first clean the TRACE data of cancellations, corrections, and reversals following Dick-Nielsen (2014). To calculate firm-level bond returns, I compute the quarterly bond return as the relative change in end-of-quarter prices (I require at least one trade in a quarter's last month) and accrued interest plus coupon payments, $(\Delta\text{Price}_t + \Delta\text{Accrued Interest}_t + \text{Coupon payments}_t)/(\text{Price}_{t-1} + \text{Accrued Interest}_{t-1})$. I drop bond-quarter observations with a current or lagged total trading volume below \$100 thd (at par), which leaves more than 2,500 bonds issued by 333 firms in the final sample. The average quarterly transaction volume is \$52 million and the average bond return -0.1%. Using issuance characteristics and secondary market transactions, I also classify insurers' bond purchases into primary and secondary market purchases, as detailed in Appendix A.2.

3.4 Additional data

Data on natural disasters are from the Spatial Hazard Events and Losses Database for the United States (SHELDUS). I retrieve information about the total number of fatalities caused by heat and storms at the state-quarter level from 2010q1 to 2018q4. Fatalities are scaled by population size based on the U.S. Census. Additionally, I obtain information about state-level annual consumption per capita by consumption type and employment by industry from the Bureau of Economic Analysis (BEA). I also use the cross-section of the number of Facebook links between U.S. states normalized by the number of respective Facebook users to measure social connectedness (Bailey et al., 2018).

4 Empirical strategy

This paper aims to estimate the causal effects of insurers' bond demand on nonfinancial firms' financing and real activities. For this purpose, I estimate regressions of the form

$$Y_{f,t} = \alpha \, \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma' \, C_{f,t} + \varepsilon_{f,t}. \tag{1}$$

The dependent variable, $Y_{f,t}$, is a firm-level outcome, such as firm f's bond issuance, and the main explanatory variable is the volume of insurers' total purchases of firm f's corporate bonds (i.e., bonds issued by f) in quarter t scaled by f's lagged total bond debt. $C_{f,t}$ is a vector of control variables and fixed effect dummies.

Identifying α from Equation (1) is challenging for two reasons. First, bond purchases are an equilibrium outcome that can capture both bond demand and supply. For example, when firms issue bonds, investors purchase bonds on the primary market and transmit the supply shock to the secondary market.[23] Second, omitted variables may simultaneously affect firm outcomes and

[23] Corporate bond market frictions (Feldhütter, 2012; Friewald and Nagler, 2019) and low price elasticity of insurers' bond demand might impair the transmission of bond supply shocks to insurers' secondary market bond purchases.

insurers' bond purchases. For example, an increase in a firm's investment opportunities might boost both the issuance of bonds and insurers' bond purchases.

I overcome these identification challenges by proposing an instrument for insurers' bond demand that relies on two institutional characteristics. First, I document that an increase in insurance premiums boosts insurers' bond demand since insurance premiums are insurers' main funding source. Second, insurers exhibit a persistent investment universe, which means that they are significantly more likely to purchase a bond if they previously invested in bonds issued by the same firm. Combining these characteristics, the total insurance premiums of a firm's previous investors capture variation in insurers' total bond demand,

$$\bar{P}_{f,t} = \sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \times \text{Premiums}_{i,f,t}. \tag{2}$$

I define $\text{Premiums}_{i,f,t}$ as the total noncommercial insurance premiums written in quarter t by insurer i in Canada or U.S. states other than the one in which firm f is located (Section A.1 details the variable construction). Excluding commercial premiums and those written in the firm's location alleviates concerns that unobserved shocks to firm f's economic environment also affect $\bar{P}_{f,t}$. $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is an indicator variable for whether insurer i has ever held bonds issued by firm f in the previous eight quarters, in which case I call insurer i a *potential investor* of firm f. Variation in $\bar{P}_{f,t}$ across firms stems from fragmentation in insurers' investment universe.

I define a firm's exposure to changes in potential investors' premiums as the quarterly growth of potential investors' premiums ($\Delta \log \bar{P}_{f,t}$) multiplied by the lagged share of the firm's bond debt held by insurers ($\%\text{Held by insurers}_{f,t-1}$),

$$\Delta\text{INVPremiums}_{f,t} = \%\text{Held by insurers}_{f,t-1} \times \Delta \log \bar{P}_{f,t}. \tag{3}$$

$\Delta\text{INVPremiums}_{f,t}$ captures relative changes in bond demand. To control for the selection of insurers across firms, all regressions include $\%\text{Held by insurers}_{f,t-1}$ as a separate control variable. Below, I document that increases in potential investors' premiums have a large and significant effect on insurers' bond purchases. On the other hand, the effect of premium decreases is economically negligible and mostly insignificant. The reason for this asymmetry is that insurers compensate for negative premium growth by adjusting their funding structure. This finding motivates my focus on insurers' bond purchases, which I instrument by firms' exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}_{f,t} = \max\{\Delta\text{INVPremiums}_{f,t}, 0\}$.[24]

The identifying assumption is that insurers do not sort into firms such that unobserved variables simultaneously correlate with firm outcomes and potential investors' premiums. In the following subsections, I provide evidence supporting this assumption. First, I show that variation in insurance supply or insurers' investment return cannot explain the effect of increases in insurance

[24] The effect of liquidity windfalls on insurers' corporate bond sales is statistically insignificant and economically negligible. Accordingly, I find that my results are robust to using insurers' bond purchases net of sales instead of insurers' gross bond purchases in the main regressions.

premiums on bond purchases. Second, I document that insurers' investment universe is mostly time invariant and unaffected by the economic environment of insurance customers. Third, using a within-firm estimator at the firm-by-insurer-by-time level, I provide evidence that the effect of potential investors' premiums on bond purchases is unaffected by changes in firm characteristics, suggesting as-good-as-random matching of insurers and firms. Finally, I propose an alternative instrument based on insurers' exposure to natural disasters that are geographically distant from firms.

4.1 Insurance premiums

I focus on noncommercial insurance premiums, which are premiums collected from households. The variation in noncommercial insurance premiums is sizable, with an average quarterly (absolute) change in premiums of approximately 20% at the insurer level.[25] Determinants of insurance premiums include local socioeconomic characteristics (see Section F.1) and risk salience after natural disasters (see Section 4.4). The volume of insurance premiums determines insurers' size and, in turn, their corporate bond demand.[26]

I formally establish this channel by regressing insurers' asset growth and corporate bond purchases on insurance premium growth. Table 2 reports the results. All specifications include insurer and insurer type-by-time fixed effects, which absorb time-invariant differences across insurers and aggregate shocks that affect all insurers of the same type (which is either life or P&C). Column (1) reports a significant correlation between premium growth and asset growth. Splitting premium growth into increases and decreases, column (2) shows that this effect is driven by premium *increases*. The estimate suggests that 70 cents of a $1 increase in insurance premiums passes through to the insurer's balance sheet, while the effect of a premium decrease is 10 times smaller. As column (3) shows, slightly less than half of the balance sheet impact of a premium increase stems from an increase in invested assets.[27]

Columns (4)-(6) explore the correlation between insurance premium growth and insurers' corporate bond purchases. Higher premium growth is significantly positively associated with larger bond purchases (column 4), particularly when premiums increase (column 5). The estimate in column (5) suggests that insurers purchase 3 cents' worth of corporate bonds upon a $1 increase in insurance premiums. Due to insurers' large size, the implied aggregate bond purchases are economically significant and correspond to approximately $500 million in the median quarter in my sample. As before, the coefficient on premium decreases is neither statistically nor economically significant. These results cannot be explained by seasonality in premiums or variation in insurance

[25]The variation in premiums is not driven by small insurers (see Figure IA.20 for the distribution across insurers) or seasonality.

[26]I illustrate the relationship between insurance premiums and insurer size in a stylized model in Section B.1. The main insight is that premiums mechanically relate to future insurance claims, which implies that asset growth is not driven by the level of premiums but the change in premiums.

[27]In additional analyses, I find that the increase in assets not related to invested assets is allocated mostly to premiums receivable (i.e., premiums due but not yet paid) and, to a lesser extent, receivables from reinsurance and affiliates.

supply or insurers' investment return, as I show in column (6), which suggests that variation in insurance demand is the key driver. Additional analyses show that insurers respond to an increase in premiums almost entirely by purchasing bonds in the secondary market and that the results do not change when bond purchases net of sales are considered (see Table IA.22).

The asymmetric effects of increases and decreases in premiums suggest that insurers smooth reductions in premiums, preventing their balance sheets from contracting immediately. This may be valuable in terms of enabling insurers to ride out short-term fluctuations in asset prices, as emphasized by the asset insulator view of insurers (Chodorow-Reich et al., 2021). In support of this view, I find corresponding evidence that insurers compensate for a premium decrease by increasing their equity capital and reducing the volume of insurance passed to reinsurers, implying that relatively more policy reserves remain on their balance sheets (see Table IA.22).

4.2 Insurers' investment universe

Corporate bond ownership is highly fragmented. A firm's bonds are held by 70 insurers on average and by 192 insurers at the 90th percentile; these figures correspond to only 6% and 16% of all insurers in the sample, respectively. The resulting overlap in bond ownership is small: among all investors of an average firm pair, only 7% invest in both firms (see Figure IA.7). Thus, there is wide variation in the set of firms' investors.

Despite this fragmented bond ownership, insurers' corporate bond portfolios are well diversified, as the average insurer holds bonds from 160 different firms (see Table IA.20). Bond holdings are also not concentrated across bond issuer industries or locations (see Figures IA.8 and IA.9).

I document that the set of firms that an insurer invests in, i.e., its investment universe, is very persistent over time. More than 90% of the firms whose bonds a given insurer currently holds also had bonds held by the same insurer in previous quarters (see Table IA.14).[28] Based on this observation, I classify insurers as a firm's potential investors if they ever held the firm's bonds in the previous eight quarters, as indicated by $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$. Consistent with this classification capturing long-term investment preferences, more than 70% of the variation in $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is explained by time-invariant differences across insurer-firm pairs, whereas changes in firm characteristics contribute only 1 percentage point to the share of explained variation (see Table IA.15).

To explore how insurers' previous bond holdings affect the allocation of current bond purchases, I construct an insurer-by-firm-by-quarter-level dataset that includes all possible pairs of firms and insurers that are included in my baseline sample at a given point in time. I estimate the following model:

$$1\{\text{Purchase}_{i,f,t}\} = \alpha \; \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) + u_{i,t} + v_{f,t} + \varepsilon_{i,f,t}, \tag{4}$$

where the indicator variable $1\{\text{Purchase}_{i,f,t}\}$ equals one if insurer i purchases firm f's bonds at

[28] Other institutional investors, e.g., equity investors, also exhibit a persistent investment universe (Koijen and Yogo, 2019).

time t and zero otherwise. Insurer-by-time fixed effects, $u_{i,t}$, absorb insurer-specific demand shocks. Firm-by-time fixed effects, $v_{f,t}$, absorb the effect of any firm characteristics that might influence insurers' purchases, such as profitability or investment opportunities. With the inclusion of these fixed effects, α is identified through the variation from insurer-firm pairs for which, in a given quarter, the two possible outcomes (purchase and no purchase) are observed for both the firm (across insurers) and the insurer (across firms).

Table 3 reports the results. In the first column, I document that insurers are more than 13 times more likely to purchase a firm's bonds if they previously invested in the same firm, with a t-statistic of almost 18. Thus, insurers' previous bond holdings are an important determinant of the allocation of bond purchases across firms.

I use this setting to examine whether unobserved firm characteristics correlate at the insurer level. Under regularity assumptions (see Khwaja and Mian, 2008), the difference in the point estimate for α in Equation (4) between regressions including and excluding the firm-by-time fixed effects reflects the amount of bias due to unobserved firm-level variables. To facilitate this comparison, column (1) in Table 3 includes only firm fixed effects, while column (2) additionally includes firm-by-time fixed effects. Intuitively, the difference in coefficients captures the effect of unobserved time-varying firm characteristics. I find no difference in the estimated coefficients. This provides direct validation that the higher likelihood of a firm's potential investors purchasing the firm's bonds is not explained by time-varying firm characteristics.

Why do insurers persistently invest in a similar set of firms? I examine two potential, nonexclusive channels: time-invariant investment preferences and information asymmetries. First, I include additional fixed effects in Equation (4) that absorb time-invariant investment preferences. For example, if individual insurers prefer to invest in firms of particular size, including insurer-by-firm size fixed effects would reduce the point estimate for α. Consistent with the existence of such preferences, the point estimate drops by 20% when I use quintiles of firms' total assets to construct firm size bins (see Table IA.16). Additional fixed effects for firms' location, industry, and rating absorb almost 50% of the baseline effect. This finding is consistent with the hypothesis in Koijen and Yogo (2019) that institutional investors have predetermined (implicit or explicit) investment mandates. Moreover, I document that previous bond holdings have a significantly stronger effect on current bond purchases for younger and more volatile firms, which indicates that persistence in insurers' investment universe partly results from information frictions between firms and insurers.

4.3 Validity of the instrument

In the first-stage regressions of my baseline analyses, I find that increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}_{f,t}$, significantly correlate with insurers' bond purchases at the firm level. This is consistent with the results of the previous analyses and shows that the instrument is meaningful. The F statistic is large and substantially exceeds 10, rejecting the hypothesis that the instrument is weak (Stock and Yogo, 2005). The instrumented second-stage regression in Equation (1) identifies the causal effect of insurers' bond purchases on firm outcomes if the exclusion restriction holds. From Equation (2) it is apparent that the exclusion restriction holds if the investment universe $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is randomly assigned but does not require it.

More generally, the exclusion restriction requires that there be no sorting of insurers and firms such that an unobserved variable simultaneously correlates with firm outcomes and potential investors' insurance premiums. An example of problematic sorting would be if insurers were more likely to invest in firms facing an economic environment similar to the insurers' own, e.g., firms in insurance customers' locations. In this case, firms' investment opportunities might correlate with the insurance demand of potential investors' customers. In the following, I provide evidence against the presence of such omitted variables.

First, I examine the effect of potential investors' premiums on the volume of bond purchases at the insurer-by-firm level. In column (3) in Table 3, I regress the volume of insurers' bond purchases on $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$, increases in insurance premiums, and their interaction. The coefficient on $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ shows that potential investors' bond purchases exceed those of other insurers by \$10 per \$1 million in an insurer's total assets, which corresponds to twice the average bond purchase volume (which is \$5 per \$1 million in total assets). The coefficient on the interaction term is significantly positive, which shows that an increase in insurance premiums amplifies the difference between potential investors and other insurers. These results are unaffected by insurer-specific shocks, which I absorb in column (4) by including insurer-by-time fixed effects.

If unobserved firm-level shocks could explain the differential effect of potential investors' premiums on bond purchases, the estimated coefficient on the interaction term would change when firm-by-time fixed effects are included. Instead, in column (5), I find that the estimate is almost identical. Similarly, the coefficient on $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ barely changes. This result is consistent with the negligible effect of including firm-by-time fixed effects in columns (1) and (2) and suggests that firm-specific shocks, such as changes in investment opportunities, do not explain why a firm's potential investors, especially those with high premium growth, purchase significantly more of a firm's bonds.

Second, I directly test whether insurers' investment universe is biased toward firms in an economic environment similar to that of the insurers' own customers. For this purpose, I regress $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ on indicators for geographic proximity, namely, whether the firm is located in the same state or region as an insurer's customers. I find that geographic proximity is neither a statistically nor economically significant determinant of insurers' investment universe (see Table IA.17).[29] I also explore other variables that capture a common economic environment, namely, the social connectedness between insurance customers' and firms' locations, which captures common

[29] I define insurance customers' location as the state with the largest total insurance premiums in the previous eight quarters. When I use the insurer's headquarters state instead, the correlation with $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ becomes positive but remains insignificant (t=1.31). The absence of a strong home bias of insurers in the corporate bond market contrasts with the findings of previous studies that document a significant home bias of institutional investors in the stock market (Coval and Moskowitz, 1999) that gives them an informational advantage (Baik et al., 2010). A potential reason for this difference is the lower information sensitivity of bonds than of stocks, which generates weaker incentives to acquire private information (Holmström, 2014). Addressing the concern that more granular, within-state geographic proximity correlates with insurers' investment universe, the instrument excludes insurance premiums written at the firm's location.

cultural factors and trade flows (Bailey et al., 2018), and employment per capita in the firm's industry in insurance customers' locations. None of these variables significantly correlate with insurers' investment universe, and the point estimates are economically negligible.

Finally, I follow the methodology in Borusyak et al. (2021) and test the exogeneity of insurance premiums to firm characteristics by regressing insurance premium growth on the lagged characteristics of the average firm in an insurer's investment universe, namely, asset growth, market-to-book, leverage, sales, cash flow, cash, and cash growth. I include insurer and time fixed effects. The estimated coefficients are not significantly different from zero and are economically negligible (see Table IA.18), suggesting that insurance premium growth is orthogonal to the characteristics of firms in insurers' investment universe after accounting for aggregate shocks and time-invariant, cross-sectional heterogeneity.

The results provide direct validation of as-good-as-random assignment of potential investors to firms, supporting the identifying assumption. This suggests that insurers' investment preferences over firms are mostly separated from their insurance business, consistent with insurers' strong reliance on unaffiliated asset managers (Carelus, 2018).

4.4 Alternative instrument based on natural disasters

By definition, time-varying unobserved heterogeneity across firms cannot be controlled for in Equation (1). Thus, one concern is that despite the aforementioned evidence for as-good-as-random assignment of potential investors and the rich set of controls in my analyses, there might be an omitted variable that simultaneously affects firm outcomes and the insurance premiums of potential investors. To address concerns over potentially remaining endogeneity, I propose an alternative instrumental variable using state-level variation in the number of fatalities caused by heat and storms and life insurers' lagged market share in each state.[30] This approach is motivated by evidence that natural disasters amplify the salience of underlying risks (Hu, 2021) but have little effect on life insurers' outflows.[31][32] From 2009 to 2018, storms were associated with 1,615 fatalities in total and affected all U.S. states. At the same time, heat was associated with 1,051 fatalities and affected 38 U.S. states.[33]

I compute life insurer i's exposure to disaster-related fatalities in state s in quarter $t-1$, denoted by Disaster fatalities$_{i,s,t-1}$, as the number of fatalities per capita in state s at $t-1$ multiplied by the median share of premiums written by insurer i in state s. Disaster fatalities$_{i,s,t-1}$ significantly correlates with the life insurance premiums written at time t in state s (see Table IA.19). The

[30] I use heat and storms since these are more frequent and widespread than other hazards. They jointly affect almost all U.S. states, providing wide cross-sectional and time series variation (see Figures IA.10).

[31] Salience theory suggests that consumers overweight information that is more salient and draws their attention, such as natural disasters (e.g., Bordalo et al., 2012).

[32] Even hurricane Katrina, the costliest disaster in the U.S. to the present day, had only a moderate effect on life insurers' expenses (Towers Watson, 2013), accounting for less than 1% of the total expenses of Metlife, one of the 5 largest U.S. life insurers (*Source:* Metlife's 2005 Annual Report).

[33] The deadly force of heat waves has recently received increasing attention, fueled by a substantial rise in their frequency and severity (e.g., The Economist, 2021).

relationship is robust to absorption of seasonality at the insurer-by-state level and of insurer-level supply shocks, which supports a salience channel through which deadly natural disasters boost households' life insurance demand. Disaster fatalities also correlate with life insurance premiums at the insurer level, while there is no significant effect on life insurance benefits (i.e., customer payouts). As a consequence, an increase in disaster fatalities raises life insurers' bond purchases.

To construct a firm-level instrument for insurers' bond demand, for each firm, I define Disaster fatalities$_{i,f,t-1}$ as the sum over Disaster fatalities$_{i,s,t-1}$ at the insurer level, excluding disasters in the firm's location and in neighboring states. Aggregating over a firm's potential investors, I use potential investors' total disaster exposure, $\sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \times \text{Disaster fatalities}_{i,f,t-1}$, to substitute potential investors' premiums in Equation (3) and denote the resulting instrumental variable for insurers' bond purchases as $\Delta\text{INVDisaster}_{f,t}$.

This approach eliminates the possible impact of (expectations about) insurers' investment performance on insurance prices or demand as a potential source of correlation between insurance premiums and firm outcomes. The identifying assumption is that no unobserved characteristics simultaneously correlate with firm outcomes and their potential investors' exposure to natural disasters. By excluding disasters in a firm's location and its neighboring states, I ensure that firms are not directly affected by disasters. Supported by the use of granular fixed effects absorbing seasonality at the firm level and state-specific shocks, this construction suggests that $\Delta\text{INVDisaster}_{f,t}$ is useful for strengthening the identification of the causal impact of bond demand on firm outcomes.

5 Bond prices and bond demand

I first explore the bond price impact of insurers' bond demand. This is important for two reasons. First, prices are helpful for disentangling bond demand from supply shocks. Second, bond prices reflect how demand shocks affect firms' funding costs, which reveals firms' incentives to opportunistically adjust their financing and investment behavior.

5.1 Secondary market

The secondary bond market is a natural starting point for the analysis since insurers' react to an increase in premiums by purchasing bonds almost entirely in the secondary rather than the primary market (see Table IA.22).

I follow secondary market bond prices over time at the bond level, ruling out cross-sectional differences between bonds or firms as alternative explanations for my results. In the main specification, I compare the quarterly bond return of firms that face large premium-driven bond purchases by insurers with that of similar bonds from firms that face smaller purchases,

$$\text{Bond return}_{b,t} = \alpha \frac{\text{Bond purchases}_{f(b),t}}{\text{Bond debt}_{f(b),t-1}} + \Gamma' C_{b,t} + u_b + v_{\text{maturity},t} + w_{\text{rating},t} + x_{\Delta\text{rating},t} + \varepsilon_{b,t}, \quad (5)$$

where firm $f(b)$ is the issuer of bond b and $C_{b,t}$ is a vector of control variables and fixed effect dummies that capture the effects of fundamentals on prices, as listed in Table 4. Insurers' bond purchases are instrumented by firms' exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}_{f,t}$. Bond fixed effects, u_b, capture time-invariant heterogeneity at the bond level. Maturity bucket-by-time fixed effects, $v_{\text{maturity},t}$, and rating-by-time fixed effects, $w_{\text{rating},t}$, capture different price trajectories depending on bonds' time to maturity (with bins separated at 5, 10, and 15 years) and credit rating, respectively. I also control for the time-varying effect of credit rating changes, $w_{\Delta\text{rating},t}$, as these correlate with insurers' investment behavior by affecting their capital requirements (Ellul et al., 2011; Becker et al., 2021). Standard errors are clustered at the bond and firm-by-time levels to account for autocorrelation at the bond level and correlation across bonds from the same firm in the same quarter.

In the first column of Table 4, I estimate Specification (5). The point estimate implies that when insurers additionally purchase 1% of a firm's outstanding bonds, bond returns increase by 47bps. For a 1 standard deviation increase in purchases, this implies an increase in bond returns of approximately 1 percentage point. In columns (2) to (5), I add control variables for firm and insurer characteristics and fixed effects that absorb industry-specific and location-specific shocks. Adding these controls has a modest impact on the coefficient on bond purchases, which suggests that the results are not biased by other determinants of bond prices.

The price impact of insurers' bond demand is economically sizable. For the median bond (with a market value of \$609 million), the estimate implies that prices increase by \$2.8 million when insurers purchase 1% of a firm's bonds. The effect is more than twice the average transaction cost of corporate bond trades estimated in prior studies, which suggests that investor demand shocks amplify OTC market frictions.[34] The magnitude is consistent with previous studies on nonfundamental demand shocks in the corporate bond market. For example, Massa and Zhang (2021) estimate that corporate bond returns dropped by 53 bps due to bond sales by hurricane Katrina-exposed P&C insurers, which (in absolute value) is close to my estimate for the price impact of the purchase of 1% of a firm's bonds.

To explore the price dynamics around insurers' bond purchases, I re-estimate Specification (5) for cumulative bond returns with a varying time lag relative to insurers' instrumented bond purchases at the monthly level.[35] Figure 1 plots the estimated coefficients. Bond prices increase in the first month of quarters with large bond purchases and stay elevated for approximately 4 months. After 6 months, bond prices have fully reverted, which means that the coefficient on instrumented bond purchases is close to and not significantly different from zero. Thus, an increase in bond

[34]O'Hara et al. (2018) estimate an average transaction cost of 17 bps for bond purchases by comparing the bond prices of less and more active investors. Chakravarty and Sarkar (2003) estimate a bid-ask spread of 21 bps by comparing average dealer sell and buy prices. Bessembinder et al. (2006) estimate the one-way trade execution costs for institutional bond trades to be 9 bps using a structural model.

[35]Specifically, I estimate

$$\text{Bond return}_{b,(t-1):(t+\tau)} = \alpha \frac{\text{Bond purchases}_{f(b),t}}{\text{Bond debt}_{f(b),t-1}} + \sum_{k=1}^{\lfloor \tau \rfloor} \beta_k \Delta\text{INVPremiums}^{>0}_{f,t+k} + \Gamma' C_{b,t} + u_b + v_{\text{maturity},t} + w_{\text{rating},t} + x_{\Delta\text{rating},t} + \varepsilon_{b,t},$$

where $\text{Bond return}_{b,(t-1):(t+\tau)}$ is the bond return between the end-of-quarter price in quarter $t-1$ and $3 \times (1+\tau)$ months later, with $\tau = \frac{j}{3}$, $j \in \{..., -1, 0, 1, ...\}$, and $C_{b,t}$ including bond and insurer controls. I control for future changes in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}_{f,t+k}$, to make sure that autocorrelation in this variable does not drive the result.

demand raises bond prices for roughly 2 quarters. The dynamic is similar to that in other studies of nonfundamental demand shocks in the corporate bond market (e.g., Massa and Zhang, 2021; Ellul et al., 2011) and consistent with gradual arbitrage shifting prices back to their fundamental value. Bond returns *before* an increase in insurers' demand do not differ across firms; i.e., there is no differential pretrend in prices, consistent with as-good-as-random matching of firms and insurers.

5.2 Primary market

Since insurers purchase bonds almost entirely in the secondary market (see Table IA.22), it is not obvious that changes in insurers' bond demand also affect primary market bond prices and, thereby, firms' funding costs. The impact on primary markets depends on the extent to which primary market participants respond to secondary market price changes. The following analysis explores this channel. Since for each bond there is only one observation in the primary market, identification relies on the cross-section of bond issuances. Specifically, I compare the average issuance yield spread of firms that face large premium-driven bond purchases by insurers with that of similar issuances of firms that face smaller purchases,

$$\text{Yield spread}_{f,t} = \alpha \ \log \text{Bond purchases}_{f,t} + \Gamma' C_{f,t} + u_{\text{maturity},t} + \varepsilon_{f,t}, \tag{6}$$

where the yield spread is averaged across issuances of the same firm in the same quarter weighted by the offering amount. The log-linear relationship between the yield spread and bond purchases is supported by scatter plots. To accommodate this relation, I also log-transform the instrument as follows: $\Delta\widetilde{\text{INVPremiums}}^{>0}_{f,t} = \log(1 + \Delta\text{INVPremiums}^{>0}_{f,t} \times \text{Bond debt}_{f,t-1})$. Maturity-by-time fixed effects, $u_{\text{maturity},t}$, absorb time-varying differences in yield spreads across issuances with a different time to maturity, and $C_{f,t}$ is a vector of control variables, such as current rating and time to maturity, as listed in Table 5. Standard errors are clustered at the firm level. I estimate Equation (6) using the subsample of firm-by-quarter observations with issuance activity.

In the first column of Table 5, I estimate Specification (6). The point estimate implies that an increase of 1% in insurers' bond purchases reduces the issuance spread by approximately 35 bps. In columns (2) to (6), I estimate alternative specifications that absorb heterogeneity in yield spreads across industries, firms' locations, and credit ratings and include additional control variables for firm and insurer characteristics. The coefficient of interest remains significantly negative with a similar magnitude.

To make explicit the spillover from insurers' secondary market purchases to the primary market, in column (7), I estimate the effect of insurers' secondary market purchases (instrumented by $\Delta\widetilde{\text{INVPremiums}}^{>0}$) on issuance yield spreads while controlling for insurers' primary market purchases.[36] The coefficient on secondary market purchases is statistically significant and negative.

[36] To maintain the same sample, I use log(1+Secondary market purchases) and log(1+Primary market purchases). However, this transformation also affects the coefficients. When I alternatively use log(Secondary market purchases) and log(Primary market purchases), the sample shrinks by roughly 150 observations, and the coefficient on log(Secondary market purchases) has a similar magnitude as the coefficient on log(Bond purchases) in the baseline

This result shows that with primary market bond demand held constant, an increase in secondary market demand spills over to the primary market.

6 Bond financing and bond demand

The previous section documents that an increase in insurers' bond demand boosts bond prices in the secondary and primary markets. Thus, firms' funding costs decrease. Below, I explore the response of firms' bond financing activities.

6.1 Baseline specification

To examine the effect of insurers' premium-driven bond purchases on firms' bond issuance, I estimate Equation (1) with the relative change in bond debt as the dependent variable. The baseline specifications include fixed effects at the region-by-time level, which absorb changes in a firm's local economic environment (which is either the U.S. Mid-Atlantic, Midwest, Northeast, Southeast, Southwest, or West). Additional specifications include more granular state-by-time fixed effects. Moreover, firm-seasonality fixed effects absorb seasonality in bond issuance and insurance premiums by interacting firm dummies with calendar quarter dummies, and industry-by-time fixed effects absorb industry-wide shocks. I use a large set of firm-level control variables that capture traditional determinants of financing activities, namely, current sales and cash flow, to control for internal funding (e.g., Frazzari et al., 1988, Almeida et al., 2004), the lagged market-to-book ratio as a measure of (expected) investment opportunities, and firm age, lagged leverage, cash holdings, and cash growth, to control for financial slack.

The main concern is that unobservable variables simultaneously correlate with firms' investment opportunities and the insurance premiums of potential investors. To address this concern, I include controls for the characteristics and economic environment of a firm's potential investors. For this purpose, for each firm, I calculate the average potential investor's P&C and life insurance profitability, life insurance fee income, investment yield, and lagged return on equity and size. These variables capture variation in insurance supply and insurers' investment success and profitability. Moreover, I control for the share of life insurers among potential investors and the logarithm of the lagged number of insurers holding a firm's bonds, capturing variation in the composition and number of investors. To control for insurers' economic environment, I include fixed effects at the insurer-type level (based on the share of lagged insurance premiums by line of business) and insurance customer-location level (based on the share of lagged insurance premiums by U.S. region), which are interacted with time dummies.

I also compute dummy variables for the level of employment per capita in a firm's industry and the level and type of consumption per capita in the states where potential investors' customers are located and interact these with time dummies. These insurer-economy fixed effects absorb time-varying differences between firms that correlate with consumption or employment patterns in

specification.

potential investors' location. For example, if insurers were more likely to invest in local employers, these firms' investment opportunities might correlate with local employment and, thereby, with insurance demand. To alleviate this concern, the inclusion of employment-by-time fixed effects implies that the estimate compares firms that have similar employment levels in their industry in the states where potential investors' customers are located.

6.2 Baseline results

Table 6 reports the estimated coefficients. I find a large positive and significant (at the 1% level) coefficient on insurers' instrumented bond purchases in all specifications. The point estimate implies that when insurers additionally purchase 1% of a firm's outstanding bonds, firms' bond issuance increases by approximately 6% of bond debt. A 1 standard deviation increase in bond purchases implies bond issuance that is 15 percentage points higher, which corresponds to roughly $140 million for the median firm (with total bond debt of $900 million). The effect of insurers' bond demand on firms' bond issuance is thus highly economically significant, which implies a substantial elasticity of firms' bond financing activities to insurers' bond demand.

The specification in column (1) includes region-by-time fixed effects. In columns (2) to (5), I add controls for the characteristics and economic environment of firms and insurers. The most refined specification in column (5) includes fixed effects for firm-specific seasonality, firm industry and state, and insurer type, location, and economy as well as a large set of control variables. These fixed effects and controls have a negligible effect on the point estimate and significance of the coefficient of interest.

The results predict that firms' bond issuance increases by approximately $6 for a $1 premium-driven increase in insurers' bond purchases. This large sensitivity of bond issuance suggests that primary markets are very price elastic and, at the same time, highly sensitive to secondary market prices and, thus, insurers' bond demand.[37] In this case, the transmission of demand shocks from the secondary to the primary market amplifies the initial effect. Consistent with this interpretation, in Table IA.24, I find that bond issuance is significantly less sensitive to insurers' bond purchases when potential investors are more active in the primary instead of the secondary bond market.

In Table IA.30, I report the OLS estimate for Equation (1), which is close to but slightly smaller than the instrumental variable estimate in Table 6. This comparison points to the strength of my instrument for insurers' bond purchases. It also suggests that the (reverse) effect of firms' bond issuance on insurers' bond purchases is relatively weak, consistent with the observation that insurers are active mainly in the secondary market. Table IA.30 also reports the coefficients for control variables, which have the expected signs. To address concerns about the truncation of the instrument at zero, I include decreases in potential investors' premiums, $\Delta\text{INVPremiums}^{<0}$, as an

[37] The high price elasticity of primary market bond demand may be supported by centralized book building and intermediation by bond underwriters, mitigating market frictions. A limited ability of primary market participants to filter out nonfundamental from fundamental determinants of secondary market prices might amplify price elasticity and the sensitivity to secondary market prices (similarly to, e.g., managers' reaction to stock price noise in Dessaint et al., 2019).

additional instrument in Table IA.29. The coefficient on ΔINVPremiums$^{<0}$ is statistically insignificant with an economically negligible magnitude in the first stage, consistent with the negligible effect of premium decreases on bond purchases at the insurer level (documented in Section 4.1). The inclusion of ΔINVPremiums$^{<0}$ has a negligible effect on the estimated coefficient of interest in the second stage, which suggests that the truncation of ΔINVPremiums$^{>0}$ at zero does not bias the results.

6.3 Alternative specifications

The identification might be jeopardized by the presence of a flow-to-performance relationship, whereby, e.g., insurers' (expected) investment return affects insurance prices (Knox and Sørensen, 2020) or insurance demand directly. However, I find that insurance premiums do *not* significantly correlate with insurers' investment return (see Section 6.3). A weak flow-to-performance relationship is plausible since insurance market outcomes are driven primarily by households' desire to insure against adverse shocks.[38] Consistent with this view, I collect anecdotal evidence from insurance agents that most insurance customers are not even aware of the fact that insurers invest their premiums in financial markets. Moreover, in Table IA.31, I show that the baseline results are robust to the exclusion of premiums for investment-related (deposit-type) insurance contracts from the instrument. I also include additional (lags for) insurance supply variables as well as fixed effect dummies for potential investors' investment yield and profitability bins interacted with time dummies to account for a time-varying and nonlinear relationship.

I also explore several alternative specifications in Table IA.31. These include rating-by-time fixed effects to absorb time-varying heterogeneity across firms with different credit ratings. I use the social connectedness between a firm's location and the location of its potential investors' customers as a proxy for unobserved economic links between U.S. regions, such as trade or common cultural values (Bailey et al., 2018). Another specification also includes industry-by-state-by-time fixed effects, which absorb changes in the local economic environment at the industry level. Moreover, I control for changes and increases in the number of a firm's potential investors and find that it does not explain the results.

I also provide results based on alternative definitions of the instrument, in which I redefine potential investors using a 10-quarter (instead of an 8-quarter) time horizon, exclude insurance premiums from the states neighboring a firm's location, and exclude insurance premiums from states in which a firm's suppliers and customers are located (based on the customer-supplier network documented in Barrot and Sauvagnat, 2016). Finally, I also substitute bond purchases with bond purchases net of sales as the main explanatory variable. All alternative specifications have a modest effect on the coefficient of interest and its significance.

Although my results are robust across a broad set of specifications, they are not based on a natural experiment. To further corroborate my findings, I propose two alternative estimation

[38]Furthermore, book value accounting and tight price regulation in insurance markets suggest that it is unlikely that moderate changes in bond issuer fundamentals have an immediate impact on insurance prices.

approaches. The first is based on a within-firm comparison of bond and commercial paper issuance, which allows me to absorb time-varying heterogeneity across firms. The second uses the alternative instrument based on natural disasters.

Similar to corporate bonds, commercial paper is publicly traded debt. It is an important component of firms' capital structure and is often used to finance investments (Kahl et al., 2015). The share of commercial paper relative to total debt is 8% on average in my sample and ranges up to 30% at the 95th percentile (see Table IA.20). In contrast to corporate bonds, commercial paper has short maturities of 45 days on average (Ou et al., 2004). For this reason, long-term investors such as insurance companies are barely active in this market, investing less than 1% of their assets in commercial paper.[39] Therefore, it is reasonable to assume that commercial paper demand is uncorrelated with changes in insurance premiums. Building on this assumption, I estimate the effect of insurers' instrumented bond purchases on firms' bond issuance *relative* to their commercial paper issuance in the following specification

$$\frac{\Delta \text{Debt}_{d,f,t}}{\text{Bond debt}_{f,t-1}} = \alpha \, \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} \times 1\{\text{Bond}_d\} + u_{f,t} + v_{f,d} + w_{d,t} + \varepsilon_{d,f,t}, \tag{7}$$

where d denotes the debt type (either corporate bonds or commercial paper), $\Delta \text{Debt}_{d,f,t}$ is the quarterly change in debt of type d, and $1\{\text{Bond}_d\}$ is an indicator for corporate bond debt. α reflects the effect of insurers' bond purchases on firms' bond issuance relative to commercial paper issuance. Insurers' corporate bond purchases are instrumented with $\Delta \text{INVPremiums}^{>0}_{f,t}$ as in the baseline specification. The important difference from the baseline specification is the inclusion of firm-by-time fixed effects, $u_{f,t}$, which absorb any firm-specific shocks that uniformly affect bond and commercial paper debt issuance, e.g., stemming from changes in investment opportunities. Thus, α is identified from variation *within* the same firm at the same point in time. I also include debt type-by-firm fixed effects, $v_{f,d}$, which absorb time-invariant heterogeneity in the debt structure across firms, and debt type-by-time fixed effects, which absorb debt type-specific aggregate shocks, such as changes in the market environment. Standard errors are clustered at the firm and debt type-time levels. I consider only the subsample of firms for which commercial paper is a relevant source of corporate financing, defined as those with positive commercial paper debt in at least one quarter from 2010q1 to 2018q4.

The first column of Table 7 estimates Equation (7) without firm-by-time fixed effects. The point estimate for the coefficient on insurers' bond purchases is significantly positive with a magnitude similar to that in the baseline results. Column (2) additionally includes firm-by-time fixed effects, which have a modest impact on the coefficient. This rules out firm-specific determinants of capital demand as an alternative explanation. As a robustness check, column (3) focuses on the subsample of firms with positive commercial paper debt in at least 50% of observations. The coefficient of interest remains statistically significant with a similar magnitude.

The final alternative estimation approach builds on variation in disaster-related fatalities, which

[39] *Source:* Z.1 Financial Accounts of the United States.

raise life insurers' premiums and corporate bond demand, as detailed in Section 4.4. By excluding disasters in a firm's location and its neighboring states and including state-by-time fixed effects, I ensure that there is no direct effect of disasters on firms. The natural disaster instrument significantly correlates with insurers' bond purchases in the first stage, and there is no indication that it is a weak instrument (the F statistic exceeds 30 in the first stage). Using the natural disaster instrument to estimate Equation (1), I find estimates similar to those in my baseline specification, which emphasize the robustness of my results (see Table IA.32).

6.4 The role of financial constraints

By reducing firms' funding costs, an increase in insurers' bond purchases motivates firms to exploit favorable funding conditions, which is a form of *corporate opportunism* (Baker, 2009). Corporate opportunism might be amplified by the presence of financial constraints, which prevent firms to pursue all desired projects (Holmstrom and Tirole, 1997; Baker et al., 2003b).[40] To explore the role of financial constraints, I use Hadlock and Pierce (2010)'s SA index, which is based on firm size and age.[41] Additionally, I examine heterogeneity across firms with different size, cash flow, and credit rating.

Observing insurers' actual bond purchases allows me to disentangle between heterogeneity in firms' reaction to an increase in bond demand (second stage) from heterogeneity in insurers' reaction to liquidity shocks (first stage). This differs from previous studies that do not observe investor transactions (e.g., Zhu, 2021) and is essential for the interpretation of the results. For example, insurers might purchase significantly more bonds from large compared to small firms (first stage) but large and small firms might not react differently to an increase in purchases (second stage).

I first sort firms into bins based on cross-sectional quartiles of firm characteristics and then estimate separate coefficients on insurers' instrumented bond purchases for each bin following specification (4) of Table 6. Time dummies interacted with quartile (or rating) dummies control for time-varying heterogeneity across firms with different characteristics. Table 8 reports the estimated coefficients. The results suggest that more constrained firms' bond issuance is not significantly more sensitive to an increase in bond demand. Instead, differences across firms are not statistically significant. Interestingly, the coefficient is particularly large for firms with a very high (AAA-A) or low (high-yield) credit rating, but smaller for those with an intermediate (BBB) rating. A potential reason for this (insignificant) difference is that firms with an intermediate rating on average benefit from particularly low financing costs already and, therefore, might respond less severely to an increase in demand (Acharya et al., 2021).[42]

[40] The banking literature highlights this channel for the transmission of credit supply shocks from banks to firms (Chava and Purnanandam, 2011; Chodorow-Reich, 2014).

[41] Hadlock and Pierce (2010) evaluate the use of firm characteristics to measure financial constraints based on qualitative evidence from SEC filings. They suggest a measure for financial constraints that negatively loads on age and positively on squared size and provide evidence that it reflects financial constraints more accurately than the KZ index from Kaplan and Zingales (1997). My results are similar when using the KZ index.

[42] There are significant differences in the sensitivity of insurers' bond purchases to an increase in premiums in the first stage. For example, insurers purchase significantly more bonds from large compared to small firms. Table IA.23

Overall, the results suggest that opportunistic bond issuance is, at the margin, not driven by financial constraints but primarily by favorable funding conditions, which firms that are differently financially constrained find equally attractive to exploit.

6.5 The underwriter channel

How do firms know about changes in insurers' bond demand? Based on anecdotal evidence I assemble from a large non-financial firm and a broker-dealer, firms typically are not sufficiently close to investors in order to directly communicate about changes in demand. Instead, firms frequently monitor secondary market bond prices. However, there is a high degree of uncertainty regarding the interpretation of variation in secondary market prices and how it would affect the funding costs for new bond issuances. For this reason, firms maintain close relationships with their bond underwriters, which have direct contact to investors, inform firms about investor demand, and help firms to set issuance prices and allocated orders.

Consistent with this anecdotal evidence, I find that firm-underwriter relationships are very persistent. On average, 70% of bond issuances in my sample involve bond underwriters that the firm has worked with in the previous year. An average issuance involves roughly 4 underwriters, out of 260 in my sample.

Bond underwriters are large broker-dealers, which are also counterparties to insurance companies in the bond market. Insurer-dealer relationships are also very persistent. On average, 80% of insurers' bond purchases (at the insurer-quarter level) are from dealers that they worked with in the previous year. The insurer-dealer network is fragmented, as insurers work with 17 dealers on average.[43]

I use the overlap between a firm's relationship underwriters and potential investors' relationship dealers as a measure for how connected underwriters are with potential investors. Specifically, I define by $\mathbb{I}(\text{Underwriter}_{u,f,t-(1:4)})$ an indicator for whether underwriter u ever has participated in firm f's bond issuances in the past 4 quarters. Then, I measure the connectedness of a firm's underwriters with potential investors as the share of potential investors' bond purchases from the firm's underwriters in the previous year,

$$\%\text{UW}_{f,t} = \frac{\sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \sum_{k=1}^{4} \mathbb{I}(\text{Underwriter}_{u,f,t-(1:4)})\text{Bond purchases}_{u,i,t-k}}{\sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \sum_{k=1}^{4} \text{Bond purchases}_{u,i,t-k}}, \quad (8)$$

where Bond purchases$_{u,i,t-k}$ are insurer i's total bond purchases from underwriter u in quarter $t-k$. Finally, $\text{UW}_{f,t}$ is an indicator for high connectedness of underwriters with potential investors, defined by the 20th percentile of the cross-sectional distribution of $\%\text{UW}_{f,t}$ (which on average

reports these results from the first stage. Insurers' corporate bond purchases for small firms do not significantly react to an increase in premiums, explaining the insignificant coefficient in the second stage in Table 8. Consistent with Acharya et al. (2021)'s finding that investors subsidize firms with a BBB rating, I find that the effect of premiums on bond purchases is particularly large for these firms (Table 8).

[43] Hendershott et al. (2020) propose a model in which insurers build relationships with dealers to mitigate search frictions. Figure IA.21 displays the cross-sectional distribution of persistence in firm-underwriter and insurer-dealer relationships.

corresponds to $\%\text{UW}_{f,t} = 0.25$). Since the measure relies on the subset of bond purchases with identified counterparties, the number of firms in the sample drops to 465.

To test the underwriter channel, I regress firms' bond debt growth on the interaction of insurers' instrumented bond purchases and $\text{UW}_{f,t}$. The coefficient on the interaction term is large and significant (see Table 9). Thus, consistent with the hypothesis, firms respond significantly more strongly to an increase in bond demand when their underwriters are well-connected with potential investors.

A possible concern is that firms with well-connected underwriters are different in other dimensions as well, which would bias the coefficient. If such differences are time-invariant or seasonal, they are absorbed by firm-by-calendar quarter fixed effects. Moreover, I include $\text{UW}_{f,t}$-by-time fixed effects, which absorb time-varying differences across firms with more- and less-connected underwriters in column (1). Column (2) additionally controls for firm and insurer characteristics, which has a modest effect on the coefficient. In column (3) I dig deeper into potential non-linearities. I find that the underwriter effect is concentrated around the lowest quintiles of $\%\text{UW}_{f,t}$. This suggests that it is important for underwriters to be connected with some critical mass of potential investors, but a further increase in connectedness has a minor effect on firms.

Finally, I zoom in on the mechanism behind the underwriter channel. The hypothesis is that underwriters are relevant for disseminating information about investor demand to firms. In this case, underwriters should become more important when information is more difficult to gather. I use the dispersion of a firm's investors, measured as the negative of the Herfindahl-Hirschman Index of insurers' bond holdings, and the number of potential investors as proxies for information barriers. To test the relevance of information barriers, I expand the regression model with a triple interaction term of insurers' instrumented bond purchases, $\text{UW}_{f,t}$, and a dummy variable for strong information barriers, which indicates the upper half of the cross-sectional distribution of investor dispersion or number of potential investors. The model also includes the two-way interactions and the variables themselves. The coefficient on the triple interaction term is large and highly significant (at the 1% level) for both proxies of information barriers (see columns (5) and (6)). This result suggests that underwriters become more important when information about investor demand is more difficult to gather and emphasizes the role of underwriters for disseminating information from investors to firms.

7 Corporate investment and bond demand

The previous section provides evidence that firms respond to an increase in insurers' bond demand by increasing bond issuance. In this section, I explore whether the additional funding is used for corporate investment.

7.1 Baseline specification

To examine the effect of insurers' premium-driven bond purchases on firms' investment activities, I estimate Equation (1) with variables for corporate investment as the dependent variable. I follow the previous literature and analyze the growth in firms' total assets and tangible assets (PPE) as well as capital and acquisition expenditures in response to insurers' instrumented bond purchases. All variables are scaled by lagged bond debt. Fixed effects and control variables are the same as used in Table 6 in the previous Section. The fixed effects absorb seasonality at the firm level and changes in firms' local environment and industry as well as changes in insurers' local economic environment and line of business. Standard errors are clustered at the firm level.

7.2 Baseline results

In the first column of Table 10, I explore effects on asset growth. The coefficient on insurers' instrumented bond purchases is large and significant at the 1% level. The point estimate implies that an increase in bond purchases by 1% of a firm's bond debt raises firms' asset growth by 5.7% of bond debt. The magnitude of this effect is almost identical to the increase in bond issuance estimated in Table 6. Thus, the vast majority of proceeds from additional bond issuance remains on firms' balance sheet. Column (2) documents that one third of this balance sheet effect is driven by an increase in tangible assets, which is also significant at the 1% level. The effect on tangible asset growth is significantly larger for firms that are more financially constrained (column 3). This is consistent with prior literature and suggests that insurers' bond demand alleviates financing frictions (e.g., Baker et al., 2003b; Warusawitharana and Whited, 2016).

Column (4) considers total corporate investment, which I measure as the sum of acquisition and capital expenditures.[44] I find a large, positive coefficient on insurers' instrumented bond purchases for total investment, significant at the 1% level. The magnitude of the effect is only slightly smaller than the increase in asset growth estimated in column (1). This shows that firms, on average, primarily increase corporate investment in response to favorable market conditions.

Columns (5) to (7) dig deeper into *how* firms invest. I find that both acquisition and capital expenditures significantly increase with insurers' instrumented bond purchases. The sensitivity of acquisitions is roughly 3 times larger than that of capital expenditures. This important role of acquisitions is consistent with the observation that firms with bond market access are relatively mature (i.e., are large, have high and stable cash flows, and high profitability; see Cantillo and Wright, 2015) and, thus, might have access to more indirect rather than direct investment opportunities. Similar to the effect on tangible asset growth, the effect on acquisitions is significantly larger for firms that are more financially constrained (column 6).

[44] Acquisition expenditures represent the cash outflow of funds used for and/or the costs relating to acquisitions, which includes the acquisition price, goodwill, and additional costs. Acquisitions are relatively frequent among the firms in my sample, as I observe positive acquisition expenditures in one third of firm-quarter observations.

7.3 Alternative specifications

To corroborate the above results, I estimate a battery of alternative specifications. First, I saturate the baseline specification with state-by-industry-by-time fixed effects. Then, the coefficient compares firms within the same industry at the same location at the same time, ruling out industry-specific shocks at a firm's location as alternative explanation. Including these granular fixed effects has a modest effect on the point estimates and their significance (see Table IA.33).

Second, I use the same robustness checks as for the effect on firms' bond issuance (Section 6.3), namely including state-by-time, rating-by-time, and social connectedness-by-insurer location-by-time fixed effects, controlling for additional insurance supply variables and for changes in the number of firms' potential investors, using alternative definitions of the instrument, and using bond purchases net of sales as main explanatory variable. All of these alternative specifications have a modest effect on the estimated coefficient on instrumented bond purchases and its significance for tangible asset growth, total investment, acquisition expenditures, and capital expenditures (see Tables IA.34 to IA.37).

Third, I use variation in disaster-related fatalities as an alternative instrument for insurers' bond purchases. The estimated coefficients are very close to those in the baseline specification and the impact on tangible asset growth, total investment, and capital expenditures remain significantly positive (see Table IA.38). These alternative specifications are consistent with the baseline results and emphasize the effect of insurers' bond demand on firm-level investment.

8 Discussion

8.1 Equity financing

Recent studies emphasize the debt financing of shareholder payouts (Farre-Mensa et al., 2020), particularly when bond prices are high (Ma, 2019). Thus, one might expect insurers' bond demand to contribute to debt-financed shareholder payouts. Consistent with this expectation, I find a significantly positive correlation of insurers' instrumented bond purchases with share repurchases (see Table IA.25). However, this effect is not significantly different from zero on average. Instead, in the absence of acquisitions, it becomes significant positive. In this case, the estimate suggests that an increase in bond purchases by 1% of a firm's bond debt increases equity repurchases by 1.4% of bond debt. I also find a positive correlation between shareholder dividends and insurers' instrumented bond purchases, which, however, is neither statistically significant on average nor conditional on the absence of acquisitions. These results suggest that the effect of insurers' bond demand on corporate investment on average dominates effects on shareholder payouts.

8.2 Leverage

The results of Section 7 show that firms' total asset growth increases to a similar extent as firms' bond issuance in response to insurers' bond demand, suggesting that substitution with other financing sources are weak. This is consistent with the negligible effect on equity repurchases documented above. These weak substitution effects suggest that firms' total debt growth (including bank and commercial debt) and leverage growth (i.e., the relative quarterly change in the leverage ratio) increase, as well. I formally test this hypothesis in Table IA.26. Consistent with absence of substitution across debt types, I find that insurers' instrumented bond purchases increase firms' total debt growth to a similar extent as their bond issuance, which is significant at the 1% level. Moreover, consistent with the absence of substitution across debt and equity, I find that insurers' instrumented bond purchases also significantly increases firms' leverage. An increase in bond purchases by 1% of a firm's bond debt raises firm's leverage growth by roughly 1.6%. Thus, insurers' bond demand does not only affect firms' bond debt but also their overall capital structure.

8.3 Persistence

In my baseline analysis, I consider the contemporaneous effect of insurers' bond purchases. Do firms subsequently rebalance away the impact of their opportunistic behavior and, if so, how fast? If insurer demand shocks are not fundamental, it seems sensible to expect firms to rebalance at some point. To address this question, I re-estimate the baseline regressions with forward-looking cumulative outcomes as depending variables.

I find that insurers' bond demand has a persistent effect on firms' bond debt and investment. The effect on cumulative bond issuance becomes insignificant and economically small only after three quarters (see Table IA.27). Similarly, the coefficients on cumulative total investment and change in tangible assets become insignificant after three quarters. However, their point estimates remain sizable, suggesting an even longer-term effect on investment policies than on bond issuance.

8.4 Aggregate effects

The baseline analysis focuses on firm-level effects. On a more aggregate level, these could be dampened by competing firms, e.g., when investment is reallocated from firms with less to those with more bond demand. The reverse might also be true as spillovers, e.g., via agglomeration effects, might amplify aggregate effects.

To test for effects at higher levels economic aggregation I adopt a "local bond market" approach. I aggregate all variables at the industry-by-region level by summing up insurers' bond purchases and holdings, firms' bond debt, potential investors' insurance premiums, and corporate investment across firms in the same U.S. region and industry.[45] Insurers' bond purchases are instrumented by the industry-by-region-level change in potential investors' premiums.

Columns (1) and (2) in Table IA.28 examine the effect on bond issuance. I find a significantly positive coefficient on insurers' bond purchases, controlling for seasonality at the industry-by-region

[45] Control variables are at the median for each industry-region-time triplet. The banking literature often employs a "local lending market" approach to estimate the aggregate effects of loan supply on firms at the county or city level (e.g., Huber, 2018; Duquerroy et al., 2021). I modify this approach for the bond market since firms with bond market access are on average larger and more mature than bank-reliant firms and, thus, plausibly operate in a broader economic environment.

level as well as for time-varying heterogeneity at the more aggregate SIC1-industry level. The magnitude is similar as in my baseline results, suggesting that spillover effects of bond issuance are relatively small. Similarly, the coefficients on total investment, acquisition and capital expenditures are significantly positive and only slightly smaller than in the baseline results (columns 3 to 6). These results suggest that insurers' bond demand affects corporate finance and investment also at higher levels of economic aggregation.

9 Conclusion

Institutional investors hold the vast majority of corporate bonds. Due to the significant reliance of non-financial firms on bond financing, an important question is whether bond investors are either "a spare tire" or affect corporate finance and economic activity.

Motivated by this question, this paper documents that insurance companies propagate shocks from household insurance markets to the real economy via the corporate bond market. I document hat an increase in household insurance premiums raises insurers' corporate bond demand and, thereby, significantly impacts bond prices and firms' funding costs, consistent with prior theories on market segmentation and limits of arbitrage (Vayanos and Vila, 2021). This increase in insurers' bond demand translates into changes in non-financial firms' financing and real economic activity. Firms opportunistically take advantage of low funding costs by increasing their bond issuance and use the proceeds for corporate investment, boosting tangible assets.

My findings suggest that institutional investors have a substantial impact on corporate finance and real economic activity. This impact is fueled by an inelastic corporate bond market, which allows investor demand to affect bond prices. The results indicate that changes in investor demand, e.g., stemming from regulatory frictions, reach-for-yield, or socially responsible investment, can generate significant spillovers to the real economy.

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Figures and Tables

Figure 1. Bond prices and insurers' bond demand.

The figure illustrates the secondary market bond price dynamics of firms that face large bond purchases by insurers in quarter 0 relative to those that face fewer bond purchases. Specifically, the figure depicts the price impact and its 90% confidence interval in bps for an increase in insurers' bond purchases by 1% of a firm's debt estimated from regressing cumulative bond returns (relative to the last month in quarter -1) on insurers' bond purchases in quarter 0. Insurers' bond purchases are instrumented by firms' exposure to increases in potential investors' premiums in quarter 0, following Equation (3).

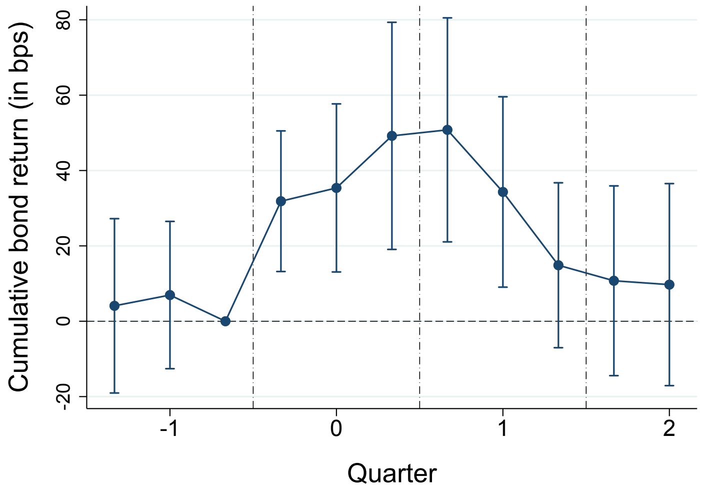

Table 1. Summary statistics.

Summary statistics at quarterly frequency from 2010q2 to 2018q4. At the insurer-by-firm level, the summary statistics for the volume of bond purchases are reported conditional on a purchase for readability.

	N	Mean	SD	p5	p50	p95
Insurer level (1,484 insurers)						
Bonds held (bil USD)	48,287	1.24	5.79	0.00	0.03	5.04
Bond purchases (mil USD)	48,287	50.66	255.23	0.00	1.20	207.75
Premiums (mil USD)	48,287	144.54	656.89	0.27	14.21	526.27
ΔPremiums/Total assets$_{t-1}$ (%)	48,287	0.22	3.37	-4.06	0.00	5.39
Insurer-by-firm level						
$100 \times \mathbb{I}$(Investor)	21,333,622	6.46	24.58	0.00	0.00	100.00
$100 \times 1\{\text{Purchase}\}$	21,333,622	0.46	6.77	0.00	0.00	0.00
Bond purchases (mil USD)	98,142	4.27	9.04	0.05	1.11	18.34
Firm level (829 firms)						
Bond debt/Total debt (%)	15,461	76.74	23.85	29.56	84.57	100.00
ΔBond debt/Bond debt$_{t-1}$ (%)	15,466	3.16	22.28	-13.29	0.00	31.82
%Held by insurers (%)	15,466	22.99	23.63	0.31	14.21	75.64
Bond purchases/Bond debt$_{t-1}$ (%)	15,466	0.98	2.59	0.00	0.11	4.54
ΔINVPremiums$^{>0}$ (%)	15,466	3.87	9.20	0.00	0.28	18.92
ΔTotal assets/Bond debt$_{t-1}$ (%)	15,466	9.45	45.04	-36.72	2.61	75.50
ΔPPE/Bond debt$_{t-1}$ (%)	15,466	2.51	12.30	-8.10	0.41	19.97
Total investment/Bond debt$_{t-1}$ (%)	15,466	12.69	23.33	0.72	5.31	46.72
AcqEx/Bond debt$_{t-1}$ (%)	15,466	4.29	16.98	0.00	0.00	21.96
CapEx/Bond debt$_{t-1}$ (%)	15,466	7.86	11.24	0.64	4.11	27.94
Issuance level: Primary market (366 firms)						
Yield spread (%)	941	2.31	1.76	0.51	1.56	6.05
Offering amount (bil USD)	941	1.36	2.18	0.23	0.65	5.00
Bond level: Secondary market (333 firms, 2,524 bonds)						
Bond return (%)	29,244	-0.09	3.13	-5.43	-0.00	5.22
Transaction volume (mil USD)	29,244	52.11	85.98	1.08	23.78	192.99

Table 2. Insurance premiums and insurers' balance sheets and bond purchases.
Each column presents estimated coefficients from a specification of the form:

$$Y_{i,t} = \alpha \, \frac{\Delta \text{Premiums}_{i,t}}{\text{Total assets}_{i,t-1}} + \Gamma' C_{i,t} + \varepsilon_{i,t}$$

at the insurer-year-quarter level, where $C_{i,t}$ is a vector of control variables and fixed effects. In columns (1)-(2), the dependent variable is the quarterly relative change in insurer i's total assets, $\frac{\Delta \text{Total assets}_{i,t}}{\text{Total assets}_{i,t-1}}$. In columns (3), the dependent variable is the quarterly change in insurer i's invested assets (including cash) scaled by lagged total assets, $\frac{\Delta \text{Invested assets}_{i,t}}{\text{Total assets}_{i,t-1}}$. In columns (4)-(6), the dependent variable is the par value of insurer i's corporate bond purchases scaled by lagged total assets, $\frac{\text{Bond purchases}_{i,t}}{\text{Total assets}_{i,t-1}}$. The main explanatory variable is the quarterly change in insurer i's noncommercial insurance premiums scaled by lagged total assets. Columns (2)-(3) and (5)-(6) distinguish between increases and decreases in premiums, defined as $\Delta\text{Premiums}^{>0} = \max\{\Delta\text{Premiums}, 0\}$ and $\Delta\text{Premiums}^{<0} = \min\{\Delta\text{Premiums}, 0\}$. Insurance supply controls are an insurer's investment yield, P&C and life insurance profitability, life insurance fee income, rating dummies, and lagged return on equity. Seasonality dummies indicate calendar quarters and are interacted with insurer dummies. t-Statistics are shown in brackets and based on standard errors clustered at the insurer level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	$\frac{\Delta \text{Total assets}}{\text{Total assets}_{t-1}}$		$\frac{\Delta \text{Invested assets}}{\text{Total assets}_{t-1}}$	$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$		
$\frac{\Delta \text{Premiums}}{\text{Total assets}_{t-1}}$	0.439***			0.018***		
	[18.08]			[4.35]		
$\frac{\Delta \text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$		0.697***	0.314***		0.034***	0.060***
		[19.20]	[10.45]		[3.54]	[3.89]
$\frac{\Delta \text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$		0.074**	-0.043		-0.006	0.003
		[2.17]	[-1.47]		[-0.53]	[0.21]
Insurance supply controls						Y
Insurer FE	Y	Y	Y	Y	Y	
Insurer type-Time FE	Y	Y	Y	Y	Y	Y
Insurer-Seasonality FE						Y
No. of obs.	48,287	48,287	48,287	48,287	48,287	48,287
No. of insurers	1,484	1,484	1,484	1,484	1,484	1,484
R^2	0.178	0.188	0.130	0.286	0.287	0.351
Standardized coefficients						
$\frac{\Delta \text{Premiums}}{\text{Total assets}_{t-1}}$	0.25			0.03		
$\frac{\Delta \text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$		0.30	0.17		0.04	0.06
p-value for H0: same coefficient on $\frac{\Delta \text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$ and $\frac{\Delta \text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$		0.00	0.00		0.03	0.04

Table 3. Persistence of insurers' portfolio allocation.
Each column presents OLS estimates from a specification of the form:

$$Y_{i,f,t} = \alpha\ \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) + \Gamma' C_{i,f,t} + \varepsilon_{i,f,t}$$

at the insurer-by-firm-by-year-quarter level, where $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ equals one if insurer i ever held bonds issued by firm f in the previous 1 to 8 quarters and zero otherwise, and $C_{i,t}$ is a vector of fixed effect dummies. Columns (1)-(2) present estimates for the effect of insurers' investment universe on the current allocation of bond purchases. Columns (3)-(5) present estimates for the effect of insurers' investment universe and increases in insurance premiums per \$100 of insurers' lagged total assets on the volume of bond purchases per \$1 million of insurers' lagged total assets. The table also reports the relative effect of $\mathbb{I}(\text{Investor})$, which is computed as the estimated coefficient α scaled by either $P(1\{\text{Purchase}\}|\mathbb{I}(\text{Investor}) = 0)$, in columns (1) and (2), or by $\mathbb{E}[\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}|\mathbb{I}(\text{Investor}) = 0]$, in columns (3) to (5). t-Statistics are shown in brackets and based on standard errors clustered at the insurer and firm levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	$1\{\text{Purchase}\}$			$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$	
$\mathbb{I}(\text{Investor})$	0.028***	0.028***	10.070***	10.231***	9.852***
	[17.96]	[18.02]	[10.01]	[10.17]	[10.55]
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$			0.003		
			[0.07]		
$\mathbb{I}(\text{Investor}) \times \frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$			2.179***	2.203***	2.313***
			[4.14]	[4.13]	[4.41]
Insurer FE			Y		
Insurer-Time FE	Y	Y		Y	Y
Firm FE	Y		Y	Y	
Firm-Time FE		Y			Y
No. of obs.	21,333,622	21,333,622	21,333,622	21,333,622	21,333,622
No. of firms	822	822	822	822	822
No. of insurers	1,479	1,479	1,479	1,479	1,479
R^2	0.041	0.058	0.006	0.010	0.018
$P(\text{Purchase}\|\mathbb{I}(\text{Investor}) = 0) = 0.0021$					
Relative impact of $\mathbb{I}(\text{Investor})$	13.40	13.43	2.50	2.41	

Table 4. Secondary market prices and insurers' bond demand.
Each column presents estimated coefficients from a specification of the form:

$$\text{Bond return}_{b,t} = \alpha \frac{\text{Bond purchases}_{f(b),t}}{\text{Bond debt}_{f(b),t-1}} + \Gamma' C_{b,t} + \varepsilon_{b,t}$$

at the bond-year-quarter level, where f is the issuer of bond b. The dependent variable is the relative difference in the end-of-quarter price and accrued interest between quarters $t-1$ and t (in %). The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by f's lagged bond debt. It is instrumented by firms' exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, as defined in Equation (3). $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of firm f's bonds held by insurers (%Held by insurers$_{f,t-1}$) in each column. Bond controls are the log time to maturity, maturity bucket dummy $\times$ Δtreasury rate$\times$investment grade dummy, maturity bucket dummy $\times$treasury rate$\times$ investment grade dummy, share of dealer purchases, log total transaction volume, and the interaction between the last two variables. Maturity dummies are for the remaining time to maturity in bins (0,5], (5,10], (10,15], (15,∞). Rating dummies are for AAA-AA, A, BBB, BB, B, and CCC ratings. ΔRating dummies are for the quarterly change in rating notches. Unrated firms are excluded. Industry dummies are at the 2-digit SIC level. The definition of other control variables and fixed effects is as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the bond and firm-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			Bond return		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	46.594***	49.199***	43.484***	44.291***	36.429***
	[2.67]	[2.69]	[2.62]	[2.92]	[2.89]
Bond controls	Y	Y	Y	Y	Y
Insurer controls		Y	Y	Y	Y
Firm controls			Y	Y	Y
Bond FE	Y	Y	Y	Y	Y
Maturity-Time FE	Y	Y	Y	Y	Y
Rating-Time FE	Y	Y	Y	Y	Y
ΔRating-Time FE	Y	Y	Y	Y	Y
Industry-Time FE				Y	Y
Region-Time FE					Y
First stage					
$\Delta\text{INVPremiums}^{>0}$	0.026***	0.026***	0.027***	0.028***	0.032***
	[3.6]	[3.6]	[3.7]	[4.3]	[4.6]
F Statistic	149.4	143.6	151.6	167.7	204.1
No. of obs.	29,244	29,244	29,244	29,244	29,244
No. of bonds	2,524	2,524	2,524	2,524	2,524
No. of firms	333	333	333	333	333
Effect of 1sd change in $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$ (in %)					
	1.04	1.10	0.97	0.99	0.82

Table 5. Primary market prices and insurers' bond demand.
Each column presents estimated coefficients from a specification of the form:

$$\text{Yield spread}_{f,t} = \alpha\ X_{f,t} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The sample includes all firm-year-quarter observations with issuance activity and positive bond purchases by insurance companies. The dependent variable is the average offering yield spread (in %) of firm f at time t defined by the difference between the offering yield and the nearest-maturity treasury bond (using the weighted average by offering amount in case of multiple issues within the same firm-quarter). The main explanatory variable in columns (1)-(6) is the logarithm of insurers' purchases of firm f's bonds, $\log(\text{Bond purchases}_{f,t})$. The main explanatory variable in column (7) is the logarithm of one plus insurers' secondary market purchases of firm f's bonds, $\log(1 + \text{Sec purchases}_{f,t})$. $\log \text{Bond purchases}_{f,t}$ and $\log(1 + \text{Sec purchases}_{f,t})$ are instrumented by firms' log-transformed exposure to increases in potential investors' premiums, $\widetilde{\Delta\text{INVPremiums}}^{>0} = \log(1 + \Delta\text{INVPremiums}^{>0} \times \text{Bond debt}_{f,t-1})$. $C_{f,t}$ is a vector of control variables and fixed effects, which includes the lagged share of firm f's bonds held by insurers ($\%\text{Held by insurers}_{f,t-1}$) in each column. Issue controls are the logarithm of the time to maturity and rating (on a scale from 1 to 7). Insurer controls are the average potential investor's P&C and life insurance profitability, life insurance fee income, and lagged size and return on equity. Maturity and rating dummies are defined as in Table 4. Unrated firms are excluded. The definitions of other control variables and fixed effects is as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Yield spread						
log(Bond purchases)	-0.351***	-0.443***	-0.454***	-0.502**	-0.377**	-0.521*	
	[-2.76]	[-3.27]	[-2.70]	[-2.52]	[-2.39]	[-1.93]	
$\log(1 + \text{Sec purchases})$							-0.173**
							[-2.57]
$\log(1 + \text{Prim purchases})$							-0.009
							[-0.35]
Issue controls	Y	Y	Y	Y	Y	Y	Y
Firm controls		Y	Y	Y	Y	Y	Y
Insurer controls				Y		Y	
Maturity-Time FE	Y	Y	Y	Y	Y	Y	Y
Region-Time FE			Y	Y		Y	
Industry FE			Y	Y		Y	
Rating-Time FE					Y	Y	
First stage							
$\widetilde{\Delta\text{INVPremiums}}$	0.134***	0.129***	0.120***	0.100***	0.109***	0.078***	0.281***
	[6.7]	[6.4]	[5.4]	[4.7]	[5.2]	[3.3]	[6]
F Statistic	43.9	40.1	27.3	19.7	26.1	10.8	34.6
No. of obs.	941	941	941	941	941	941	941
No. of firms	366	366	366	366	366	366	366
Effect of 1sd change in (in %)							
log(Bond purchases)	-0.57	-0.71	-0.73	-0.81	-0.61	-0.84	
$\log(1 + \text{Sec purchases})$							-0.53

Table 6. Bond financing and insurers' bond demand.

Each column presents estimated coefficients from a specification of the form:

$$\frac{\Delta \text{Bond debt}_{f,t}}{\text{Bond debt}_{f,t-1}} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The dependent variable is the relative quarterly change in firm f's bond debt. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, following Equation (3). $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of the firm's bonds held by insurers ($\%\text{Held by insurers}_{f,t-1}$) in each column. Firm controls are sales, cash flow, age, and lagged market-to-book, leverage, cash and cash growth. Insurer controls are the share of life insurers among potential investors, the average potential investor's P&C and life insurance profitability, life insurance fee income, investment yield, lagged return on equity, and lagged size; and the log lagged number of investors. Additional controls are a firm's earnings volatility, z-score, stock return, Hadlock and Pierce (2010)'s SA index deferred taxes, an indicator for whether the firm paid dividends in the past 4 quarters, the firm's lagged size, asset growth, PPE; the average potential investor's rating, portfolio size, lagged underwriting profitability, lagged investment yield, lagged P&C and life insurance profitability, and lagged life insurance fee income; and the lagged log number of insurers holding the firm's bonds. Seasonality dummies indicate calendar quarters and are interacted with firm dummies. Industry dummies are at the 2-digit SIC level. Insurer location is based on insurance premiums written by U.S. region, and insurer type is based on insurance premiums written by line of business. Insurer economy dummies are for employment in a firm's industry and for consumption per capita at insurance customers' locations. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			$\frac{\Delta \text{Bond debt}}{\text{Bond debt}_{t-1}}$		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	5.834***	5.894***	6.343***	6.362***	6.552***
	[3.41]	[4.42]	[4.39]	[4.60]	[3.75]
Insurer controls		Y	Y	Y	Y
Firm controls			Y	Y	Y
Additional controls					Y
Region-Time FE	Y	Y	Y	Y	
Firm-Seasonality FE		Y	Y	Y	Y
Industry-Time FE			Y	Y	Y
Insurer type-Time FE				Y	Y
Insurer location-Time FE				Y	Y
Insurer economy-Time FE					Y
State-Time FE					Y
First stage					
$\Delta\text{INVPremiums}^{>0}$	0.021***	0.029***	0.028***	0.030***	0.024***
	[5.5]	[7]	[6.4]	[6.8]	[5.5]
F Statistic	73.8	139.9	117.8	122.4	72.9
No. of obs.	15,466	15,466	15,466	15,466	15,466
No. of firms	829	829	829	829	829
Effect of 1sd change in $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$ (in %)					
	0.15	0.15	0.16	0.17	0.17

Table 7. Bond financing and insurers' bond demand: within-firm estimates.
Each column presents estimated coefficients from a specification of the form:

$$\frac{\Delta\text{Debt}_{d,f,t}}{\text{Bond debt}_{f,t-1}} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} \times \mathbb{I}(\text{Bond}_d) + u_{f,t} + v_{f,d} + w_{d,t} + \varepsilon_{d,f,t}$$

at the debt type-firm-year-quarter level. Debt types are corporate bonds and commercial paper. The dependent variable is firm f's quarterly change in (bond or commercial paper) debt relative to lagged bond debt. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt and interacted with bonds as debt type. It is instrumented by firms' exposure to increases in potential investors' premiums interacted with the bond debt dummy, $\Delta\text{INVPremiums}^{>0} \times \mathbb{I}(\text{Bond}_d)$, as defined in Equation (3). The sample in columns (1) and (2) includes firms with positive commercial paper debt in at least one quarter between 2010q1 and 2018q4, and that in column (3) only firms with with positive commercial paper debt in at least 50% of quarters between 2010q1 and 2018q4. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)
Dependent variable:	$\frac{\Delta\text{Debt}}{\text{Bond debt}_{t-1}}$		
Sample:	CP-reliant		Very CP-reliant
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times 1\{\text{Bond}\}$	6.509***	7.129***	7.052***
	[4.36]	[3.78]	[3.83]
Firm-Time FE		Y	Y
Firm-Debt type FE	Y	Y	Y
Debt Time-Time FE	Y	Y	Y
First stage			
$\Delta\text{INVPremiums}^{>0} \times \mathbb{I}(\text{Bonds})$	0.050***	0.050***	0.062***
	[4.6]	[4]	[4]
F Statistic	66.3	66.3	69.6
No. of obs.	4,628	4,628	3,340
No. of firms	151	151	109

Table 8. Bond financing and insurers' bond demand: Cross-sectional heterogeneity.
Each column reports the coefficient from a regression of firms' relative quarterly change in bond debt on insurers' corporate bond purchases scaled by lagged bond debt, where the latter is instrumented by $\Delta \text{INVPremiums}^{>0}$. The coefficient varies with the segment of the cross-section of firms, which is split into quartiles by (column 1) Hadlock and Pierce (2010)'s SA index for financial constraints, (column 2) lagged size (total assets), (column 3) lagged cash flow scaled by total assets, and (column 4) by credit rating (with segments representing either a AAA-A, BBB, or high yield (HY) rating). A larger SA index indicates tighter financial constraints. Controls are as in column (4) of Table 6 and additionally include time dummies interacted with quartile (or rating) dummies. *t*-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
	Coefficient on $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$			
Cross-section by	SA index	Size	Cash flow	Rating
Quart1 / High-yield	6.770***	4.954	6.229*	9.005***
	[2.86]	[0.39]	[1.79]	[2.83]
Quart2 / BBB rated	3.171	2.444	6.047**	3.487**
	[0.86]	[0.86]	[2.08]	[2.58]
Quart3 / AAA-A rated	6.783***	6.505***	9.064***	11.819**
	[2.78]	[3.72]	[2.74]	[2.47]
Quart4	6.667**	7.639***	4.975**	
	[2.40]	[6.02]	[2.41]	
p-value for H0: same coefficient on				
Quart1 / HY & Quart2 / BBB	0.350	0.840	0.970	0.110
Quart1 / HY & Quart3 / AAA-A	1.000	0.900	0.560	0.600
Quart1 & Quart4	0.980	0.830	0.750	.
Quart2 & Quart4	0.430	0.090	0.750	

Table 9. Bond financing and insurers' bond demand: The underwriter channel.
Each column presents estimated coefficients from a specification of the form:

$$\frac{\Delta\text{Bond debt}_{f,t}}{\text{Bond debt}_{f,t-1}} = \alpha\frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} \times \text{UW}_{f,t} + \beta\frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \gamma_t\text{UW}_{f,t} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The regressions estimate whether the connectedness between a firm's underwriters and potential investors affects the sensitivity of firms' bond issuance to insurers' bond purchases. Bond purchases are instrumented by firms' exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, following Equation (3). $\text{UW}_{f,t}$ is a dummy variable that equals one if firm f's underwriters are well connected with potential investors and zero otherwise. UW:Quint x is a dummy variable that equals one if the connectedness between firm f's underwriters and potential investors is in the x-th quintile and zero otherwise. Dispersed INV is a dummy variable that equals one if the Herfindahl-Hirschman index of insurers' lagged holdings of a firm's bonds is in the lower tercentile of the cross-sectional distribution, and zero otherwise. Many INV is a dummy variable that equals one if a firm's number of potential investors is in the upper tercile of the cross-sectional distribution and zero otherwise. The definitions of other variables and fixed effects are as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:			$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$			
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	2.024	2.510	2.492		6.787***	7.432***
	[0.95]	[1.16]	[1.01]		[3.14]	[2.93]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW	5.147**	4.722*	5.021*		-0.017	-0.468
	[2.10]	[1.82]	[1.83]		[-0.01]	[-0.16]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW:Quint1				2.813		
				[1.12]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW:Quint2				7.604***		
				[3.75]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW:Quint3				9.277**		
				[2.53]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW:Quint4				6.335***		
				[2.59]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW:Quint5				9.218**		
				[2.24]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW $\times$ Dispersed INV					13.463***	
					[3.16]	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW $\times$ Many INV						13.672***
						[3.46]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ Dispersed INV					-11.260***	
					[-3.51]	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ Many INV						-9.917***
						[-3.41]
Firm controls		Y			Y	Y
Insurer controls		Y			Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y
UW-Time FE	Y	Y	Y			
Industry-Time FE			Y	Y	Y	Y
Region-Time FE			Y	Y	Y	Y
UW quintile-Time FE				Y		
UW-Dispersed INV-Time FE					Y	
UW-Many INV-Time FE						Y
First stage						
$\Delta\text{INVPremiums}^{>0}$	0.057***	0.061***	0.064***	0.082***	0.063***	0.054**
	[3]	[3.2]	[3]	[3.8]	[2.6]	[2.3]
F Statistic	53.9	54.3	35.3	7.7	16.9	17.5
No. of obs.	4,717	4,717	4,717	4,717	4,717	4,717
No. of firms	465	465	465	465	465	465

Table 10. Corporate investment and insurers' bond demand.
Each column presents estimated coefficients from a specification of the form:

$$Y_{f,t} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, as defined in Equation (3). $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of the firm's bonds held by insurers ($\%\text{Held by insurers}_{f,t-1}$) in each column. In column (1), the dependent variable is the quarterly change in the firm's total assets scaled by its lagged bond debt. In columns (2) and (3), the dependent variable is the quarterly change in the firm's property, plant and equipment (PPE) scaled by its lagged bond debt. In columns (4) and (5), the dependent variable is the firm's total investment (defined as the sum of acquisitions and capital expenditures) scaled by its lagged bond debt. In column (6), the dependent variable is the firm's acquisition expenditures scaled by its lagged bond debt. In column (7), the dependent variable is the firm's capital expenditures scaled by its lagged bond debt. *Constr* is an indicator variable for firms in the upper tercile of the cross-sectional distribution of the lagged SA index. Control variables and fixed effects are defined as in Table 6. *t*-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	$\frac{\Delta\text{Total assets}}{\text{Bond debt}_{t-1}}$	$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$		$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$	$\frac{\text{AcqEx}}{\text{Bond debt}_{t-1}}$		$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	6.558***	2.088***	1.532***	5.961***	3.639***	2.627**	1.137***
	[2.82]	[3.72]	[2.61]	[4.42]	[3.46]	[2.42]	[2.91]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$Constr			2.404*			4.474*	
			[1.78]			[1.78]	
Constr			-0.041**			-0.058**	
			[-2.23]			[-2.15]	
Firm controls	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y
Insurer location-Time FE	Y	Y	Y	Y	Y	Y	Y
Insurer economy-Time FE	Y	Y	Y	Y	Y	Y	Y
First stage							
$\Delta\text{INVPremiums}^{>0}$	0.029***	0.029***	0.031***	0.029***	0.029***	0.031***	0.029***
	[6.7]	[6.7]	[6]	[6.7]	[6.7]	[6]	[6.7]
F Statistic	113.9	113.9	47.9	113.9	113.9	47.9	113.9
No. of obs.	15,466	15,466	15,466	15,466	15,466	15,466	15,466
No. of firms	829	829	829	829	829	829	829
Standardized coefficient							
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.38	0.44	0.32	0.66	0.56	0.40	0.26

A Data and sample construction

Table IA.11. Variable definitions and data sources.

Note: *NAIC* refers to data from statutory filings to the National Association of Insurance Commissioners, which are retrieved from S&P Global Market Intelligence.

Variable	**Definition**
Insurer level	
Bonds held	Par value of corporate bonds (*Source: NAIC*)
Bond purchases	Par value of corporate bond purchases (*Source: NAIC*)
Premiums	Direct insurance premiums written (*Source: NAIC*)
ΔTotal assets/Total assets$_{t-1}$	Quarterly change in the book value of total assets scaled by lagged total assets (*Source: NAIC*)
ΔInvested assets/Total assets$_{t-1}$	Quarterly change in the book value of total invested assets (including cash) scaled by lagged total assets (*Source: NAIC*)
Size	Natural logarithm of total assets (*Source: NAIC*)
Return on equity	Annualized income after taxes as a percent of insurer's capital and surplus (*Source: NAIC*)
Investment yield	Annualized investment return based on invested assets (*Source: NAIC*)
P&C insurance profitability	Ratio of the difference between net premiums earned and losses and loss adjustment costs to total liabilities (*Source: NAIC*)
Life insurance profitability	Ratio of net income to direct insurance premiums written (*Source: NAIC*)
Life insurance fee income	Ratio of income from fees associated with investment management, administration, and contract guarantees from separate accounts to direct insurance premiums written (*Source: NAIC*)
# Firms held	Number of issuers (identified by 6-digit CUSIP) in an insurer's corporate bond portfolio (*Source: NAIC*)
Rating	Insurer's financial strength rating, numeric from 1 to 15 (*Source: AM Best*)
Insurer-by-firm level	
$\mathbb{I}$(Investor)	Indicator variable for whether in the previous 8 quarters the insurer has ever held bonds issued by the firm (*Source: NAIC*)
$\mathbb{I}$(Purchase)	Indicator variable for whether in the current quarter the insurer has purchased bonds that have been issued by the firm (*Source: NAIC*)
Bond purchases	Par value of corporate bonds purchased by the insurer that have been issued by the firm (*Source: NAIC*)
Firm level	
ΔBond debt/Bond debt$_{t-1}$	Quarterly change in bond debt (the sum of senior and subordinated bonds) scaled by lagged bond debt (*Source: Capital IQ*)
ΔBond debt/Bond debt$_{t-1}$	Quarterly change in bond debt (the sum of senior and subordinated bonds) scaled by lagged bond debt (*Source: Capital IQ*)
%Held by insurers$_{f,t-1}$	Ratio of the lagged total par value of bonds held by insurers relative to the firm's lagged bond debt (*Sources: Capital IQ, NAIC*)
Bond purchases/Bond debt$_{t-1}$	Ratio of the total par value of bonds purchased by insurers relative to lagged bond debt (*Sources: Capital IQ, NAIC*)
ΔINVPremiums$^{>0}$	Maximum of zero and ΔINVPremiums defined in Equation (3) (*Sources: Capital IQ, NAIC*)

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Table IA.11 – *Continued from previous page*

Variable	Definition
ΔTotal assets/Bond debt$_{t-1}$	Quarterly change in the book value of total assets scaled by lagged bond debt (*Sources: Capital IQ, Compustat*)
ΔPPE/Bond debt$_{t-1}$	Quarterly change in net property, plant and equipment scaled by lagged bond debt (*Sources: Capital IQ, Compustat*)
Total investment/Bond debt$_{t-1}$	Quarterly change in total investment (the sum of acquisitions and capital expenditures) scaled by lagged bond debt (*Sources: Capital IQ, Compustat*)
AcqEx/Bond debt$_{t-1}$	Cash outflow used for acquisitions scaled by lagged bond debt (*Sources: Capital IQ, Compustat*)
CapEx/Bond debt$_{t-1}$	Capital expenditures scaled by lagged bond debt (*Sources: Capital IQ, Compustat*)
Asset growth	Quarterly change in total assets scaled by lagged total assets (*Source: Compustat*)
Sales	Sales scaled by lagged total assets (*Source: Compustat*)
Cash flow	Sales net of the cost of goods sold and selling, general, and administrative expenses scaled by lagged total assets (*Source: Compustat*)
Cash	Cash and short-term investments scaled by total assets (*Source: Compustat*)
Market-to-book	Ratio of the book value of assets less the book value of equity plus the market value of equity to the book value of assets (*Source: Compustat*)
Age	Number of years that the firm has been in Compustat (*Source: Compustat*)
Leverage	Ratio of book value of total assets to book equity (*Source: Compustat*)
Earnings volatility	Standard deviation of the trailing 12 quarters of the ratio of cash flow to lagged total assets (*Source: Compustat*)
Z-score	Modified Altman's z-score, defined by Graham and Leary (2011) as $(3.3 \times \text{operating income} + \text{sales} + 1.4 \times \text{retained earnings} + 1.2 \times (\text{current assets} - \text{current liabilities}))/\text{book assets}$ (*Source: Compustat*)
SA index	Hadlock and Pierce (2010)'s index for financial constraints, defined as $-0.737 \min\{4.5 \times 10^3, size\} + 0.043 \min\{4.5 \times 10^3, size\}^2 - 0.04 \min\{37, age\}$, where $size$ is the log of inflation-adjusted (to 2004) book assets and age the number of years that the firm has been in Compustat (*Sources: Compustat, FRED*)
Deferred taxes	Deferred income tax expense scaled by lagged total assets (*Source: Compustat*)
Size	Natural logarithm of total assets (*Source: Compustat*)
Dividend indicator	Indicator variable that equals one if the firm ever paid positive dividends in the past four quarters (*Source: Compustat*)
Stock return	Stock return in the past year lagged by one month (*Source: CRSP*)
Rating	Current end-of-quarter rating for categories AAA-AA, A, BBB, BB, B, CCC, CC-D, and unrated. The minimum rating is used if two ratings are available and the middle rating is used if three ratings are available (*Source: Mergent FISD*)

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Table IA.11 – *Continued from previous page*

Variable	Definition
Region	U.S. region: Northeast (CT, ME, MA, NH, RI, VT) or Mid-Atlantic (DE, DC, MD, NJ, NY, PA), or Southeast (AL, AR, FL, GA, PR, VI) or Southeast (MS, NC, SC, TN, VA, WV) or Midwest (IA, IN, IL, KS, KY, MI MN, MO, ND, NE, OH, SD, WI) or Southwest (CO, LA, NM, OK, TX, UT) or West (AZ, AK, CA, HI, ID MT, NV, OR, WA, WY, AS)
Industry	Industry categories based on 2-digit SIC if not stated otherwise
Insurer type	Type of potential investors. First, I calculate for each firm the share of premiums written in accident & health life, deposit type, annuity, pure life, accident & health P&C, home- & farmowners, and private auto insurance by the average potential investor. Second, I compute the first three principal components of these variables and indicator variables for the upper half of the cross-sectional distribution of the principal components. Finally, insurer type fixed effects are based on all possible combinations of these indicator variables (*Source: NAIC*)
Insurer location	Location of potential investors. First, I calculate for each firm a variable for each U.S. region that reflects the share of premiums written by potential investors in this region. Then, I compute the first three principal components of these variables and follow the above methodology to construct insurer location fixed effects (*Source: NAIC*)
Consumption	Consumption per capita and consumption type at potential investors' location. I start with the total consumption by function (e.g., food and beverages, housing, health) and population in the past year at the state level. For each firm, I compute a variable for each consumption function that reflects the average consumption per capita weighted by total insurance premiums written by potential investors in the respective states. Then, I compute the first three principal components of consumption variables and follow the above methodology to construct consumption fixed effects (*Sources: BEA Table SAEXP1, Census, NAIC*)
Employment	Employment per capita in the firm's industry at potential investors' location. I start with the number of employees by industry and population estimate in the past year at the state level. For each firm, I compute the average employment per capita in the firm's industry weighted by total insurance premiums written by potential investors in the respective states. Employment fixed effects are based on the cross-sectional quintiles of this variable (*Sources: BEA Table CAEMP25N, Census, NAIC*)
Social connectedness	Average social connectedness index from Bailey et al. (2018) between the firm's and its potential investors' locations (at the state level) weighted by potential investors' total insurance premiums written in the respective states. Social connectedness fixed effects are based on the cross-sectional quartiles of this variable (*Sources: `https://dataforgood.fb.com/`, NAIC*)
Issuance level: primary market	
Yield spread	Average difference between offering yield and the contemporaneous yield on its nearest-maturity treasury bond across all bond issues for the same firm-year-quarter weighted by offering amount (*Source: Mergent FISD*)

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Table IA.11 – *Continued from previous page*

Variable	**Definition**
Offering amount	Total offering amount at the firm-by-year-quarter level (*Source: Mergent FISD*)
Rating FE	Current end-of-quarter rating with categories AAA-AA, A, BBB, BB, B, CCC, and CC-D. The minimum rating is used if two ratings are available and the middle rating is used if three ratings are available (*Source: Mergent FISD*)
Rating	Current end-of-quarter rating on scale from 1 (AAA) to 7 (CC-D) (*Source: Mergent FISD*)
Maturity FE	Based on dummies for the time to maturity at issuance according to the following bins: (0,5], (5,10], (10,15], (15,∞) (*Source: Mergent FISD*)
Bond level: secondary market	
Bond return	Relative change in end-of-quarter prices and accrued interest plus coupon payments, (ΔPrice$_t$ + ΔAccrued Interest$_t$ + Coupon payments$_t$)/(Price$_{t-1}$ + Accrued Interest$_{t-1}$) (*Source: TRACE*)
Transaction volume	Total par value of bond transactions in the current quarter (*Source: TRACE*)
Rating FE	Current end-of-quarter rating with categories AAA-AA, A, BBB, BB, B, CCC, and CC-D. The minimum rating is used if two ratings are available and the middle rating is used if three ratings are available (*Source: Mergent FISD*)
ΔRating FE	Change in rating (in notches) between current and previous quarter (*Source: Mergent FISD*)
Maturity FE	Based on dummies for the remaining time to maturity at the transaction date according to the following bins: (0,5], (5,10], (10,15], (15,∞). (*Source: TRACE, Mergent FISD*)

A.1 Insurance premiums

Schedule T of U.S. insurers' statutory filings reports the total amount of direct premiums written (excluding reinsurance ceded or assumed) for each U.S. insurer and quarter separately for each U.S. state and territory and Canada. To detect reporting errors, I compare total premiums at the insurer level (across locations) from Schedule T with the total premiums reported in the overview schedule of the same filing. I exclude insurer-quarter observations if the discrepancy between Schedule T and the overview schedule is larger than \$50 thousand and 50% of the average of the two reported total premiums. To cross-check the reliability of my sample of insurance premiums, I compare industry-wide premiums and their geographical distribution with official reports from the NAIC.[46]

To exclude commercial insurance business, I use the share of direct premiums written for noncommercial insurance at the insurer-quarter level (which is not available at the insurer-

[46] The NAIC annually publishes aggregate balance sheets and cash flows of the U.S. insurance industry in the *Statistical Compilation of Annual Statement Information for Life/Health Insurance Companies* and *Statistical Compilation of Annual Statement Information for Property/Casualty Insurance Companies*.

state-quarter level). I define the share of noncommercial life insurance as the sum of direct premiums written covering individual life insurance (which provides financial benefits to a beneficiary upon the insured's death), individual annuities (which guarantee a stream of annuity payments), individual accident & health contracts, and deposit-type contracts (which do not expose the insurer to any mortality or morbidity risk) relative to all premiums.[47] These are reported on Exhibit 1 of life insurers' statutory filings. The measure excludes contracts that cover a group of individuals (e.g., the employees of a company or members of an organization), namely group life insurance, group annuities, and group accident & health insurance, and credit life insurance (for which a break-down into individual and group contracts is not available).

I follow S&P Global Market Intelligence' classification in defining the share of noncommercial P&C insurance as the sum of direct premiums written for farmowners' and homeowners' multiple peril insurance (which provides property and liability coverage for homes and farms) and private auto physical damage and liability insurance (which provides protection against damages and liability to injuries and damages arising from car accidents) relative to all premiums. These are reported on the underwriting and investment exhibit of P&C insurers' statutory filings. The measure excludes P&C contracts that are used by firms, e.g., product liability, fidelity, or workers' compensation insurance.

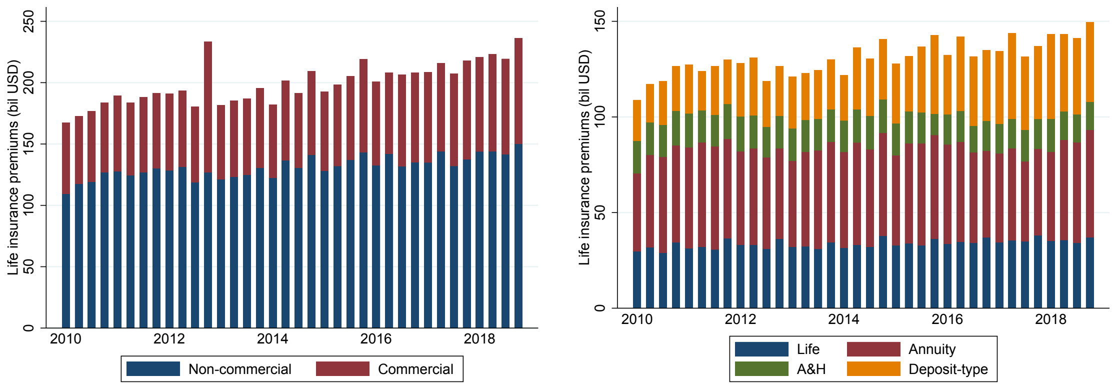
Figures IA.2 and IA.3 illustrate the aggregate dynamics of life and P&C insurance premiums by line of business. Following the above definition, noncommercial insurance is the dominating line of business for both types of insurers. The distribution of noncommercial premiums across more granular lines of business is very stable over time, suggesting that there are no disruptive shifts in insurance business. P&C premiums in particular display some seasonality within years, which I account for by including firm-calendar-quarter time fixed effects in the main regressions.

There is substantial geographic variation of insurance premiums in my sample, with the most premiums being written in California, New York, and Florida (see Figure IA.18).

Insurers that focus on commercial insurance business are excluded from the sample, which I define as insurers with less than \$50 thousand noncommercial direct premiums written or less than 10% of direct premiums written in noncommercial lines of business in the median quarter. For the remaining insurers, I winsorize premiums at the insurer-state-quarter-year level at 1%/99%. I measure the total noncommercial premiums written by insurer i at quarter t in locations other than firm f's location by treating all direct premiums written at

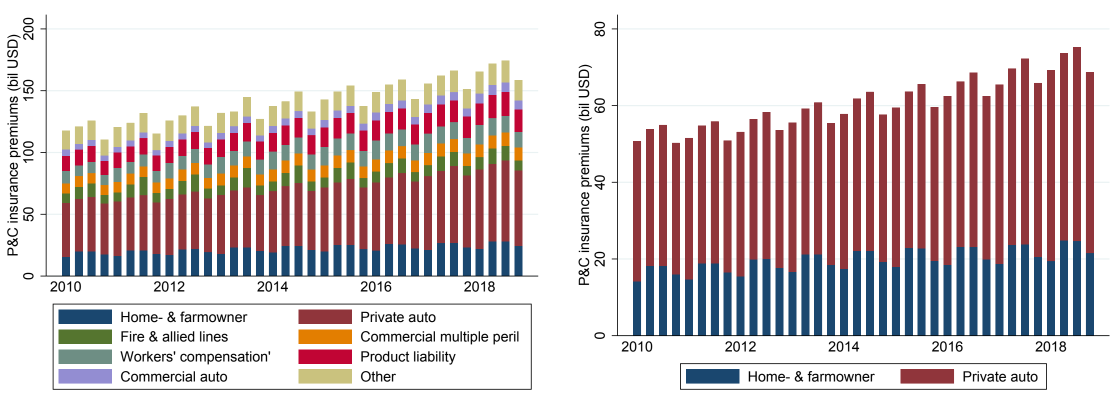
[47] Definitions of insurers' lines of business come from S&P Global Market Intelligence, `https://content.naic.org/consumer_glossary`, `https://www.acli.com/industry-facts/glossary`, and the NAIC Statutory Issue Paper No. 50.

Figure IA.2. Life insurance premiums.
Figure (a) depicts the total life insurance premiums written by the U.S. insurance industry by quarter and type. Noncommercial premiums are for individual life insurance, individual annuities, individual accident & health contracts, and deposit-type contracts. Commercial premiums are the residuals of the total premiums written. Figure (b) depicts the total noncommercial life insurance premiums written by insurers in the sample by quarter and line of business.



(a) All U.S. life insurers. (b) Insurers included in the sample.

Figure IA.3. P&C insurance premiums.
Figure (a) depicts the total P&C insurance premiums written by the U.S. insurance industry by quarter and type. Other lines of business include accident & health, financial and mortgage guarantees, medical professional liability, aircraft, fidelity, surety, and marine insurance. Figure (b) depicts the total noncommercial P&C insurance premiums written by insurers in the sample by quarter and line of business.



(a) All U.S. life insurers. (b) Insurers included in the sample.

the firm's location as noncommercial,

$$\text{Premiums}_{i,f,t} = \max\left\{\sum_s \text{noncommercial}_{i,t} \times \text{DPW}_{i,s,t} - \text{DPW}_{i,\text{location}(f),t},\ 0\right\}, \qquad \text{(IA.9)}$$

where $DPW_{i,s,t}$ are direct premiums written by insurer i in location s in quarter t and noncommercial$_{i,t}$ is the share of noncommercial premiums written (as defined above). By assuming that all premiums at the firm's location are noncommercial, the measure is a conservative estimate for the *actual* noncommercial premiums written in locations other than firm f's location (which is not observable since noncommercial$_{i,t}$ is available only at the insurer-time level).

A.2 Corporate bond holdings and transactions

I identify securities on insurers' Schedule D filings as corporate bonds if they are categorized as such by either insurers or Mergent FISD (matched by by 9-digit CUSIP).

To merge bonds with firm characteristcs, I begin with the link table provided by CapitalIQ, which matches security identifiers reported by insurers, CUSIP and ISIN, to the CapitalIQ firm-level identifier, companyid. I supplement the sample by matching (1) the leading six digits of the CUSIP (the issuer CUSIP) reported by insurers with the same identifier in Compustat and (2) the TRACE issuer ticker (merged to insurer holdings by 9-digit CUSIP) to the same identifier in Compustat, deriving the companyid using the CapitalIQ-Compustat link table. Additionally, I match bonds to Mergent FISD and copy missing companyids from observations with the same issuer or parent identifier in FISD within the same year. Finally, I copy missing companyids from observations with the same six-digit CUSIP within the same year. To ensure that bond issuers are correctly identified, I manually check that six-digit CUSIP, ticker, and Mergent FISD matches have the same company name reported by insurers and CapitalIQ. Finally, I merge the insurer-CapitalIQ-matched sample to Compustat using the CapitalIQ-Compustat link table.

Figure IA.4. Share of matched insurers' corporate bond holdings.

The figure depicts the cross-sectional distribution of the share of insurers' corporate bond holdings matched to Capital IQ and Compustat over time at the insurer-quarter level. The figure includes only insurers in the baseline sample.

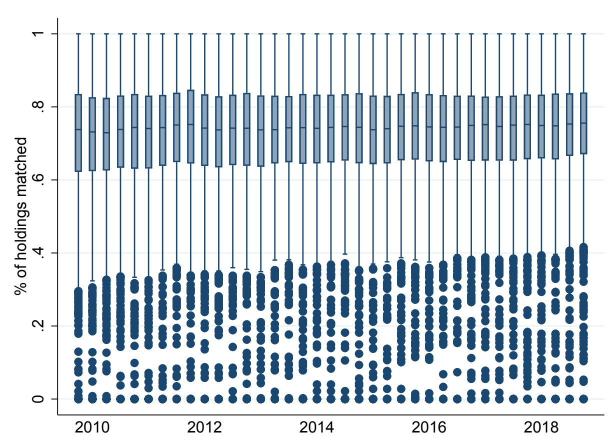


Table IA.12. Matching corporate bond investments to Capital IQ and Compustat.
The table depicts the number of observations for all insurer-security-quarter-level corporate bond holdings (and the total par value across insurers and quarters in parentheses) from Schedule D filings and the share matched to Capital IQ and Compustat. "Matched by: Capital IQ link" uses the Capital IQ link table. "Matching by: Ticker (TRACE & Compustat)" indicates observations first matched to TRACE by CUSIP, second to Compustat by using the ticker, and third to Capital IQ by using the Capital IQ-Compustat link table. "Matched by: 6-digit CUSIP (Compustat)" indicates observations first matched to Compustat by using the 6-digit CUSIP and second to Capital IQ by using the Capital IQ link table. "Copied from: same issuer ID (Mergent)" indicates observations whose Capital IQ identifier is copied from other observations with the same Mergent FISD issuer ID within the same year. "Copied from: same 6-digit CUSIP" indicates observations whose Capital IQ identifier is copied from other observations with the same 6-digit CUSIP within the same year.

Holdings: Capital IQ match	
Nr. of observations (par value)	16,125,582 ($ 68,108 bil)
% matched by: Capital IQ link	86.84% (79.74%)
% matched by: Ticker (TRACE & Compustat)	0.01% (0.02%)
% matched by: 6-digit CUSIP (Compustat)	1.13% (2.69%)
% copied from: same issuer ID (Mergent)	0.02% (0.02%)
% copied from: same 6-digit CUSIP	0.47% (1.04%)
% matched (par value)	88.48% (83.52%)
Total matched (par value)	14,267,989 ($ 56,883 bil)
Holdings: Compustat match	
% matched (par value)	66.25% (60.88%)
Total matched (par value)	10,682,974 ($ 41,466 bil)

A.3 Matching NAIC counterparties to Mergent FISD

I match the counterparties reported by insurers for corporate bond purchases to bond underwriters in FISD Mergent. First, I manually consolidate broker-dealers reported in FISD Mergent's "Agents" table to the group level using information on company structure from S&P Global Market Intelligence, `https://brokercheck.finra.org/`, and company resources. Second, because there is no common identifier for underwriters, I match the consolidated underwriters from FISD with counterparties reported by insurers using a combination of fuzzy string merging and manual matching. I manually ensure the quality of the final match by comparing underwriters' names in FISD and reported by insurers.

Table IA.13. Matching corporate bond purchases to Mergent FISD agents.
The table depicts the (share of the) number and total par value of corporate bond purchases whose counterparty is missing and whose counterparty is matched to Mergent FISD.

Purchases: Counterparty match	
% missing counterparty (par value)	18.6% (32.4%)
% matched (par value)	70.9% (61.3%)
Total matched (par value)	994,778 (USD 2,306 bil)

A.4 Classifying primary and secondary market bond purchases

I use three criteria to identify secondary market trades. (1) I match NAIC purchases to TRACE secondary market transactions at the CUSIP level. I flag purchases as secondary market trades if they are matched to a TRACE transaction reported for the same or previous day with a transaction volume and total price paid that differ by not more than $5,000, and with a price difference smaller than 5%. Additionally, (2) purchases made at least 3 days after a bond's offering date, and (3) purchases made after the offering date that involve the payment of accrued interest are also flagged as secondary market trades.

I use two criteria to identify primary market trades. (1) Purchases are flagged as as primary market trades if they are at the offering price, do not involve the payment of accrued interest, and occur within less than 3 days around the offering date.[48] (2) Additionally, purchases are flagged as primary market trades if they are at the offering price, do not involve the payment of accrued interest, occur within less than 3 days around the offering date, and the counterparty is one of the issue's underwriters. This measure likely overclassifies primary market trades since previous studies usually rely on trades only on the offering date (e.g., Nikolova et al., 2020).

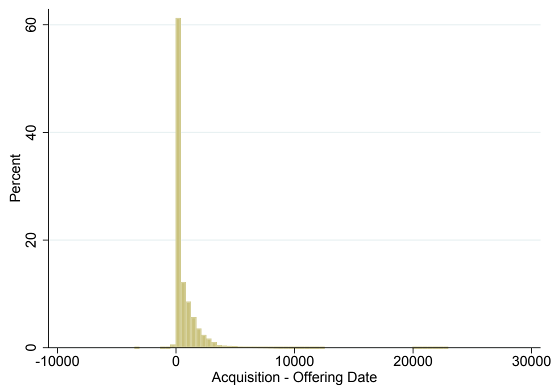
If the above methodology categorizes a bond purchase as both primary and secondary market trade, I flag it as unclassified. Several observations suggest that the classification strategy is reasonable:

- Less than 1% of all purchases fit into both the primary and secondary market category.
- Figures IA.5 (a) and (b) show that a large mass of purchases involve zero accrued interest and take place at the offering date. This supports the use of these indicators to identify primary market dates.
- Figure IA.5 (c) shows a large mass of purchases for small price differences between insurer purchases and TRACE transactions after matching to NAIC transaction for the same CUSIP on the same or previous day with the smallest price difference.

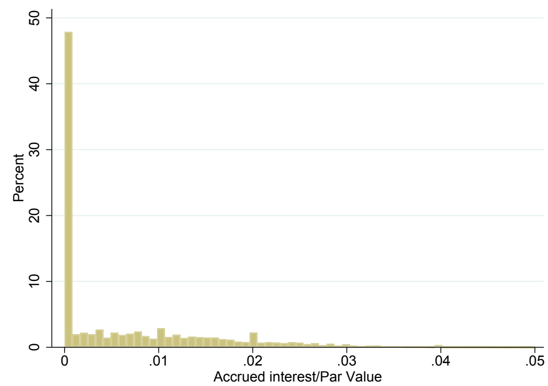
[48] The results are unaffected by using a larger time window to identify primary market trades.

Figure IA.5. Corporate bond purchases and issue characteristics.

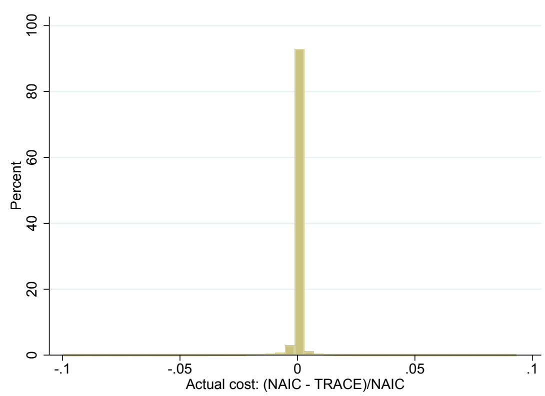
Figure (a) illustrates the distribution of the time (in days) between the offering and purchase dates at the transaction level. Figure (b) illustrates the distribution of accrued interest paid scaled by par value at the transaction level. Figure (c) illustrates the distribution of the relative difference between TRACE and NAIC cost of purchase for all NAIC acquisitions matched to the NAIC transaction for the same CUSIP on the same or previous day with the smallest price difference.



(a) Time lag between aquisition and offering date.



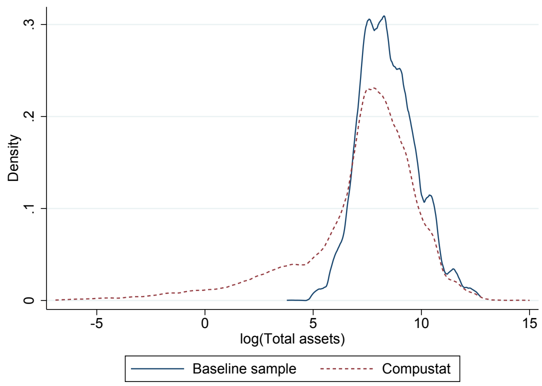
(b) Accrued interest.



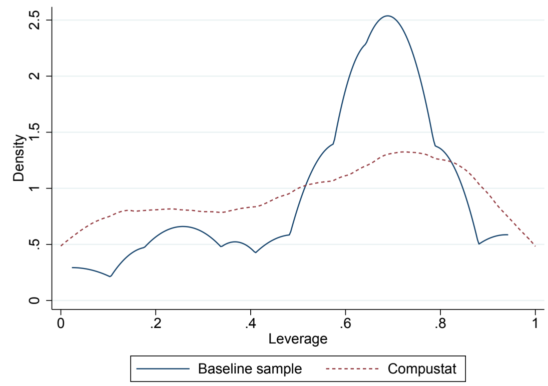
(c) Relative difference between TRACE and NAIC bond price.

A.5 Comparison with Compustat firms

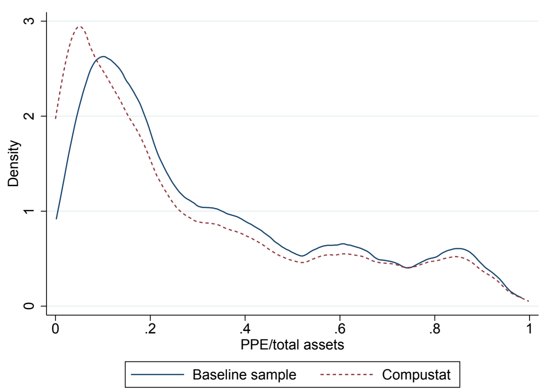
Figure IA.6. Comparison of firm characteristics between my sample and Compustat firms. The figures depict kernel densities for the cross-sectional distribution of average firm characteristics (from 2010q2 to 2018q4) for firms in my sample compared to all firms in Compustat.



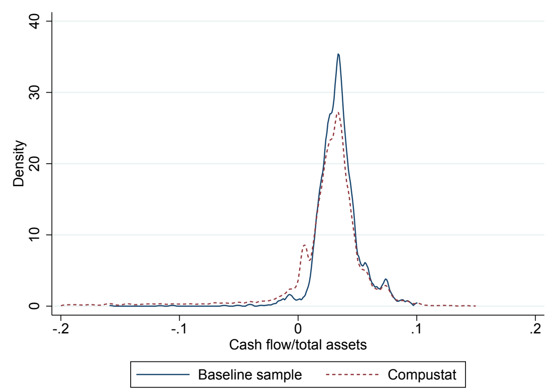
(a) Size.



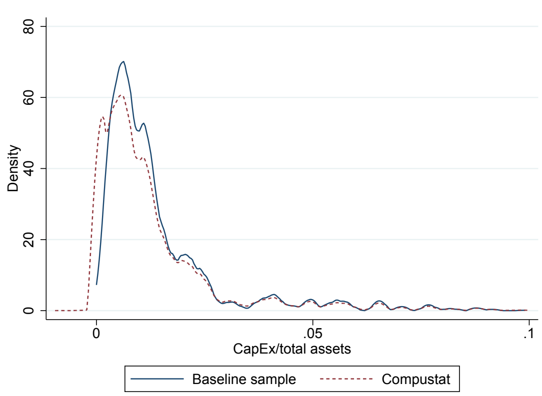
(b) Leverage.



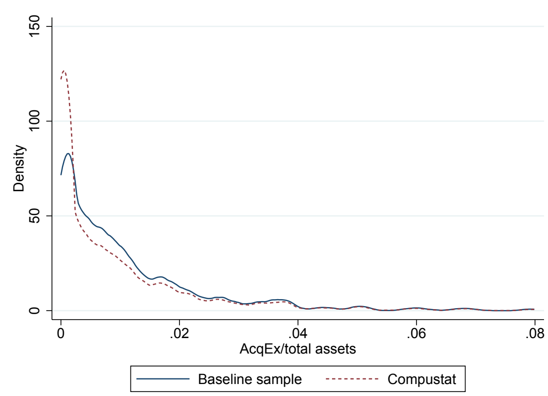
(c) PPE.



(d) Cash flow.



(e) CapEx.



(f) AcqEx.

B Instrument derivation and validity

B.1 Insurers' balance sheet and insurance premiums

Consider a stylized insurer that sells one-period insurance contracts to policyholders with unit mass in a competitive insurance market.[49] Insured losses L_t per contract are to be paid by the insurer to policyholders at t. The actuarially fair premium is $P_{t-1} = \mathbb{E}[L_t]$ to be paid by each policyholder to the insurer at $t-1$. Total asset dynamics satisfy

$$\Delta A_t = A_t - A_{t-1} = P_t - L_t + R_t, \tag{IA.10}$$

where R_t is the net cash flow from other business activities (including the investment return and shareholder payouts). Assuming that losses are independently distributed across policyholders, it is $L_t = \mathbb{E}[L_t] = P_{t-1}$, which implies that

$$\Delta A_t = P_t - P_{t-1} + R_t = \Delta P_t + R_t. \tag{IA.11}$$

Therefore, $\frac{\partial \Delta A_t}{\partial \Delta P_t} = 1 + \frac{\partial R_t}{\partial \Delta P_t}$, which implies that changes in premiums pass through to the insurer's assets if they are not offset by other activities (i.e., if $\frac{\partial R_t}{\partial \Delta P_t} = 0$). Consistent with this relationship, my empirical results show that premium increases pass through to insurers' total assets, while premium decreases are compensated by adjustments to insurers' funding sources which boost R_t.

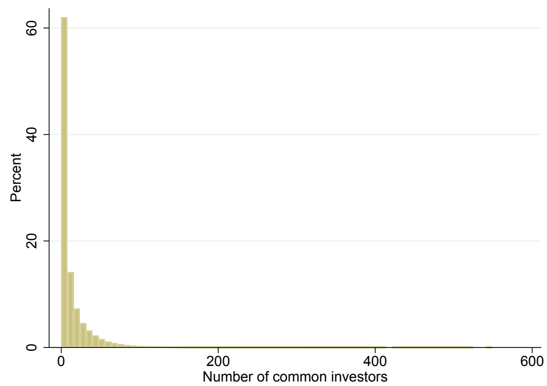
As an implication, the volume of insurance premiums is an important determinant for insurers' balance sheet size,

$$A_t = A_0 + \sum_{\tau=1}^{t} \Delta A_t = P_0 + R_0 + \sum_{\tau=1}^{t} (\Delta P_t + R_t) = P_t + \sum_{\tau=0}^{t} R_t. \tag{IA.12}$$

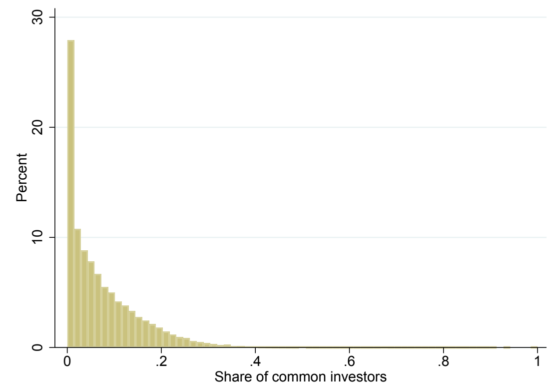
[49] The insights from this model are qualitatively unchanged when allowing for imperfect competition in the insurance market.

B.2 Investment universe

Figure IA.7. Fragmentation of bond ownership.
The figures show the pooled distribution of (a) a firm pair's number of common investors (i.e., insurers currently holding both firms' bonds) and (b) its share relative to a firm pair's total number of investors at the firm pair-by-year-by-quarter level from 2010q2 to 2018q4.

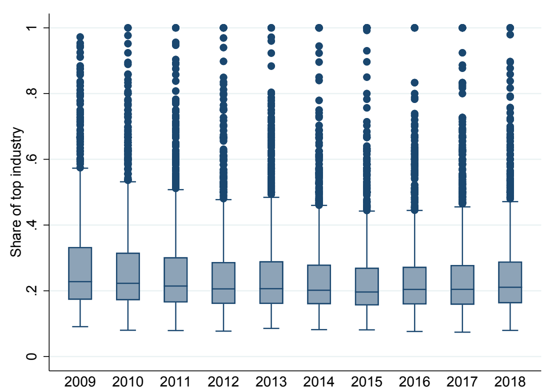


(a) Number of common investors.

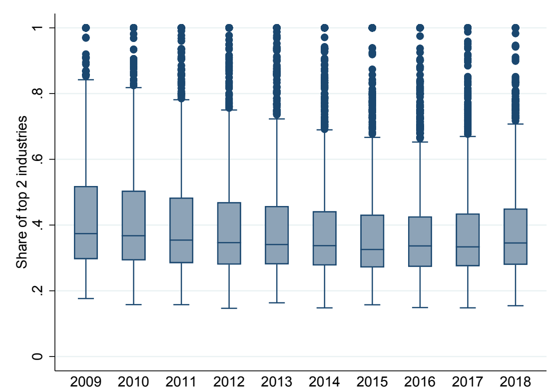


(b) Share of common investors.

Figure IA.8. Concentration of bond holdings across issuer industries.
The figures show box plots of the share of insurers' corporate bond holdings in the top (a) one and (b) two industries (at the 2-digit SIC level) among all industry-matched corporate bond holdings at the insurer level based on end-of-year holdings.



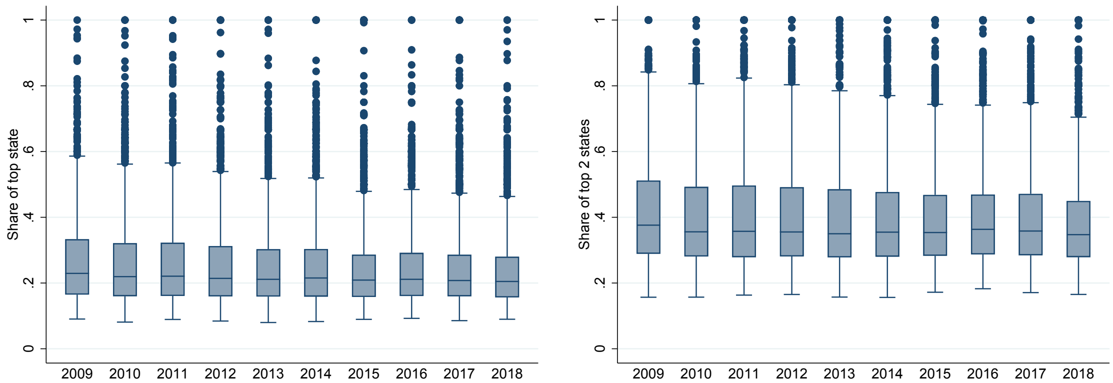
(a) Top 1 industry.



(b) Top 2 industries.

Figure IA.9. Concentration of bond holdings across issuer locations.

The figures show box plots of the share of insurers' corporate bond holdings in the top (a) one and (b) two U.S. states among all state-matched corporate bond holdings at the insurer level based on end-of-year holdings.



(a) Top 1 state. (b) Top 2 states.

Table IA.14. Persistence of the set of firms invested in.

The table reports the percentage of corporate bond issuers in the current year's portfolio that were ever held in the previous one to 10 quarters. Each cell is a pooled median value across insurers in the same portfolio size decile and across quarters from 2009q4 to 2018q4. Corporate bond portfolio size deciles are based on the distribution of the total corporate bond portfolio's par value across insurers in 2009q4.

Bond portfolio size decile	Previous quarters									
	1	2	3	4	5	6	7	8	9	10
1	92.9%	92.9%	93.0%	93.1%	93.1%	93.1%	93.2%	93.2%	93.2%	93.2%
2	93.6%	93.7%	93.7%	93.8%	93.9%	93.9%	93.9%	93.9%	94.0%	94.0%
3	93.0%	93.1%	93.2%	93.4%	93.4%	93.5%	93.5%	93.5%	93.6%	93.6%
4	93.1%	93.2%	93.3%	93.4%	93.5%	93.5%	93.6%	93.6%	93.6%	93.6%
5	93.5%	93.6%	93.7%	93.8%	93.9%	93.9%	93.9%	94.0%	94.0%	94.0%
6	93.4%	93.6%	93.7%	93.8%	93.9%	94.0%	94.0%	94.0%	94.0%	94.1%
7	93.7%	93.8%	94.0%	94.2%	94.2%	94.3%	94.3%	94.4%	94.4%	94.4%
8	94.8%	94.9%	95.0%	95.2%	95.3%	95.4%	95.4%	95.4%	95.5%	95.5%
9	95.4%	95.5%	95.6%	95.8%	95.9%	95.9%	96.0%	96.0%	96.0%	96.1%
10	96.3%	96.5%	96.6%	96.8%	96.8%	96.9%	96.9%	96.9%	97.0%	97.0%

Table IA.15. Variance decomposition of insurers' investment universe.

The table reports the variation explained by firm, insurer, and time fixed effects (R^2) in insurers' investment universe implied by $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$. $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is equal to one if insurer i ever held firm f's bonds in the previous 8 quarters and zero otherwise. The sample includes all possible insurer-firm pairs of firms and insurers included in the baseline sample at time t.

	Baseline	Firm FE & Insurer-time FE	Firm-time FE & Insurer-time FE	Insurer-firm FE	Insurer-firm FE & Firm-time FE	Insurer-firm FE & Firm-time FE & Insurer-time FE
SD(Residuals)	0.24	0.21	0.21	0.12	0.12	0.12
R^2		0.22	0.23	0.74	0.75	0.76
Adj. R^2		0.22	0.23	0.73	0.74	0.75

B.2.1 Investment preferences.

Table IA.16. Persistence of insurers' portfolio allocation: Preferences over firm characteristics. Each column presents OLS estimates from a specification of the form:

$$1\{\text{Purchase}_{i,f,t}\} = \alpha\ \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) + \Gamma' C_{i,f,t} + \varepsilon_{i,f,t}$$

at the insurer-by-firm-by-year-quarter level, where $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ equals one if insurer i ever held bonds issued by firm f in the previous 1 to 8 quarters and zero otherwise, and $C_{i,t}$ is a vector of fixed effect dummies. Firm size bins are based on the quintiles of the cross-sectional distribution of firms' total assets. Firm industry is based on the 2-digit SIC classification. Firm rating bins are unrated, AA-AAA, A, BBB, BB, B, CCC, D-CC. Firm age is the firm's current age standardized to mean zero and unit variance. Firm volatility is the idiosyncratic volatility of the firm's equity standardized to mean zero and unit variance. log Bond debt is the logarithm of the firm's total bond debt. The *difference in α relative to baseline* is the relative difference of the point estimate for α compared to that in column (2) of Table 3. t-Statistics are shown in brackets and based on standard errors clustered at the insurer and firm levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:			1{Purchase}			
$\mathbb{I}$(Investor)	0.022***	0.027***	0.024***	0.022***	0.015***	0.023***
	[16.67]	[17.81]	[16.81]	[15.35]	[13.37]	[14.76]
$\mathbb{I}$(Investor) × log Bond debt						0.010***
						[7.29]
$\mathbb{I}$(Investor) × Firm age						-0.006***
						[-5.07]
$\mathbb{I}$(Investor) × Firm volatility						0.005***
						[3.49]
Insurer-Time FE	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y
Firm size-Insurer FE	Y				Y	
Firm state-Insurer FE		Y			Y	
Firm industry-Insurer FE			Y		Y	
Firm rating-Insurer FE				Y	Y	
No. of obs.	21,333,622	21,333,622	21,333,622	21,333,622	21,333,622	21,333,622
No. of firms	822	822	822	822	822	822
No. of insurers	1,479	1,479	1,479	1,479	1,479	1,479
R^2	0.066	0.062	0.067	0.066	0.080	0.059
$P(1\{\text{Purchase}\}\|\mathbb{I}(\text{Investor}) = 0) = 0.21\%$						
Relative increase in 1{Purchase} :	10.79	12.84	11.78	10.74	7.28	
Difference in α relative to baseline:	-0.20	-0.04	-0.12	-0.20	-0.46	

Table IA.17. Local determinants of potential investors.

Each column presents OLS estimates for the effect of local determinants on the likelihood of insurer i being a potential investors of firm f,

$$\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) = \alpha\ X_{i,f,t} + \Gamma' C_{i,f,t} + \varepsilon_{i,f,t}$$

at the insurer-firm-year-quarter level, where $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ equals one if insurer i ever held bonds issued by firm f in the previous 1 to 8 quarters and zero otherwise, and $C_{i,t}$ is a vector of fixed effect dummies. Social connectedness is the logarithm of Bailey et al. (2018)'s social connectedness index between firm's and insurance customers' locations. %Same-industry-employed is the employment per capita in the firm's industry in insurance customers' locations. t-Statistics are shown in brackets and based on standard errors clustered at the insurer and firm levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	$\mathbb{I}$(Investor)					
1{Same state}	-0.002					
	[-1.15]					
1{Same region}		0.000				
		[0.14]				
Social connectedness			0.000			
			[0.12]			
Social connectedness: Terc2				-0.000		
				[-0.03]		
Social connectedness: Terc3				0.000		
				[0.24]		
%Employed same industry					-0.014	
					[-0.18]	
%Employed same industry: Terc2						-0.003
						[-1.27]
%Employed same industry: Terc3						0.000
						[0.19]
Insurer-Time FE	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y
No. of obs.	17,116,269	17,116,269	17,116,269	17,116,269	17,116,269	17,116,269
No. of firms	1,445	1,445	1,445	1,445	1,445	1,445
No. of insurers	822	822	822	822	822	822
R^2	0.239	0.239	0.239	0.239	0.239	0.239
Standardized coefficients:						
1{Same state}	-0.00					
1{Same region}		0.00				
Social connectedness			0.00			
Social connectedness: Terc2				0.00		
%Employed same industry					-0.00	
%Employed same industry: Terc2						-0.01

B.2.2 Premiums and lagged firm characteristics.

Table IA.18. Correlation between insurance premiums and lagged firm characteristics.
Each column provides estimates for regressions of insurers' noncommercial insurance premium growth on 1-quarter lagged firm characteristics,

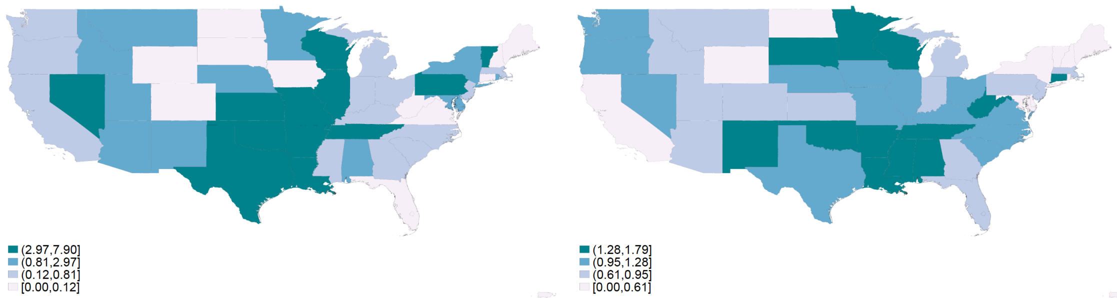
$$\Delta \log \text{Premiums}_{i,t} = \alpha\, \overline{X}_{i,t-1} + u_i + v_t + \varepsilon_{i,t}$$

at the insurer-year-quarter level, where u_i are insurer fixed effects and v_t are time fixed effects. $\overline{X}_{i,t-1}$ is the average of lagged firm characteristics across firms in insurer i's investment universe at time t, i.e., $\bar{X}_{i,t-1} = \frac{1}{\sum_f \mathbb{I}(\text{Investor}_{i,f,t-(1:8)})} \sum_f \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) x_{f,t-1}$ for firm characteristic $x_{f,t-1}$. All variables are normalized to have zero mean and unit variance. t-Statistics are shown in brackets and based on standard errors clustered at the insurer level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. variable:	$\Delta \log$ Premiums						
$\frac{\Delta\text{Total assets}}{\text{Total assets}_{t-1}}$	-0.006						
	[-1.00]						
Market-to-book		-0.009					
		[-1.28]					
Leverage			-0.002				
			[-0.46]				
$\frac{\text{Sales}}{\text{Total assets}_{t-1}}$				0.003			
				[0.42]			
$\frac{\text{Cash flow}}{\text{Total assets}_{t-1}}$					0.007		
					[0.81]		
$\frac{\Delta\text{Cash}}{\text{Total assets}_{t-1}}$						0.002	
						[0.29]	
$\frac{\text{Cash}}{\text{Total assets}_{t-1}}$							-0.008
							[-1.22]
Insurer FE	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y
No. of obs.	43,708	43,708	43,708	43,708	43,708	43,708	43,708
No. of insurers	1,487	1,487	1,487	1,487	1,487	1,487	1,487
R^2	0.064	0.064	0.063	0.063	0.064	0.063	0.064
Within R^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000

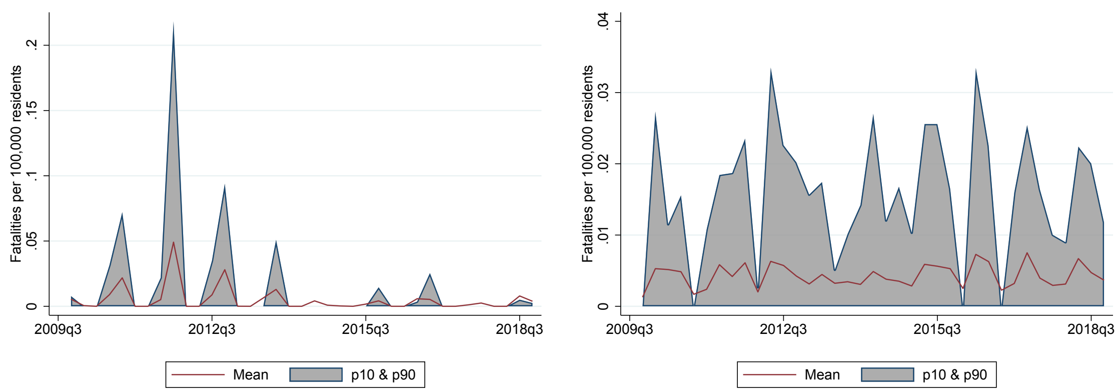
B.3 Natural disaster exposure

Figure IA.10. Geographic variation in natural disasters.
The figures depict the state-level standard deviation of fatalities per 100,000 residents caused by (a) heat and (b) storms from 2010q1 to 2018q4, scaled by 100 for readability.



(a) Heat. (b) Storms.

Figure IA.11. Time variation in natural disasters.
The figures illustrate the cross-sectional distribution of fatalities per 100,000 residents at the state-year-quarter level caused by (a) heat and (b) storms from 2009q4 to 2018q4.



(a) Heat. (b) Storms.

Table IA.19. Natural disasters, insurance premiums, and insurers' balance sheet.
Column (1) presents estimated coefficients from a specification of the form:

$$\log \text{Premiums}_{i,s,t} = \alpha \text{ Disaster fatalities}_{i,s,t-1} + u_{i,t} + v_{i,s,\text{quarter}(t)} + \varepsilon_{i,s,t}$$

at the insurer-state-year-quarter level, where $u_{i,t}$ are insurer-by-time fixed effects and $v_{i,s,\text{quarter}(t)}$ are insurer-by-state-by-calendar quarter (seasonality) fixed effects, the use of which necessitates the exclusion of several insurers active in only one state. $\log \text{Premiums}_{i,s,t}$ are noncommercial life insurance premiums written by insurer i in state s at t. Disaster fatalities$_{i,s,t-1}$ are the total fatalities per 100,000 residents caused by heat and storms in state s at time $t-1$ weighted by the median share of premiums written by insurer i in state s. Columns (2)-(6) present estimated coefficients from a specification of the form:

$$Y_{i,t} = \alpha \text{ Disaster fatalities}_{i,t-1} + u_{i,\text{quarter}(t)} + v_t + \varepsilon_{i,t}$$

at the insurer-year-quarter level, where $u_{i,\text{quarter}(t)}$ are insurer-by-calendar quarter (seasonality) fixed effects and v_t are time fixed effects. Disaster fatalities$_{i,t-1}$ is the sum of Disaster fatalities$_{i,s,t-1}$ across states. Insurance supply controls are an insurer's return on equity, investment yield, life insurance profitability, fee income, and rating dummies. t-Statistics are shown in brackets and based on standard errors clustered at the insurer, state, state-time, and region-time levels in column (1) and at the insurer level in columns (2)-(6). ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

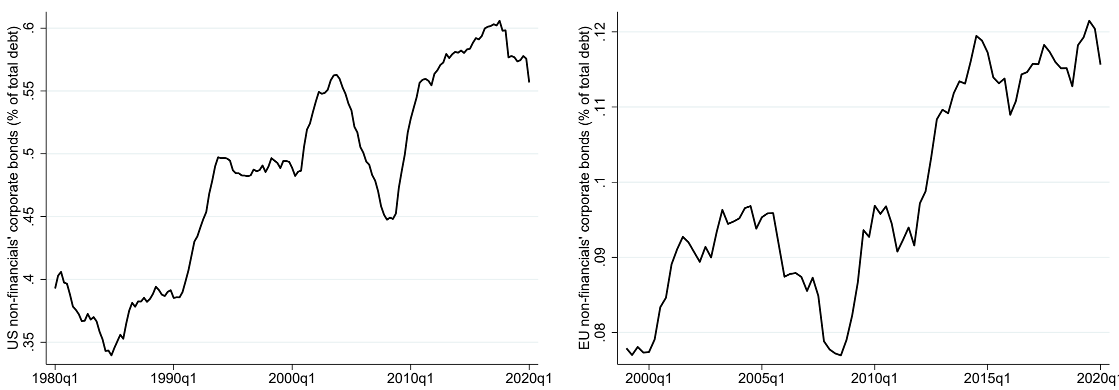
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		log Premiums		log Benefits	$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$	
Level:	Insurer-State			Insurer		
Disaster fatalities	3.261***	1.430**	1.173**	0.315		
	[4.74]	[2.55]	[2.25]	[0.65]		
ΔDisaster fatalities$^{>0}$					0.067**	0.071***
					[2.50]	[2.62]
Insurance supply controls			Y			Y
Insurer FE		Y	Y	Y	Y	
Insurer-Time FE	Y					
Insurer-State-Seasonality FE	Y					
Insurer-Seasonality FE						Y
Time FE		Y	Y	Y	Y	Y
No. of obs.	597,988	16,552	16,552	16,552	16,552	16,552
No. of insurers	451	505	505	505	505	505
R^2	0.970	0.953	0.958	0.956	0.349	0.408

C Additional figures

Figure IA.12. Bond debt as percentage of GDP.
The figures depict the volume of nonfinancial firms' corporate bond debt relative to GDP. (a) Data are retrieved from the Z.1 Financial Accounts of the United States, Release Table B.103. (b) Corporate bonds are measured by total debt securities. Data are retrieved from the ECB Statistical Data Warehouse for the EU19.

(a) US. (b) EU.

Figure IA.13. Bond debt share.
The figures depict the volume of nonfinancial firms' corporate bond debt relative to their total debt. Total debt is measured as the sum of debt securities and loans. (a) Data are retrieved from the Z.1 Financial Accounts of the United States, Release Table B.103. (b) Corporate bonds are measured by total debt securities. Data are retrieved from the ECB Statistical Data Warehouse for the EU19.



(a) US. (b) EU.

Figure IA.14. Corporate bond holdings by investor type.
The figure depicts the share of corporate bond holdings by different investor types in the U.S. after foreign holdings are excluded. Data are from the Z.1 Financial Accounts of the United States, Release Table L.213.

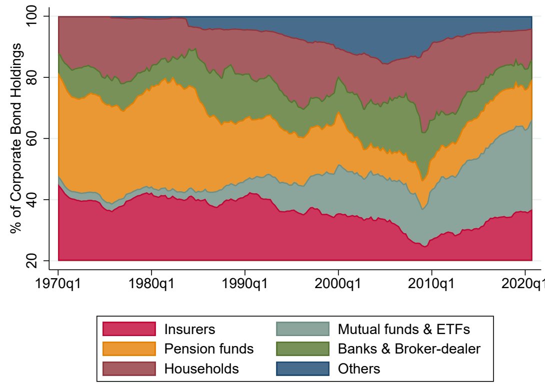
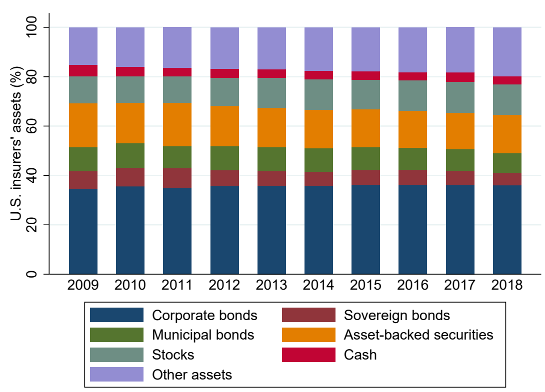
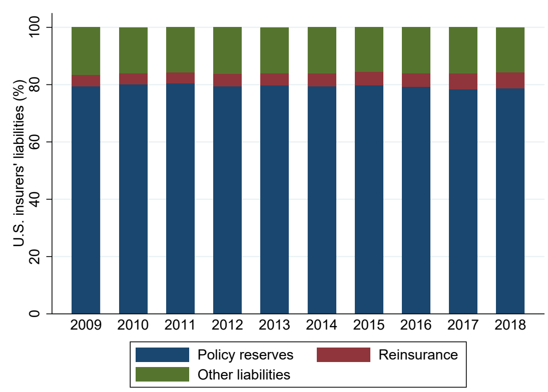


Figure IA.15. Insurers' assets and liabilities.
The figures depict the breakdown of U.S. insurers' aggregate general account assets and liabilities at year-end based on statutory filings. (a) Assets include cash and all invested assets. Sovereign bonds include U.S. treasuries and foreign sovereign bonds. Other assets include mortgage loans, real estate, derivatives, and other investments. (b) Policy reserves include contract reserves, interest maintenance reserves, and asset valuation reserves. Other liabilities include borrowings, taxes, payables to parents, subsidiaries, and affiliates, and other liabilities.



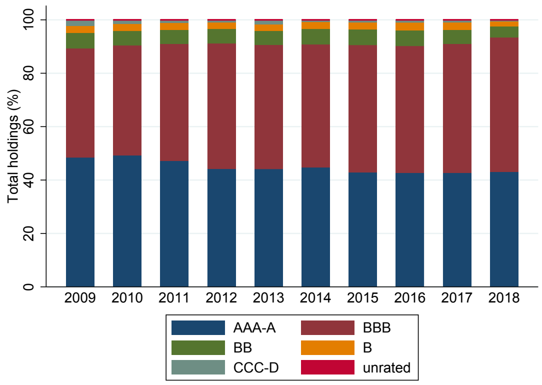
(a) Assets.



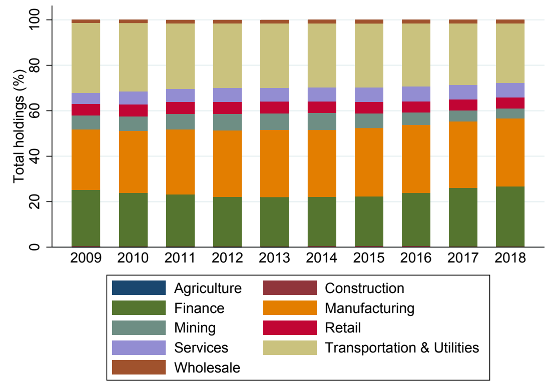
(b) Liabilities.

Figure IA.16. Insurers' corporate bond holdings.

The figures depict the allocation of U.S. insurers' corporate bond holdings (at par value) across (a) credit ratings and (b) industries. Credit rating is determined by insurers' self-reported rating or the current rating in Mergent FISD, whichever is lower. Figure (b) includes only bond holdings matched to Compustat's SIC industry classification.



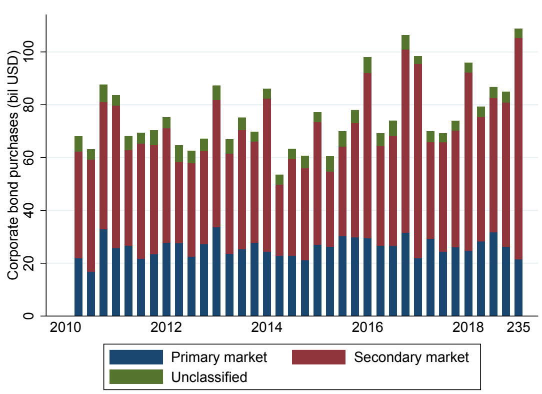
(a) Credit rating.



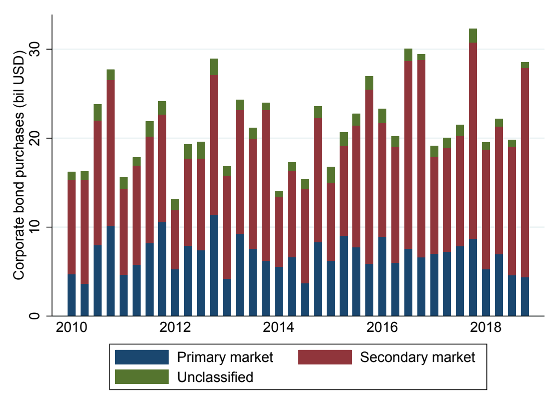
(b) Industry.

Figure IA.17. Insurers' corporate bond purchases.

The figures depict the total par value of corporate bond purchases by insurers in the baseline sample for (a) all issuers and (b) firms in the baseline sample, and the breakdown into primary market, secondary market, and unclassified purchases.

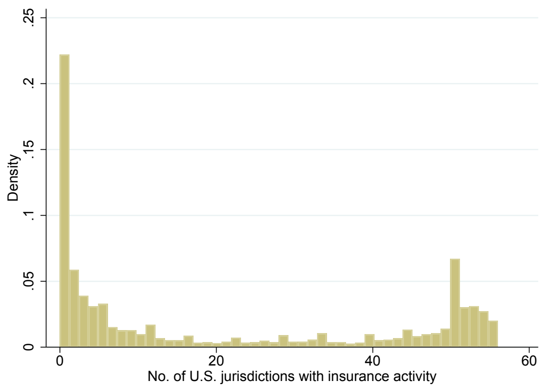


(a) All bond issuers.

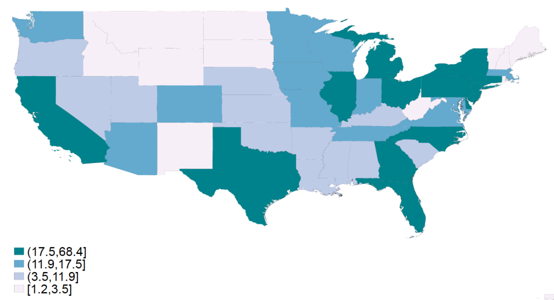


(b) Matched bond issuers.

Figure IA.18. Geographic distribution of insurance premiums.
(a) Histogram of the number of jurisdictions (50 U.S. states, DC, and 5 U.S. territories) in which an insurer writes positive insurance premiums, pooled across insurers and year-quarter observations from 2010q1 to 2018q4 for insurers in the baseline sample. (b) Geographic distribution of annual insurance premiums (in billion USD) written by insurers in the baseline sample in an average year (from 2010 to 2018) across U.S. states.



(a) No. of U.S. states in which an insurer is active in.



(b) Geographic distribution of insurance premiums (billion USD).

Figure IA.19. Geographic distribution of insurers' bond holdings.
The figure illustrates insurers' corporate bond holdings by issuer location (at par value in billion USD) for insurers in the baseline sample in an average quarter (from 2010q1 to 2018q4).

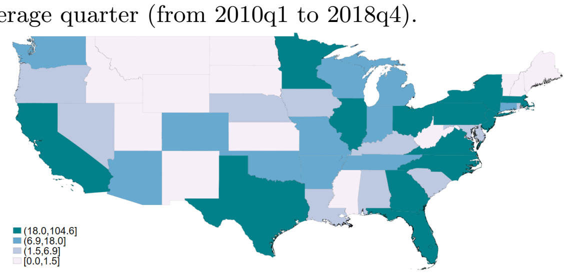


Figure IA.20. Insurer-level variation in insurance premiums.
The figures depict the distribution of the average absolute quarterly change in noncommercial insurance premiums, $\frac{1}{n_t}\sum_t \frac{|\text{Premiums}_{i,t}-\text{Premiums}_{i,t-1}|}{\text{Premiums}_{i,t-1}}$, across insurers.

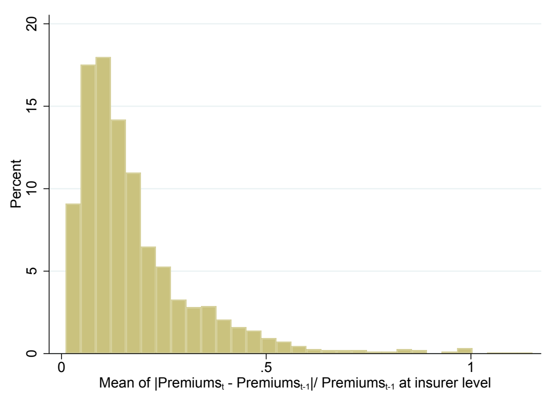
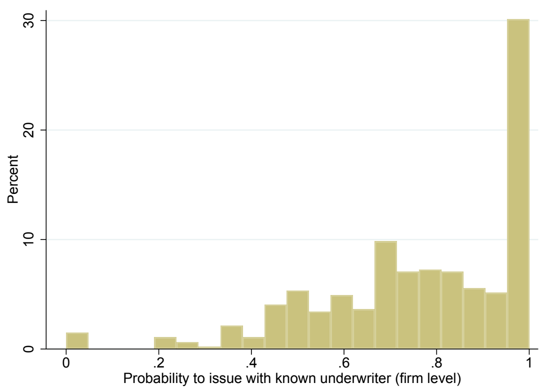
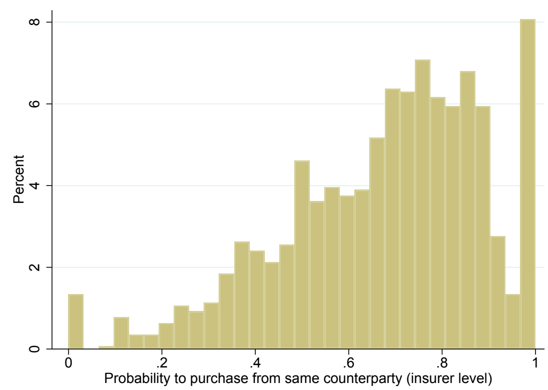


Figure IA.21. Underwriter relationships.
Figure (a) depicts the histogram across firms of the firm-level share of bond issuances involving an underwriter that the firm worked with in the previous 4 quarters. Figure (b) depicts the histogram across insurers of the insurer-level share of purchases (at the quarter level) involving a dealer that the insurer has worked with in the previous 4 quarters.



(a) Firm-underwriter relationship.



(b) Insurer-dealer relationship.

D Additional tables

D.1 Summary statistics

Table IA.20. Summary statistics for additional insurer and firm characteristics.
Summary statistics at quarterly frequency from 2010q2 to 2018q4.

	N	Mean	SD	p5	p50	p95
Insurer level						
Life insurer	48,287	0.36	0.48	0.00	0.00	1.00
ΔTotal assets/Total assets$_{t-1}$ (%)	48,287	1.17	5.85	-6.89	0.91	9.82
Bond purchases/Total assets$_{t-1}$ (%)	48,287	1.58	2.35	0.00	0.77	6.18
Return on equity	48,287	4.40	21.04	-28.64	4.83	33.49
Investment yield	48,287	3.18	1.59	0.73	3.04	5.78
# Firms held	48,287	160.17	270.58	4.00	61.00	692.00
P&C profitability	30,756	5.40	5.18	-0.56	4.70	15.48
Life profitability	17,531	10.44	35.77	-33.92	4.88	73.50
Life fee income	17,531	1.82	4.99	0.00	0.00	12.88
Firm level: Firm characteristics						
Total assets (bil USD)	15,466	13.37	31.12	0.73	4.43	49.38
log Total assets$_{t-1}$	15,466	8.50	1.29	6.59	8.38	10.79
ΔTotal assets$_{t-1}$/Total assets$_{t-2}$ (%)	15,466	1.63	7.43	-6.52	0.69	11.81
Sales/Total assets$_{t-1}$ (%)	15,466	23.87	17.68	5.59	19.28	61.38
Cash flow/Total assets$_{t-1}$ (%)	15,466	3.41	2.13	0.36	3.30	7.15
Capex$_{t-1}$/Total assets$_{t-1}$ (%)	15,464	1.47	2.28	0.17	0.83	5.13
ΔCash$_{t-1}$/Total assets$_{t-1}$ (%)	15,466	0.09	3.53	-5.35	0.02	5.33
Cash$_{t-1}$/Total assets$_{t-1}$ (%)	15,466	10.79	11.81	0.46	6.79	36.24
PPE$_{t-1}$/Total assets$_{t-1}$ (%)	15,466	31.63	26.10	3.29	22.12	85.37
Deferred Taxes$_{t-1}$/Total assets$_{t-1}$ (%)	15,466	-0.02	0.70	-1.00	0.00	0.88
Market-to-book$_{t-1}$	15,466	1.80	0.92	0.93	1.52	3.77
Leverage$_{t-1}$	15,466	3.72	4.40	1.58	2.53	9.08
Age (yrs)	15,466	30.58	14.62	8.50	28.50	53.75
Stock return (%)	15,466	16.53	38.61	-41.06	13.68	83.37
SA index	15,466	-4.15	0.41	-4.63	-4.19	-3.41
Z-score	15,466	0.83	0.68	-0.31	0.86	1.86
Dividend payer	15,466	0.62	0.49	0.00	1.00	1.00
SD(Earnings)	15,466	0.49	0.01	0.48	0.49	0.51
Commercial paper/Total debt (%)	2,642	8.32	10.73	0.00	4.08	30.39
ΔCommercial paper/Bond debt$_{t-1}$ (%)	2,421	-0.01	10.91	-16.63	0.00	16.37
Equity repurchases/Bond debt$_{t-1}$ (%)	14,797	4.90	10.40	0.00	0.22	24.92
%UW	4,757	40.89	17.76	9.65	41.17	69.12
Firm level: Insurer characteristics						
%Life insurers (%)	15,466	69.77	19.49	33.91	71.26	100.00
Insurers' Δ log total assets$_{t-1}$ (%)	15,466	-0.75	17.49	-23.39	0.71	17.94
Insurers' return on equity$_{t-1}$ (%)	15,466	8.14	5.13	0.09	8.02	16.61
Insurers' investment yield$_{t-1}$	15,466	4.27	0.68	3.12	4.27	5.34
Insurers' P&C profitability (%)	15,466	4.65	2.06	0.00	4.99	7.48
Insurers' life profitability (%)	15,466	11.78	11.91	-2.41	9.19	33.84
Insurers' life fee income (%)	15,466	3.25	2.19	0.03	3.08	7.18
# Investors	15,466	68.43	91.07	1.00	31.00	271.00
Δlog # Investors$_{t-1}$	15,466	0.01	0.22	-0.28	0.00	0.32
Insurers' rating	15,466	2.76	0.53	1.80	2.83	3.46
Insurers' log # firms held	15,466	6.12	0.54	5.15	6.16	6.99
# Pot. investors	15,466	80.16	102.53	2.00	38.00	308.00

Table IA.21. Summary statistics for additional issuance and bond characteristics.
Summary statistics at quarterly frequency from 2010q2 to 2018q4.

	N	Mean	SD	p5	p50	p95
Issuance level: Primary market						
Time to maturity (yrs)	941	10.90	6.20	4.89	9.99	25.53
AA-AAA rating	941	0.05	0.22	0.00	0.00	1.00
A rating	941	0.25	0.43	0.00	0.00	1.00
BBB rating	941	0.38	0.49	0.00	0.00	1.00
High yield	941	0.32	0.47	0.00	0.00	1.00
Bond level: Secondary market						
Time to maturity (yrs)	29,244	9.33	8.72	0.96	6.13	28.41
AA-AAA rating	29,244	0.09	0.29	0.00	0.00	1.00
A rating	29,244	0.34	0.47	0.00	0.00	1.00
BBB rating	29,244	0.45	0.50	0.00	0.00	1.00
High yield	29,244	0.12	0.32	0.00	0.00	1.00

D.2 Insurance premiums

Table IA.22. Insurance premiums and insurers' balance sheet: Additional evidence.
Each column presents estimated coefficients from a specification of the form:

$$Y_{i,t} = \alpha \frac{\Delta\text{Premiums}_{i,t}}{\text{Total assets}_{i,t-1}} + \Gamma' C_{i,t} + \varepsilon_{i,t}$$

at the insurer-year-quarter level, where $C_{i,t}$ is a vector of control variables and fixed effects. The main explanatory variable is the quarterly change in insurer i's noncommercial insurance premiums scaled by lagged total assets, distinguishing between increases and decreases in premiums. In columns (1) and (2), the dependent variable is the par value of corporate bond purchases via the primary and secondary market lagged total assets, respectively. In column (3), the dependent variable is the par value of corporate bond purchases net of sales scaled by lagged total assets. In column (4), the dependent variable is the quarterly change in net reinsurance premiums ceded (i.e., reinsurance business ceded minus assumed) scaled by lagged total assets. In column (5), the dependent variable is the quarterly change in insurance reserves scaled by lagged total assets. In column (6), the dependent variable is the quarterly net equity issuance, measured as the change in insurers' capital and surplus due to changes in issued stock, surplus notes, and reinsurance scaled by lagged total assets. Other variables are defined as in Table 2. t-Statistics are shown in brackets and based on standard errors clustered at the insurer level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	$\frac{\text{Prim purchases}}{\text{Total assets}_{t-1}}$	$\frac{\text{Sec purchases}}{\text{Total assets}_{t-1}}$	$\frac{\text{Net purchases}}{\text{Total assets}_{t-1}}$	$\frac{\Delta\text{Reinsurance}}{\text{Total assets}_{t-1}}$	$\frac{\Delta\text{Reserves}}{\text{Total assets}_{t-1}}$	$\frac{\text{Equity issuance}}{\text{Total assets}_{t-1}}$
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$	0.007*	0.048***	0.045***	0.656***	0.125***	0.032***
	[1.70]	[3.67]	[3.38]	[11.57]	[9.73]	[4.97]
$\frac{\Delta\text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$	0.003	0.003	-0.016	0.794***	-0.008	-0.014**
	[0.83]	[0.26]	[-1.17]	[13.40]	[-0.77]	[-2.15]
Insurance supply controls	Y	Y	Y	Y	Y	Y
Insurer-Seasonality FE	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y
No. of obs.	48,287	48,287	48,287	48,287	48,287	48,287
No. of insurers	1,484	1,484	1,484	1,484	1,484	1,484
R^2	0.417	0.324	0.213	0.548	0.407	0.300
p-value for H0: same coefficient on $\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$ and $\frac{\Delta\text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$						
	0.62	0.04	0.01	0.03	0.00	0.00

D.3 Financing activities

Table IA.23. Bond financing and insurers' bond demand: Cross-sectional heterogeneity in the first stage.

Each column reports the coefficient from a regression of insurers' corporate bond purchases scaled by lagged bond debt on $\Delta\text{INVPremiums}^{>0}$ at the firm-year-quarter level. The coefficient varies with the segment of the cross-section of firms, which is split into quartiles by (column 1) Hadlock and Pierce (2010)'s SA index for financial constraints, (column 2) lagged size (total assets), (column 3) lagged cash flow scaled by total assets, and (column 4) by credit rating (with segments representing either a AAA-A, BBB, or high yield (HY) rating). A larger SA index indicates tighter financial constraints. Controls are as in column (4) of Table 6 and additionally include time dummies interacted with quartile (or rating) dummies. *t*-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
	Coefficient on $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$			
Cross-section by	SA index	Size	Cash flow	Rating
Quart1 / HY rated	0.036***	0.005	0.027***	0.024***
	[3.84]	[0.75]	[2.89]	[2.93]
Quart2 / BBB rated	0.018***	0.018**	0.024***	0.043***
	[2.81]	[2.26]	[3.33]	[5.13]
Quart3 / AAA-A rated	0.027***	0.041***	0.023***	0.013**
	[3.37]	[5.86]	[3.66]	[2.28]
Quart4	0.026***	0.075***	0.033***	
	[3.06]	[5.88]	[4.09]	
p-value for H0: same coefficient on				
Quart1 / HY and Quart2 / BBB	0.100	0.180	0.830	0.110
Quart1 / HY and Quart3 / AAA-A	0.460	0.000	0.740	0.290
Quart1 and Quart4	0.400	0.000	0.620	.
Quart2 and Quart4	0.470	0.000	0.420	.

Table IA.24. Bond financing and insurers' bond demand: Primary and secondary market investors.

Each column presents estimated coefficients from a specification of the form:

$$\frac{\Delta \text{Bond debt}_{f,t}}{\text{Bond debt}_{f,t-1}} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \beta \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} \times \text{Prim}_{f,t-1} + \gamma_t \ \text{Prim}_{f,t-1} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The dependent variable is the relative change in bond debt. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, following Equation (3). $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of the firm's bonds held by insurers (%Held by insurers$_{f,t-1}$) in each column. *Prim* is an indicator variable for firms whose average potential investor's primary market activity is in the top (columns 1-3) 20%, (column 4) 15%, and (column 5) 25% of the cross-sectional distribution, which corresponds on average to a maximum average share of purchases in the secondary market in the lagged 4 quarters of (columns 1-3) 0.559, (column 4) 0.548, and (column 5) 0.568, respectively. Control variables and fixed effects are defined as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$		
Threshold:		p20		p15	p25
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	7.735***	9.546***	9.915***	7.855***	8.020***
	[3.96]	[4.36]	[3.96]	[4.51]	[3.74]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ Prim	-5.071**	-6.150***	-5.327**	-4.310*	-2.840
	[-2.53]	[-2.80]	[-2.31]	[-1.85]	[-1.27]
Insurer controls		Y	Y	Y	Y
Firm controls		Y	Y	Y	Y
Region-Time FE	Y	Y		Y	Y
Firm-Cal. quarter FE	Y	Y	Y	Y	Y
Prim-Time FE	Y	Y	Y	Y	Y
Industry-Time FE		Y	Y	Y	Y
Insurer type-Time FE		Y	Y	Y	Y
Insurer location-Time FE		Y	Y	Y	Y
Insurer economy-Time FE			Y		
State-Time FE			Y		
First stage					
$\Delta\text{INVPremiums}^{>0}$	0.023***	0.024***	0.021***	0.028***	0.022***
	[5.3]	[5.3]	[4.4]	[6.1]	[4.8]
F Statistic	42.2	32.6	22.8	49.7	31.4
No. of obs.	15,466	15,466	15,466	15,466	15,466
No. of firms	829	829	829	829	829

Table IA.25. Equity financing and insurers' bond demand.
Each column presents estimated coefficients from a specification of the form:

$$Y_{f,t} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, following Equation (3). $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of the firm's bonds held by insurers (%Held by insurers$_{f,t-1}$) in each column. Columns (1) to (3) estimate the effect of insurers' bond demand on the firm's equity repurchases scaled by lagged bond debt. Columns (4) to (6) estimate the effect of insurers' bond demand on the firm's shareholder dividends scaled by lagged bond debt. Firm controls are sales, cash flow, age, earnings volatility, z-score, stock return, Hadlock and Pierce (2010)'s SA index, deferred taxes, an indicator for whether the firm paid dividends in the past 4 quarters; lagged market-to-book, leverage, cash, cash growth, size, asset growth, and PPE. The definitions of other control variables and fixed effects are as in Table 10. SIC1 and SIC2 refer to the 1-digit and 2-digit SIC industry classifications, respectively. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		$\frac{\text{Equity repurchases}}{\text{Bond debt}_{t-1}}$			$\frac{\text{Dividends}}{\text{Bond debt}_{t-1}}$	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.856	1.376**	1.554*	0.040	0.228	0.303
	[1.63]	[2.11]	[1.96]	[0.27]	[1.06]	[1.32]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times 1\{\text{Acq}\}$		-1.388*	-1.297		-0.192	-0.167
		[-1.65]	[-1.43]		[-0.74]	[-0.70]
$1\{\text{Acq}\}$		0.007	0.006		0.001	0.001
		[0.73]	[0.56]		[0.34]	[0.38]
Firm controls	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y		Y	Y	
Region-Time FE	Y	Y		Y	Y	
SIC1-State-Time FE			Y			Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y
Insurer location-Time FE	Y	Y	Y	Y	Y	Y
First stage						
$\Delta\text{INVPremiums}^{>0}$	0.028***	0.030***	0.027***	0.028***	0.031***	0.027***
	[6.4]	[5.3]	[4.4]	[6.4]	[4.4]	[4.4]
F Statistic	102.3	39.4	23.8	102.3	19.8	23.8
No. of obs.	14,710	14,710	12,944	14,710	8,663	12,944
No. of firms	814	814	743	814	471	743
Standardized coefficient $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.21	0.34	0.38	0.03	0.17	0.21

Table IA.26. Leverage and insurers' bond demand.
Each column presents estimated coefficients from a specification of the form:

$$Y_{f,t} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. In columns (1-3), the dependent variable is the relative quarterly change in the firm's total debt. In columns (4-6), the dependent variable is the relative quarterly change in the firm's leverage ratio. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by firms' exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, as defined in Equation (3). $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of firm f's bonds held by insurers (%Held by insurers$_{f,t-1}$) in each column. Firm controls are sales, cash flow, age, and lagged market-to-book, leverage, cash and cash growth. Insurer controls are the share of life insurers, an average potential investor's P&C and life insurance profitability, life insurance fee income, investment yield, lagged return on equity, lagged size, and the log lagged number of investors. Industry dummies are at the 2-digit SIC level. Insurer location is based on insurance premiums written by U.S. region and insurer type is based on insurance premiums written by line of business. Insurer economy dummies are for employment in a firm's industry and for consumption per capita at insurance customers' location. t-statistics are shown in brackets and clustered at the firm level. ***, **, * indicate significance at the 1%, 5% and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		$\frac{\Delta\text{Total debt}}{\text{Total debt}_{t-1}}$			$\frac{\Delta\text{Leverage}}{\text{Leverage}_{t-1}}$	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	4.695***	5.103***	5.293***	1.669**	1.922***	1.596**
	[2.86]	[3.11]	[3.35]	[2.53]	[2.63]	[2.31]
Insurer controls	Y	Y	Y	Y	Y	Y
Firm controls		Y	Y		Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y
Firm-Cal. quarter FE	Y	Y	Y	Y	Y	Y
Industry-Time FE		Y	Y		Y	Y
Insurer type-Time FE			Y			Y
Insurer location-Time FE			Y			Y
First stage						
$\Delta\text{INVPremiums}^{>0}$	0.029***	0.028***	0.030***	0.029***	0.028***	0.030***
	[7]	[6.4]	[6.8]	[7]	[6.4]	[6.8]
F Statistic	139.9	117.8	122.4	139.9	117.8	122.4
No. of obs.	15,466	15,466	15,466	15,466	15,466	15,466
No. of firms	829	829	829	829	829	829
1sd Effect	0.12	0.13	0.14	0.04	0.05	0.04

D.4 Persistence

Table IA.27. Bond financing, corporate investment, and insurers' bond demand: Persistence.
Each column presents estimated coefficients from a specification of the form:

$$Y_{f,t:(t+h)} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \sum_{k=1}^{h} \beta_k \Delta\text{INVPremiums}^{>0}_{f,t+k} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, as defined in Equation (3). The regression controls for future exposure to increases in potential investors' premiums. $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of firm f's bonds held by insurers (%Held by insurers$_{f,t-1}$) in each column. Columns (1-3) estimate the effect of insurers' bond purchases on the cumulative change in the firm's bond debt from $t-1$ to $t+h$ scaled by lagged bond debt. Column (4-6) estimate the effect of insurers' bond purchases on the firm's cumulative total investment from t to $t+h$ scaled by lagged bond debt. Columns (7-9) estimate the effect of insurers' bond purchases on the cumulative change in the firm's PPE from $t-1$ to $t+h$ scaled by lagged bond debt. Control variables are defined as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable:		$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$			$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$			$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$	
Time horizon:	t+1	t+2	t+3	t+1	t+2	t+3	t+1	t+2	t+3
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	7.670***	7.487***	0.701	8.350***	7.094**	3.668	3.599***	3.567**	3.424
	[3.53]	[2.63]	[0.22]	[3.51]	[1.99]	[0.86]	[3.27]	[2.07]	[1.57]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
First stage									
$\Delta\text{INVPremiums}^{>0}$	0.025***	0.024***	0.026***	0.026***	0.023***	0.024***	0.026***	0.024***	0.025***
	[5.9]	[5.7]	[5.8]	[6.3]	[5.4]	[5.6]	[6.4]	[5.5]	[5.8]
F Statistic	107.8	96.5	99.1	125.1	88.5	89.4	128.5	93.1	95.1
No. of obs.	14,133	13,007	12,026	14,327	13,027	11,864	14,505	13,330	12,244
No. of firms	792	750	725	792	755	714	796	764	730

D.5 Aggregate effects

Table IA.28. Bond financing, corporate investment, and insurers' bond demand: Aggregate effects.

Each column presents estimated coefficients from a specification of the form:

$$Y_{g,t} = \alpha \frac{\text{Bond purchases}_{g,t}}{\text{Bond debt}_{g,t-1}} + \Gamma' C_{g,t} + \varepsilon_{g,t}$$

at the industry (2-digit SIC)-region-year-quarter level. The main explanatory variable is the total volume of insurers' purchases bonds issued by the industry-region pair g in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$. $C_{g,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of the industry-region pair g's bonds held by insurers ($\%\text{Held by insurers}_{g,t-1}$) in each column. Columns (1) and (2) estimate the effect of insurers' bond purchases on the relative change in the firm's total bond debt. Columns (3) and (4) estimate the effect of insurers' bond purchases on the firm's total investments scaled by lagged bond debt. Columns (5) and(6) estimate the effect of insurers' bond purchases on the firm's acquisition and capital expenditures scaled by lagged bond debt, respectively. SIC1 and SIC2 refer to the 1-digit and 2-digit SIC industry classification, respectively. Total bond debt, investment, cash acquisitions, and capital expenditures are aggregated across firms for each industry-region pair. Control variables are for the median firm and are defined as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the SIC1-time level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$		$\frac{\Delta\text{Total investment}}{\text{Bond debt}_{t-1}}$		$\frac{\text{AcqEx}}{\text{Bond debt}_{t-1}}$	$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	7.303***	8.268***	4.186**	3.704*	3.166*	1.012*
	[2.85]	[2.97]	[2.14]	[1.89]	[1.89]	[1.87]
Firm controls		Y		Y		
Insurer controls		Y		Y	Y	Y
SIC2-Region-Seasonality FE	Y	Y	Y	Y	Y	Y
SIC1-Time FE	Y	Y	Y	Y	Y	Y
First stage						
$\Delta\text{INVPremiums}^{>0}$	0.080***	0.077***	0.080***	0.077***	0.081***	0.081***
	[3.2]	[3.1]	[3.2]	[3.1]	[3.2]	[3.2]
F Statistic	26.1	23.3	26.1	23.3	26.0	26.0
No. of obs.	4,224	4,224	4,224	4,224	4,224	4,224
No. of SIC1-Time clusters	235	235	235	235	235	235
Standardized coefficients						
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.66	0.75	0.63	0.56	0.63	0.30

E Robustness

E.1 Bond financing

Table IA.29. Bond financing and insurers' bond demand: Non-linearity of the instrument.
The table re-estimates the regressions from Table 6 using decreases in potential investors' premiums as an additional instrument. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	5.740***	6.131***	6.563***	6.542***	6.612***
	[3.37]	[4.64]	[4.57]	[4.75]	[3.78]
Insurer controls		Y	Y	Y	Y
Firm controls			Y	Y	Y
Additional controls					Y
Region-Time FE	Y	Y	Y	Y	
Firm-Seasonality FE		Y	Y	Y	Y
Industry-Time FE			Y	Y	Y
Insurer type-Time FE				Y	Y
Insurer location-Time FE				Y	Y
Insurer economy-Time FE					Y
State-Time FE					Y
First stage					
$\Delta\text{INVPremiums}^{>0}$	0.021***	0.030***	0.029***	0.031***	0.025***
	[5.2]	[7.3]	[6.7]	[6.9]	[5.5]
$\Delta\text{INVPremiums}^{<0}$	0.002	-0.009	-0.008	-0.007	-0.002
	[.3]	[-1.4]	[-1.2]	[-1]	[-.2]
F Statistic	37.0	71.7	60.1	62.0	36.5
No. of obs.	15,466	15,466	15,466	15,466	15,466
No. of firms	829	829	829	829	829
Effect of 1sd change in $\frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}}$ (in %)					
	0.15	0.16	0.17	0.17	0.17

Table IA.30. Bond financing and insurers' bond demand: Coefficients of control variables.
The table restates the regressions from Table 6 and additionally reports the OLS estimate in column (1) and the estimated coefficients of control variables. *t*-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	$\frac{\Delta \text{Bond debt}}{\text{Bond debt}_{t-1}}$					
	OLS	IV				
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	4.180***	5.834***	5.894***	6.343***	6.362***	6.552***
	[26.33]	[3.41]	[4.42]	[4.39]	[4.60]	[3.75]
$\frac{\text{Sales}}{\text{Total assets}_{t-1}}$	0.267***			0.121*	0.114	0.219***
	[3.52]			[1.66]	[1.60]	[2.67]
$\frac{\text{Cash flow}}{\text{Total assets}_{t-1}}$	0.156			-0.242	-0.246	0.005
	[0.71]			[-1.19]	[-1.21]	[0.02]
Market-to-book$_{t-1}$	0.001			-0.007	-0.008	-0.009
	[0.18]			[-0.88]	[-1.16]	[-0.95]
Leverage$_{t-1}$	-0.001			-0.000	-0.001	-0.001
	[-1.61]			[-0.62]	[-0.74]	[-1.58]
$\frac{\Delta \text{Cash}_{t-1}}{\text{Total assets}_{t-1}}$	-0.203***			-0.124*	-0.149**	-0.221***
	[-2.83]			[-1.78]	[-2.08]	[-2.98]
$\frac{\text{Cash}_{t-1}}{\text{Total assets}_{t-1}}$	-0.013			-0.086*	-0.076*	-0.011
	[-0.25]			[-1.89]	[-1.66]	[-0.21]
Age	-0.003			-0.000	-0.002	-0.001
	[-0.11]			[-0.01]	[-0.10]	[-0.04]
log Total assets$_{t-1}$	0.036***					0.029**
	[2.77]					[2.07]
$\frac{\Delta \text{Total assets}_{t-1}}{\text{Total assets}_{t-1}}$	0.103***					0.064
	[3.49]					[1.55]
$\frac{\text{PPE}_{t-1}}{\text{Total assets}_{t-1}}$	0.060					0.052
	[1.06]					[0.85]
$\frac{\text{Deferred Taxes}_{t-1}}{\text{Total assets}_{t-1}}$	-0.468					-0.373
	[-1.50]					[-1.15]
SD(Earnings)	-0.730*					-0.084
	[-1.69]					[-0.13]
Dividend payer	-0.002					-0.002
	[-0.20]					[-0.24]
Z-score	-0.049***					-0.040***
	[-3.67]					[-2.60]
SA index	-0.047					-0.013
	[-0.94]					[-0.23]
Stock return	0.006					0.012
	[0.80]					[1.39]
Insurers' P&C profitability	-0.000		-0.001	-0.002	-0.003	-0.002
	[-0.17]		[-0.69]	[-1.04]	[-1.35]	[-0.60]
Insurers' life profitability	-0.001**		-0.001***	-0.001***	-0.001***	-0.001**
	[-2.42]		[-2.88]	[-2.92]	[-2.78]	[-2.56]
Insurers' life fee income	0.002		-0.002	-0.002	-0.001	0.002
	[0.46]		[-0.92]	[-1.16]	[-0.51]	[0.28]
Insurers' roe$_{t-1}$	0.000		-0.000	-0.000	0.000	0.000
	[0.24]		[-0.89]	[-0.11]	[0.31]	[0.22]
%Life insurer	-0.101***		-0.069***	-0.084***	-0.094***	-0.107***
	[-3.36]		[-2.74]	[-3.11]	[-3.49]	[-3.46]
Insurer size	0.003		-0.002	-0.001	0.000	0.011
	[0.25]		[-0.37]	[-0.14]	[0.09]	[0.83]
log # Investors$_{t-1}$	-0.046***		-0.033***	-0.034***	-0.034***	-0.035***
	[-6.74]		[-4.07]	[-4.00]	[-4.07]	[-3.32]
Insurers' rating'	0.006					0.007
	[0.56]					[0.61]
Insurers' log # firms held	0.007					-0.008
	[0.29]					[-0.28]
Insurers' P&C profitability$_{t-1}$	-0.001					-0.001
	[-0.31]					[-0.35]
Insurers' life profitability$_{t-1}$	0.000					0.000
	[0.93]					[0.85]
Insurers' life fee income$_{t-1}$	-0.004					-0.004
	[-0.68]					[-0.67]
Insurers' investment yield$_{t-1}$	-0.007					-0.006
	[-0.71]					[-0.59]
Firm-Seasonality FE	Y		Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y			Y	Y	Y
Insurer type-Time FE	Y				Y	Y
Insurer location-Time FE	Y				Y	Y
Insurer economy-Time FE	Y					Y
No. of obs.	15,466	15,466	15,466	15,466	15,466	15,466

Table IA.31. Bond financing and insurers' bond demand: Robustness.

Each column presents estimates for the effect of insurers' bond purchases on the relative change in the firm's bond debt analogously to Table 6. The main explanatory variable in columns (1)-(8) is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt, and in column (9), it is the total volume of insurers' net purchases of firm f's bonds in quarter t scaled by lagged bond debt. Bond purchases are instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, excluding premiums from the firm's headquarters state and additionally (column 6) deposit-type life insurance, (column 7) states neighboring the firm's headquarters, and (column 8) customer and supplier states. In column (5), the definition of potential investors is based on the previous 10 quarters. Social connectedness bins are based on the quartiles of Bailey et al. (2018)'s social connectedness index between a firm's and its potential investors' location. Insurance supply controls are the current value and 4 lags of a firm's investors' return on equity, investment yield, P&C and life insurance profitability, and life insurance fee income and commissions. Insurer investment yield bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' investment yield. Insurer profitability bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' insurance profitability. SIC1 and SIC2 refer to the 1-digit and 2-digit SIC industry classifications, respectively. The definitions of other control variables and fixed effects are as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable:					$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$				
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	7.083***	8.676***	6.568***	6.869**	7.148***	7.391***	6.617***	6.993***	
	[3.31]	[3.36]	[3.42]	[2.47]	[3.79]	[4.71]	[3.70]	[3.72]	
Δ log #Pot. investors$^{>0}$				0.048					
				[0.74]					
Δ log #Pot. investors				-0.053					
				[-1.05]					
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$									8.603***
									[3.27]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Additional controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurance supply controls		Y							
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE	Y								
Insurer location-Time FE		Y	Y	Y	Y	Y	Y	Y	Y
SIC1-State-Time FE		Y							
Insurer inv yield-Time FE		Y							
Insurer profitability-Time FE		Y							
First stage									
$\Delta\text{INVPremiums}^{>0}$	0.021***	0.019***	0.022***	0.018***					0.019***
	[4.7]	[3.7]	[5]	[3.6]					[3.8]
$\Delta\text{INVPremiums}^{>0}_{1:10}$					0.024***				
					[5.3]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$						0.026***			
						[6.2]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex neigbor}}$							0.023***		
							[5.3]		
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$								0.022***	
								[5.1]	
F Statistic	47.0	33.5	46.3	27.8	72.0	91.8	72.3	62.9	34.7
No. of obs.	15,456	13,483	15,329	15,456	15,466	15,449	15,425	15,448	13,483
No. of firms	829	748	829	829	829	828	829	829	748
Effect of 1sd change in(in %)									
$\frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}}$	0.18	0.23	0.17	0.18	0.18	0.19	0.17	0.18	
$\frac{\text{Net bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}}$									0.22

Table IA.32. Bond financing and insurers' bond demand: Natural disaster instrument.
Each column presents estimated coefficients from a specification of the form:

$$\frac{\Delta \text{Bond debt}_{f,t}}{\text{Bond debt}_{f,t-1}} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The dependent variable is the relative quarterly change in firm f's bond debt. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in disaster fatalities at potential investors' location (including only life insurers), $\Delta\text{INVDisaster}^{>0}$. SIC1 and SIC2 refer to the 1-digit and 2-digit SIC industry classifications, respectively. The definitions of other control variables and fixed effects are as in Table 6. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	$\frac{\Delta \text{Bond debt}}{\text{Bond debt}_{t-1}}$					
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	7.517***	7.004***	6.842**	6.821***	7.756***	7.381***
	[2.61]	[2.65]	[2.57]	[2.72]	[2.90]	[2.92]
Insurer controls			Y	Y	Y	Y
Firm controls				Y	Y	Y
Additional controls					Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y	Y	Y	Y	Y
State-Time FE		Y	Y	Y	Y	Y
Insurer type-Time FE					Y	Y
Insurer location-Time FE					Y	Y
Insurer economy-Time FE						Y
SIC1-State-Time FE						Y
First stage						
$\Delta\text{INVDisaster}^{>0}$	0.003***	0.003***	0.003***	0.004***	0.004***	0.004***
	[3.3]	[3.5]	[3.4]	[3.7]	[3.7]	[3.9]
F Statistic	31.0	32.3	30.9	35.3	32.4	32.9
No. of obs.	15,168	15,168	15,168	15,168	15,168	15,168
No. of firms	815	815	815	815	815	815
Effect of 1sd change in $\frac{\text{Bond purchases}_t}{\text{Bond debt}_{t-1}}$ (in %)	0.20	0.18	0.18	0.18	0.20	0.19

E.2 Corporate investment

Table IA.33. Corporate investment and insurers' bond demand: Robustness controlling for industry-by-state-specific trends.

The table re-estimates the regressions from Table 10 additionally controlling for SIC1-by-state-by-time fixed effects, whereby SIC1 is the 1-digit SIC classiciation.

t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	$\frac{\Delta\text{Total assets}}{\text{Bond debt}_{t-1}}$	$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$		$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$	$\frac{\text{AcqEx}}{\text{Bond debt}_{t-1}}$		$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	9.229**	2.776***	1.852**	8.243***	5.118***	3.605**	1.290**
	[2.41]	[2.94]	[2.16]	[3.33]	[2.81]	[2.10]	[2.05]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$ ×Constr			4.858*			7.951*	
			[1.78]			[1.87]	
Constr			-0.045			-0.078*	
			[-1.56]			[-1.82]	
Firm controls	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y
SIC1-State-Time FE	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y
Insurer location-Time FE	Y	Y	Y	Y	Y	Y	Y
Insurer economy-Time FE	Y	Y	Y	Y	Y	Y	Y
First stage							
$\Delta\text{INVPremiums}^{>0}$	0.022***	0.022***	0.026***	0.022***	0.022***	0.026***	0.022***
	[4.3]	[4.3]	[4.4]	[4.3]	[4.3]	[4.4]	[4.3]
F Statistic	44.9	44.9	15.8	44.9	44.9	15.8	44.9
No. of obs.	13,494	13,494	13,494	13,494	13,494	13,494	13,494
No. of firms	748	748	748	748	748	748	748
Standardized coefficient							
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.53	0.58	0.39	0.92	0.78	0.55	0.29

Table IA.34. Corporate investment and insurers' bond demand: Robustness for tangible asset growth.

Each column presents estimates for the effect of insurers' bond purchases on the change in the firm's PPE analogously to Table 10. The main explanatory variable in columns (1)-(7) is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt, and in column (8), it is the total volume of insurers' net purchases of firm f's bonds in quarter t scaled by lagged bond debt. Bond purchases are instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, excluding premiums from the firm's headquarters state and additionally (column 5) deposit-type life insurance, (column 6) states neighboring the firm's headquarters, and (column 7) customer and supplier states. In column (4), the definition of potential investors is based on the previous 10 quarters. Social connectedness bins are based on the quartiles of Bailey et al. (2018)'s social connectedness index between a firm's and its potential investors' location. Insurance supply controls are the current value and 4 lags of a firm's investors' return on equity, investment yield, P&C and life insurance profitability, and life insurance fee income and commissions. Insurer investment yield bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' investment yield. Insurer profitability bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' insurance profitability. The definitions of other control variables and fixed effects are as in Table 10. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$							
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	1.900***	2.676**	1.703**	2.137***	1.849***	1.975***	1.972***	
	[2.62]	[2.22]	[2.21]	[3.02]	[3.19]	[2.90]	[2.79]	
$\Delta \log \#\text{Pot. investors}^{>0}$		0.005						
		[0.13]						
$\Delta \log \#\text{Pot. investors}$		-0.030						
		[-0.93]						
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$								1.997***
								[3.01]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurance supply controls			Y					
Rating-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE	Y							
Insurer location-Time FE		Y	Y	Y	Y	Y	Y	Y
Insurer inv yield-Time FE			Y					
Insurer profit-Time FE			Y					
First stage								
$\Delta\text{INVPremiums}^{>0}$	0.024***	0.018***	0.024***					0.026***
	[5.5]	[3.7]	[5.4]					[5.8]
$\Delta\text{INVPremiums}^{>0}_{1:10}$				0.026***				
				[5.5]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$					0.028***			
					[6.6]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex neigbor}}$						0.025***		
						[5.7]		
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$							0.024***	
							[5.5]	
F Statistic	68.9	30.2	56.2	79.0	106.3	85.3	74.4	84.6
No. of obs.	15,456	15,456	15,329	15,456	15,449	15,425	15,448	15,456
No. of firms	829	829	829	829	828	829	829	829

Table IA.35. Corporate investment and insurers' bond demand: Robustness for total investment. Each column presents estimates for the effect of insurers' bond purchases on the firm's total investment analogously to Table 10. The main explanatory variable in columns (1)-(7) is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt, and in column (8), it is the total volume of insurers' net purchases of firm f's bonds in quarter t scaled by lagged bond debt. Bond purchases are instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, excluding premiums from the firm's headquarters state and additionally (column 5) deposit-type life insurance, (column 6) states neighboring the firm's headquarters, and (column 7) customer and supplier states. In column (4), the definition of potential investors is based on the previous 10 quarters. Social connectedness bins are based on the quartiles of Bailey et al. (2018)'s social connectedness index between a firm's and its potential investors' location. Insurance supply controls are the current value and 4 lags of a firm's investors' return on equity, investment yield, P&C and life insurance profitability, and life insurance fee income and commissions. Insurer investment yield bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' investment yield. Insurer profitability bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' insurance profitability. The definitions of other control variables and fixed effects are as in Table 10. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$							
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	6.410***	7.087**	5.569***	6.977***	5.581***	6.562***	6.253***	
	[3.59]	[2.49]	[3.04]	[3.80]	[3.73]	[3.82]	[3.59]	
$\Delta \log \#\text{Pot. investors}^{>0}$		0.128*						
		[1.68]						
$\Delta \log \#\text{Pot. investors}$		-0.148**						
		[-2.28]						
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$								6.431***
								[3.82]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurance supply controls			Y					
Rating-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE	Y							
Insurer location-Time FE		Y	Y	Y	Y	Y	Y	Y
Insurer inv yield-Time FE			Y					
Insurer profit-Time FE			Y					
First stage								
$\Delta\text{INVPremiums}^{>0}$	0.024***	0.018***	0.024***					0.026***
	[5.5]	[3.7]	[5.4]					[5.8]
$\Delta\text{INVPremiums}^{>0}_{1:10}$				0.026***				
				[5.5]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$					0.028***			
					[6.6]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex neigbor}}$						0.025***		
						[5.7]		
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$							0.024***	
							[5.5]	
F Statistic	68.9	30.2	56.2	79.0	106.3	85.3	74.4	84.6
No. of obs.	15,456	15,456	15,329	15,456	15,449	15,425	15,448	15,456
No. of firms	829	829	829	829	828	829	829	829

Table IA.36. Corporate investment and insurers' bond demand: Robustness for acquisition expenditures.

Each column presents estimates for the effect of insurers' bond purchases on the firm's acquisition expenditures analogously to Table 10. The main explanatory variable in columns (1)-(7) is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt, and in column (8), it is the total volume of insurers' net purchases of firm f's bonds in quarter t scaled by lagged bond debt. Bond purchases are instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, excluding premiums from the firm's headquarters state and additionally (column 5) deposit-type life insurance, (column 6) states neighboring the firm's headquarters, and (column 7) customer and supplier states. In column (4), the definition of potential investors is based on the previous 10 quarters. Social connectedness bins are based on the quartiles of Bailey et al. (2018)'s social connectedness index between a firm's and its potential investors' location. Insurance supply controls are the current value and 4 lags of a firm's investors' return on equity, investment yield, P&C and life insurance profitability, and life insurance fee income and commissions. Insurer investment yield bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' investment yield. Insurer profitability bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' insurance profitability. The definitions of other control variables and fixed effects are as in Table 10. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	$\frac{\text{AcqEx}}{\text{Bond debt}_{t-1}}$							
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	3.865***	4.000*	3.121**	4.143***	3.042***	4.331***	3.894***	
	[2.87]	[1.90]	[2.29]	[2.99]	[2.67]	[3.22]	[2.92]	
$\Delta \log$ #Pot. investors$^{>0}$		0.124**						
		[2.18]						
$\Delta \log$ #Pot. investors		-0.119**						
		[-2.36]						
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$								4.037***
								[3.12]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurance supply controls			Y					
Rating-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE	Y							
Insurer location-Time FE		Y	Y	Y	Y	Y	Y	Y
Insurer inv yield-Time FE			Y					
Insurer profit-Time FE			Y					
First stage								
$\Delta\text{INVPremiums}^{>0}$	0.024***	0.018***	0.024***					0.026***
	[5.5]	[3.7]	[5.4]					[5.8]
$\Delta\text{INVPremiums}^{>0}_{1:10}$				0.026***				
				[5.5]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$					0.028***			
					[6.6]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex neigbor}}$						0.025***		
						[5.7]		
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$							0.024***	
							[5.5]	
F Statistic	68.9	30.2	56.2	79.0	106.3	85.3	74.4	84.6
No. of obs.	15,456	15,456	15,329	15,456	15,449	15,425	15,448	15,456
No. of firms	829	829	829	829	828	829	829	829

Table IA.37. Corporate investment and insurers' bond demand: Robustness for capital expenditures.

Each column presents estimates for the effect of insurers' bond purchases on the firm's capital expenditures analogously to Table 10. The main explanatory variable in columns (1)-(7) is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt, and in column (8), it is the total volume of insurers' net purchases of firm f's bonds in quarter t scaled by lagged bond debt. Bond purchases are instrumented by the firm's exposure to increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, excluding premiums from the firm's headquarters state and additionally (column 5) deposit-type life insurance, (column 6) states neighboring the firm's headquarters, and (column 7) customer and supplier states. In column (4), the definition of potential investors is based on the previous 10 quarters. Social connectedness bins are based on the quartiles of Bailey et al. (2018)'s social connectedness index between a firm's and its potential investors' location. Insurance supply controls are the current value and 4 lags of a firm's investors' return on equity, investment yield, P&C and life insurance profitability, and life insurance fee income and commissions. Insurer investment yield bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' investment yield. Insurer profitability bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' insurance profitability. The definitions of other control variables and fixed effects are as in Table 10. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:				$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$				
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	1.164**	1.121	1.062**	1.332***	1.050***	1.009**	1.100**	
	[2.32]	[1.38]	[2.27]	[2.59]	[2.61]	[2.18]	[2.22]	
Δ log #Pot. investors$^{>0}$		-0.014						
		[-0.61]						
Δ log #Pot. investors		0.011						
		[0.57]						
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$								1.063**
								[2.25]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurance supply controls			Y					
Rating-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE	Y							
Insurer location-Time FE		Y	Y	Y	Y	Y	Y	Y
Insurer inv yield-Time FE			Y					
Insurer profit-Time FE			Y					
First stage								
$\Delta\text{INVPremiums}^{>0}$	0.024***	0.018***	0.024***					0.026***
	[5.5]	[3.7]	[5.4]					[5.8]
$\Delta\text{INVPremiums}^{>0}_{1:10}$				0.026***				
				[5.5]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$					0.028***			
					[6.6]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex neigbor}}$						0.025***		
						[5.7]		
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$							0.024***	
							[5.5]	
F Statistic	68.9	30.2	84.9	79.0	106.3	85.3	74.4	84.6
No. of obs.	15,456	15,456	15,456	15,456	15,449	15,425	15,448	15,456
No. of firms	829	829	829	829	828	829	829	829

Table IA.38. Corporate investment and insurers' bond demand: natural disaster instrument.
Each column presents estimated coefficients from a specification of the form:

$$Y_{f,t} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma' C_{f,t} + \varepsilon_{f,t}$$

at the firm-year-quarter level. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is instrumented by the firm's exposure to increases in disaster fatalities at potential investors' location (including only life insurers), $\Delta\text{INVDisaster}^{>0}$. $C_{f,t}$ is a vector of control variables and fixed effect dummies. It includes the lagged share of the firm's bonds held by insurers ($\%\text{Held by insurers}_{f,t-1}$) in each column. In columns (1) and (2), the dependent variable is the quarterly change in the firm's property, plant and equipment (PPE) scaled by its lagged bond debt. In columns (3) and (4), the dependent variable is the firm's total investment (defined as the sum of acquisitions and capital expenditures) scaled by its lagged bond debt. In column (5), the dependent variable is the firm's acquisition expenditures scaled by its lagged bond debt. In column (6), the dependent variable is the firm's capital expenditures scaled by its lagged bond debt. SIC1 and SIC2 refer to the 1-digit and 2-digit SIC industry classifications, respectively. The definitions of other control variables and fixed effects are as in Table 10. t-Statistics are shown in brackets and based on standard errors clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$		$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$		$\frac{\text{AcqEx}}{\text{Bond debt}_{t-1}}$	$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	1.815*	1.603	6.577***	5.390*	2.398	2.313**
	[1.80]	[1.41]	[2.72]	[1.87]	[1.52]	[2.22]
Firm controls		Y		Y		
Insurer controls		Y		Y		
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y
Insurer type-Time FE	Y	Y	Y	Y	Y	Y
Insurer location-Time FE	Y	Y	Y	Y	Y	Y
Insurer economy-Time FE	Y	Y	Y	Y	Y	Y
SIC1-State-Time FE		Y		Y		
First stage						
$\Delta\text{INVDisaster}^{>0}$	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
	[4]	[3.5]	[4]	[3.5]	[4]	[4]
F Statistic	36.1	25.4	36.1	25.4	36.1	36.1
No. of obs.	15,168	13,175	15,168	13,175	15,168	15,168
No. of firms	815	735	815	735	815	815
Standardized coefficient $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.39	0.34	0.74	0.61	0.37	0.54

F Additional analyses

F.1 Insurance premiums and socioeconomic characteristics

In this section, explore insurance demand driven by socioeconomic characteristics. For this purpose, I rely on insurer-state-level quarterly non-commercial insurance premiums from 2011q1 to 2018q4 and socioeconomic characteristics for U.S. states, retrieved from the U.S. Bureau of Economic Analysis (BEA) and Census. As potential economic determinant for insurance demand, I include the log total income per capita at the state-quarter level in the lagged 4 quarters (retrieved from the U.S. BEA). As potential social determinants for insurance demand, I include the level of education, measured by the share of residents with a bachelor's degree (among those aged at least 25 years), the share of seniors (residents aged at least 65 years), the share of married residents (among those aged at least 15 years), the share of divorced residents (among those aged at least 15 years), and the share of married households with kids, which are all retrieved from the U.S. Census, recorded at the state-year level, and lagged by one calendar year relative to insurance premiums.

Table IA.39 depicts the results of regressions of log insurance premiums on these characteristics. I absorb time-invariant heterogeneity in insurers' activity across states by including insurer-state fixed effects and aggregate trends by including region-time fixed effects. Thus, the coefficients are identified off local variation in socioeconomic characteristics. In an additional specification I also include insurer-time fixed effects, which absorb any variation in insurer characteristics, such as financial strength or investment success.

I find that socioeconomic characteristics significantly correlate with insurance premiums. Income is particularly important for P&C insurance, as a 1% increase in income relates to roughly 1% increase in insurance premiums. Insurance premiums for annuities correlate mostly with education and family status, suggesting that households are more inclined to save for retirement when being more educated or married without kids, while having kids significantly reduces annuity premiums, consistent with higher opportunity costs. Insurance premiums for pure life insurance are mostly correlated with a higher share of seniors, which is consistent with a higher mortality risk in this age group.

Table IA.39. Insurance premiums and socioeconomic characteristics.
Each column presents OLS estimates for a specification of the form:

$$\log \text{Premiums}_{i,s,t} = \alpha\, X_{i,s,t} + \Gamma' C_{i,s,t} + \varepsilon_{i,s,t}$$

at the insurer-state-year-quarter level including only U.S. states from 2011q1 to 2018q4, where $C_{i,s,t}$ is a vector of fixed effect dummies. The dependent variable is the log total volume of non-commercial insurance premiums for (1-2) P&C insurance, (3-4) annuities, (5-6) pure life insurance. The explanatory variables are the log total income per capita in the lagged 4 quarters (Source: U.S. BEA) and the share of the population with a bachelor's degree, aged at least 65 years, married, divorced, and the share of households with kids lagged by one calendar year (Source: U.S. Census). Regions are the U.S. Mid-Atlantic, Midwest, Northeast, Southeast, Southwest, West. Columns (2), (4), and (6) only include insurers that are active in at least two states at a given point in time. t-statistics are shown in brackets and clustered at insurer and state-time levels. ***, **, * indicate significance at the 1%, 5% and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	log Insurance premiums					
Type:	P&C		Annuity		Pure life	
log Income	0.987***	1.013***	-0.116	0.215	0.226**	0.211**
	[5.16]	[5.77]	[-0.42]	[0.98]	[2.30]	[2.36]
% Bachelor	1.077*	0.645	1.644**	1.723**	0.747**	0.658**
	[1.93]	[1.22]	[1.98]	[2.14]	[2.55]	[2.24]
% $\geq$ 65 yrs	-0.063	-0.817	0.854	1.041	1.978**	1.783**
	[-0.03]	[-0.49]	[0.38]	[0.53]	[2.40]	[2.30]
% Married	1.332*	0.852	1.481*	1.277	0.025	0.017
	[1.88]	[1.23]	[1.66]	[1.51]	[0.08]	[0.05]
% Married w/ kids	-1.046	-0.538	-1.931*	-1.971**	-0.239	-0.319
	[-1.26]	[-0.70]	[-1.80]	[-1.98]	[-0.55]	[-0.73]
% Divorced	-2.258**	-1.823*	-0.589	-0.261	-0.673	-0.628
	[-2.32]	[-1.95]	[-0.43]	[-0.20]	[-1.37]	[-1.27]
Insurer-State FE	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y
Insurer-Time FE		Y		Y		Y
No. of obs.	354,827	345,250	233,995	232,114	485,304	483,482
No. of insurers	959	658	389	330	482	420
R^2	0.905	0.940	0.887	0.927	0.963	0.979

F.2 Insurance premiums and insurers' investment return

A potential concern in my baseline analysis is that bond prices directly affect insurance premiums through insurers' investment return. In this case, lower expected investment returns associated with higher bond prices would correlate with higher insurance markups (Knox and Sørensen, 2020). This section explores the correlation between expected investment returns and total non-commercial insurance premiums.

I follow Knox and Sørensen (2020) and use insurers' reported net investment yield (in %) as the main measure for expected investment returns. In column (1) of Table IA.40 I find a significantly positive correlation between investment yield and total insurance premiums, controlling for aggregate shocks with time fixed effects and for time-invariant heterogeneity across life and P&C insurers by including insurer type fixed effects. The coefficient drops in size and becomes insignificant upon the inclusion of insurer fixed effects in column (2). Thus, time-invariant differences across insurers explain the positive correlation between investment yield and insurance premiums, i.e., that larger insurers tend to have a larger investment yield on average. The coefficient remains insignificant when controlling for differential trends for P&C and life insurers in column (3).

Thus, the correlation between investment return and insurance premiums tends to be positive - yet, insignificant at the insurer level. These results suggest that it is implausible that an increase in bond prices, which is associated with a *decrease* in expected investment returns, leads to an increase in insurance premiums, as it would imply a negative correlation between investment return and insurance premiums.

Table IA.40. Insurers' investment return and insurance premiums.
Each column presents OLS estimates for a specification of the form:

$$\log \text{Insurance premiums}_{i,t} = \alpha \text{ Inv yield}_{i,t} + \Gamma' C_{i,t} + \varepsilon_{i,t}$$

at the insurer-year-quarter level, where $C_{i,t}$ is a vector of fixed effect dummies. Each column presents estimates for the effect of insurers' net investment yield on non-commercial insurance premiums written. t-statistics are shown in brackets and clustered at the insurer level. ***, **, * indicate significance at the 1%, 5% and 10% level.

	(1)	(2)	(3)
Dependent variable:	log Insurance premiums		
Investment yield	0.372***	0.015	0.016
	[11.66]	[1.50]	[1.61]
Time FE	Y	Y	
Insurer type FE	Y		
Insurer FE		Y	Y
Insurer type-Time FE			Y
No. of obs.	47,502	47,502	47,502
No. of insurers	1,499	1,499	1,499
R^2	0.458	0.959	0.959
1-sd effect			
	0.60	0.02	0.03