Investor-Driven Corporate Finance: Evidence from Insurance Markets*

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Abstract

I study the effect of bond investor demand on the financing and investment decisions of non-financial firms using granular data on the bond transactions of insurance companies. Liquidity inflows from insurance premiums combined with insurers' persistent investment preferences identify bond demand shifts in the secondary market. These raise bond prices and reduce firms' financing costs. In response, firms issue more bonds, especially when they have well-connected bond underwriters. The proceeds are used for investment activities, particularly by financially constrained firms. My findings emphasize that bond investors significantly affect corporate decisions through their price impact.

Keywords: Institutional Investors, Insurance, Corporate Bonds, Corporate Investment.

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Abstract

I study the effect of bond investor demand on the financing and investment decisions of non-financial firms using granular data on the bond transactions of insurance companies. Liquidity inflows from insurance premiums combined with insurers' persistent investment preferences identify bond demand shifts in the secondary market. These raise bond prices and reduce firms' financing costs. In response, firms issue more bonds, especially when they have well-connected bond underwriters. The proceeds are used for investment activities, particularly by financially constrained firms. My findings emphasize that bond investors significantly affect corporate decisions through their price impact.

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1 Introduction

Corporate bonds account for more than half of U.S. nonfinancial firms' total debt, with institutional investors being the primary holders. Thus, changes in investor demand may have substantial effects on firms' financing and real activities. However, our understanding of how bond investors affect firms is relatively limited, e.g., compared to the extensive literature on banks. Addressing this gap, in this paper, I examine shifts in investor demand within the secondary bond market and quantify their impact on nonfinancial firms' financing and investment decisions.

Investors commonly purchase bonds in the secondary market, which boasts a total daily trading volume of nearly $40 billion and accounts for more than two-thirds of the total annual transaction volume of corporate bonds.[1] Traditionally, the prevailing view has been that financial markets are highly elastic. In this case, nonfundamental shifts in investor demand have no significant effect on firms' financing costs and decisions. Recent studies have challenged this view by documenting the importance of investors in times of financial stress, such as the 2008 Global Financial Crisis. However, an important remaining question is whether demand shifts within the secondary market are sufficiently strong to affect nonfinancial firms in normal times, when financial markets are relatively liquid and firms face relatively few constraints.

Addressing this question requires the identification of investor demand shifts unrelated to stress events and microlevel data that allow for the differentiation of demand shifts in secondary markets and the outcomes of primary market offerings. The U.S. insurance sector serves as an ideal laboratory owing to its detailed regulatory reporting requirements, which include comprehensive information on insurers' corporate bond transactions. By merging these regulatory data with information on bond issuers, my sample encompasses nearly 1,500 insurers and more than 870 nonfinancial firms, covering the period from 2010 to 2018.

[1] I compute the total annual transaction volume of corporate bonds as the sum of the par volume traded in the secondary market (from the Trade Reporting and Compliance Engine (TRACE)) and offering amounts in the primary market (from Mergent FISD). Total daily trading volume is from the FINRA TRACE Fact Book 2022.

Exploiting two salient characteristics of insurers' investment behavior, I identify shifts in secondary market bond demand. First, insurance premiums serve as insurers' primary source of financing, totaling nearly $2 trillion annually. I document that insurers respond to inflows of insurance premiums by purchasing corporate bonds mostly in the secondary market, which is consistent with opportunity costs of holding cash. Second, insurers focus on specific bond issuers, those who are past bondholders being 19 times more likely to invest in the same firm's bonds than those who are not.[2] I use the premiums collected by a firm's past bondholders, referred to as its "potential investors", to construct a firm-level instrument for insurers' bond demand. To account for potential home bias in insurers' investments, the instrument is based only on the premiums paid by households located outside a firm's state, thus removing the effects of local shocks.

The identification strategy rests on the assumption that shocks to a firm's investment opportunities do not differentially affect the insurance premium growth of its past bondholders. Intuitively, it seems unlikely that households' insurance demand is driven by the investment opportunities of the firms in which an insurer invests. Supporting the identifying assumption, firm-specific shocks do not explain the larger bond purchases by past bondholders with larger premium inflows, suggesting as-good-as-random matching of firms and insurers. Moreover, the main results are robust to including granular fixed effects and control variables, which absorb variation in firm and insurer characteristics and their economic environment. Finally, in robustness analyses, I exploit variation in life insurance demand driven by natural disasters to relax the identifying assumption.

For firms with high bond ownership by insurers, a 1 standard deviation higher growth in potential investors' premiums is associated with the insurance sector additionally purchasing 1.2% of a firm's outstanding bonds. The first set of results shows that such premium-driven demand shifts accelerate the growth in firms' bond debt. The estimate implies that when insurers additionally purchase 1% of a firm's outstanding bonds, the stock of the firm's bond debt grows by approximately 6 ppt faster. Notably, the identifying variation stems from insurers' bond purchases

[2] Additional analyses suggest that the persistence in insurers' bond investments is driven by time-invariant investment preferences and costs to screen bond issuers.

in the secondary market, highlighting the role of their price impact rather than of primary market activity. The finding is robust to controlling for firm and insurer characteristics and is consistent with firms timing capital markets (Baker et al., 2003; Greenwood et al., 2010; Ma, 2019; Mota, 2023). Demand shifts also increase bond debt growth *relative* to commercial paper debt growth for the same firm and time, ruling out firm-specific shocks as an alternative explanation.

The second set of results documents the impact of bond demand shifts on firms' investment decisions. Using potential investors' premiums as an instrument, I estimate that when insurers additionally purchase 1% of a firm's outstanding bonds, total investment expenditures increase by approximately 6 ppt relative to outstanding bonds. This investment response mirrors the sensitivity of bond debt, and is accompanied by faster growth in property, plant, and equipment.

The sensitivity of corporate investment to external finance is potentially consistent with underinvestment due to financing frictions (Holmstrom and Tirole, 1997) or with free cash flows allowing managers to pursue unprofitable projects (Jensen, 1986). To explore these possibilities, I first examine the role of financial constraints, sorting firms into terciles of the size–age index from Hadlock and Pierce (2010). The results show that the sensitivity of bond debt growth to demand shifts does *not* significantly increase with tighter financial constraints, indicating similar levels of opportunism across firms. Nonetheless, investment activities show a significantly stronger response for more constrained firms, which is consistent with the relaxation of financing frictions. Second, I examine firms' equity prices as a proxy for (expected) profitability. Stock returns exhibit a significantly negative correlation with demand shifts only for firms with an intermediate level of financial constraints. Together, these results suggest that positive bond demand shifts, on the one hand, can alleviate financing frictions for the most constrained firms but, on the other hand, may amplify free cash flow problems for mildly constrained firms.

Firms' significant response to investor demand raises the question of how managers become aware of demand shifts. I provide evidence for bond underwriters as a valuable source of information. For this purpose, I exploit the persistent underwriter relationships of firms and insurers to measure how strongly connected a firm's underwriters are to the same firm's potential investors. The results show that bond debt growth is significantly more responsive to investor demand when underwriters are well connected to investors.

Moreover, I document that firms cater to the distinct investment preferences of insurance companies. Compared with mutual funds, insurers prefer longer-term bonds with better credit ratings, driven by regulation and long-term liabilities. In response to demand shifts by insurers, firms cater to these preferences by increasing the maturity of bond issuances and avoiding credit rating downgrades.

Finally, supporting the empirical strategy, I document that premium-driven demand shifts significantly increase bond prices. Using potential investors' premiums as an instrument, I estimate that bond returns in the secondary market increase by about 70 basis points (bps) when insurers purchase an additional 1% of the issuer's outstanding bonds. This magnitude is consistent with estimates in the asset pricing literature (Chaudhary et al., 2023). Subsequently, bond prices revert back to their initial level, suggesting that premium-driven demand shifts are not driven by firm fundamentals. Moreover, I find that premium-driven bond purchases affect the yield spreads of new bond issuances to an extent comparable to their impact on secondary market prices. This finding suggests that demand shifts in the secondary market influence firms' financing costs in the primary market, consistent with bonds from the same issuer being close substitutes.

My findings offer new insights into the relationship between nonbank financial intermediaries and the real economy, highlighting how investors affect corporate decisions through their price impact. The results are important for understanding the consequences of firms' increasing reliance on bond financing (Berg et al., 2021; Darmouni and Papoutsi, 2024) and the role of bond investors in the economy more broadly. In particular, my analysis emphasizes the need to explicitly consider investors in economic models and policy, which is crucial for informing financial regulation, e.g., of insurance markets, and for assessing the potential effects of central banks' corporate bond purchases.

This paper contributes to understanding the role of financial intermediaries in the real economy by focusing on the investment behavior of insurance companies in the secondary bond market. A growing literature documents the price impact of investors in secondary markets (Ellul et al., 2011; Koijen and Yogo, 2019; Gabaix and Koijen, 2022; Bretscher et al., 2024; Jansen, 2024). Nonetheless, evidence on the pass-through of demand shifts from investors in the secondary market to firms in the primary market is scarce. The most closely related papers are those of Siani (2024), who estimates a structural model of segmented primary and secondary bond markets, and Coppola (2024), who documents the role of investor heterogeneity in fire sales and their impact on nonfinancial firms.[3] Instead, using insurance premium flows, I identify demand shifts in the secondary bond market and trace their impact on corporate financing and investment decisions in reduced form, controlling for investor heterogeneity.[4] In contrast to studies on fire sales and crises, my results are not driven by the extraordinary financial constraints of investors and firms during times of stress but, instead, shed light on the interaction of frictions in financial markets during normal times with investor preferences and firms' ability to exploit favorable financing conditions.[5]

My analysis also complements studies on flow-induced trading by bond funds (Chernenko and Sunderam, 2012; Zhu, 2021).[6] Zhu (2021) finds that fund flows affect corporate decisions through funds' participation in primary market offerings. In contrast, insurers respond to premium inflows by purchasing bonds in the secondary market, e.g., because they have a high demand for immediacy or due to institutional characteristics. Because investment performance drives fund flows (Goldstein et al., 2017), an identification concern is that fund flows may correlate with the (expected) fundamentals of bond issuers. My empirical approach based on insurance premium flows alleviates

[3]Fire sales are also explored by Aslan and Kumar (2018), Massa and Zhang (2021), and Liu et al. (2021).

[4]Relatedly, the banking literature documents the effects of credit supplied by banks (Khwaja and Mian, 2008; Chodorow-Reich, 2014), e.g., through monitoring (Holmstrom and Tirole, 1997). By highlighting the importance of dealer relationships in the secondary market for bond issuance in the primary market, I extend prior research on investment banks as dealer-underwriters (Yasuda, 2005; Nikolova et al., 2020; Nagler and Ottonello, 2022).

[5]Binsbergen and Opp (2019) emphasize the importance of disinvestment costs, suggesting that investment responds more strongly to positive than negative funding shocks.

[6]Equity fund flows also affect corporate decisions (Edmans et al., 2012; Khan et al., 2012), as managers learn about investment opportunities from equity prices (Bakke and Whited, 2010). The significant differences between equity and debt (markets), particularly in terms of the information sensitivity of prices (Dang et al., 2020) and their distinct impact on the incentives and behavior of creditors and lenders (Myers and Majluf, 1984), suggest that it is important to separately investigate equity and bond markets and investors.

this concern because these flows are driven by demand for insurance rather than investment and thus do not respond to insurers' investment performance (Darmouni et al., 2024). Moreover, using detailed information on insurance customers, I directly filter out flows that are more likely to correlate with issuer fundamentals, thereby isolating the effects from potential confounders.

Finally, this paper contributes to the understanding of how the distinct economic frictions faced by insurance companies interact with the corporate bond market, which is important, as insurers hold more than one-third of outstanding corporate bonds. Unlike funds, insurers are regulated and have stable long-term liabilities, which bolsters their demand for long-term bonds with high credit ratings. Driven by these investment preferences, my results shed light on the behavior of firms with relatively weak financial constraints and highlight how these constraints interact with the transmission of investor demand.[7] I also document that firms cater to the distinct investment preferences of insurers with respect to bond maturities and credit ratings, extending recent evidence on catering (Baker and Wurgler, 2004; Mota and Siani, 2024). Moreover, complementing studies that associate insurers with a stabilizing role in financial markets (Timmer, 2018; Chodorow-Reich et al., 2021), I show that insurers smooth negative funding shocks by pooling cash flows across business activities.

2 Institutional background

2.1 Insurance market

Insurers perform two roles. On the one hand, they insure against risks, such as property loss and damage (P&C insurance) and longevity and mortality risk (life insurance). For this purpose, insurers collect insurance premiums from customers and use these premiums to build reserves for potential future claims. Premiums in the U.S. were \$1.7 trillion in 2019, corresponding to 8%

[7] More than 10% of insurers' corporate bond holdings have an investment-grade credit rating (BBB or better). Comparing insurers with bond funds in Lipper, insurers account for 79% of their joint investment-grade corporate bond holdings but only 31% of their joint high-yield holdings, on average, from 2010 to 2018.

of GDP. Premiums come mainly from noncommercial insurance business and are insurers' main financing sources, as reserves account for about three-quarters of insurers' total liabilities.[8]

On the other hand, insurers invest premiums in financial assets. The total invested assets of the U.S. insurance sector (excluding cash) totaled \$6.7 trillion in 2019, which emphasizes the importance of insurers as investors.[9] Corporate bond holdings account for 36% of these assets. Insurers have strong incentives to invest in high-quality assets due to risk-based capital regulation (Becker and Ivashina, 2015; Becker et al., 2022). As a result, 90% of insurers' corporate bond holdings have an investment-grade credit rating, i.e., of at or above BBB-.

Insurers are regulated at the state level. Therefore, they are required to be licensed in each state in which they are active. As a consequence, the insurance market is geographically fragmented: the median insurer is active in 7 states.[10]

2.2 Corporate bond market

U.S. nonfinancial companies' corporate bond debt reached nearly \$6 trillion in 2019, corresponding to 27% of U.S. GDP (source: Z.1 Financial Accounts of the U.S.). The majority of corporate bonds are issued by investment-grade borrowers (Berg et al., 2021). Institutional investors (insurers and pension, mutual, and other funds) dominate the corporate bond market and jointly hold approximately 80% of bonds outstanding, with insurers preferring longer-term and higher-rated bonds than do funds (see Figures IA.11 and IA.12).

The secondary bond market is an over-the-counter market subject to significant market frictions, such as costly search (Friewald and Nagler, 2019) and market power (O'Hara et al., 2018). To mitigate frictions, investors maintain persistent relationships with dealers (Hendershott et al., 2020).

In the primary bond market, the average U.S. nonfinancial firm issues about two bonds per year

[8] Figures IA.1, IA.2, IA.10, and IA.12 illustrate the distribution and time series of insurance premiums written and the composition of insurers' assets, liabilities, and corporate bond portfolios.

[9] *Source*: NAIC Capital Markets Special Report "U.S. Insurers' Cash and Invested Assets Reach Almost \$7 Trillion at Year-End 2019".

[10] For simplicity, by *states*, I am referring to the 50 U.S. states, the District of Columbia, and the 5 U.S. territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands).

with a joint offering amount of $1 billion. Investment banks operate as dealers in the secondary market and as underwriters in the primary market. Underwriters facilitate the issuance of securities by providing placement services to firms and allocating bonds to investors, leveraging persistent relationships (Yasuda, 2005; Nikolova et al., 2020; Nagler and Ottonello, 2022).

3 Data and descriptive statistics

I combine microlevel data on insurance companies and their bond investments with information on firm characteristics and bond prices. Detailed definitions and documentation are provided in Appendix A. Table 1 provides summary statistics for the main variables, and Tables IA.12 and IA.13 present those for additional variables.

3.1 Insurer characteristics and investments

Financial data for U.S. P&C and life insurers are from their statutory filings collected by the National Association of Insurance Commissioners (NAIC) and obtained from S&P Global Market Intelligence. Schedule D provides detailed information on bond holdings, acquisitions, and disposals in the general account at the security level, including the transaction date, par value, price, and counterparty. Combining this information, I reconstruct end-of-quarter holdings from 2009q4 to 2018q4. I use par values as these are not affected by changes in issuer fundamentals over time.

Changes in holdings can be due to actual transactions or other events such as bond redemptions or within-insurance group 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 counterparty does not indicate a transfer (e.g., stating "portfolio transfer") or adjustment (e.g., stating "record gain on bond"). A total of 94% of reported bond acquisitions are flagged as actual purchases (by par value), which I further classify into primary and secondary market purchases using information on offering dates, prices, accrued interest, and TRACE trade flags (detailed in Appendix A.4). On average, 63% of insurers' classified corporate bond purchases (by par value) are in the secondary market, and this share is very stable over time (see Figure IA.13). In an average quarter from 2010 to 2018, U.S. insurers jointly purchased corporate bonds with a total par value of $111 billion.

From insurers' financial statements, I obtain quarterly information about investment and insurance activities and the state-level breakdown of direct premiums. I also retrieve insurers' financial strength ratings from A.M. Best. I drop insurers with negligible corporate bond investments or negligible noncommercial insurance business, defined as insurers with less than $100,000 invested in corporate bonds (at par) or noncommercial direct insurance premiums below $50,000 or less than 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 or missing insurer characteristics (such as investment yield), which leaves 1,488 insurers. In insurer-level analyses, after dropping singletons, the sample includes 1,451 insurers, with average corporate bond holdings of $1.2 billion and purchases of $69 million per quarter. Unless indicated otherwise, I exclude commercial premiums and adjust premiums by the lagged ratio of net premiums collected to direct premiums written (detailed in Appendix A.1). Average premiums are $114 million, and quarterly premium growth ranges from -1.9% to 2.5% of total assets at the 5th and 95th percentiles.

I match insurers' bond investments to information about firms, i.e., bond issuers (detailed in Appendix A.2). 67% of bond holdings are matched to Capital IQ and Compustat in the median insurer–quarter (34%/96% at the 5th/95th percentiles, respectively), and this matching probability is stable over time. At the insurer-by-firm level, the average quarterly bond purchase volume in the secondary market, conditional on bonds being purchased, is $2.5 million, with wide variation. The probability of an insurer purchasing a firm's bonds is 0.4%, which indicates substantial fragmentation.

3.2 Firm characteristics

I obtain quarterly data on U.S. firms' balance sheets and cash flows from Compustat and on their debt structure from Capital IQ and stock prices from CRSP. Firms enter the sample only if at least one insurer ever held bonds issued by the firm in the previous 8 quarters. Following the corporate finance literature, I exclude the finance (SIC 6000–6999), utilities (SIC 4900–4999), and public administration (SIC above 8999) sectors; drop small firms (with median total assets below $1 million); and exclude observations when equity either is below zero or exceeds total assets. To strengthen the data quality, I require that the total debt reported in Capital IQ and Compustat do not differ by more than 25%.

A key variable is the quarterly growth in a firm's bond debt, reflecting total net bond issuance. Thus, bond debt is required to be nonmissing in the current and previous quarters. For consistency, other variables are also scaled by lagged bond debt. Total corporate investment is computed as the sum of acquisition expenditures (i.e., indirect investment) and capital expenditures (i.e., direct investment), which are both cash flow variables. In addition, I consider the growth in total assets and in property, plant, and equipment, which reflect changes in firms' balance sheets. The sample is saturated with a wide range of control variables that have been shown to capture determinants of capital structure and investment activities, such as cash flow and the market-to-book ratio.

The final baseline sample includes 876 firms and spans from 2010q2 to 2018q4. Since all the firms in the sample have access to the bond market, they are relatively large, with total assets of $4.4 billion at the median, and jointly account for 64% of the total assets of U.S. nonfinancial firms in Compustat.[11] Bond debt ranges from 29% to 100% of total debt at the 5th and 95th percentiles, respectively. On average, the insurance sector holds 23% and purchases 1.3% of a firm's outstanding bonds per quarter, emphasizing the importance of insurers as investors.

3.3 Bond characteristics and prices

I merge the baseline firm-level sample with information about individual bonds using the CUSIP as identifier. Bond characteristics, issuance yields, and credit ratings are from Mergent FISD, a

[11] In Appendix A.5, I compare the cross-sectional distribution of firm characteristics for my sample with that for all firms in Compustat. The firms closely resemble one another, with the main difference being that those in my sample are larger and have greater leverage.

comprehensive database of publicly offered bonds.[12] I calculate the yield spread as the difference between the issuance yield and that on the nearest-maturity treasury bond and drop bonds in foreign currency.[13] Issuances are aggregated to the firm-by-quarter level using the total offering amount and the offering amount–weighted average yield spread. After merging with the baseline sample, nearly half of the firms remain in the sample. The average offering amount is $1.3 billion, and the average issuance yield spread is 2.5% across all firm-by-quarter observations with issuances.

Information about firms' bond underwriters is retrieved from Mergent FISD. Owing to the absence of a common identifier, I match underwriters from FISD with the counterparties reported in insurers' bond transactions using a combination of fuzzy string merging and manual matching. This creates a uniquely detailed dataset about the investor–underwriter–firm network, connecting 68% of insurers' corporate bond purchases to underwriters in FISD.[14] I define underwriter connectedness, denoted %UW, as the ratio of the bond purchases by a firm's potential investors from that firm's underwriters to those from all underwriters (detailed in Section 5.4). This measure ranges from 8.5% to 68.5% at the 5th and 95th percentiles, respectively, revealing substantial heterogeneity in the ties between underwriters and investors.

Secondary market data are retrieved from TRACE, which records the near universe of U.S. corporate bond transactions. The data are cleaned of cancellations, corrections, and reversals following Dick-Nielsen (2014). I exclude primary market trades and aggregate observations to the bond-by-month level. Bond returns are defined as the relative change in end-of-month prices 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 observations with a current or lagged total trade volume below $100,000. After merging with the baseline sample, 3,851 bonds issued by 670 firms are left in the sample, with an average quarterly transaction volume of $56 million.

[12] Credit ratings are from S&P, Moody's, and 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.

[13] When the issuance yield is not reported, I use the offering price and coupon to impute the yield. The imputed yields are almost identical to the reported yields, suggesting that the imputation procedure is reliable.

[14] Counterparty names are missing (e.g., reported as "various") for 20% of insurers' bond purchases and, in this case, cannot be matched.

4 Empirical strategy

This paper aims to estimate the causal effects of bond demand shifts on nonfinancial firms' financing and investment activities. I relate firm outcomes $Y_{f,t}$ to the insurance sector's bond purchases of the bonds issued by firm f scaled by bonds outstanding, i.e., bond debt:

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

where $C_{f,t}$ is a vector of control variables and fixed effects. Identifying α from Equation (1) is challenging for two reasons. First, bond purchases are an equilibrium outcome that conflates supply and demand. For example, larger bond issuances may be absorbed by larger bond purchases. Second, omitted variables may affect firm outcomes and bond demand simultaneously. For example, an increase in a firm's investment opportunities may increase both bond issuances and purchases.

I overcome this identification challenge by isolating demand shifts induced by insurance premium flows. I construct an instrumental variable that exploits that insurers with larger premium inflows purchase more bonds and, in particular, bonds issued by firms in which they previously invested. For this purpose, I define by $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ a dummy variable equal to one if insurer i ever held bonds issued by firm f in the prior eight quarters and zero otherwise. Insurers with $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) = 1$ are called the *potential investors* of the firm. The total premiums of potential investors weighted by their corporate bond portfolio size $CB_{i,t-1}$ are given by

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

where $P_{i,f,t} = \text{Premiums}_{i,f,t}/\text{Total assets}_{i,t-1}$ are insurance premiums written by insurer i scaled by its lagged total assets, and $w_{i,f,t-1} = \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) CB_{i,t-1}$ are premium weights. $P_{i,f,t}$ excludes commercial insurance premiums and those written at firm f's location, which removes the impact of shocks to the firm's economic environment.

To identify premium-induced bond purchases, I focus on premium increases, $\max(\Delta \log \bar{P}_{f,t}, 0)$, which I multiply by the ownership share of the insurance sector, $h_{f,t-1}$, defined as the lagged ratio of insurers' holdings of firm f's bonds over its bond debt:

$$\Delta\text{INVPremiums}^{>0}_{f,t} = h_{f,t-1} \times \max(\Delta \log \bar{P}_{f,t}, 0). \tag{3}$$

In Appendix B.1, I show that $\Delta\text{INVPremiums}^{>0}_{f,t}$ is equal to the insurance sector's amount of bond purchases under the assumptions that the average portfolio weight of potential investors is sticky and that insurers' investments grow proportionally to premiums. I also provide a stylized model and empirical evidence supporting these assumptions. The relevance of $\Delta\text{INVPremiums}^{>0}_{f,t}$ is supported by first-stage regressions. Moreover, I document the robustness to alternative instrument constructions that use lagged portfolio weights or premium levels.

To illustrate the instrument construction, consider two hypothetical insurers, A and B. A invests 20% of total assets in corporate bonds, and insurer B invests 10% of total assets. In period $t-1$, A and B collect noncommercial premiums of \$10 and \$5 in states other than the firm's location, respectively. $\bar{P}_{f,t-1}$ takes the sum of these premiums multiplied by the amount of total corporate bond holdings and scaled by total assets: $\bar{P}_{f,t-1} = 0.2 \times \$10 + 0.1 \times \$5 = \$2.5$. In period t, insurer A's premiums grow from \$10 to \$12, while B's premiums drop from \$5 to \$4. Total weighted premiums are equal to $\bar{P}_{f,t} = 0.2 \times \$12 + 0.1 \times \$4 = \$2.8$. Thus, total premium growth is $\Delta \log \bar{P}_{f,t} = 4.9\%$. When bond holdings grow proportionally to insurance premiums, as argued in Appendix B.1, the 4.9% increase in premiums translates into a 4.9% increase in holdings. For example, if insurers collectively hold \$10 worth of firm f's bonds at $t-1$, then the amount of hypothetical bond purchases is

$$\Delta\text{INVPremiums}^{>0}_{f,t} = \frac{\$10}{\text{Bond debt}_{f,t-1}} \times 0.049 = \frac{\$0.49}{\text{Bond debt}_{f,t-1}}. \tag{4}$$

While the mutual fund literature has proposed similar instruments for demand shifts by funds (e.g., Lou, 2012; Zhu, 2021), $\Delta\text{INVPremiums}^{>0}_{f,t}$ is tailored to the unique institutional characteristics of insurance companies in two ways. First, insurance premiums are very persistent over time as policyholders frequently roll over their insurance contracts; the correlation between $\log \bar{P}_{f,t-1}$ and $\log \bar{P}_{f,t}$ exceeds 95%. When policyholders roll over their insurance contracts, they generate premium inflows. Because insurance premiums are set to reflect expected claims, these inflows from rollovers approximately offset claim outflows, generating a net cash flow close to zero. As a result, bond purchases are driven by premium growth rather than the level of premiums, as formally shown in Appendix B.1. Consistent with these stylized balance sheet dynamics, bond purchases load positively on the current level and negatively on the lagged level of premiums (see Table IA.14). Moreover, firm–insurer sorting on persistent premiums may threaten the identification when the instrument is based on premium levels.[15] For these reasons, $\Delta\text{INVPremiums}^{>0}_{f,t}$ is based on growth rather than the level of insurance premiums.

Second, prior studies have used lagged portfolio weights to weight fund flows, motivated by the observation that mutual funds proportionally expand or liquidate existing holdings in response to flows. I test whether insurers behave similarly by regressing the percentage change in bond holdings on premium inflows in column (6) of Table 3, following the specification in Lou (2012). A coefficient close to one would indicate that insurers hold portfolio weights constant when investing new premiums, conditional on having invested in the firm before. Instead, the estimated coefficient is 0.38. Whereas flows do not affect optimal portfolio choices in frictionless markets, this estimate suggests that insurers dynamically adjust their investment allocations to frictions in the corporate bond market. Moreover, relying on lagged portfolio weights may threaten the identification if these weights reflect expectations about firm fundamentals (see Section 4.2). For these reasons, I construct premium weights based on the persistent component of the investment universe of insurers, captured by the dummy variable $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$, rather than lagged portfolio weights.

[15] Although premium weights are defined by insurers' past investment universe, an identification based on premium levels would be threatened if insurers with large *past* premiums sorted into firms with better investment opportunities. In this case, when premiums are persistent, insurers with large *current* premiums may be concentrated in firms with high bond debt growth.

The following sections provide empirical support for the identification strategy by documenting the relationship between premium inflows and bond purchases and the determinants of insurers' investment choices and by using a within-firm estimator. Moreover, I propose a robustness analysis that uses spikes in life insurance demand after natural disasters to relax the identifying assumption.

4.1 Insurance premiums

Insurance premiums are insurers' main financing source. In my analyses, I use noncommercial insurance premiums (i.e., those collected from households) and thereby exclude variation in firms' insurance take-up and in insurers' use of alternative financing sources (such as funding agreements). The variation in noncommercial direct premiums written is sizable, with an absolute quarterly change of 18% for the average insurer.[16]

Reinsurance and the timing of premium payments affect the realized cash flow from selling insurance. Insurers with better investment opportunities may use less reinsurance and seek faster premium collection. To ensure that such behavior does not bias the results, I compute premiums as direct premiums written (i.e., unadjusted total premiums for new contracts) adjusted by the insurer's trailing average ratio of net premiums collected (i.e., the realized cash flow after reinsurance) to direct premiums written ("net-to-gross premiums ratio"), unless indicated otherwise. Appendix A.1 details the variable construction.

The stylized balance sheet dynamics in Appendix B.1 point to premium growth as the determinant of asset purchases. Incorporating this insight, I regress an insurer's growth in total financial investments (including cash) as well as corporate bond purchases on premium growth in Table 2. All specifications include fixed effects that absorb time-invariant differences across insurers, seasonality, and systematic shocks that affect all life or all P&C insurers, such as regulatory changes. Column (1) reports a significantly positive correlation between premiums and total investments. This effect is driven by premium increases (column (2)). The estimate implies that 86 cents of

[16]The variation in premiums is not driven by small insurers or seasonality. Determinants of premiums include local socioeconomic characteristics and risk salience after natural disasters (see Section 4.3).

every dollar increase in premiums pass through to an insurer's investments. In contrast, the effect of premium decreases is close to zero and not statistically significant. The latter result suggests that insurers prevent their balance sheets from contracting immediately after premium decreases, consistent with the asset insulator view of insurers (Chodorow-Reich et al., 2021).[17]

Insurers face incentives to invest their premiums, driven by long-term liabilities. Columns (3) to (5) show a significant relationship between higher premium increases and larger bond purchases. For every dollar increase in insurance premium flows, insurers purchase 22 cents' worth of corporate bonds, which is close to the average share of assets invested in corporate bonds.[18] This relationship is unaffected by the inclusion of controls for insurer characteristics, such as investment return or underwriting profitability, indicating that it is driven by variation in insurance demand rather than supply. Assuming that insurers distribute bond purchases evenly among the firms in which they previously invested (165 on average), the estimate suggests that insurers purchase 0.1 cents of an average firm's bonds (= 0.22/165) in response to a \$1 premium inflow. The aggregate volume of premium-driven bond purchases ($\hat{\alpha} \sum_i \Delta \text{Premiums}_{i,t}^{>0}$) is equal to \$2 billion in an average quarter. Thus, premium inflows trigger significant shifts in bond demand.

In column (5), I isolate bond purchases in the secondary market as the dependent variable, which leads to a decrease in the coefficient on premium increases to 0.16. This finding suggests that more than 70% of premium-driven bond purchases are made in the secondary market, which facilitates the use of premium inflows to construct an instrument for demand shifts in the secondary market.[19] Consistent with this result, premium inflows are associated with purchases of old rather than newly issued bonds (see Table IA.14).

[17]Consistent with this interpretation, insurers compensate for premium decreases by raising equity capital and reducing the share of insurance passed on to reinsurers (see Table IA.14).

[18]The results are robust to using bond purchases net of sales as the dependent variable (see Table IA.14).

[19]This estimate is a lower bound for the actual share of premium-driven secondary market purchases because more than 20% of bond purchases are assigned to neither the primary nor the secondary market (see Figure IA.13).

4.2 Insurers' investment universe and instrument validity

$\Delta\text{INVPremiums}^{>0}_{f,t}$ identifies the impact of demand shifts in Equation (1) if the following moment condition is satisfied:

$$\mathbb{E}\left[\sum_{f,t} \Delta\text{INVPremiums}^{>0}_{f,t}\ \varepsilon^{\perp}_{f,t}\right] = 0, \tag{5}$$

where $\varepsilon^{\perp}_{f,t}$ are unobserved firm characteristics residualized by controls and fixed effects. The condition requires that firm-specific shocks to bond issuance do not correlate with the instrument. Equation (5) holds when insurance premiums are random, which, however, is not a necessary condition. Instead, the identification rests on the assumption that for firm f and date t,

$$\mathbb{E}\left[\ \overline{\frac{P_{f,t}}{P_{f,t-1}}}\ \frac{\overline{w}_{f,t-1}}{\widetilde{w}_{f,t-2}}\ \varepsilon^{\perp}_{f,t} \mid \Delta\bar{P}_{f,t} > 0, h_{f,t-1}\right] = 0, \tag{6}$$

where $\overline{\frac{P_{f,t}}{P_{f,t-1}}}$ is the average premium growth of potential investors (weighted by $w_{i,f,t-1}P_{i,f,t-1}$) and $\overline{w}_{f,t-1}$ and $\widetilde{w}_{f,t-2}$ are the average premium weights across insurers (both weighted by $P_{i,f,t-1}$). In Appendix B.2, I show that under regularity assumptions, Equation (6) ensures that the moment condition is satisfied.[20]

Equation (6) requires that a firm's unobserved characteristics $\varepsilon^{\perp}_{f,t}$ are orthogonal to potential investors' average premium growth adjusted by the growth in average premium weights. Thus, a potential identification concern is that premium weights may reflect firm characteristics. To alleviate this concern, I exploit persistence in the investment universe of insurers: more than 90% of the firms currently held by a given insurer were held by the same insurer in previous quarters, consistent with stable preferences, e.g., due to due diligence costs (Zhu, 2021) or mandates (Koijen and Yogo, 2019).[21] To capture the persistent component of insurers' investment universe, I define the firm's

[20]Specifically, in Appendix B.2, I use the approximation $\Delta \log \bar{P}_{f,t} \approx \frac{\bar{P}_{f,t}-\bar{P}_{f,t-1}}{\bar{P}_{f,t-1}}$ and assume that conditional on $\Delta\bar{P}_{f,t} > 0$, $h_{f,t-1}$ is orthogonal to $\varepsilon^{\perp}_{f,t}$. To justify this assumption, all regressions control for $h_{f,t-1}$.

[21]I document the persistence in the investment universe of insurers in Tables IA.8 and IA.9. Persistence in portfolio

potential investors as insurers who ever held the firm's bonds in the previous eight quarters, denoted by $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$. 68% of the variation in $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is time invariant, whereas changes in firm characteristics explain 2%. The baseline specifications use $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ to weight premiums (see Equation 2). In addition, I document the robustness to alternative weights.

The main threat to identification is that the average premium growth of potential investors $\overline{\frac{P_{f,t}}{P_{f,t-1}}}$ correlates with unobserved firm characteristics $\varepsilon^{\perp}_{f,t}$. To absorb the impact of aggregate shocks, all regressions include time fixed effects. Thus, the identifying variation stems from fragmentation in bond ownership.[22] To investigate insurer-firm sorting, I construct an insurer-by-firm-by-quarter-level dataset that includes all possible pairs of firms and insurers that are included in the baseline sample. I estimate the following linear probability model:

$$1\{\text{Purchase}_{i,f,t}\} = \alpha\ \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) + u_{i,t} + v_{f,t} + \varepsilon_{i,f,t}, \tag{7}$$

where $1\{\text{Purchase}_{i,f,t}\}$ equals one if insurer i purchases firm f's bonds in quarter t and zero otherwise and $u_{i,t}$ and $v_{f,t}$ are insurer- and firm-by-time fixed effects, respectively. The estimated coefficient in column (1) in Table 3 implies that insurers are 19 times more likely to purchase a firm's bonds if they previously invested in the same firm (t-statistic: 19.62).

Under regularity assumptions, the difference in the point estimate in Equation (7) between regressions including and excluding $v_{f,t}$ reflects the amount of bias due to sorting of insurers based on unobserved firm characteristics (Khwaja and Mian, 2008; Chodorow-Reich, 2014). I replace firm-by-time with firm fixed effects in column (2). The difference in the estimated coefficient α compared with that in column (1) is neither economically nor statistically significant.

In columns (3) to (5), I regress the par value of insurer i's secondary market purchases of firm

allocations is more pronounced for more opaque (younger and more volatile) firms, consistent with the presence of due diligence costs, and partly explained by insurer-by-firm characteristic fixed effects, which absorb time-invariant investment preferences (see Table IA.10).

[22] On average, a firm's bonds are held by 70 insurers, corresponding to 5% of all insurers in the sample. Despite fragmented bond ownership, insurers are reasonably diversified. Insurers on average invest in 165 different issuers (see Table IA.13) and in multiple industries and locations (see Figures IA.6 and IA.7).

f's bonds on $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$, premium increases, and their interaction.[23] The coefficient on the interaction term shows that potential investors invest significantly more of their premium inflows in a given firm's bonds than do other insurers. A firm's potential investors respond to a \$1 premium inflow by purchasing approximately 0.09 cents of the firm's bonds, which is consistent with the insurer-level estimates from Table 2. The point estimates are almost identical and not significantly different when including insurer-by-time or firm-by-time fixed effects (columns 4 and 5). These findings provide validation of as-good-as-random matching of firms and insurers.

In addition to this evidence, in the following, I discuss specific threats to identification. Insurance premiums might respond to changes in firm characteristics that affect insurers' investment returns (Knox and Sørensen, 2024). However, alleviating this concern, insurance premiums are *not* sensitive to insurers' investment returns (Darmouni et al., 2024). This is consistent with premium flows being driven by households' desire to insure against adverse events rather than by investment motives, which is an important difference to fund flows. Moreover, I show that my results are robust to controlling for insurers' investment returns, to excluding premiums for deposit-type contracts (which households might use for investment), and to isolating premium flows driven by natural disasters.

Furthermore, insurers may sort into firms that are similarly exposed to aggregate shocks. For example, larger and less capitalized insurers tend to invest in riskier firms. Sorting may interfere with the identifying assumption if it implies that premium inflows and firm outcomes are exposed to a common factor, such as the local business cycle. In contrast, I find that insurers are not more likely to invest in firms located in close proximity or with greater social connectedness to the location of insurance customers, which proxies for unobserved social ties. Insurers are also not more likely to invest in firms in industries that are associated with a larger share of employment in insurance customers' locations. Moreover, I find that the premium inflows of insurers with different

[23] Because insurers invest in many firms, average firm-by-insurer-level bond purchases are small relative to insurers' total assets. To improve the readability of coefficients, I scale bond purchases by total assets/\$1 million and premium increases by total assets/\$100,000.

characteristics are similarly exposed to aggregate shocks and that insurers do not systematically sort into firms that share a similar exposure to aggregate factors.[24]

These findings suggest the absence of problematic firm–insurer sorting, which is consistent with diversification motives and insurers' reliance on unaffiliated asset managers. To address potentially remaining concerns, I remove premiums written in close proximity to firms and show that my results are robust to including control variables and fixed effects based on the characteristics of a firm's potential investors.

4.3 Alternative instrument based on natural disasters

In additional robustness analyses, I use natural disasters as plausibly exogenous shocks to life insurance demand, exploiting variation in the number of fatalities caused by heat and storms.[25] Whereas P&C insurers experience large net outflows after natural disasters owing to surging insurance claims (Liu et al., 2021), heat and storm events have no significant impact on life insurers' payouts as the number of fatalities is modest compared with the size of life insurers' customer base.[26] At the same time, disasters increase the salience of underlying risks and, thereby, insurance demand (Gallagher, 2014; Hu, 2022). Therefore, a high number of fatalities is associated with greater net inflows for life insurers, driven by more premiums collected. I focus on the bond purchases resulting from these inflows to life insurers and exclude P&C insurers in this analysis of natural disasters.

I denote by Disaster fatalities$_{i,t-1}$ life insurer i's exposure to disaster fatalities in quarter $t-1$, defined as the sum across states s of fatalities per 100,000 residents in s multiplied by the average share of insurer i's premiums written in s. Disaster fatalities$_{i,t-1}$ is significantly correlated with greater life insurance premium inflows but not with life insurance claim outflows (see Table IA.11). These net inflows result in larger bond purchases (see Table 2). I aggregate the exposure to disaster

[24]The results on firm-insurer sorting are reported in Tables IA.4 to IA.7.

[25]Heat and storms are more frequent and widespread than are other hazards. They jointly affect almost all U.S. states, providing wide variation (see Figures IA.8 and IA.9). In an average year between 2009 and 2018, storms were associated with a total of 162 fatalities and heat with 105 fatalities in the U.S.

[26]E.g., hurricane Katrina, the costliest disaster in U.S. history to date, had only a moderate effect on life insurers' expenses (source: *Hurricane Katrina – Analysis of the Impact on the Insurance Industry* by Towers Watson, 2013).

fatalities across a firm's potential investors and substitute the resulting variable for premiums $\overline{P}_{f,t}$ into Equation (3), which yields the alternative instrument $\Delta\text{INVDisasters}^{>0}_{f,t}$ (Appendix B.5 provides further details).

$\Delta\text{INVDisasters}^{>0}_{f,t}$ identifies bond demand shifts if life insurers do not sort into firms that are exposed to the same disasters. To rule out a common direct exposure, for each firm, I exclude disasters in the state in which the firm is located and all of the neighboring states. The firm region-by-time fixed effects included in the regressions absorb more widespread spatial effects of disasters. Moreover, firm-by-calendar quarter fixed effects remove spurious correlations from disaster seasonality. Because disaster occurrence is plausibly exogenous to firm characteristics, the use of $\Delta\text{INVDisasters}^{>0}_{f,t}$ relaxes the identifying assumption.

5 Bond financing and bond demand

In the following, I present the paper's main results, which document firms' response to demand shifts. I start with an analysis of bond financing.

5.1 Baseline specification

To examine the effect of bond demand on firms' bond debt, I estimate Equation (1) with a firm's quarterly growth in the stock of bond debt as the dependent variable and instrumenting the insurance sector's bond purchases with increases in potential investors' premiums.[27] Standard errors are clustered at the firm and region-by-time level. This approach accounts for correlated residuals–on the one hand, within firms over time, and on the other hand, across firms located in the same region at a given point in time. The empirical specifications include the following fixed effects and controls. Firm-seasonality fixed effects absorb time-invariant firm characteristics and seasonality by interacting firm dummies with calendar quarter dummies. Fixed effects at the region-by-time

[27] In the baseline results, total bond purchases is taken as the main explanatory variable, which mitigates measurement error from assigning purchases to the primary and secondary markets (see Appendix A.4). The results are robust to using secondary market purchases as the main explanatory variable instead (see Table IA.15).

level absorb fluctuations in aggregate and local macroeconomic conditions. Industry-by-time fixed effects absorb industry-wide (2-digit Standard Industrial Classification (SIC)) shocks. Moreover, I control for traditional determinants of corporate finance at the firm level, namely, sales and cash flow, reflecting internal funding (Frazzari et al., 1988, Almeida et al., 2004); the market-to-book ratio as a measure of (expected) investment opportunities; and firm age, leverage, cash holdings, and cash growth, capturing financial slack.

I also control for the characteristics of potential investors, absorbing potentially confounding variation in insurance markets. All regressions include lagged insurer ownership $h_{f,t-1}$ to control for investment preferences by insurers relative to other investors. Moreover, for each firm-quarter, I calculate the average potential investor's profitability, life insurance fee income, investment yield, return on equity and size, and the share of life insurers among potential investors. These variables capture variation in insurance supply and insurers' investment success, profitability, and type. To control for omitted shocks that affect all insurers with similar characteristics, I include granular fixed effects that absorb differential trends of firms whose potential investors are in different lines of business or in different locations (based on lagged insurance premiums). Thus, the main estimate compares firms with a similar investor base.

Finally, I compute dummy variables based on the average employment in the firm's industry and consumption per capita at the customer locations of potential investors (for a detailed description, see Table IA.1). Fixed effects based on the interaction of these dummies with time dummies absorb shocks to the local economic environment of potential investors, alleviating the concern that insurers might invest in firms with common economic exposure.

5.2 Baseline results

Panel A in Table 4 reports the estimated coefficients. Column (1) includes firm-seasonality, industry-by-time, and region-by-time fixed effects. The coefficient on insurers' instrumented bond purchases is significantly positive at the 1% level. Thus, firms exploit favorable financing conditions, which is consistent with survey evidence (Graham, 2022) and with anecdotal evidence that issuers are able to swiftly react to changing market conditions. The first-stage (Cragg–Donald Wald) F statistic, which is well above 20, suggests that the estimates are not contaminated by a potentially weak instrument.

In columns (2) and (3), I successively include the additional fixed effects and controls described above, with negligible effects on the point estimate and its significance. The result is also robust to using potential investors' disaster exposure as an alternative instrument (column 4). In column (5), I additionally control for insurers' primary market purchases, which has little effect on the estimated coefficient. This suggests that the main effect is driven by insurers' price impact in the secondary market.

The point estimate implies that the growth in bond debt is about 6 ppt (0.3 standard deviations) faster when insurers additionally purchase 1% of a firm's outstanding bonds.[28] In combination with the yield impact estimated in Section 8, the results suggest that a 10 bps reduction in financing costs is associated with approximately 4.7 ppt faster bond debt growth ($= 6.14/0.13 \times 0.10$). The magnitude of this semielasticity is consistent with results from prior studies. For example, Foley-Fisher et al. (2016) investigate the impact of the Fed's 2011 maturity extension program on U.S. nonfinancial firms. They estimate that a 42 bps reduction in long-term yields was associated with 33 ppt faster long-term debt growth for fully long-term-debt–dependent firms relative to firms that do not use long-term debt, suggesting that bond debt growth increased by 7.9 ppt per 10 bps reduction in yield ($= 0.33/0.42 \times 0.1$).[29]

For firms with average insurer ownership, the first-stage coefficient in column (3) implies that

[28] Investor segmentation (Siani, 2024) and secondary market illiquidity (Goldstein et al., 2019) contribute to primary market elasticity and, therefore, may elevate firms' response. Moreover, fixed issuance costs lead to lumpy issuance volumes (Bolton et al., 2013).

[29] The Fed's maturity extension program reduced long-term yields by 42 bps (Foley-Fisher et al., 2016, p.412), which accelerated long-term debt growth by 33 ppt for firms with only long-term debt relative to firms that used no long-term debt (see their Table 5). Dathan and Davydenko (2020) estimate a similar semielasticity of firms' total debt to yield changes induced by passive bond funds. The banking literature offers estimates with comparable magnitudes for the sensitivity of corporate debt to loan market conditions, e.g., to the availability of bank loan ratings (Sufi, 2009).

insurers purchase an additional 0.4% of outstanding bonds ($= 0.085 \times 0.23 \times 0.2$) in response to 1 standard deviation higher premium growth $\Delta \log \bar{P}$ (which is 0.2). This effect increases to 1.2% for firms with the 5% largest insurer ownership. In dollar terms, a back-of-the-envelope calculation (detailed in Appendix B.3) implies that bond purchases increase by 0.11 cents when a firm's potential investors receive $1 in additional premiums. This firm-level estimate closely matches the corresponding insurer- and insurer-by-firm-level estimates in Section 4. Taking the second-stage coefficient into account, a $1 premium inflow results in 0.66 cents larger bond debt growth, highlighting the significant elasticity of bond supply.

5.3 Alternative specifications

First, in Table IA.15, I assess the robustness of the baseline results across various alternative specifications. These include additional firm controls, parametric and nonparametric controls for insurers' profitability and investment success, and state-by-industry-by-time and rating-by-time fixed effects. I also show that the estimate is robust to excluding purchases in the primary market and purchases of newly issued bonds from the main explanatory variable.[30] Furthermore, the results are robust to alternative definitions of the instrument, which use the level of premiums or lagged portfolio weights in Equation (2).[31] The results are also robust to excluding premiums for deposit-type contracts from the instrument.

Second, I compare bond debt growth to commercial paper debt growth. Like bonds, commercial paper is an important component of firms' capital structure (Kahl et al., 2015), but due to its short maturity, it is barely held by long-term investors such as insurance companies. In Table IA.16, I document that demand shifts increase a firm's bond debt growth significantly more than

[30] Issuance dates are not available for all bonds purchased by insurers because not all bonds in the NAIC data can be matched to bond characteristics in Mergent FISD. To ensure a conservative estimate in this robustness analysis, for such bonds, I define the (hypothetical) issuance date as the earliest acquisition date observed in the NAIC data.

[31] When premium levels are used, the instrument is equal to INVPremiums $= \bar{P}_{f,t}/\text{Bond debt}_{f,t-1}$. The instrument is less powerful when it is based on the level of premiums, and the instrument becomes nonsignificant in the first stage when it uses the level of premiums and lagged portfolio weights as premium weights. These results are consistent with the institutional characteristics of insurers highlighted in Section 4 and hence support the construction of the baseline instrument.

its commercial paper debt growth, consistent with the baseline results. An important difference between this specification and the baseline specification is that it allows for the inclusion of firm-by-time fixed effects, which absorb firm-specific shocks. The estimated coefficient is robust to including these fixed effects, consistent with the identifying variation being orthogonal to firm fundamentals.

5.4 Underwriter channel

Why are firms so responsive to investor demand? According to anecdotal evidence, investors typically do not communicate demand shifts directly to firms. In contrast, investors have close ties with investment banks, which act as dealers in the bond market. Investment banks also inform firms about investor demand and support firms in setting issuance prices in their role as underwriters. Consistent with this anecdotal evidence, investor–dealer and firm–underwriter relationships are highly persistent.[32]

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

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

where Bond $\text{purchases}_{i,u,t-k}$ represents insurer i's total bond purchases from underwriter u in quarter $t-k$. Finally, I define $\text{UW}_{f,t}$ as an indicator of underwriters being strongly connected with potential investors, which equals one if $\%\text{UW}_{f,t}$ exceeds the 20th percentile of its cross-sectional distribution (which, on average, corresponds to 0.24) and zero otherwise. Since the measure relies on the subset of bond purchases with identified counterparties, the number of firms in the sample decreases to 492.

[32] On average, 73% of insurers' annual bond purchases are from the same dealers from whom they made purchases in the previous year. Similarly, 74% of bond issuance volumes involve underwriters that the issuer used in the previous year.

To test the underwriter channel, I interact insurers' instrumented bond purchases with $\mathrm{UW}_{f,t}$ in Panel B in Table 4. The coefficient on the interaction term is significantly positive (column (6)). Thus, firms respond significantly more strongly to bond demand shifts when their underwriters are well connected with potential investors. A possible alternative explanation is that firms with well-connected underwriters differ in other dimensions. I account for such differences by controlling for firm and insurer characteristics as well as by including $\mathrm{UW}_{f,t}$-by-time fixed effects, which directly absorb time-varying differences across firms with more- and less-connected underwriters.

Moreover, I document that underwriter connectedness becomes more important when information about investors is more difficult to gather. Specifically, I use the dispersion of a firm's investors, measured as the negative value of the Herfindahl–Hirschman index of insurers' bond holdings, and the number of potential investors as proxies for information barriers. Then, I expand the regression specification with a triple interaction term of insurers' instrumented bond purchases, $\mathrm{UW}_{f,t}$, and dummy variables for strong information barriers, which are equal to one for observations in the upper tercile of the cross-sectional distribution of investor dispersion and of the number of potential investors and zero otherwise. The specification also includes all related two-way interactions and the variables themselves. The coefficient on the triple interaction term is significantly positive for both proxies for information barriers (columns (7) and (8)), consistent with the hypothesis. These results emphasize the role of underwriters in facilitating corporate opportunism.

6 Corporate investment and bond demand

6.1 Baseline results

In the following, I estimate Equation (1) with variables that reflect firms' investment activities as dependent variables. I define total investment as the sum of acquisition and capital expenditures.[33]

[33] Acquisition expenditures represent the cash outflow of funds used for and/or costs that relate to acquisitions, including the acquisition price and additional costs. Acquisitions are relatively frequent among the firms in my sample, as acquisition expenditures are positive in one-third of firm–quarter observations.

Additionally, I explore the growth in firms' property, plant, and equipment (PPE) and total assets. The empirical specification is analogous to that in Panel A in Table 4.

Panel A in Table 5 reports the estimated coefficients. The main result implies that investment increases by 6.3 ppt relative to outstanding bonds when insurers additionally purchase 1% of the firm's outstanding bonds (column (1)). The magnitude of the coefficient is similar to that for bond debt growth in Table 4, suggesting that opportunistic bond financing is mostly used to fund investment activities. The coefficient is significant at the 1% level and robust to using potential investors' disaster exposure as an alternative instrument (column (2)).

The investment response is consistent with results from prior studies. For example, Coppola (2024) estimates that a 50-ppt higher ex-ante insurer ownership of a firm's bonds is associated with a 2 to 3 ppt higher total investment (relative to total assets) during the Global Financial Crisis, as it alleviates fire sales. This effect slightly exceeds the impact of insurers purchasing 1% of bonds on total investment implied by column (1), which is 1.6% of assets.[34]

Columns (3) to (6) delve into *how* firms invest. I find that both acquisition and capital expenditures increase significantly with premium-driven bond purchases. When insurers additionally purchase 1% of a firm's outstanding bonds, acquisition expenditures increase by 3.9 ppt, and capital expenditures increase by 0.9 ppt, both relative to outstanding bonds. The strong response of acquisitions is consistent with the fact that firms with bond market access are relatively mature (Cantillo and Wright, 2000). The results are again robust to using disaster exposure as an alternative instrument. Finally, I also examine firms' balance sheet dynamics (columns (7) and (8)). Both PPE growth and total asset growth significantly increase with instrumented bond purchases, with magnitudes consistent with the estimated sensitivity of cash flows.

These results are robust to a variety of alternative empirical specifications. In particular, the estimated response in investment is similar in magnitude and significance to the baseline result when I exclude primary market purchases or newly issued bonds from the explanatory variable, use

[34] To compare the results, I rescale the coefficient in column (1) of Panel A in Table 5 by the average ratio of bond debt to lagged total assets (25%), which yields 1.5 ($= 6.3 \times 0.25$).

alternative definitions of the instrument, or include granular controls for insurers' investment success and profitability and fixed effects at the rating-by-time and state-by-industry-by-time levels.[35]

6.2 Underinvestment vs. free cash flows

The response of investment to bond demand shifts is potentially consistent with underinvestment since favorable external finance could relax financing frictions (Holmstrom and Tirole, 1997) or with free cash flow problems, allowing managers to pursue unprofitable projects (Jensen, 1986). To shed light on these potential channels, I exploit cross-sectional variation in firms' financial constraints and evidence from firms' equity prices.

First, I explore the role of financing frictions, using the size–age (SA) index of Hadlock and Pierce (2010) to measure the tightness of financial constraints.[36] Columns (1) to (4) in Panel B of Table 5 report firms' investment response separately for firms in the lower, intermediate, and upper terciles of the SA index. To ensure that the coefficients do not capture differences in average investment, I include fixed effects for each SA tercile. The estimated coefficients imply a stronger investment response of more financially constrained firms, with significant differences across SA terciles for total investment and acquisition and capital expenditures.[37]

The observation that more constrained firms respond more in terms of investment but not significantly differently in terms of bond debt growth (see Section 7.1) suggests that they substitute other financing sources. Indeed, column (5) shows that firms in the lowest SA tercile significantly reduce "other debt" in response to demand shifts (this debt category in Capital IQ includes debt not classified as bonds or bank debt, such as deposits and asset-backed securities). Instead, other debt of more constrained firms does not significantly respond.

Second, I investigate firms' quarterly stock returns between end-of-quarter prices at $t-1$ and

[35] The estimated coefficients for the robustness analyses are reported in Table IA.17.

[36] The SA index loads negatively on firm age and positively on squared firm size. Hadlock and Pierce (2010) motivate the use of this index to measure financial constraints based on qualitative evidence from SEC filings.

[37] The relatively low average level of financial constraints of bond issuers might weaken the statistical power of cross-sectional tests. The SA index ranges from -4.63 to -3.35 at the 5th and 95th percentiles, respectively, in the baseline sample and from -4.57 to 0.25 for all U.S. nonfinancial firms in Compustat.

t as a proxy for changes in their (expected) profitability. Column (6) shows that stock returns in the intermediate SA tercile respond significantly negatively to demand shifts. In contrast, there is no significant response for the most or least constrained firms.

These results suggest the presence of both underinvestment and free cash flow problems. Positive bond demand shifts relax financing frictions for the most financially constrained firms, which aggressively increase investment in response, consistent with underinvestment. Firms with mild financial constraints also display greater investment activity, but the significantly negative stock market reaction indicates free cash flow problems. Finally, the least constrained firms significantly substitute other sources of financing, accompanied by a mild stock market reaction. Thus, these firms may face both weak underinvestment and weak free cash flow problems.

7 Additional Results

7.1 Role of financial conditions

In the following, I explore the impact of financial conditions on the elasticity of firms' bond debt growth. To measure financial conditions, I use the SA index, firm size, profitability (measured by cash flow), and credit rating. I sort firms into bins based on the terciles of firm characteristics and ratings and then estimate separate coefficients on instrumented bond purchases for each bin following specification (3) in Table 4.

Columns (5) to (8) in Table 6 show significant differences in the sensitivity of insurers' bond purchases in the first-stage regressions according to firm size. Insurers purchase significantly more bonds of larger firms upon premium inflows. Moreover, bond purchases are greater for less constrained firms with larger cash flows and for BBB-rated firms. Instead, the second-stage regressions in columns (1) to (4) indicate that the response of bond debt to demand shifts does not significantly differ across firms. The effect of credit ratings stands out, with BBB-rated firms being less responsive than those with a high-yield or AAA–A rating. A potential reason is that BBB-rated firms already benefit from large investor demand on average (Acharya et al., 2024).

7.2 Catering to investor preferences

The investment preferences of insurance companies and mutual funds, the two largest groups of corporate bond investors, differ in two key dimensions: bond maturities and credit ratings. Driven by distinct economic frictions resulting from risk-based regulation and long-term liabilities (especially of life insurers), insurers prefer higher-rated and long-term bonds.[38] I examine whether firms cater to these preferences in response to demand shifts from insurers.

First, I estimate the effect of demand shifts on the maturity of newly issued bonds. For this purpose, I regress a dummy for whether the bond issuances in a given firm-quarter exhibit an average maturity of at least 10 years on the instrumented logarithm of insurers' bond purchases. The coefficient in column (1) of Table 7 is significantly positive. In column (2), I consider that firms might respond with a time lag and examine the bond issuances in the four quarters following demand shifts. The estimate implies a 7 ppt higher probability of issuing long-term rather than short-term bonds in response to insurers purchasing 1% of outstanding bonds. Moreover, owing to their long-term liabilities, I exploit that life insurers have a stronger preference for long-term bonds than do P&C insurers. Thus, firms have a greater incentive to increase bond maturities when demand shifts are driven by life insurers. I define by *Life INV* an indicator that equals 1 if life insurers account for more than half of a firm's potential investors and zero otherwise. In column (3), I find that firms held by life insurers are nearly twice as likely as other firms to issue long-term bonds in response to demand shifts. Columns (4) and (5) show that these results are robust to using the average maturity of bond issuances as dependent variable.

Second, firms may cater to insurers' preference for high credit ratings by increasing their efforts to avoid downgrades.[39] I define by $1\{\text{Downgrade}_{f,t+1}\}$ an indicator that equals 1 if firm f's lowest

[38] I compare fund and insurer bond holdings in Figure IA.12.

[39] Prior studies emphasize the significant influence of debt issuers on credit ratings. For example, issuers may solicit ratings from multiple agencies and then choose the most favorable ratings. Bongaerts et al. (2012) document such "rating shopping" for corporate bonds near the investment-grade threshold. Generally, credit rating agencies are

credit rating is downgraded from quarter end t to $t+1$. Regressing $1\{\text{Downgrade}_{f,t+1}\}$ on instrumented bond purchases, I estimate that firms are significantly less likely to be downgraded following demand shifts (column (6)). To address the concern that insurers may sort into firms with a low probability of being downgraded, the regression includes firm controls and firm-by-calendar quarter fixed effects to absorb firm-specific and seasonal variation in downgrade probabilities and rating-by-time fixed effects to absorb rating-specific shocks. To narrow in on the effects of catering, I exploit that capital requirements for insurers increase more steeply at and below the investment-grade threshold. This creates particularly strong incentives to avoid downgrades for BBB- or worse-rated firms. Indeed, these firms are more likely than better-rated firms to avoid downgrades in response to demand shifts (column (7)).

8 Bond prices and bond demand

In this section, I investigate the price impact of premium-driven demand shifts. This analysis validates the identification strategy and reveals the transmission of demand shifts through prices.

8.1 Secondary market

I follow secondary market prices over time at the bond level, eliminating time-invariant differences across bonds with fixed effects. The specification compares the bond returns of firms that face large premium-driven bond purchases with those of similar bonds from other firms as follows:

$$\begin{aligned}\text{Bond return}_{b,t}^{-1:x} = & \alpha_x \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma_x' C_{b,t} + u_{b,x} + v_{\text{Maturity},\text{Rating},t,x} \\ & + w_{\text{Industry},t,x} + y_{\Delta\text{Rating},x} + \varepsilon_{b,t,x}, \end{aligned} \tag{9}$$

reluctant to downgrade issuers at the investment-grade threshold and, in particular, following mergers and acquisitions, which are often accompanied by leverage-reduction plans and optimistic projections of synergies (Acharya et al., 2024). Rating agencies are also reluctant to downgrade issuers with performance-sensitive debt (Herpfer and Maturana, 2021), suggesting that they accommodate issuers.

where firm f is the issuer of bond b and bond purchases are instrumented by $\Delta\text{INVPremiums}^{>0}_{f,t}$ in quarter t. Bond $\text{return}^{-1:x}_{b,t}$ is the bond return based on end-of-month prices and accrued interest between months $fmoq(t)-1$ and $fmoq(t)+x$, where $fmoq(t)$ is the first month of quarter t. $C_{b,t}$ is a vector of the firm and insurer characteristics listed in Table 4, including insurer ownership $h_{f,t-1}$. Bond fixed effects $u_{b,x}$ capture time-invariant heterogeneity at the bond level. Maturity bucket-by-credit rating-by-time fixed effects $v_{\text{Maturity},\text{Rating},t,x}$ capture differences in return trajectories driven by remaining time to maturity and credit rating. Additional fixed effects control for heterogeneity across industries $w_{\text{Industry},t,x}$ and credit rating changes $y_{\Delta\text{Rating},x}$ which may correlate with insurers' investment behavior (Ellul et al., 2011). The identifying variation is at the firm level instead of the bond level. This is important because the price impact of demand shifts increases with the level of aggregation: bonds of the same firm are easily substitutable, which can mute the price impact of bond-level demand shifts within firm-by-time buckets, whereas demand shifts at higher levels of aggregation have been found to significantly affect bond prices (Chaudhary et al., 2023).[40]

Figure 1 displays the estimated coefficients α_x, varying the time horizon of bond returns x on the x-axis. Bond returns increase by approximately 70 bps when insurers additionally purchase 1% of the firm's outstanding bonds. The result implies a decrease in yields of 14 bps for the median bond duration (which is 5 years). The implied elasticity of bond demand is $-1/(70/100) = -1.4$, which is consistent with the literature (Chaudhary et al., 2023; Bretscher et al., 2024; Jansen, 2024). Prices start to revert to their initial level in the quarter following demand shifts, which is consistent with models of price pressure (Duffie et al., 2007). Moreover, the results show that prices do not significantly differ *before* demand shifts, supporting the identification strategy.

[40]Choi et al. (2020) show that corporate bond sales by distressed funds have a negligible price impact after controlling for firm-by-time fixed effects. My empirical approach differs from theirs in that I analyze demand shifts at a higher level of aggregation and instrument bond transactions using insurance premium flows. This, as well as the different characteristics of insurers and funds, e.g., in their sophistication as bond traders, may explain why I find a significant price impact.

8.2 Primary market

Bonds issued by the same issuer are close substitutes, suggesting that demand shifts in the secondary market can affect firms' financing costs in the primary market. In the following, I investigate the impact on issuance yields. Since each bond appears only once in the primary market, the identification relies on variation in the cross-section of firms conditional on bond issuance. Specifically, I compare the issuance yield spread of firms that face large premium-driven bond purchases with that of similar firms facing smaller premium-driven purchases as follows:

$$\text{Yield spread}_{f,t} = \alpha \log(\text{Bond purchases}_{f,t}) + \Gamma' C_{f,t} + u_{\text{Maturity},t} + \varepsilon_{f,t}. \tag{10}$$

To accommodate a log-linear relation between yield spreads and bond purchases, I log-transform the instrument, $\Delta\widetilde{\text{INVPremiums}}_{f,t} = \log(\Delta\text{INVPremiums}^{>0}_{f,t} \times \text{Bond debt}_{f,t-1})$, and thus, the estimates are conditional on a positive growth of potential investors' premiums. Maturity-by-time fixed effects $u_{\text{Maturity},t}$ imply that α is based on comparing firms that, at the same time, issue bonds with similar times to maturity. $C_{f,t}$ is a vector of control variables that includes the logarithm of bonds' time to maturity and that of issuers' credit rating (on a scale ranging from 1 for AAA to 6.67 for CCC-) as well as insurer ownership $h_{f,t-1}$. Standard errors are clustered at the firm- and region-by-time levels.

Table 8 reports the estimated coefficients. The coefficient on insurers' instrumented bond purchases is significantly negative (column (1)). The estimate implies that yield spreads decrease by 0.46 bps when insurers' premium-driven bond purchases increase by 1%. Columns (2) and (3) enrich the specification by including additional control variables for firm and insurer characteristics and credit rating-by-time and industry fixed effects. The estimate remains significantly negative and, in the most saturated specification, implies an elasticity of 0.58 bps. It is also robust to using potential investors' natural disaster exposure as an alternative instrument (column (5)).

I also compute the effect of insurers purchasing 1% of a firm's outstanding bonds (rather than the effect of a 1% increase in purchases) using the average bond purchases and lagged bond debt

($199 million and $6.5 billion, respectively, in the sample of Table 8). The estimate implies that yields decrease by 13 to 16 bps when insurers additionally purchase 1% of outstanding bonds. This magnitude is economically significant as it corresponds to more than half of the difference between the issuance yield spreads of issuers with a BBB+ and AAA- credit rating and is close to the impact of purchases by the Fed's corporate credit facilities in 2020 (Boyarchenko et al., 2022).

To isolate the transmission from secondary market purchases to primary market yields, in column (4), I additionally control for insurers' primary market purchases. However, this does not meaningfully affect the estimate for α, which remains significantly negative. Thus, the impact on issuance yields is driven by demand shifts in the secondary market instead of the primary market. Finally, in column (6), I document a significant decrease in the coupon rates of newly issued bonds in response to premium-driven bond purchases, which is consistent with a lower issuance yield.

Consistently, across empirical specifications, the estimated impact of insurers purchasing 1% of outstanding bonds on primary market yields matches the price impact in the secondary market. This finding suggests an almost one-to-one pass-through from the secondary to the primary market. This strong pass-through is consistent with recent studies. For example, Coppola (2024) documents that primary market yields mirror the effect of investor composition on fire sale discounts in the secondary market. The result is consistent with models predicting that issuance spreads compensate primary market investors for the expected cost of selling bonds in the secondary market (e.g., Bruche and Segura, 2017). Then, higher secondary market prices, driven by insurer demand, reduce issuance spreads. Moreover, investors may not be able to distinguish between insurers trading on fundamentals and those trading on noise. Thus, learning from higher secondary market prices, as in the models by Grossman (1976) and Glebkin and Kuong (2023), may increase demand in the primary market. Finally, in Siani (2024)'s model, underwriters select equilibrium issuance yields to nurture their relationships with both bond issuers and primary market investors. Thus, in response to demand shifts that reduce secondary market yields, underwriters reduce issuance yields to balance the distribution of surplus between issuers and investors.

9 Conclusion

Nonfinancial firms rely heavily on bond financing, with the majority of corporate bonds being held by institutional investors. Therefore, it is important to understand whether bond investors are solely “spare tires”, absorbing capital demand shocks, or whether they impact corporate decisions themselves and, if so, through what channels. These questions are particularly relevant in the context of the secondary bond market, which accounts for a large share of investor activity. Motivated by these considerations, this paper provides evidence that investors affect corporate financing and investment decisions through their price impact in the secondary bond market.

To identify nonfundamental demand shifts, I draw on transaction-level data from U.S. insurance companies and construct a novel firm-level instrument that combines segmentation of insurers across bond issuers and liquidity inflows from insurance premiums paid by households.

Firms respond opportunistically to demand shifts by issuing more bonds, especially when they have underwriters that are well connected with insurers. The elasticity is economically meaningful, implying that when insurers purchase an additional 1% of a firm’s outstanding bonds, bond debt grows approximately 6 ppt faster. The proceeds are, on average, used for acquisition and capital expenditures. Heterogeneity across firms and evidence from equity prices suggest that positive demand shifts may relax financial frictions for the most constrained firms but can amplify free cash flow problems for mildly constrained firms.

The sensitivity of corporate decisions to bond demand emphasizes the importance for economic analyses to explicitly consider investors and their price impact. The findings also point to significant spillovers of financial regulations, such as capital requirements, through investment behavior.

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Figure and Tables

Figure 1. Secondary market prices and insurers' bond demand.

This figure depicts the secondary market bond price dynamics of firms that face premium-driven bond purchases in months $0, 1$, and 2 relative to that of other firms. Specifically, it plots the estimated price impact and its 90% confidence interval in bps for additional premium-driven bond purchases of 1% of a firm's outstanding bonds in the first quarter (months 0, 1 and 2), which is estimated using the specification in Equation (9). The dependent variable is the bond return between months $fmoq(t) - 1$ and $fmoq(t) + x$, where $fmoq(t)$ is the first month in quarter t. The time horizon of bond returns, x, is varied on the x-axis. Standard errors are clustered at the firm and firm region-by-time levels.

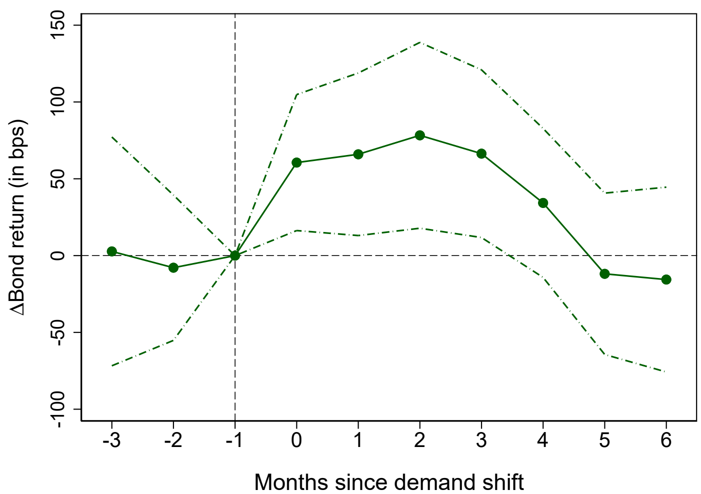

Table 1. Summary statistics.

This table reports summary statistics at quarterly frequency from 2010q2 to 2018q4. Insurer-by-firm–level statistics are based on a sample that includes all possible pairs of firms and insurers that are included in the baseline sample at a given point in time, and in this case, for readability, the summary statistics for bond purchases are reported conditional on a purchase. All variables are winsorized at the 1%/99% levels.

	N	Mean	SD	p5	p50	p95
Insurer level (1,451 insurers)						
Bond holdings (bil USD)	45,113	1.23	5.81	0.00	0.03	5.02
Bond purchases (mil USD)	45,113	68.74	348.53	0.00	1.50	267.33
Bond purchases/Total assets$_{t-1}$ (%)	45,113	1.81	2.56	0.00	0.99	6.77
Bond purchases (Prim)/Total assets$_{t-1}$ (%)	45,113	0.39	0.77	0.00	0.00	1.88
Bond purchases (Sec)/Total assets$_{t-1}$ (%)	45,113	1.11	1.94	0.00	0.35	4.85
Premiums (mil USD)	45,113	114.02	500.89	0.02	7.48	424.79
ΔPremiums/Total assets$_{t-1}$ (%)	45,113	0.12	1.42	-1.86	0.00	2.54
$100 \times \Delta$Disasters$^{>0}$	15,839	0.60	1.38	0.00	0.05	3.17
Insurer-by-firm level						
$100 \times \mathbb{I}$(Investor)	43,103,580	4.40	20.52	0.00	0.00	0.00
$100 \times 1\{$Purchase$\}$	43,103,580	0.40	6.33	0.00	0.00	0.00
Bond purchases (sec; mil USD)	173,610	2.46	7.09	0.00	0.25	11.43
Firm level (876 firms in the baseline sample)						
Bond debt/Total debt (%)	15,765	76.91	23.91	29.05	84.90	100.00
ΔBond debt/Bond debt$_{t-1}$ (%)	15,767	3.05	21.20	-12.67	0.00	31.71
Insurer ownership (%)	15,767	23.30	23.92	0.46	14.32	76.89
Bond purchases/Bond debt$_{t-1}$ (%)	15,767	1.29	3.72	0.00	0.17	5.69
ΔINVPremiums$^{>0}$ (%)	15,767	1.21	2.86	0.00	0.09	5.88
ΔINVDisasters$^{>0}$ (%)	15,539	9.97	18.77	0.00	1.22	49.75
Total investment/Bond debt$_{t-1}$ (%)	15,767	12.56	22.61	0.74	5.37	46.22
Acquisitions/Bond debt$_{t-1}$ (%)	15,767	4.23	16.71	0.00	0.00	21.32
CapEx/Bond debt$_{t-1}$ (%)	15,767	7.82	10.81	0.65	4.16	27.75
ΔTotal assets/Bond debt$_{t-1}$ (%)	15,767	9.15	43.76	-36.77	2.64	75.45
ΔPPE/Bond debt$_{t-1}$ (%)	15,767	2.51	12.45	-8.34	0.41	20.01
%UW (%)	4,871	40.24	17.65	8.52	40.61	68.45
$100 \times 1\{$Downgrade$_{t+1}\}$	12,944	4.48	20.69	0.00	0.00	0.00
Issuance level: Primary market						
Yield spread (%)	677	2.52	1.93	0.42	1.85	6.38
Offering amount (bil USD)	677	1.34	1.93	0.23	0.70	5.00
$100 \times 1\{$LT bond$\}$	677	46.82	49.94	0.00	0.00	100.00
Coupon (%)	677	4.69	1.96	1.73	4.50	8.38
Bond level: Secondary market (3,851 bonds)						
Bond return (%)	41,674	0.44	4.60	-6.25	0.20	8.09
Transaction volume (mil USD)	41,674	56.34	77.23	1.42	28.50	212.93

Table 2. Insurance premiums, natural disasters, and insurers' bond purchases.

This table reports estimated coefficients from a specification of the following form:

$$Y_{i,t} = \alpha X_{i,t} + \Gamma' C_{i,t} + \varepsilon_{i,t}$$

at the insurer-by-quarter level, where $C_{i,t}$ is a vector of control variables and fixed effects. The dependent variables are in columns (1) and (2), the quarterly growth in insurer i's invested assets (including cash) scaled by lagged total assets; in (3) and (4), the par value of corporate bond purchases scaled by lagged total assets; and, in (5) and (6), the par value of corporate bond purchases in the secondary market scaled by lagged total assets. In columns (1) to (5), the main explanatory variable is the quarterly growth in noncommercial insurance premiums scaled by lagged total assets and, in (6), the exposure to disaster fatalities. Column (6) includes only life insurers. Column (2) distinguishes between increases and decreases in premiums, defined as $\Delta X^{>0} = \max\{\Delta X, 0\}$ and $\Delta X^{<0} = \min\{\Delta X, 0\}$. Insurer controls are an insurer's investment yield, P&C and life insurance profitability, life insurance fee income, credit rating dummies, and lagged return on equity. Seasonality dummies identify calendar quarters. t-statistics are shown in brackets and based on standard errors clustered at the insurer and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Sample:	Baseline					Life
Dependent variable:	$\frac{\Delta\text{Investments}}{\text{Total assets}_{t-1}}$		$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$		$\frac{\text{Bond purchases (Sec)}}{\text{Total assets}_{t-1}}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\frac{\Delta\text{Premiums}}{\text{Total assets}_{t-1}}$	0.57***					
	[11.64]					
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$		0.86***	0.22***	0.22***	0.16***	
		[11.86]	[5.67]	[5.44]	[5.22]	
$\frac{\Delta\text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$		0.08	-0.10**	-0.10**	-0.08***	
		[1.06]	[-2.50]	[-2.47]	[-2.76]	
ΔDisaster fatalities$^{>0}$						0.07***
						[3.49]
ΔDisaster fatalities$^{<0}$						-0.01
						[-0.25]
Insurer controls				Y	Y	Y
Insurer-Seasonality FE	Y	Y	Y	Y	Y	Y
Life insurer-Time FE	Y	Y	Y	Y	Y	
Time FE						Y
No. of obs.	45,113	45,113	45,113	45,113	45,113	15,837
No. of insurers	1,451	1,451	1,451	1,451	1,451	500
Standardized coefficients						
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$		0.20	0.09	0.09	0.09	
$\frac{\Delta\text{Disasters}^{>0}}{\text{Total assets}_{t-1}}$						0.04
p-value for H0: Same coefficient on decreases and increases		0.00	0.00	0.00	0.00	0.04

Table 3. Persistence of insurers' portfolio allocation.

Columns (1) to (5) report OLS estimates from a specification of the following 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-quarter level, where $C_{i,f,t}$ is a vector of fixed effects. $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ flags potential investors and is equal to one if insurer i ever held bonds issued by firm f in the previous 1 to 8 quarters and zero otherwise. Columns (1) and (2) report estimates for the effect of $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ on the decision to purchase a firm's bonds, and columns (3) to (5) for the effect of $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ and increases in insurance premiums on the volume of secondary market bond purchases, the latter two scaled by insurers' lagged total assets. Column (6) reports the OLS estimate from a specification of the following form:

$$\frac{\Delta \text{Held}_{i,f,t}}{10^{-3} \cdot \text{Held}_{i,f,t-1}} = \beta \, \frac{\Delta \text{Premiums}^{>0}_{i,f,t}}{10^{-3} \cdot \text{Total assets}_{i,t-1}} + u_i + v_t + \varepsilon'_{i,f,t}$$

at the insurer-by-firm-by-quarter level, where u_i and v_t are insurer and time fixed effects, respectively. The sample is conditional on insurer i holding firm f's bonds in the prior quarter $t-1$, $\text{Held}_{i,f,t-1} > 0$. The table also reports the implied relative effects of $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ and its interaction with a one-standard deviation increase in insurance premium increases, which are computed by scaling with $\mathbb{E}[1\{\text{Purchase}\}|\mathbb{I}(\text{Investor}) = 0]$ in columns (1) and (2), and with $\mathbb{E}[\frac{\text{Bond purchases (sec)}}{10^{-6} \cdot \text{Total assets}_{t-1}}|\mathbb{I}(\text{Investor}) = 0]$ 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)	(6)
Dependent variable:	$1\{\text{Purchase}\}$		$\frac{\text{Bond purchases (sec)}}{10^{-6} \cdot \text{Total assets}_{t-1}}$			$\frac{\Delta \text{Held}}{10^{-3} \cdot \text{Held}_{t-1}}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{I}$(Investor)	0.04***	0.04***	10.62***	10.82***	9.43***	
	[19.62]	[19.47]	[9.96]	[10.18]	[9.81]	
$\frac{\Delta \text{Premiums}^{>0}}{10^{-3} \cdot \text{Total assets}_{t-1}}$			0.00			0.38***
			[0.46]			[3.54]
$\mathbb{I}(\text{Investor}) \times \frac{\Delta \text{Premiums}^{>0}}{10^{-3} \cdot \text{Total assets}_{t-1}}$			0.86***	0.88***	0.87***	
			[5.71]	[5.82]	[5.82]	
Firm FE		Y	Y	Y		
Firm-Time FE	Y				Y	
Insurer-Time FE	Y	Y		Y	Y	
Insurer FE			Y			Y
Time FE			Y			Y
No. of obs.	43,103,580	43,103,580	43,103,580	43,103,580	43,103,580	1,516,186
No. of firms	876	876	876	876	876	876
No. of insurers	1,484	1,484	1,484	1,484	1,484	1,476
Relative effect of $\mathbb{I}$(Investor)	19.02	19.04	4.15	4.23	3.69	
Relative effect of $\mathbb{I}(\text{Investor}) \times sd\left(\frac{\Delta \text{Premiums}^{>0}}{10^{-3} \cdot \text{Total assets}_{t-1}}\right)$			3.64	3.72	3.70	
$\mathbb{E}[1\{\text{Purchase}\}\|\mathbb{I}(\text{Investor}) = 0] = 0.002$, $\mathbb{E}[\frac{\text{Bond purchases (sec)}}{10^{-6} \cdot \text{Total assets}_{t-1}}\|\mathbb{I}(\text{Investor}) = 0] = 2.56$						

Table 4. Corporate bond debt and insurers' bond demand.

This table reports estimated coefficients from specifications as in Equation (1) at the firm-by-quarter level. The dependent variable is the growth in the stock of a firm's bond debt. The main explanatory variable is the total volume of insurers' purchases of the firm's bonds in quarter t scaled by its lagged bond debt. It is instrumented by either increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, or disaster exposure, $\Delta\text{INVDisasters}^{>0}$. Each column controls for lagged insurer ownership $h_{f,t-1}$. *Panel A* reports the baseline results. *Panel B* reports the effects of underwriter connectedness. *UW* indicates whether a firm's underwriters are well connected with potential investors. *Dispersed INV* indicates whether the Herfindahl–Hirschman index of insurers' lagged holdings of a firm's bonds is in the lower tercile of its cross-sectional distribution. *Many INV* indicates whether the number of a firm's potential investors is in the upper tercile of its cross-sectional distribution. Firm controls are a firm's age and lagged sales, cash flow, cash, and cash growth, and market-to-book ratio and leverage ratio. Insurer controls are the share of life insurers among the firm's potential investors, the average potential investor's P&C and life insurance profitability, life insurance fee income, investment yield, and lagged return on equity and size. Seasonality dummies identify calendar quarters. Industry dummies are at the 2-digit SIC level. Insurer characteristics dummies reflect the lines of business and U.S. regions in which potential investors write insurance premiums. Insurer economy dummies are based on the number of employees in the firm's industry and consumption per capita at potential investors' customer locations. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:				$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$				
			Panel A				**Panel B**	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	5.65***	5.82***	6.14***	6.27***	5.49***	1.96	7.62**	6.08*
	[4.08]	[4.30]	[4.37]	[3.90]	[5.70]	[0.71]	[2.26]	[1.95]
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$					-3.57*			
					[-1.90]			
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW						5.88**	1.09	1.95
						[2.32]	[0.32]	[0.49]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW $\times$ Dispersed INV							9.80**	
							[2.42]	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW $\times$ Many INV								9.63**
								[2.28]
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	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer characteristics-Time FE		Y	Y	Y	Y	Y	Y	Y
Insurer economy-Time FE			Y	Y	Y			
UW-Time FE						Y	Y	Y
Omitted interactions							Y	Y
First stage								
$\Delta\text{INVPremiums}^{>0}$	0.083***	0.087***	0.085***		0.113***			
	[4.3]	[4.39]	[4.34]		[6.28]			
$\Delta\text{INVDisasters}^{>0}$				0.019***				
				[3.8]				
F Statistic	46.5	49.4	45.1	30.8	185.3			
No. of obs.	15,767	15,767	15,767	15,514	15,767	4,871	4,871	4,871
No. of firms	876	876	876	864	876	492	492	492
Effect of 1sd change in $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.21	0.22	0.23	0.23	0.20			

Table 5. Corporate investment and insurers' bond demand.

This table reports estimated coefficients from specifications as in Equation (1) at the firm-by-quarter level. The main explanatory variable is the total volume of insurers' purchases of the firm's bonds in quarter t scaled by its lagged bond debt. It is instrumented by either increases in potential investors' premiums, ΔINVPremiums$^{>0}$, or disaster exposure, ΔINVDisasters$^{>0}$. Each column controls for lagged insurer ownership $h_{f,t-1}$. Baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects. Control variables and fixed effects are defined as in Table 4. In *Panel A*, the dependent variables are in columns (1) and (2), total investment (the sum of acquisition and capital expenditures); in (3) and (4), acquisition expenditures; in (5) and (6), capital expenditures; in (7), the quarterly change in property, plant and equipment; and, in (8), the quarterly change in total assets, all scaled by lagged bond debt. In *Panel B*, insurers' bond purchases are instrumented by ΔINVPremiums$^{>0}$. *SA:Terc* are indicators for the terciles of the SA index for financial constraints. The dependent variables are as in Panel A and, in (5), the quarterly change in other debt, scaled by lagged bond debt, and, in (6), the firm's quarterly stock return. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time level. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$		$\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$		$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$		$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$	$\frac{\Delta\text{Assets}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	6.30***	4.51**	3.91***	1.25	0.91***	1.87**	2.24***	5.78**
	[3.77]	[2.54]	[2.90]	[1.04]	[3.33]	[2.34]	[3.43]	[2.50]
Firm controls	Y		Y		Y		Y	Y
Insurer controls	Y		Y		Y		Y	Y
Baseline FE	Y	Y	Y	Y	Y	Y	Y	Y
First stage								
ΔINVPremiums$^{>0}$	0.085***		0.085***		0.085***		0.085***	0.085***
	[4.34]		[4.34]		[4.34]		[4.34]	[4.34]
ΔINVDisasters$^{>0}$		0.019***		0.019***		0.019***		
		[3.8]		[3.8]		[3.8]		
F Statistic	45.1	30.8	45.1	30.8	45.1	30.8	45.1	45.1
No. of obs.	15,767	15,514	15,767	15,514	15,767	15,514	15,767	15,767
No. of firms	876	864	876	864	876	864	876	876
Standardized coefficient	1.04	0.75	0.87	0.28	0.31	0.64	0.67	0.49

Panel B	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$	$\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$	$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$	$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$	$\frac{\Delta\text{Other Debt}}{\text{Bond debt}_{t-1}}$	Stock Return
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ SA:Terc1	3.75**	2.41	0.37	0.82	-3.15*	-1.04
	[2.04]	[1.57]	[1.09]	[1.10]	[-1.85]	[-1.54]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ SA:Terc2	4.83**	2.25	0.87*	2.70**	-0.09	-2.42**
	[2.16]	[1.43]	[1.68]	[2.45]	[-0.07]	[-2.13]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ SA:Terc3	15.55***	11.30**	2.15**	4.25*	2.04	-0.35
	[2.62]	[2.46]	[2.27]	[1.96]	[0.98]	[-0.23]
Firm controls	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y
Baseline FE	Y	Y	Y	Y	Y	Y
SA index tercile FE	Y	Y	Y	Y	Y	Y
No. of obs.	15,767	15,767	15,767	15,767	4,890	15,767
No. of firms	876	876	876	876	357	876
p-value for H0: Same coefficient for						
Terc1 and Terc3	0.06	0.06	0.08	0.13	0.13	0.66
Terc2 and Terc3	0.08	0.05	0.24	0.50	0.38	0.26

Table 6. Corporate bond debt and insurers' bond demand: The role of financial conditions.

This table reports estimated coefficients from specifications analogous to column (3) in Table 4. Each column corresponds to one regression, with coefficients for each tercile of either the SA index for financial constraints, lagged size (i.e., total assets), lagged cash flow scaled by total assets, or credit rating, including tercile (or rating) dummies as controls. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Second Stage Coefficient on $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$				First Stage Coefficient on $\Delta\text{INVPremiums}^{>0}$			
Cross-section by	SA index	Size	Cash flow	Rating	SA index	Size	Cash flow	Rating
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Terc1 / HY	5.53***	5.23**	5.90*	9.45***	0.11***	0.03	0.05	0.08**
	[2.68]	[2.07]	[1.84]	[3.27]	[2.99]	[0.98]	[1.57]	[2.48]
Terc2 / BBB	5.62***	6.21***	5.38***	4.17***	0.08**	0.09***	0.06**	0.13***
	[3.22]	[3.24]	[2.90]	[3.02]	[2.30]	[3.05]	[2.00]	[3.76]
Terc3 / AAA-A	8.54**	6.56***	6.70***	9.77**	0.06**	0.21***	0.11***	0.10**
	[2.53]	[4.43]	[3.90]	[2.37]	[2.36]	[4.97]	[3.88]	[2.18]
p-value for H0: Same coefficient on								
Terc1/HY & Terc2/BBB	0.97	0.74	0.86	0.09	0.55	0.18	0.73	0.34
Terc1/HY & Terc3/AAA-A	0.43	0.60	0.81	0.94	0.34	0.00	0.19	0.72
Terc2/BBB & Terc3/AAA-A	0.43	0.86	0.54	0.13	0.76	0.02	0.31	0.64

Table 7. Catering to insurers' investment preferences.

This table reports estimated coefficients from specifications at the firm-by-quarter level. The dependent variables are in column (1), a dummy variable indicating whether bond issuances have an average maturity of at least ten years; in (2) and (3), the analogous dummy for the average maturity of issuances in the following four quarters; in (4) and (5), the average residual maturity of new bond issuances in the following four quarters, weighted by offering amounts; and, in (6) and (7), a dummy for downgrades of the lowest credit rating from quarter end t to $t+1$. The main explanatory variable in (1) to (5) is the logarithm of insurers' bond purchases, instrumented by log-transformed increases in potential investors' premiums, $\Delta\widetilde{\text{INVPremiums}}_{f,t} = \log(\Delta\text{INVPremiums}^{>0}_{f,t} \times \text{Bond debt}_{f,t-1})$, and that in (6) and (7) is bond purchases scaled by lagged bond debt, instrumented by increases in potential investors' premiums. The sample includes, in (1), observations of issuances; in (2) to (5), observations with at least one issuance in the following four quarters; and in (6) and (7), firms with a credit rating of B or better. *Life INV* indicates whether life insurers account for more than half of potential investors. *≤BBB rated* indicates a credit rating of BBB or worse. Rating dummies indicate the credit rating categories AAA-AA, A, BBB, BB, and B. Each column controls for lagged insurer ownership $h_{f,t-1}$. Other control variables and fixed effects are defined as in Table 4. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	$1\{\text{LT bond}\}$	$1\{\text{LT bond}_{t+(1:4)}\}$		$\overline{\text{Maturity}}_{t+(1:4)}$		$1\{\text{Downgrade}_{t+1}\}$	
log(Bond purchases)	0.10***	0.18***	0.13***	1.78***	1.28***		
	[3.95]	[7.32]	[4.29]	[6.35]	[3.94]		
log(Bond purchases) × Life INV			0.09**		1.14**		
			[2.39]		[2.28]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$						-1.31**	-0.05
						[-2.14]	[-0.08]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \leq$ BBB rated							-1.58*
							[-1.67]
Firm controls		Y	Y			Y	Y
Time FE	Y	Y		Y			
Life INV-Time FE			Y		Y		
Rating-Time FE						Y	Y
Firm-Seasonality FE						Y	Y
First stage							
$\Delta\widetilde{\text{INVPremiums}}$	0.424***	0.467***	0.574***	0.503***	0.638***		
	[13.22]	[12.96]	[10.65]	[13.79]	[11.65]		
ΔINVPremiums						0.108***	0.115**
						[4.9]	[2.5]
F Statistic	294.2	300.7	87.8	362.0	100.2	61.0	30.2
No. of obs.	677	856	856	856	856	12,944	12,944
No. of firms	352	374	374	374	374	699	699
Effect of purchasing 1% of outstanding bonds	0.03	0.07	0.05	0.73	0.52		

Table 8. Primary market prices and insurers' bond demand.

This table reports estimated coefficients from specifications as in Equation (10) at the firm-by-quarter level. The dependent variable in columns (1) to (5) is the average issuance yield spread (in ppt) of firm f in quarter t, defined by the difference between the issuance yield and the nearest-maturity treasury bond, and in (6), it is the average coupon rate (in ppt) of bond issuances. The main explanatory variable is the logarithm of insurers' bond purchases, instrumented in columns (1) to (4) and (6) by log-transformed increases in potential investors' premiums and, in (5), by log-transformed potential investors' disaster exposure. The sample comprises firm-quarter observations with issuances. $C_{f,t}$ is a vector of control variables and fixed effects, which includes lagged insurer ownership $h_{f,t-1}$ in each column. Issue controls are the logarithm of the residual maturity and of the firm's credit rating. Maturity dummies indicate the bins (0,7.5], (7.5,10], (10,15], and (15,∞) (in years). Rating dummies indicate the credit rating categories AAA-AA, A, BBB, BB, B, CCC, and unrated. Other control variables and fixed effects are defined as in Table 4. The *Effect of purchasing 1% of outstanding bonds* is the implied impact of purchasing 1% of a firm's outstanding bonds using average purchases and lagged bond debt. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:			Yield spread			Coupon
log(Bond purchases)	-0.46***	-0.47***	-0.58***	-0.46***	-0.50**	-0.42***
	[-3.39]	[-2.68]	[-3.26]	[-2.90]	[-2.45]	[-2.85]
log(1 + Bond purchases (prim))				0.01		
				[0.24]		
Issue controls	Y		Y	Y	Y	Y
Firm controls		Y	Y			
Insurer controls			Y			
Maturity-Time FE	Y	Y	Y	Y	Y	Y
Rating-Time FE		Y				
Industry FE			Y			
First stage						
$\Delta\widetilde{\text{INVPremiums}}$	0.251***	0.228***	0.212***	0.215***		0.251***
	[8.3]	[6]	[6.9]	[7.5]		[8.3]
$\Delta\widetilde{\text{INVDisasters}}$					0.248***	
					[6]	
F Statistic	97.6	58.8	58.5	101.5	67.3	97.6
No. of obs.	677	677	677	677	462	677
No. of firms	352	352	352	352	288	352
Effect of purchasing 1% of outstanding bonds	-0.13	-0.13	-0.16	-0.13	-0.14	-0.12

Internet Appendix for

Investor-Driven Corporate Finance: Evidence from Insurance Markets

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A Data and sample construction

Table IA.1: Variable definitions and main 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	
Bond holdings	Par value of corporate bond holdings (*Source: NAIC*)
Bond purchases	Par value of corporate bond purchases (*Source: NAIC*)
Bond purchases (prim)	Par value of corporate bond purchases in the primary market (*Sources: NAIC, TRACE, Mergent FISD*)
Bond purchases (sec)	Par value of corporate bond purchases in the secondary market (*Sources: NAIC, TRACE, Mergent FISD*)
Bond purchases (ex issuances)	Par value of corporate bond purchases excluding bonds issues in the same quarter (*Sources: NAIC, Mergent FISD*)
Premiums	Noncommercial insurance premiums adjusted by the net-to-gross premiums ratio (*Source: NAIC*)
Unadjusted premiums	Direct noncommercial insurance premiums written, not adjusted by the net-to-gross premiums ratio (*Source: NAIC*)
Net-to-gross premiums ratio	4-quarter trailing average ratio of total net premiums collected to total direct premiums written (*Source: NAIC*)
$CB_{i,t-1}$	Lagged total book value of corporate bond holdings (*Sources: NAIC*)
ΔDisasters$^{>0}$	The maximum of zero and Disaster fatalities$_{i,t-1}$ as defined in Equation (IA.38) (*Sources: NAIC, SHELDUS*)
ΔInvestments/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 percentage of the insurer's capital and surplus (*Source: NAIC*)
Investment yield	Annualized investment return based on invested assets (*Source: NAIC*)
# Firms held	Number of issuers (identified by 6-digit CUSIP) in the insurer's corporate bond portfolio (*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*)
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 ever held bonds issued by the firm (*Source: NAIC*)
1{Purchase}	Indicator variable for whether, in the current quarter, the insurer purchases bonds issued by the firm (*Source: NAIC*)

Continued on next page

Table IA.1 – *Continued from previous page*

Variable	**Definition**
Bond purchases	Par value of corporate bonds purchased in the current quarter by the insurer issued by the firm (*Source: NAIC*)
Firm level	
ΔBond debt/Bond debt$_{t-1}$	Quarterly change in the stock of bond debt (the sum of senior and subordinated bonds) scaled by lagged bond debt (*Source: Capital IQ*)
Insurer ownership ($\mathrm{h}_{f,t-1}$)	Ratio of the lagged total par value of the firm's 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 the firm's bonds purchased by insurers relative to the firm's lagged bond debt (*Sources: Capital IQ, NAIC*)
ΔINVPremiums$^{>0}$	Maximum of zero and $h_{f,t-1}\Delta \log \bar{P}_{f,t}$ with $\bar{P}_{f,t} = \sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) CB_{i,t-1} P_{i,f,t}$ (*Sources: Capital IQ, NAIC*)
ΔINVPremiums$^{>0}$ (PF weights)	Alternative instrument defined as the maximum of zero and $h_{f,t-1}\Delta \log \bar{P}_{f,t}$ with $\bar{P}_{f,t} = \sum_i \kappa_{i,f,t-1} CB_{i,t-1} P_{i,f,t}$, where $\kappa_{i,f,t-1}$ is the portfolio weight of firm f's bonds in insurer i's corporate bond portfolio (*Sources: Capital IQ, NAIC*)
INVPremiums	Alternative instrument defined as $\bar{P}_{f,t}$/Bond debt$_{f,t-1}$ with $\bar{P}_{f,t} = \sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) CB_{i,t-1} P_{i,f,t}$ (*Sources: Capital IQ, NAIC*)
INVPremiums (PF weights)	Alternative instrument defined as $\bar{P}_{f,t}$/Bond debt$_{f,t-1}$ with $\bar{P}_{f,t} = \sum_i \kappa_{i,f,t-1} CB_{i,t-1} P_{i,f,t}$, where $\kappa_{i,f,t-1}$ is the portfolio weight of firm f's bonds in insurer i's corporate bond portfolio (*Sources: Capital IQ, NAIC*)
ΔINVDisasters$^{>0}$	Maximum of zero and $h_{f,t-1}\Delta \log \bar{D}_{f,t}$ with $\bar{D}_{f,t}$ defined in Equation (IA.39) (*Sources: Capital IQ, NAIC, SHELDUS*)
Total investment/Bond debt$_{t-1}$	The firm's total investment (the sum of acquisition and capital expenditures) scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Acquisitions/Bond debt$_{t-1}$	The firm's cash outflow used for acquisitions scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
CapEx/Bond debt$_{t-1}$	The firm's capital expenditures scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
ΔTotal assets/Bond debt$_{t-1}$	Quarterly change in the firm's total assets scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
ΔPPE/Bond debt$_{t-1}$	Quarterly change in the firm's net property, plant and equipment scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
%UW	Share of potential investors' bond purchases from the firm's underwriters in the previous 4 quarters, as defined in Section 5.4 (*Sources: NAIC, Mergent FISD*)
1{Downgrade$_{t+1}$}	Indicator for a downgrade of the firm's lowest credit rating (across Moody's, S&P, and Fitch) from quarter-end t to $t+1$ (*Source: Mergent FISD*)
Size	Natural logarithm of the firm's total assets (*Source: Compustat*)
Asset growth	Quarterly change in the firm's total assets scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Cash	The firm's cash and short-term investments scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Cash growth	Quarterly change in the firm's cash and short-term investments scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Sales	The firm's sales scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)

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Table IA.1 – *Continued from previous page*

Variable	**Definition**
Cash flow	The firm's sales net of the cost of goods sold and selling, general, and administrative expenses scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Deferred taxes	The firm's deferred income tax expense scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Tangibility	The firm's net property, plant and equipment scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Market-to-book	Ratio of the book value of the firm's total assets less the book value of equity plus the market value of equity to the firm's book value of assets (*Source: Compustat*)
Leverage	Ratio of the book value of the firm's total assets to the firm's book value of equity (*Source: Compustat*)
Age	Number of years that the firm has been in Compustat (*Source: Compustat*)
Stock return	The firm's stock return over (1) the current quarter when used as a dependent variable in the main analysis and (2) the previous year when used as control variable (*Source: CRSP*)
SA index	Hadlock and Pierce (2010)'s index of firm 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*)
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*)
Dividend payer	Indicator variable that equals one if the firm ever paid positive dividends in the past four quarters (*Source: Compustat*)
Earnings volatility	Standard deviation of the trailing 12 quarters of the ratio of the firm's cash flow to lagged total assets (*Source: Compustat*)
(Credit) Rating FE	The firm's current end-of-quarter credit 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*)
Region FE	U.S. region in which the firm's headquarters is located: Northeast (CT, ME, MA, NH, RI, VT), Mid-Atlantic (DE, DC, MD, NJ, NY, PA), Southeast (AL, AR, FL, GA, PR, VI), Southeast (MS, NC, SC, TN, VA, WV), Midwest (IA, IN, IL, KS, KY, MI MN, MO, ND, NE, OH, SD, WI), Southwest (CO, LA, NM, OK, TX, UT) or West (AZ, AK, CA, HI, ID MT, NV, OR, WA, WY, AS)
Industry FE	Industry categories based on 2-digit SIC if not stated otherwise

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Table IA.1 – *Continued from previous page*

Variable	**Definition**
Insurer characteristics FE	Type and location of potential investors: First, for each insurance line of business (accident & health life, deposit type, annuity, pure life, accident & health P&C, home- & farmowners, and private auto insurance), I define a firm-by-quarter–level variable as the average lagged share of premiums written in this line of business by a firm's potential investors. Second, I compute the first three principal components of these variables; and third, for each of the three principal components, I compute an indicator variable for the upper half of its cross-sectional distribution. I define insurer line of business dummies for the eight possible joint outcomes of these three indicator variables, and repeat this procedure for the share of premiums written by U.S. region. (*Source: NAIC*)
Consumption FE	Consumption per capita by consumption type in potential investors' location: I start with the total consumption by consumption type in the previous calendar year at the state level (types are motor vehicles and parts, furnishings and durable household equipment, recreational goods and vehicles, other durable goods, food and beverages purchased for off-premises consumption, clothing and footwear, gasoline and other energy goods, other nondurable goods, household consumption expenditures for services, housing and utilities, health care, transportation services, recreation services, food serves and accommodations, financial services and insurance, other services, and final consumption expenditures of nonprofit institutions serving households). First, I define a firm-by-quarter–level variable for each consumption type that reflects the average consumption per capita across states weighted by total insurance premiums written by potential investors. Second, I compute the first three principal components of these variables and follow the above methodology to construct consumption dummies (*Sources: BEA Table SAEXP1, U.S. Census, NAIC*)
Employment FE	Employment per capita in the firm's industry in potential investors' location: I start with the number of employees by industry in the previous calendar year at the state level. I define a firm-by-quarter–level variable as the average employment per capita in the firm's industry across states weighted by total insurance premiums written by potential investors. I define employment dummies based on the cross-sectional quintiles of this variable (*Sources: BEA Table CAEMP25N, U.S. Census, NAIC*)
Insurer investment yield FE	First, I compute the first two principal components of the current value and four lags of the average investment yield of the firm's potential investors. Second, for each of the two principal components, I compute indicator variables for exceeding the 25th, 50th, and 75th percentiles of their cross-sectional distribution, respectively. Finally, I define investment yield dummies for the joint outcomes of these indicator variables. (*Sources: NAIC*)

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Table IA.1 – *Continued from previous page*

Variable	**Definition**
Insurer profitability FE	First, I compute the first two principal components of the current value and four lags of the average P&C and life insurance profitability of the firm's potential investors. Second, for each of the two principal components, I compute indicator variables for exceeding the 25th, 50th, and 75th percentiles of their cross-sectional distribution, respectively. Finally, I define insurer profitability dummies for the joint outcomes of these indicator variables. (*Sources: NAIC*)
Issuance level: Primary market	
Yield spread	Average difference between issuance yield and the contemporaneous yield on its nearest-maturity treasury bond across all bond issuances for the same firm–quarter weighted by offering amount (*Source: Mergent FISD, FRED*)
Offering amount	Total offering amount at the firm-by-quarter level (*Source: Mergent FISD*)
1{LT bond}	Indicator for the average remaining time to maturity of new bond issuances in a firm–quarter (weighted by offering amount) being at least 10 years (*Source: Mergent FISD*)
Coupon	Average coupon rate on new bond issuances in a firm–quarter (weighted by offering amount) (*Source: Mergent FISD*)
Maturity	Average time to maturity on new bond issuances (weighted by offering amount) (*Source: Mergent FISD*)
Rating FE	Current end-of-quarter rating with 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*)
Rating control	Logarithm of the credit rating on numerical scale from 1 (AAA) to 7 (CC-D) and 8 (unrated) (*Source: Mergent FISD*)
Maturity FE	Based on dummies for the time to maturity at issuance according to the following bins: (0,7.5], (7.5,10], (10,15], (15,∞) (*Source: Mergent FISD*)
Bond level: Secondary market	
Bond return	Relative change in bond prices and accrued interest plus coupon payments, $(\Delta\text{Price}_t + \Delta\text{Accrued Interest}_t + \text{Coupon payments}_t)/(\text{Price}_{t-1} + \text{Accrued Interest}_{t-1})$ (*Source: TRACE, Mergent FISD*)
Transaction volume	Total par value of bond transactions in the current month (*Source: TRACE*)
Rating FE	Current end-of-month credit rating with 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*)
ΔRating FE	Based on the change in the credit rating between months $t-1$ and $t+2$ (*Source: Mergent FISD*)
Maturity FE	Based on dummies for the remaining time to maturity at the transaction date according to the following bins: (0,3.5], (3.5,7], (7,15], and (15,∞). (*Source: Mergent FISD*)

A.1 Insurance premiums

Direct premiums written are defined as the contractually determined amount charged by insurers to the policyholder and, thus, exclude reinsurance ceded or assumed. Schedule T of U.S. insurers' statutory filings reports the total amount of direct premiums written for each U.S. insurer and quarter separately for each U.S. state and territory and Canada. To detect reporting errors, I compare the 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 both \$50,000 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.[1]

To exclude commercial insurance business, I use the share of direct premiums written for noncommercial insurance at the insurer–quarter level (it is not available at the insurer–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 death of the insured), individual annuities (which guarantee a stream of annuity payments), individual accident and health contracts, and deposit-type contracts (which do not expose the insurer to any mortality or morbidity risk) relative to all premiums.[2] These are reported in 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, group accident and health insurance, and credit life insurance (for which a breakdown into individual and group contracts is not available).

[1] 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*.

[2] Robustness analyses exclude premiums for deposit-type contracts because these may be used purely for investment. 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.

I follow S&P Global Market Intelligence's 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 insurance coverage for firms, e.g., product liability, fidelity, or workers' compensation insurance contracts.

Figures IA.1 and IA.2 illustrate the aggregate dynamics of life and P&C insurance direct premiums written by line of business. Noncommercial insurance is the dominant 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 were no disruptive shifts in the insurance business during the sample period. Premiums, particularly in P&C insurance, display some seasonality within years, which I account for by including calendar quarter fixed effects in the main regressions.

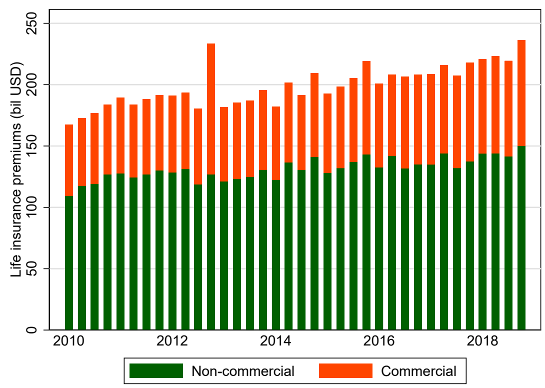
Insurers that focus on commercial insurance business are excluded from the sample; I define these as insurers with noncommercial premiums below \$50,000 or below 10% of total premiums in the median quarter from 2009q4 to 2018q4. For the remaining insurers, I winsorize premiums at the insurer–state–quarter level at 1%/99%. I remove all (commercial and noncommercial) direct premiums written at the firm's location from total direct noncommercial premiums written by insurer i in quarter t:

$$\mathrm{DPW}_{i,f,t}^{\text{unadjusted}} = \max\left\{\sum_{s} \text{noncommercial}_{i,t} \times \mathrm{DPW}_{i,s,t} - \mathrm{DPW}_{i,\text{location}(f),t},\ 0\right\}, \qquad \text{(IA.1)}$$

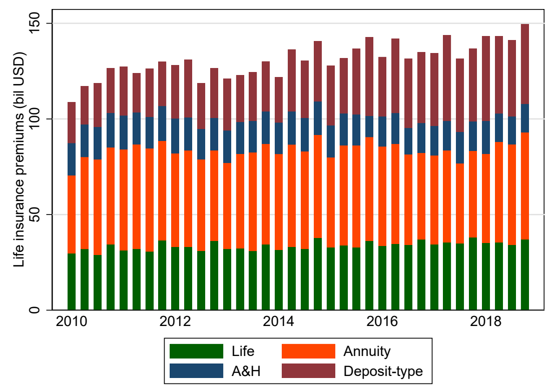
where $DPW_{i,s,t}$ is direct premiums written by insurer i in location s in quarter t and $\text{noncommercial}_{i,t}$ is the share of noncommercial premiums written (as defined above). By removing all premiums in the firm's location, the measure is a conservative estimate for the *actual* noncommercial premiums

Figure IA.1. Direct premiums written: Life insurance.

Figure (a) depicts the total direct 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 and health contracts, and deposit-type contracts. Commercial premiums are the residuals of the total premiums written. Figure (b) depicts the total direct noncommercial life insurance premiums written by insurers in the sample by quarter and line of business.



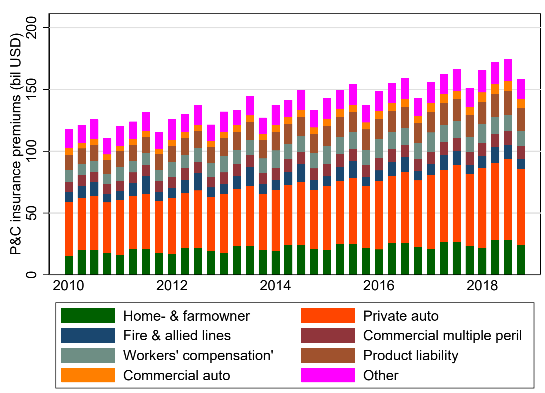
(a) All U.S. insurers.



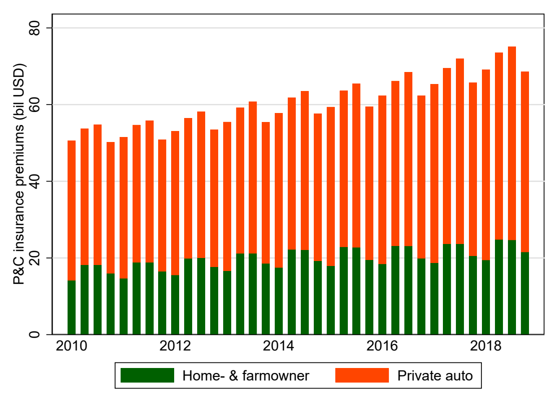
(b) Insurers included in the sample.

Figure IA.2. Direct premiums written: P&C insurance.

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



(a) All U.S. insurers.



(b) Insurers included in the sample.

written in locations other than firm f's location (which is not observable since noncommercial$_{i,t}$ is available only at the insurer–quarter level).

Finally, I take into account that direct premiums written are not necessarily equal to the actual cash flow from policyholders to insurers, which is called *net premiums collected*. Net premiums collected adjust direct premiums written by the amount of reinsurance and the timing of premium payments from policyholders to insurers. Because both adjustments may be influenced by the insurer and thus can be endogenous to the insurer's investment opportunities, I rely on the lagged net-to-gross premiums ratio, defined as the 4-quarter trailing average ratio of total net premiums collected to total direct premiums written at the insurer level:

$$\xi_{i,t-1} = \frac{1}{4}\sum_{\tau=1}^{4} \frac{\text{NPC}_{i,t-\tau}}{\text{DPW}_{i,t-\tau}}. \tag{IA.2}$$

I winsorize $\xi_{i,t-1}$ at 0 and 20. $\xi_{i,t-1}$ is highly persistent over time, with 75% of its variation explained by time-invariant heterogeneity across insurers and a correlation between $\xi_{i,t-1}$ and $\xi_{i,t-2}$ of 97%.

Finally, I define (adjusted) noncommercial premiums as

$$\text{Premiums}_{i,f,t} = \xi_{i,t-1} \times \text{DPW}^{\text{unadjusted}}_{i,f,t}, \tag{IA.3}$$

with scaled premiums equal to $P_{i,f,t} = \frac{\text{Premiums}_{i,f,t}}{\text{Total assets}_{i,t-1}}$, and Premiums$_{i,t}$ analogously at the insurer level. The main analyses use adjusted noncommercial premiums, unless indicated otherwise.

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 9-digit CUSIP).

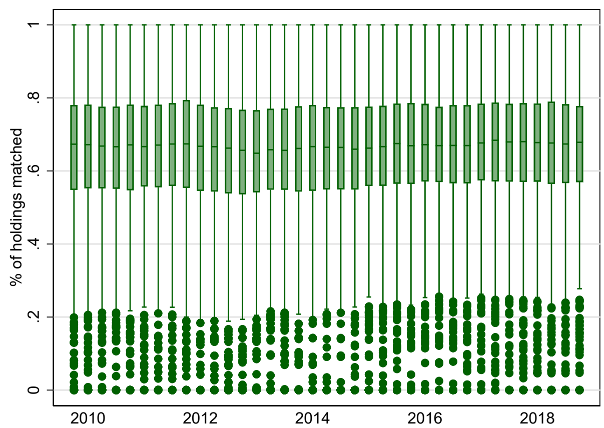
To merge bonds with firm characteristics, I begin with the link table provided by Capital IQ, which matches the security identifiers reported by insurers (CUSIP and ISIN) to the Capital IQ firm-level identifier *companyid*. I supplement the sample by matching (1) the leading six digits of the CUSIP (the 6-digit issuer CUSIP) reported by insurers to the same identifier in Compustat and (2) the TRACE issuer ticker (merged to insurer filings by 9-digit CUSIP) to the firm ticker in Compustat, deriving the *companyid* using the Capital IQ–Compustat link table. Additionally, I retrieve missing *companyid*s from observations with the same 6-digit CUSIP. Finally, I match bonds to Mergent FISD and retrieve missing *companyid*s from observations with the same issuer or parent identifier in FISD. To ensure that bond issuers are correctly identified, for a random subsample, I manually compare the company names reported by insurers to those in Capital IQ. Finally, I merge the insurer filings–Capital IQ-matched sample to Compustat using the Capital IQ–Compustat link table.

Table IA.2. Matching corporate bond investments to Capital IQ and Compustat.
This table reports 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 matched first 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. “Copied from: same 6-digit CUSIP” indicates observations whose Capital IQ identifier is copied from other observations with the same 6-digit CUSIP.

Holdings: Capital IQ match	
Nr. of observations (par value)	16,340,889 ($ 69,279 bil)
% matched by: Capital IQ link	88.43% (79.06%)
% matched by: Ticker (TRACE & Compustat)	0.01% (0.01%)
% matched by: 6-digit CUSIP (Compustat)	0.95% (2.12%)
% copied from: same issuer ID (Mergent)	0.03% (0.02%)
% copied from: same 6-digit CUSIP	0.55% (1.24%)
% matched (par value)	89.97% (82.46%)
Total matched (par value)	14,702,134 ($ 57,124 bil)
Holdings: Compustat match	
% matched (par value)	59.08% (51.12%)
Total matched (par value)	9,653,949 ($ 35,415 bil)

Figure IA.3. 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.



A.3 Matching insurers' counterparties to underwriters

I match the counterparties reported by insurers for corporate bond purchases to underwriters in FISD Mergent. First, I manually consolidate underwriters reported in FISD Mergent's "Agents" table to the group level by using information on underwriters' company structure from S&P Global Market Intelligence, `https://brokercheck.finra.org/`, and company resources. There are 94 underwriters used by the firms in my sample. The top five underwriters (by total offering amount in an average year from 2010 to 2018) are Merrill Lynch/Bank of America, Citigroup, JP Morgan, Goldman Sachs, and Mitsubishi UFJ Securities.

Second, because there is no common identifier for underwriters, I match the consolidated underwriters from FISD with counterparties reported by insurers by using a combination of fuzzy string merging and manual matching. I manually ensure the quality of the final match by comparing underwriter names in FISD to those reported by insurers. There are more than 200 matched counterparties in the sample. The top five counterparties used by insurers in my sample (by total par value purchased in an average year from 2010 to 2018) are Citigroup, JP Morgan, Merrill Lynch/Bank of America, Goldman Sachs, and Barclays.

Table IA.3. Matching corporate bond purchases to Mergent FISD agents.
The table depicts the (share of the) number (and, in parentheses, of the 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)	19.5% (33.5%)
% matched (par value)	68.4% (57.1%)
Total matched (par value)	1,129,429 ($ 2,815 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 secondary market transaction (with flag "S1") 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 flagged as secondary market trades.

Purchases are flagged 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. This classification plausibly tends to overclassify primary market trades.[3] If the above methodology categorizes a bond purchase as both a primary and a secondary market trade, I flag it as unclassified.

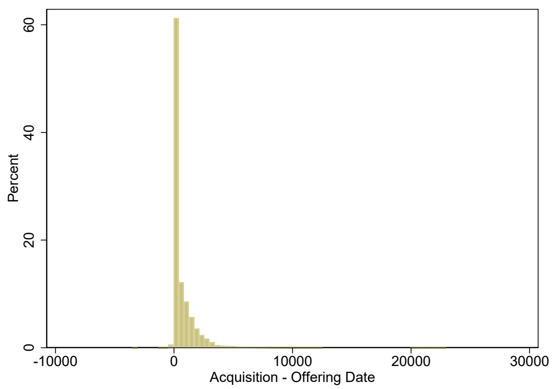
Several observations support this classification strategy:

- Only 1% of all purchases fit into both the primary and secondary market categories.
- Figures IA.4 (a) and (b) show that a large mass of purchases involve zero accrued interest and take place on the offering date. This supports the use of these indicators to identify primary market trades.
- Figure IA.4 (c) shows that a large mass of purchases exhibits small price differences between insurer purchases and TRACE transactions after matching to the NAIC transaction for the same CUSIP on the same or previous day with the smallest price difference.
- 97% of transactions (by volume) eventually classified as secondary market trades by criteria (2) or (3) occur in a different quarter than that of the offering or involve nonzero accrued interest or a transaction price that differs from the offering price by more than 5%. This suggests that the methodology does not overclassify secondary market trades.

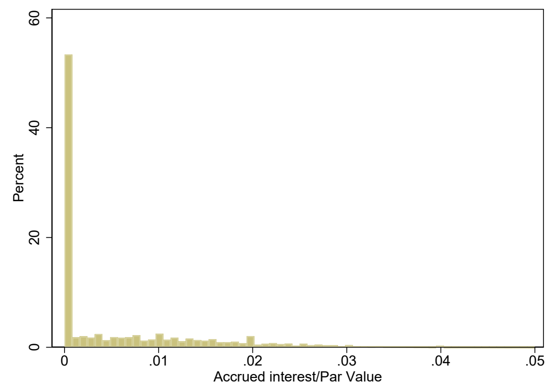
[3] Previous studies usually rely on a narrower classification. For example, Nikolova et al. (2020) define bond purchases as primary market trades only if they occur on the offering date and are from a bond issue's underwriter.

Figure IA.4. Corporate bond purchases and issue characteristics.

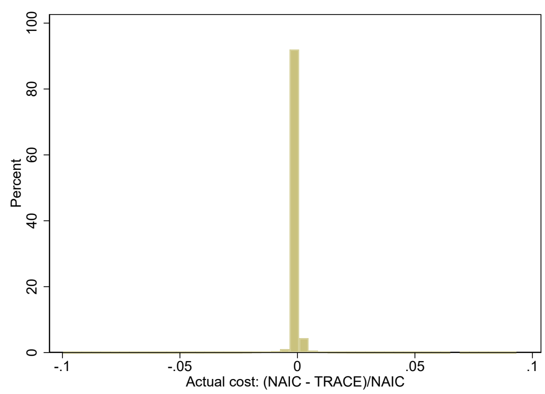
Figure (a) illustrates the distribution of the time (in days) between the offering and purchase dates at the transaction level. Figure (b) illustrates the distribution of accrued interest paid scaled by par value at the transaction level, truncated at 0 and 0.05. Figure (c) illustrates the distribution 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, truncated at -0.1 and 0.1.



(a) Time lag between purchase and offering date.



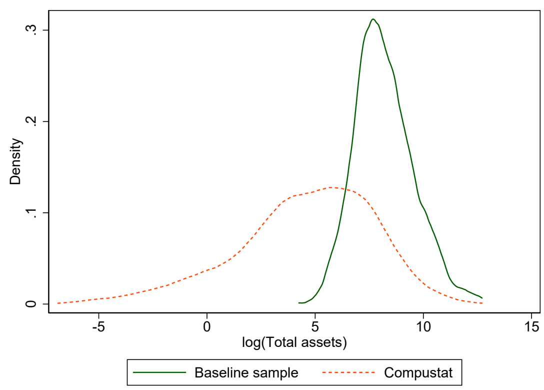
(b) Accrued interest.



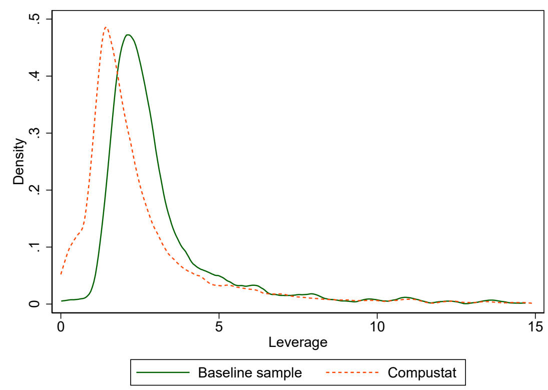
(c) Relative difference between TRACE and NAIC bond price.

A.5 Comparison with Compustat firms

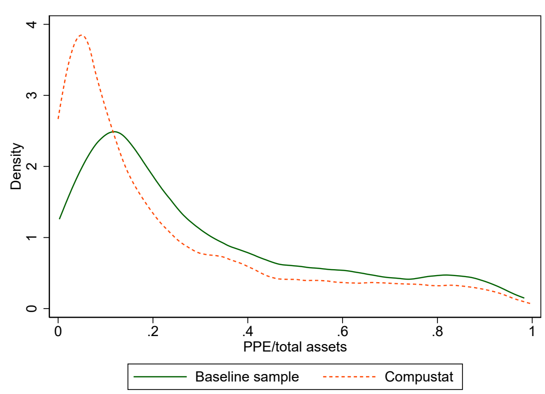
Figure IA.5. Comparison of firm characteristics with those of all nonfinancial firms in Compustat. The figures depict kernel densities for the cross-sectional distribution of average firm characteristics (from 2010q2 to 2018q4) for firms in my sample compared with those of all nonfinancial firms in Compustat (excluding financial firms with SIC 6000–6999, utilities with SIC 4900–4999, and firms in public administration with SIC above 8999).



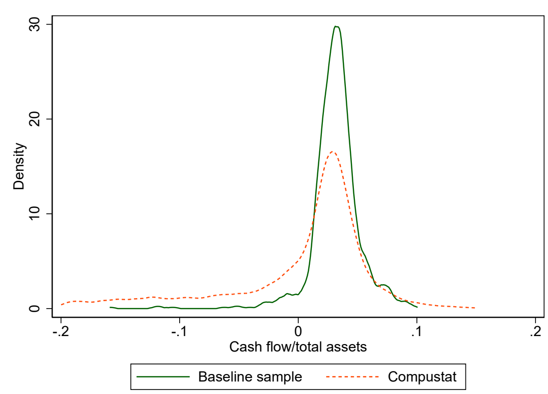
(a) Size.



(b) Leverage.



(c) PPE.



(d) Cash flow.

B Instrument derivation and validity

B.1 Stylized balance sheet dynamics

This section provides a stylized model of an insurer's balance sheet to illustrate the relationship between premium and investment dynamics. This motivates the relevance of $\Delta\text{INVPremiums}^{>0}$ as an instrument for actual bond purchases.

Consider an insurer that sells one-period insurance contracts to a unit mass of policyholders indexed by $j \in [0, 1]$ in a competitive insurance market.[4] Payments for insurance claims $L_{t,j}$ to policyholder j are made by the insurer at t. The actuarially fair premium is $P_{t-1,j} = \mathbb{E}[L_{t,j}]$ to be paid to the insurer at $t - 1$ (without loss of generality, the discount rate is set to zero). The insurer's total assets evolve according to

$$\Delta A_t = A_t - A_{t-1} = \int_0^1 P_{t,j} - L_{t,j} \; dj + R_t, \tag{IA.4}$$

where R_t is the net cash flow from other business activities (including investment returns and equity financing). Assuming that claims are identically and independently distributed across policyholders, total premium income is given by $P_t = \int_0^1 P_{t,j} \; dj = P_{t,0}$ and total claim payments are equal to $L_t = \int_0^1 L_{t,j} \; dj = \mathbb{E}[L_{t,0}] = P_{t-1}$, which implies that

$$\Delta A_t = P_t - P_{t-1} + R_t = \Delta P_t + R_t. \tag{IA.5}$$

This implies that premium growth drives asset growth, modulated by the response of other business activities R_t: $\frac{\Delta A_t}{\Delta P_t} = 1 + \frac{R_t}{\Delta P_t}$. This is consistent with the results in Table 2 for premium increases $\Delta P_t > 0$, whereas the empirical results suggest that the response of R_t offsets premium decreases $\Delta P_t < 0$. As an implication, total insurance premiums are an important determinant of insurers'

[4] The insights remain qualitatively unchanged when insurers have market power.

balance sheet size (with insurer origination at $t = 0$):

$$A_t = A_0 + \sum_{\tau=1}^{t} \Delta A_\tau = P_0 + R_0 + \sum_{\tau=1}^{t} (\Delta P_\tau + R_\tau) = P_t + \sum_{\tau=0}^{t} R_\tau. \tag{IA.6}$$

Motivated by this theoretical insight, I define by

$$\Omega_{f,t} = \frac{\sum_i \kappa_{i,f,t} CB_{i,t}}{\sum_i w_{i,f,t-1} P_{i,f,t}} \tag{IA.7}$$

the ratio of the insurance sector's bond holdings to potential investors' weighted premium flows, where $CB_{i,t}$ is the total amount of corporate bond holdings, $\kappa_{i,f,t}$ is the weight of firm f in insurer i's corporate bond portfolio, $P_{i,f,t}$ is the volume of insurance premiums scaled by lagged total assets, and $w_{i,f,t-1} = \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) CB_{i,t-1}$. $\Omega_{f,t}$ reflects the premium-weighted average portfolio weight adjusted by the ratio of insurers' assets to premiums.[5]

Consistent with a persistent average portfolio weight and a persistent relationship between assets and premiums, as predicted by Equation (IA.6), I find that $\Omega_{f,t}$ is very stable over time, with the correlation between $\Omega_{f,t}$ and $\Omega_{f,t-1}$ being 92% and $\Omega_{f,t-1}$ explaining 84% of the variation in $\Omega_{f,t}$. The insurance sector's total holdings of firm f's corporate bonds are given by

$$\text{Bond holdings}_{f,t} = \sum_i \kappa_{i,f,t} CB_{i,t} = \Omega_{f,t} \bar{P}_{f,t}, \tag{IA.9}$$

where $\bar{P}_{f,t} = \sum_i w_{i,f,t-1} P_{i,f,t}$ is defined in Equation (2). Bond purchases scaled by lagged bond

[5] To see this, note that if $\frac{CB_{i,t}}{A_{i,t}} = \frac{CB_{i,t-1}}{A_{i,t-1}}$ and $\kappa_{i,f,t} > 0 \Leftrightarrow \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) = 1$, then

$$\Omega_{f,t} = \sum_i \kappa_{i,f,t} \frac{CB_{i,t}}{w_{i,f,t-1} P_{i,f,t}} \tilde{M}_{i,f,t} = \sum_i \kappa_{i,f,t} \frac{CB_{i,t}/A_{i,t}}{CB_{i,t-1}/A_{i,t}} \frac{A_{i,t-1}}{\text{Premiums}_{i,f,t}} \tilde{M}_{i,f,t} = \sum_i \kappa_{i,f,t} \frac{A_{i,t}}{\text{Premiums}_{i,f,t}} \tilde{M}_{i,f,t} \tag{IA.8}$$

with weights $\tilde{M}_{i,f,t} = \frac{w_{i,f,t-1} P_{i,f,t}}{\sum_j w_{j,f,t-1} P_{j,f,t}}$ that sum to one across insurers.

debt are equal to (using that $\log(1+x) \approx x$)

$$\begin{aligned}
&\frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} && \text{(IA.10)}\\
&= \frac{\Omega_{f,t}\bar{P}_{f,t} - \Omega_{f,t-1}\bar{P}_{f,t-1}}{\text{Bond debt}_{f,t-1}} && \text{(IA.11)}\\
&= \frac{\Omega_{f,t-1}\Delta\bar{P}_{f,t} + \bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} && \text{(IA.12)}\\
&= \frac{\Omega_{f,t-1}\bar{P}_{f,t-1}\frac{\Delta\bar{P}_{f,t}}{\bar{P}_{f,t-1}} + \bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} && \text{(IA.13)}\\
&\approx \frac{\Omega_{t-1}\bar{P}_{f,t-1}\Delta\log\bar{P}_{f,t}}{\text{Bond debt}_{f,t-1}} + \frac{\bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} && \text{(IA.14)}\\
&= \frac{\frac{\sum_i \kappa_{i,f,t-1}CB_{i,t-1}}{\bar{P}_{f,t-1}}\bar{P}_{f,t-1} \times \Delta\log\bar{P}_{f,t}}{\text{Bond debt}_{f,t-1}} + \frac{\bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} && \text{(IA.15)}\\
&= \frac{\sum_i \kappa_{i,f,t-1}CB_{i,t-1}}{\text{Bond debt}_{f,t-1}} \times \Delta\log\bar{P}_{f,t} + \frac{\bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} && \text{(IA.16)}\\
&= \Delta\text{INVPremiums}_{f,t} + \Delta\Omega_{f,t}\frac{\bar{P}_{f,t}}{\text{Bond debt}_{f,t-1}}. && \text{(IA.17)}
\end{aligned}$$

If $\Omega_{f,t} = \Omega_{f,t-1}$, then $\Delta\Omega_{f,t} = 0$ and, thus, bond purchases coincide with $\Delta\text{INVPremiums}_{f,t}$. Therefore, the strong persistence in $\Omega_{f,t}$ documented above points to $\Delta\text{INVPremiums}_{f,t}$ as a relevant instrument for bond purchases. Nonetheless, the residual, $\Delta\Omega_{f,t}\frac{\bar{P}_{f,t}}{\text{Bond debt}_{f,t-1}}$, may be correlated with $\Delta\text{INVPremiums}_{f,t}$, e.g., because premium flows also affect cash flows from other business activities. I find that this correlation weakens the relation between $\Delta\text{INVPremiums}_{f,t}$ and bond purchases if $\Delta\text{INVPremiums}_{f,t} < 0$. Instead, the analysis focuses on positive demand shifts $\max(\Delta\text{INVPremiums}_{f,t}, 0)$, whose relevance is shown in the first-stage regressions in Table 4.

B.2 Instrument validity

Proposition IA.1. *Approximating $\Delta \log \bar{P}_{f,t} \approx \frac{\bar{P}_{f,t}}{\bar{P}_{f,t-1}} - 1$, the moment condition in Equation (5) is equivalent to*

$$\mathbb{E}\left[\sum_{f,t} h_{f,t-1} 1\{\Delta \bar{P}_{f,t} > 0\} \left(\frac{\sum_i w_{i,f,t-1} P_{i,f,t}}{\sum_i w_{i,f,t-2} P_{i,f,t-1}} - 1 \right) \varepsilon^{\perp}_{f,t} \right] = 0. \tag{IA.18}$$

Proof. It holds that

$$\mathbb{E}\left[\sum_{f,t} \Delta \text{INVPremiums}^{>0}_{f,t} \; \varepsilon^{\perp}_{f,t}\right] \tag{IA.19}$$

$$= \mathbb{E}\left[\sum_{f,t} h_{f,t-1} \max(\Delta \log \bar{P}_{f,t}, 0) \; \varepsilon^{\perp}_{f,t}\right] \tag{IA.20}$$

$$= \mathbb{E}\left[\sum_{f,t} h_{f,t-1} 1\{\Delta \bar{P}_{f,t} > 0\} \log \left(\frac{\bar{P}_{f,t}}{\bar{P}_{f,t-1}} \right) \; \varepsilon^{\perp}_{f,t}\right] \tag{IA.21}$$

$$\approx \mathbb{E}\left[\sum_{f,t} h_{f,t-1} 1\{\Delta \bar{P}_{f,t} > 0\} \left(\frac{\sum_i w_{i,f,t-1} P_{i,f,t}}{\sum_i w_{i,f,t-2} P_{i,f,t-1}} - 1 \right) \; \varepsilon^{\perp}_{f,t}\right]. \tag{IA.22}$$

The first equality follows from the definition of $\Delta \text{INVPremiums}^{>0}_{f,t}$. The second equality follows from $\max(X, 0) = 1\{X > 0\}X$ for a random variable X. Finally, I use the approximation $\Delta \log \bar{P}_{f,t} \approx \frac{\bar{P}_{f,t}}{\bar{P}_{f,t-1}} - 1$ and the definition of $\bar{P}_{f,t}$. □

Proposition IA.2. *Assume that lagged insurer ownership is uncorrelated with residualized firm characteristics:*

$$\mathbb{E}\left[h_{f,t-1} \varepsilon^{\perp}_{f,t} \mid \Delta \bar{P}_{f,t} > 0\right] = 0. \tag{IA.23}$$

The moment condition in Equation (IA.18) is satisfied if, for all f and t, the following condition *holds:*

$$\mathbb{E}\left[\overline{\frac{P_{f,t}}{P_{f,t-1}}}\ \frac{\overline{w}_{f,t-1}}{\widetilde{w}_{f,t-2}}\ \varepsilon^{\perp}_{f,t} \mid \Delta\bar{P}_{f,t} > 0, h_{f,t-1}\right] = 0, \tag{IA.24}$$

where $\overline{w}_{f,t-1}$ and $\widetilde{w}_{f,t-2}$ are the average insurer's premium weights, both weighted by lagged premiums $P_{i,f,t-1}$, and $\overline{\frac{P_{f,t}}{P_{f,t-1}}}$ is the average potential investor's premium growth, weighted by $w_{i,f,t-1}P_{i,f,t-1}$.

Proof. First, note that

$$\mathbb{E}\left[\sum_{f,t} h_{f,t-1}1\{\Delta\bar{P}_{f,t} > 0\}\frac{\sum_i w_{i,f,t-1}P_{i,f,t}}{\sum_i w_{i,f,t-2}P_{i,f,t-1}}\ \varepsilon^{\perp}_{f,t}\right] \tag{IA.25}$$

$$= \mathbb{P}\left(\Delta\bar{P}_{f,t} > 0\right)\mathbb{E}\left[h_{f,t-1}\frac{\sum_i w_{i,f,t-1}P_{i,f,t}}{\sum_i w_{i,f,t-2}P_{i,f,t-1}}\varepsilon^{\perp}_{f,t} \mid \Delta\bar{P}_{f,t} > 0\right] \tag{IA.26}$$

$$= \mathbb{P}\left(\Delta\bar{P}_{f,t} > 0\right)\mathbb{E}\left[h_{f,t-1}\frac{\sum_i w_{i,f,t-1}P_{i,f,t-1}}{\sum_i w_{i,f,t-2}P_{i,f,t-1}}\frac{\sum_i w_{i,f,t-1}P_{i,f,t}}{\sum_i w_{i,f,t-1}P_{i,f,t-1}}\varepsilon^{\perp}_{f,t} \mid \Delta\bar{P}_{f,t} > 0\right] \tag{IA.27}$$

$$= \mathbb{P}\left(\Delta\bar{P}_{f,t} > 0\right)\mathbb{E}\left[h_{f,t-1}\frac{\overline{w}_{f,t-1}}{\widetilde{w}_{f,t-2}}\sum_i \frac{w_{i,f,t-1}P_{i,f,t-1}}{\sum_j w_{j,f,t-1}P_{j,f,t-1}}\frac{P_{i,f,t}}{P_{i,f,t-1}}\varepsilon^{\perp}_{f,t} \mid \Delta\bar{P}_{f,t} > 0\right] \tag{IA.28}$$

$$= \mathbb{P}\left(\Delta\bar{P}_{f,t} > 0\right)\mathbb{E}\left[h_{f,t-1}\mathbb{E}\left[\overline{\frac{P_{f,t}}{P_{f,t-1}}}\frac{\overline{w}_{f,t-1}}{\widetilde{w}_{f,t-2}}\varepsilon^{\perp}_{f,t} \mid \Delta\bar{P}_{f,t} > 0, h_{f,t-1}\right] \mid \Delta\bar{P}_{f,t} > 0\right], \tag{IA.29}$$

where $\overline{\frac{P_{f,t}}{P_{f,t-1}}} = \sum_i \tilde{s}_{i,f,t-1}\frac{P_{i,f,t}}{P_{i,f,t-1}}$ is the average potential investor's premium growth weighted by $\tilde{s}_{i,f,t-1} = \frac{w_{i,f,t-1}P_{i,f,t-1}}{\sum_j w_{j,f,t-1}P_{j,f,t-1}}$ (note that $\tilde{s}_{i,f,t-1} = 0$ if insurer i is not a potential investor), and $\overline{w}_{f,t-1} = \sum_i \frac{P_{i,f,t-1}}{\sum_j P_{j,f,t-1}}w_{i,f,t-1}$ and $\widetilde{w}_{f,t-2} = \sum_i \frac{P_{i,f,t-1}}{\sum_j P_{j,f,t-1}}w_{i,f,t-2}$ are the average insurer's premium weights weighted by lagged premiums. The first equality follows from the law of total probability, conditioning on the event $\{\Delta\bar{P}_{f,t} > 0\}$ and using that $1\{\Delta\bar{P}_{f,t} > 0\} = 0$ if $\Delta\bar{P}_{f,t} \leq 0$. The second equality multiplies the nominator and denominator with $\sum_i w_{i,f,t-1}P_{i,f,t-1}$. The third equality applies the definition of $\overline{w}_{f,t-1}$ and $\widetilde{w}_{f,t-1}$ and multiplies the nominator and denominator by $P_{i,f,t-1}$. The final equality follows from the law of iterated expectations applied by conditioning on the value of $h_{f,t-1}$ and using the definition of $\overline{\frac{P_{f,t}}{P_{f,t-1}}}$.

Second, using the law of total probability, it is

$$\mathbb{E}\left[h_{f,t-1}1\{\Delta\bar{P}_{f,t} > 0\}\varepsilon^{\perp}_{f,t}\right] = \mathbb{P}(\Delta\bar{P}_{f,t} > 0)\mathbb{E}\left[h_{f,t-1}\varepsilon^{\perp}_{f,t} \mid \Delta\bar{P}_{f,t} > 0\right]. \tag{IA.30}$$

Therefore, if Equations (IA.24) and (IA.23) are satisfied, the moment condition in Equation (IA.18) is satisfied:

$$\mathbb{E}\left[\sum_{f,t} h_{f,t-1} 1\{\Delta \bar{P}_{f,t} > 0\} \left(\frac{\sum_i w_{i,f,t-1} P_{i,f,t}}{\sum_i w_{i,f,t-2} P_{i,f,t-1}} - 1\right) \varepsilon^{\perp}_{f,t}\right] \tag{IA.31}$$

$$= \sum_{f,t} \mathbb{E}\left[h_{f,t-1} 1\{\Delta \bar{P}_{f,t} > 0\} \frac{\sum_i w_{i,f,t-1} P_{i,f,t}}{\sum_i w_{i,f,t-2} P_{i,f,t-1}} \varepsilon^{\perp}_{f,t}\right]$$

$$- \sum_{f,t} \mathbb{E}\left[h_{f,t-1} 1\{\Delta \bar{P}_{f,t} > 0\} \varepsilon^{\perp}_{f,t}\right] \tag{IA.32}$$

$$= \sum_{f,t} \mathbb{P}\left(\Delta \bar{P}_{f,t} > 0\right) \mathbb{E}\Bigg[h_{f,t-1} \underbrace{\mathbb{E}\left[\overline{\frac{P_{f,t}}{P_{f,t-1}}} \frac{\overline{w}_{f,t-1}}{\widetilde{w}_{f,t-2}} \varepsilon^{\perp}_{f,t} \mid \{\Delta \bar{P}_{f,t} > 0\}, h_{f,t-1}\right]}_{=0} \mid \Delta \bar{P}_{f,t} > 0\Bigg]$$

$$- \sum_{f,t} \mathbb{P}(\Delta \bar{P}_{f,t} > 0) \underbrace{\mathbb{E}\left[h_{f,t-1} \varepsilon^{\perp}_{f,t} \mid \Delta \bar{P}_{f,t} > 0\right]}_{=0} = 0, \tag{IA.33}$$

where the first equality follows from the linearity of expectations, the second equality follows from applying Equations (IA.29) and (IA.30), and the third equality follows from applying Equations (IA.23) and (IA.24). □

B.3 Back-of-the-envelope calculation

To interpret the first-stage coefficient reported in Table 4, it is useful to rewrite the key component of the instrument as follows:

$$\Delta \log \bar{P}_{f,t} = \log \frac{\sum_i w_{i,f,t-1} P_{i,f,t}}{\sum_i w_{i,f,t-2} P_{i,f,t-1}} \tag{IA.34}$$

$$= \log \frac{\hat{w}_{f,t-1} \sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \text{Premiums}_{i,f,t}}{\hat{w}_{f,t-2} \sum_i \mathbb{I}(\text{Investor}_{i,f,t-1-(1:8)}) \text{Premiums}_{i,f,t-1}}, \tag{IA.35}$$

where $\text{Premiums}_{i,f,t}$ is the USD amount of noncommercial premiums written in states other than the location of f (adjusted by the net-to-gross premiums ratio) and $\hat{w}_{f,t-1} = \sum_i \frac{\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \text{Premiums}_{i,f,t}}{\sum_j \mathbb{I}(\text{Investor}_{j,f,t-(1:8)}) \text{Premiums}_{j,f,t}} \frac{w_{i,f,t-1}}{\text{Total assets}_{i,t-1}}$ is the premium-weighted average premium weight scaled by lagged total assets. For a constant average premium weight, $\hat{w}_{f,t-1} = \hat{w}_{f,t-2}$, a \$1 increase in the premiums collected by potential investors corresponds to

$$\Delta \log \bar{P}_{f,t} = \log \frac{1 + \sum_i \mathbb{I}(\text{Investor}_{i,f,t-1-(1:8)})\text{Premiums}_{i,f,t-1}}{\sum_i \mathbb{I}(\text{Investor}_{i,f,t-1-(1:8)})\text{Premiums}_{i,f,t-1}}. \tag{IA.36}$$

Thus, in response to a \$1 increase in potential investors' premiums, bond purchases increase, on average, by

$$\beta \times \mathbb{E}\left[\text{Bond debt}_{f,t-1} \times h_{f,t-1} \times \log \frac{1 + \sum_i \mathbb{I}(\text{Investor}_{i,f,t-1-(1:8)})\text{Premiums}_{i,f,t-1}}{\sum_i \mathbb{I}(\text{Investor}_{i,f,t-1-(1:8)})\text{Premiums}_{i,f,t-1}}\right], \tag{IA.37}$$

where β is the coefficient on $\Delta\text{INVPremiums}^{>0}_{f,t}$ in the first-stage regression.

B.4 Insurers' investment preferences

Table IA.4. Insurer characteristics and investment preferences.
This table reports the coefficient β from regressions of the following form:

$$Y_{i,t}^F = \beta X_{i,t}^I + u_t + \varepsilon_{i,t}$$

at the insurer-by-quarter level from 2010q1 to 2018q4. u_t are time fixed effects. $Y_{i,t}^F$ is the characteristic of the average bond issuer that insurer i has previously invested in, i.e., with $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) = 1$. $X_{i,t}^I$ is the characteristic of insurer i. Each cell corresponds to a separate regression for different characteristics of firms (columns) and insurers (rows), considering size (log of total assets), leverage, and credit rating for both firms and insurers as well as idiosyncratic equity return volatility of firms, defined as in Ang et al. (2009), and the RBC capital ratio, equity investment share (relative to all equity and bond investments), and insurance business type (life or P&C) of insurers. A larger value of the rating variables indicates higher credit risk. All variables except for the life insurance indicator are standardized to zero mean and unit variance. t-statistics are shown in brackets and based on standard errors clustered at the insurer and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
Firm characteristic:	Rating	Size	Volatility	Leverage
Insurer rating	-0.077***	0.174***	-0.029	0.037***
	[-3.09]	[6.94]	[-1.46]	[2.99]
Insurer size	0.362***	-0.493***	0.220***	-0.055***
	[15.37]	[-26.82]	[13.71]	[-4.44]
log(Insurer RBC ratio)	-0.107***	0.084***	-0.087***	-0.012
	[-5.63]	[4.05]	[-6.56]	[-0.77]
Insurer leverage	0.220***	-0.314***	0.131***	-0.022**
	[10.93]	[-15.42]	[9.77]	[-2.46]
Insurer %equity	0.031	0.053**	0.042**	0.010
	[1.20]	[2.01]	[2.34]	[0.62]
Life insurer	0.555***	-0.789***	0.350***	-0.061**
	[12.06]	[-17.70]	[10.76]	[-2.48]

Table IA.5. Local determinants of potential investors.

Each column presents OLS estimates for the effect of a common economic environment on the likelihood of insurer i being a potential investor of firm f,

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

at the insurer-by-firm-by-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, $u_{i,t}$ are insurer-by-time fixed effects, and $v_{f,t}$ are firm-by-time fixed effects. An insurer's state (region) is the state (region) in which the largest amount of premiums were written in the previous eight quarters. Social connectedness is the logarithm of Bailey et al. (2018)'s social connectedness index between firms' and insurance customers' locations. %Employed same industry is the employment per capita in the firm's industry in insurance customers' locations. *Terc* is the cross-sectional tercile of the respective variable. 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}	-0.00					
	[-1.51]					
1{Same region}		-0.00				
		[-0.30]				
Social connectedness			-0.00			
			[-0.53]			
Social connectedness: Terc2				-0.00		
				[-0.74]		
Social connectedness: Terc3				-0.00		
				[-0.76]		
%Employed same industry					-0.07	
					[-0.90]	
%Employed same industry: Terc2						0.00
						[0.81]
%Employed same industry: Terc3						-0.00
						[-0.32]
Insurer-Time FE	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y
No. of obs.	37,711,991	37,711,991	37,711,991	37,711,991	37,711,991	37,711,991
No. of firms	876	876	876	876	876	876
No. of insurers	1,451	1,451	1,451	1,451	1,451	1,451
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						0.00

Table IA.6. Exposure of insurance premiums to aggregate factors.
This table reports the coefficient β on the interaction term in specifications of the following form:

$$Y_{i,t} = \beta X_{i,t-1} \times M_t + \alpha X_{i,t-1} + u_t + \varepsilon_{i,t}$$

at the insurer-by-quarter level from 2010q1 to 2018q4. u_t are time fixed effects. The dependent variable is either (A) the level or (B) change in insurance premiums, both scaled by lagged total assets. Each cell corresponds to a separate regression for different insurer characteristics $X_{i,t-1}$, which are lagged credit rating, size (log of total assets), log regulatory capital (RBC) ratio, leverage, equity investment share (relative to all equity and bond investments), and insurance business type (life or P&C), and different macroeconomic factors, which are the change in log GDP and in log VIX as well as the 10-year treasury rate and term spread, defined as the 10-year minus 3-month treasury rate. All variables except for the life insurance indicator are standardized to zero mean and unit variance. t-statistics are shown in brackets and based on standard errors clustered at the insurer and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Factor:	(1) ΔGDP	(2) ΔVIX	(3) 10Y rate	(4) Term spread
(A) Premiums				
Insurer rating × Factor	-0.001	-0.005*	-0.005	0.005
	[-0.26]	[-1.66]	[-0.84]	[0.56]
Insurer size × Factor	0.001	0.005	-0.000	-0.016***
	[0.40]	[1.09]	[-0.11]	[-2.99]
log(Insurer RBC ratio) × Factor	-0.001	0.005	0.008	-0.004
	[-0.21]	[1.00]	[1.09]	[-0.49]
Insurer leverage × Factor	0.000	0.004	-0.003	-0.013***
	[0.16]	[1.28]	[-0.95]	[-2.88]
Insurer %equity × Factor	0.003*	0.002***	-0.006	-0.012**
	[1.76]	[5.17]	[-1.65]	[-2.00]
Life insurer × Factor	-0.003	0.012	0.005	-0.013
	[-0.35]	[1.06]	[0.38]	[-0.84]
(B) ΔPremiums				
Insurer rating × Factor	-0.015	-0.003	0.008	0.012
	[-1.39]	[-0.26]	[0.68]	[1.14]
Insurer size × Factor	0.005	0.012	-0.005	-0.013*
	[0.76]	[1.65]	[-0.70]	[-1.94]
log(Insurer RBC ratio) × Factor	0.005	0.009	-0.010	-0.012
	[0.63]	[0.97]	[-1.23]	[-1.63]
Insurer leverage × Factor	-0.001	0.019***	-0.005	-0.013**
	[-0.15]	[2.67]	[-0.69]	[-1.98]
Insurer %equity × Factor	0.005	-0.001	-0.009**	-0.004
	[1.10]	[-0.25]	[-1.97]	[-0.85]
Life insurer × Factor	0.011	0.060***	-0.019	-0.044**
	[0.41]	[2.59]	[-0.84]	[-1.98]

Table IA.7. Sorting of insurers across firms based on aggregate factors.

This table reports the estimated coefficient γ from specifications of the following form:

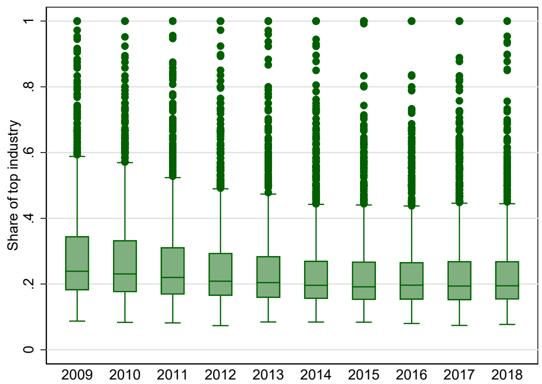
$$\bar{\beta}_i^F = \gamma \beta_i^I + \varepsilon_i$$

at the insurer level. β_i^I is estimated in the regression $Y_{i,t} = \beta_i^I M_t + \varepsilon'_{i,t}$ at quarterly frequency, where M_t is an aggregate factor (change in log GDP and in log VIX as well as the 10-year treasury rate and term spread, defined as the 10-year minus 3-month treasury rate) and $Y_{i,t}$ is either (A) the level or (B) change in insurance premiums, both scaled by lagged total assets. To compute $\bar{\beta}_i^F$, I first estimate β_f^F from regressions $\frac{\Delta\text{Bond debt}_{f,t}}{\text{Bond debt}_{f,t-1}} = \beta_f^F M_t + \varepsilon''_{f,t}$. $\hat{\beta}_{i,t}^F$ is the average β_f^F among bond issuers in which insurer i has previously invested, i.e., with $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) = 1$. $\bar{\beta}_i^F$ is the insurer-specific median of $\hat{\beta}_{i,t}^F$. $\bar{\beta}_i^F$ and β_i^I are truncated at the 1st and 99th percentiles. All variables are standardized to zero mean and unit variance. t-statistics are shown in brackets and based on standard errors clustered at the state-by-insurer type level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

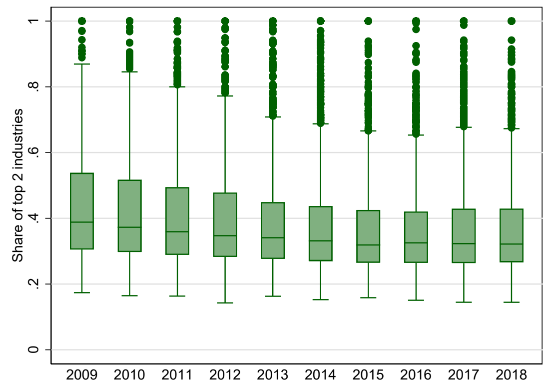
	(1)	(2)	(3)	(4)
Dependent variable:	Average firm's exposure ($\bar{\beta}^F$)			
Factor:	ΔGDP	ΔVIX	10Y rate	Term spread
(A) Premiums				
$\beta^I(\Delta\text{GDP})$	-0.020			
	[-0.67]			
$\beta^I(\Delta\text{VIX})$		-0.016		
		[-0.63]		
$\beta^I(\text{10Y rate})$			0.019	
			[0.68]	
$\beta^I(\text{Term spread})$				0.001
				[0.04]
(B) ΔPremium				
$\beta^I(\Delta\text{GDP})$	-0.080**			
	[-2.46]			
$\beta^I(\Delta\text{VIX})$		-0.030		
		[-0.98]		
$\beta^I(\text{10Y rate})$			-0.019	
			[-0.84]	
$\beta^I(\text{Term spread})$				-0.024
				[-0.82]

Figure IA.6. Concentration of bond holdings across issuer industries.

The figures show box plots of the share of insurers' corporate bond holdings in the top (a) 1 and (b) 2 industries (at the 2-digit SIC level) among all industry-matched corporate bond holdings at the insurer level based on end-of-year holdings.



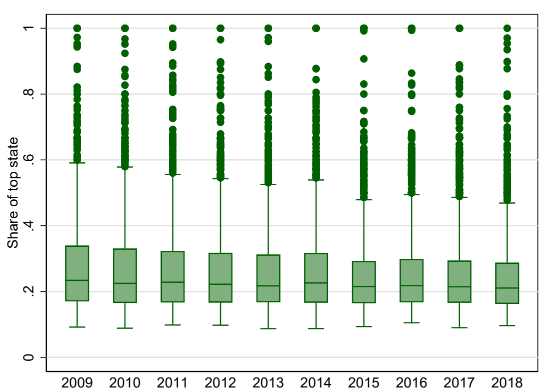
(a) Top 1 industry.



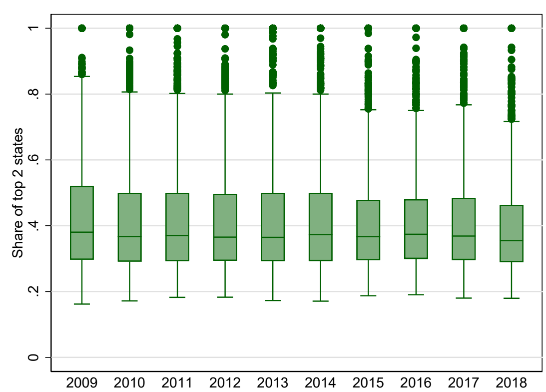
(b) Top 2 industries.

Figure IA.7. Concentration of bond holdings across firms' locations.

The figures show box plots of the share of insurers' corporate bond holdings from bond issuers located in the top (a) 1 and (b) 2 U.S. states among all issuer 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.8. Persistence in the investment universe of insurers.

This table reports the percentage of corporate bond issuers in the current year's portfolio whose bonds 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	92.4%	92.5%	92.5%	92.7%	92.7%	92.7%	92.7%	92.8%	92.8%	92.8%
2	93.3%	93.4%	93.4%	93.5%	93.5%	93.6%	93.6%	93.6%	93.7%	93.7%
3	92.4%	92.5%	92.6%	92.8%	92.9%	92.9%	93.0%	93.0%	93.1%	93.1%
4	92.7%	92.8%	92.9%	93.0%	93.1%	93.1%	93.2%	93.2%	93.2%	93.3%
5	93.2%	93.3%	93.4%	93.5%	93.6%	93.6%	93.7%	93.7%	93.7%	93.8%
6	92.8%	93.0%	93.2%	93.4%	93.5%	93.5%	93.6%	93.6%	93.7%	93.7%
7	93.2%	93.4%	93.5%	93.7%	93.8%	93.9%	93.9%	94.0%	94.0%	94.0%
8	94.3%	94.4%	94.6%	94.8%	94.9%	95.0%	95.0%	95.1%	95.1%	95.2%
9	95.1%	95.3%	95.4%	95.6%	95.6%	95.7%	95.7%	95.8%	95.8%	95.9%
10	96.1%	96.3%	96.4%	96.6%	96.6%	96.7%	96.7%	96.8%	96.8%	96.9%

Table IA.9. Variance decomposition of insurers' investment preferences.

This 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.

Fixed Effects:	None	Firm & Insurer-Time	Firm-Time & Insurer-Time	Insurer-Firm	Insurer-Firm & Firm-Time	Insurer-Firm & Firm-Time & Insurer-Time
SD(Residuals)	0.21	0.18	0.18	0.12	0.11	0.11
R^2		0.20	0.21	0.68	0.70	0.70
Adj. R^2		0.20	0.21	0.68	0.69	0.69

Table IA.10. Persistence of insurers' portfolio allocation: Determinants.
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-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 $C_{i,f,t}$ is a vector of fixed effect dummies. Insurer size quintiles in column (1) are indicators based on the cross-sectional distribution of insurers' total assets. Firm age is the firm's current age standardized to zero mean and unit variance. Firm volatility is the idiosyncratic volatility of the firm's equity defined as in Ang et al. (2009) standardized to zero mean and unit variance. log Bond debt is the logarithm of the firm's total bond debt. 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. The *difference in α relative to baseline* is the relative difference between the point estimate for α in this table and 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)	(7)
Dependent variable:				1{Purchase}			
$\mathbb{I}$(Investor) × Insurer size:Quint1	0.006**						
	[2.36]						
$\mathbb{I}$(Investor) × Insurer size:Quint2	0.009***						
	[5.64]						
$\mathbb{I}$(Investor) × Insurer size:Quint3	0.011***						
	[8.33]						
$\mathbb{I}$(Investor) × Insurer size:Quint4	0.025***						
	[11.81]						
$\mathbb{I}$(Investor) × Insurer size:Quint5	0.052***						
	[18.70]						
$\mathbb{I}$(Investor)		0.028***	0.035***	0.033***	0.029***	0.028***	0.021***
		[15.95]	[19.61]	[18.81]	[18.73]	[16.70]	[15.67]
$\mathbb{I}$(Investor) × log(Bond debt)		0.015***					
		[8.94]					
$\mathbb{I}$(Investor) × Firm age		-0.007***					
		[-6.31]					
$\mathbb{I}$(Investor) × Firm volatility		0.005***					
		[3.27]					
Insurer-Time FE	Y	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y	Y
Firm state-Insurer FE			Y				Y
Firm industry-Insurer FE				Y			Y
Firm size-Insurer FE					Y		Y
Firm rating-Insurer FE						Y	Y
No. of obs.	39,003,099	33,210,282	39,003,099	39,003,099	39,003,099	39,003,099	39,003,099
No. of firms	876	874	876	876	876	876	876
No. of insurers	1,484	1,484	1,484	1,484	1,484	1,484	1,484
Relative effect of $\mathbb{I}$(Investor)			18.49	17.41	15.16	14.77	11.00
Difference in α relative to baseline:			-0.03	-0.09	-0.20	-0.22	-0.42

B.5 Natural disaster exposure

This section details the construction of the natural disaster–based instrument. I retrieve information since 2005Q1 about the number of fatalities from heat and storms from the Spatial Hazard Events and Losses Database for the United States (SHELDUS), and scale it by population size from the U.S. Census. I exclude all P&C insurers from the natural disaster–based instrument. To mitigate the potential impact of extremely severe disasters on life insurance pricing or payouts, I drop the most extreme disasters (those in the top 5% in terms of fatalities per capita by hazard) and winsorize remaining fatality counts at 5%/95%, which also ensures that the results are not driven by outliers.

I denote as Disaster fatalities$_{i,t-1}$ life insurer i's exposure to disaster fatalities in quarter $t-1$, defined as the sum across all states s (in which i is active) of the number of fatalities per 100,000 residents in state s at $t-1$ multiplied by the average share of direct premiums written by insurer i in state s, namely,

$$\text{Disaster fatalities}_{i,t-1} = \sum_{s} \text{Fatalities}_{s,t-1} \times 1\{\text{DPW}_{i,s,t} > 0\} \times \frac{1}{n_i} \sum_{\tau} \frac{\text{DPW}_{i,s,\tau}}{\sum_h \text{DPW}_{i,h,\tau}}, \tag{IA.38}$$

where n_i is the number of dates with nonmissing observations for insurer i and DPW$_{i,s,t}$ are the total (unadjusted) direct premiums written by insurer i in state s in quarter t.

Column (8) in Table 2 shows that increases in Disaster fatalities$_{i,t-1}$ significantly raise insurers' bond purchases, controlling for insurer-specific seasonality, aggregate trends, and insurer characteristics. This effect is driven by insurance premiums, which increase with disaster fatalities at both the insurer-by-state and insurer levels, whereas life insurance payouts do not significantly correlate with disasters (see Table IA.11).

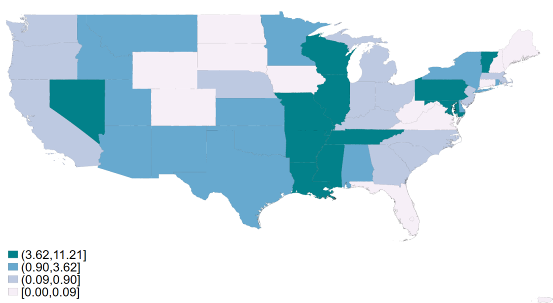
Firms might be subject to the same disasters as insurers, which would be a potential concern if sorting of insurers across firms was correlated with common disaster exposure. To address this concern, I exclude from Disaster fatalities$_{i,t-1}$ the state in which a firm is located and all of its neighboring states, and denote the resulting variable by Distant disaster fatalities$_{i,f,t-1}$. Aggregating across all life insurers that are potential investors yields

$$\overline{D}_{f,t} = \sum_{\text{Life insurers } i} \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \times \frac{CB_{i,t-1}}{\text{Total assets}_{i,t-1}} \times \text{Distant disaster fatalities}_{i,f,t-1}, \tag{IA.39}$$

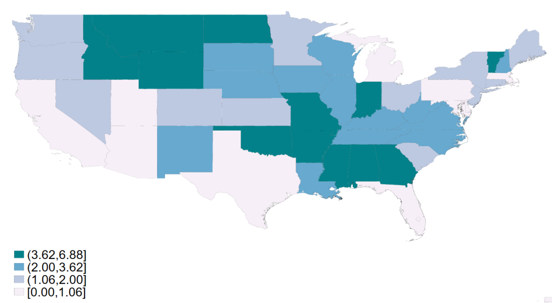
where $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \times \frac{CB_{i,t-1}}{A_{i,t-1}}$ are the premium weights analogous to Equation (2). I use $\overline{D}_{f,t}$ as a substitute for premiums $\overline{P}_{f,t}$ in Equation (3) to define an alternative instrument denoted $\Delta\text{INVDisasters}^{>0}_{f,t}$:

$$\Delta\text{INVDisasters}^{>0}_{f,t} = h_{f,t-1} \times \max\left(\Delta \log \bar{D}_{f,t}, 0\right). \tag{IA.40}$$

Figure IA.8. 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, multiplied by 100 for readability and winsorized at 1/99%.



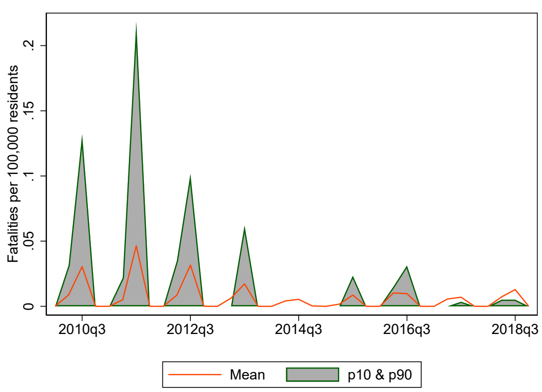
(a) Heat.



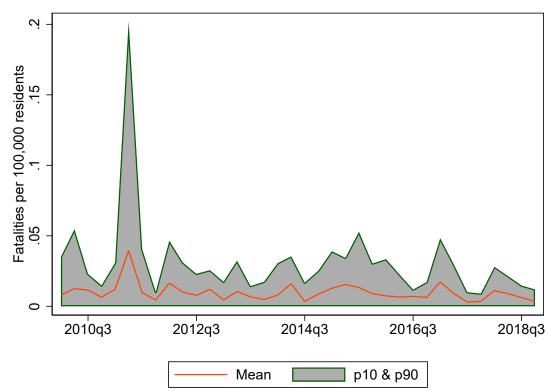
(b) Storms.

Figure IA.9. Time-series variation in natural disasters.

The figures illustrate the cross-sectional distribution of fatalities per 100,000 residents at the state–quarter level caused by (a) heat and (b) storms from 2010q1 to 2018q4, scaled by 100 for readability and winsorized at 1%/99%.



(a) Heat.



(b) Storms.

Table IA.11. Natural disasters, insurance premiums, and insurers' balance sheet.
Columns (1) and (2) report estimated coefficients from specifications of the following form:

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

at the insurer-by-state-by-quarter level, where $u_{i,t}$ are insurer-by-time fixed effects and $v_{i,s,season}$ are insurer-by-state-by-calendar quarter fixed effects, the use of which necessitates the exclusion of several insurers active in only one state. $\log(\text{Premiums}_{i,s,t})$ are the direct noncommercial life insurance premiums written by insurer i in state s at t. In column (1), the explanatory variable is Disaster fatalities$_{i,s,t-1}$ = Fatalities$_{s,t-1} \times 1\{\text{DPW}_{i,s,t} > 0\} \times \frac{1}{n_i} \sum_\tau \frac{\text{DPW}_{i,s,\tau}}{\sum_h \text{DPW}_{i,h,\tau}}$, namely the total fatalities per 100,000 residents caused by heat and storms in state s at time $t-1$ multiplied by the average share of premiums written by insurer i in state s, and in column (2), it is Fatalities$_{s,t-1}$. The sample in column (2) is restricted to insurer-state pairs in which the insurer underwrites at least 5% of life premiums on average. Columns (3) to (8) report estimated coefficients from specifications of the following form:

$$Y_{i,t} = \alpha\ X_{i,t-1} + u_{i,season} + v_t + \varepsilon_{i,t}$$

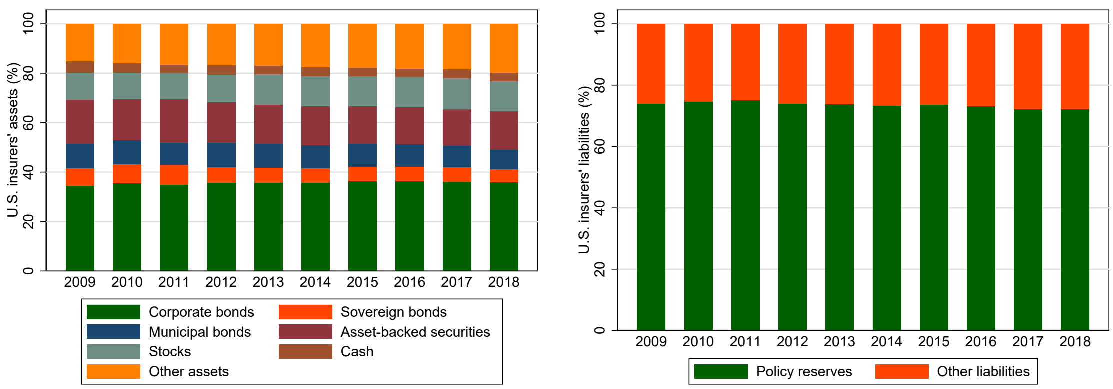
at the insurer-by-quarter level, where $u_{i,season}$ are insurer-by-calendar quarter fixed effects and v_t are time fixed effects. In columns (3), (4), and (6) to (8), the explanatory variable Disaster fatalities$_{i,t-1}$ is the sum of Disaster fatalities$_{i,s,t-1}$ across states s, and in column (5), the explanatory variable is the unweighted sum of Fatalities$_{s,t-1}$ across states s in which insurer i is active (indicated by $\text{DPW}_{i,s,t} > 0$). The dependent variable in columns (3) to (5) is the logarithm of total direct noncommercial insurance premiums written, that in column (6) is the logarithm of total life insurance benefits paid to policyholders (i.e., insurance claims), and that in columns (7) and (8) is the total volume of corporate bond purchases in quarter t scaled by lagged total assets. Insurer controls are an insurer's investment yield, life insurance profitability, fee income, rating dummies, and lagged return on equity. t-statistics are shown in brackets and based on standard errors clustered at the insurer and state levels in columns (1) and (2) and at the insurer and region-by-time levels in columns (3) to (8). The sample includes only life insurers. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Level:	Insurer-State		Insurer					
Sample:	Full	Significant activity	Full					
Dependent variable:	log(Direct Premiums Written)					log(Benefits)	$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disaster fatalities	3.61***		1.27***	1.25***		0.22		
	[4.35]		[3.29]	[3.30]		[0.81]		
Fatalities (unweighted)		0.26*			0.16**			
		[1.77]			[2.40]			
ΔDisaster fatalities$^{>0}$							0.07***	0.07***
							[3.15]	[2.96]
Insurer controls				Y	Y			Y
Insurer-Time FE	Y	Y						
Insurer-State-Seasonality FE	Y	Y						
Time FE			Y	Y	Y	Y	Y	Y
Insurer FE			Y	Y	Y	Y		
Insurer-Seasonality FE								Y
No. of obs.	598,047	58,369	15,780	15,780	15,780	15,238	15,780	15,780
No. of insurers	450	397	500	500	500	494	500	500

C Additional figures

Figure IA.10. 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 are cash and 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 reinsurance as well as borrowings, taxes, and other liabilities, excluding separate accounts.



(a) Assets. (b) Liabilities.

Figure IA.11. Corporate bond holdings by investor type.

This figure depicts the share of corporate bond holdings of 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.

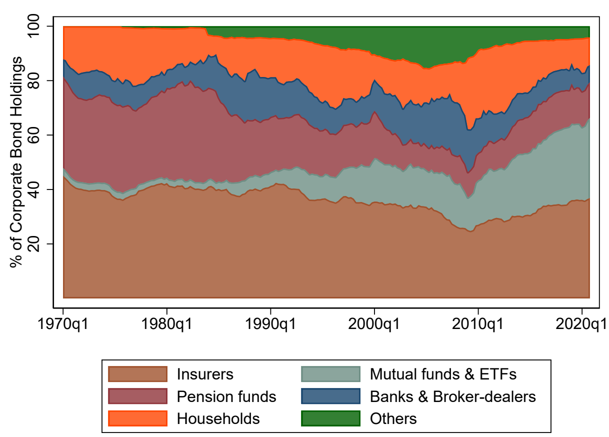
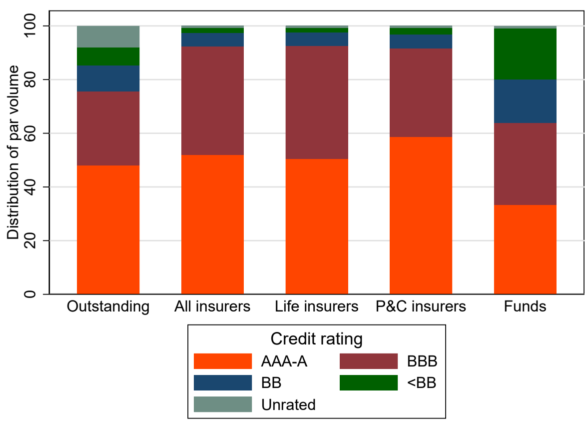
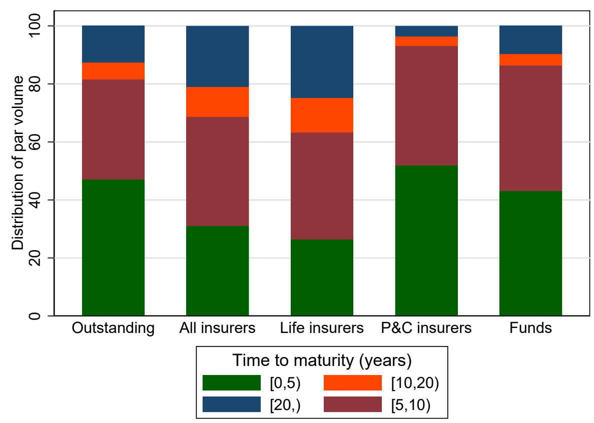


Figure IA.12. Comparing the corporate bond holdings of insurers and funds.
The figures depict the distribution of (1) the amount outstanding of all corporate bonds that are held by at least one fund or insurer, (2) the par value of all corporate bonds held by all P&C and life insurers, (3) the par value of all corporate bonds held by bond mutual funds, (4) the par value of all corporate bonds held by life insurers, and (5) by P&C insurers at year-end 2014. The sample includes all U.S. bond funds in the Lipper database (approximately 650 funds) and U.S. life and P&C insurers. To ensure comparability, I convert the market values of fund holdings to par values by using the volume-weighted average price from either TRACE, insurers' bond trades or bond holdings, in that order, or, if unavailable, the average price of bonds with a similar maturity and credit rating. The figures are robust to using the market value of fund holdings instead.

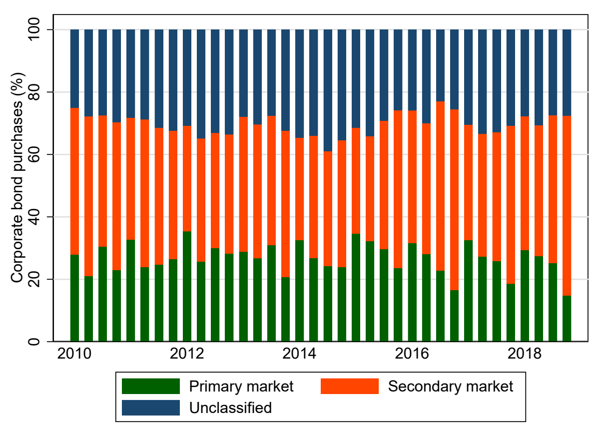


(a) Credit rating.



(b) Time to maturity.

Figure IA.13. Insurers' corporate bond purchases by market.
This figure depicts the breakdown of insurers' corporate bond purchases (by par value) into those in the primary market, those in the secondary market, and unclassified purchases.



D Additional tables

D.1 Summary statistics

Table IA.12. Additional summary statistics for insurer, issuance, and bond characteristics.
This table reports summary statistics at quarterly frequency from 2010q2 to 2018q4. All variables are winsorized at the 1%/99% levels.

	N	Mean	SD	p5	p50	p95
Insurer level						
Life insurer	45,113	0.35	0.48	0.00	0.00	1.00
ΔInvestments/Total assets$_{t-1}$ (%)	45,113	0.86	4.53	-5.65	0.68	7.59
Bond purchases (New)/Total assets$_{t-1}$ (%)	32,415	0.78	1.16	0.00	0.38	3.01
Bond purchases (Old)/Total assets$_{t-1}$ (%)	32,415	1.55	2.34	0.00	0.74	5.99
Return on equity	45,113	4.42	160.31	-28.39	4.75	32.99
Investment yield	45,113	3.12	1.57	0.71	2.98	5.71
# Firms held	45,113	165.49	282.36	4.00	62.00	717.00
P&C insurance profitability	29,130	5.37	5.20	-0.58	4.67	15.53
Life insurance profitability	15,983	9.30	31.21	-33.92	4.85	68.75
Life insurance fee income	15,983	1.85	4.99	0.00	0.00	13.24
Issuance level: Primary market						
Time to maturity (yrs)	677	10.43	5.95	4.20	9.14	23.84
Duration	677	7.33	2.72	3.87	6.81	13.25
Offering price	677	99.88	1.03	99.01	99.91	100.00
AA-AAA rated	677	0.04	0.20	0.00	0.00	0.00
A rated	677	0.19	0.39	0.00	0.00	1.00
BBB rated	677	0.34	0.47	0.00	0.00	1.00
High yield	677	0.42	0.49	0.00	0.00	1.00
Unrated	677	0.01	0.09	0.00	0.00	0.00
Bond level: Secondary market						
Time to maturity (yrs)	41,674	8.94	8.81	1.08	5.92	28.07
AA-AAA rated	41,674	0.08	0.27	0.00	0.00	1.00
A rated	41,674	0.25	0.43	0.00	0.00	1.00
BBB rated	41,674	0.40	0.49	0.00	0.00	1.00
High yield	41,674	0.25	0.43	0.00	0.00	1.00
Unrated	41,674	0.02	0.12	0.00	0.00	0.00
Duration	41,225	6.19	4.41	1.02	4.98	15.55

Table IA.13. Additional summary statistics for firm characteristics.

This table reports summary statistics at quarterly frequency from 2010q2 to 2018q4. All variables are winsorized at the 1%/99% levels.

	N	Mean	SD	p5	p50	p95
Firm level: Firm characteristics						
$\text{Sales}_{t-1}/\text{Bond debt}_{t-1}$ (%)	15,767	150.09	194.69	17.01	86.14	531.43
$\text{Cash flow}_{t-1}/\text{Bond debt}_{t-1}$ (%)	15,767	20.34	23.89	1.07	14.27	60.14
$\Delta\text{Cash}_{t-1}/\text{Bond debt}_{t-1}$ (%)	15,767	0.36	20.24	-29.89	0.11	30.17
$\text{Cash}_{t-1}/\text{Bond debt}_{t-1}$ (%)	15,767	63.10	86.02	1.69	30.67	240.47
$\text{PPE}_{t-1}/\text{Bond debt}_{t-1}$ (%)	15,767	172.30	189.78	13.21	114.60	528.76
$\text{Deferred Taxes}_{t-1}/\text{Bond debt}_{t-1}$ (%)	15,767	-0.03	3.87	-5.38	0.00	5.23
$\text{Market-to-book}_{t-1}$	15,767	1.79	0.93	0.92	1.52	3.79
Leverage_{t-1}	15,767	3.67	4.18	1.58	2.53	8.81
Age (yrs)	15,767	29.82	14.95	7.25	27.75	53.50
Stock return (%)	15,767	16.14	38.68	-42.71	13.53	82.97
SA index	15,767	-4.12	0.43	-4.63	-4.17	-3.35
Z-score	15,767	0.82	0.68	-0.32	0.85	1.84
Dividend payer	15,767	0.61	0.49	0.00	1.00	1.00
Earnings volatility	15,767	0.49	0.01	0.48	0.49	0.51
Commercial paper/Total debt (%)	2,633	8.12	10.71	0.00	3.71	30.39
$\Delta\text{Commercial paper}/\text{Bond debt}_{t-1}$ (%)	2,436	0.19	10.76	-16.04	0.00	16.59
Firm level: Insurer characteristics						
Insurer return on equity_{t-1} (%)	15,767	8.19	5.07	0.20	8.02	16.67
Insurer investment yield_{t-1}	15,767	4.26	0.70	3.10	4.26	5.32
Insurer P&C profitability (%)	15,767	4.70	2.01	0.00	5.02	7.44
Insurer life profitability (%)	15,767	11.44	11.25	-2.37	9.22	31.92
Insurer life fee income (%)	15,767	3.28	2.19	0.04	3.11	7.23

D.2 Insurance premiums

Table IA.14. Insurance premiums and insurer balance sheets: Additional evidence.
This table reports estimated coefficients from specifications of the following form:

$$Y_{i,t} = \alpha X_{i,t} + \Gamma' C_{i,t} + \varepsilon_{i,t}$$

at the insurer-by-quarter level, where $C_{i,t}$ is a vector of control variables and fixed effects. The dependent variables are in columns (1) and (2), the par value of corporate bond purchases; in (3), of old bonds, defined as those issued at least 6 days before purchase; in (4), of new bonds, defined as those issued less than 6 days before purchases; in (5), of all bonds net of sales; in (6), the quarterly change in net reinsurance premiums paid to reinsurers (i.e., reinsurance business ceded less of that assumed); in (7), the quarterly change in insurance policy reserves; and in (8), the quarterly net equity issuance, measured as the change in capital and surplus due to changes in issued stock, surplus notes, and reinsurance, all scaled by lagged total assets. The explanatory variable in columns (1) and (2) is the (lagged) level of noncommercial insurance premiums scaled by lagged total assets. In columns (3) to (8), it is the quarterly change in noncommercial insurance premiums scaled by lagged total assets, distinguishing between increases and decreases in premiums. In column (6), premiums are not adjusted by the lagged net-to-gross premiums ratio. Control variables and fixed effects are defined as in Table 2. t-statistics are shown in brackets and based on standard errors clustered at the insurer and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable:			$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$			$\frac{\Delta\text{Reinsurance}}{\text{Total assets}_{t-1}}$	$\frac{\Delta\text{Reserves}}{\text{Total assets}_{t-1}}$	$\frac{\Delta\text{Equity}}{\text{Total assets}_{t-1}}$
Type of bonds:	All		Old	New	Net			
$\frac{\text{Premiums}}{\text{Total assets}_{t-1}}$	0.03***	0.06***						
	[4.24]	[6.59]						
$\frac{\text{Premiums}_{t-1}}{\text{Total assets}_{t-1}}$		-0.03***						
		[-4.19]						
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$			0.28***	0.05***	0.16***		0.34***	0.08***
			[6.06]	[2.92]	[4.68]		[10.86]	[5.03]
$\frac{\Delta\text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$			-0.14***	-0.01	-0.08**		-0.07**	-0.04***
			[-2.91]	[-0.79]	[-1.99]		[-2.55]	[-2.60]
$\frac{\Delta\text{Unadj. Premiums}^{>0}}{\text{Total assets}_{t-1}}$						0.67***		
						[11.58]		
$\frac{\Delta\text{Unadj. Premiums}^{<0}}{\text{Total assets}_{t-1}}$						0.79***		
						[12.83]		
Insurer controls			Y	Y	Y	Y	Y	Y
Insurer-Seasonality FE			Y	Y	Y	Y	Y	Y
Life insurer-Time FE			Y	Y	Y	Y	Y	Y
No. of obs.	45,113	45,054	32,012	32,012	45,113	45,113	45,113	45,113
No. of insurers	1,451	1,451	1,366	1,366	1,451	1,451	1,451	1,451
p-value for H0: same coefficient on decreases and increases								
			0.00	0.03	0.00	0.07	0.00	0.00

E Robustness

Table IA.15. Corporate bond debt and insurers' bond demand: Robustness.

This table reports estimated coefficients for the effect of insurers' bond purchases on the growth in the stock of a firm's bond debt following the specification in column (3) in Table 4. The main explanatory variable in columns (1) and (4) to (10) is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It excludes primary market purchases in column (2), and it excludes bonds issued in the same quarter t in column (3). The main explanatory variable is instrumented in columns (2) to (4) and (7) to (10) by increases in potential investors' premiums, $h_{f,t-1}\max(\Delta \log \bar{P}_{f,t}, 0)$, and in (5) and (6) by the level of potential investors' premiums, $\bar{P}_{f,t}/\text{Bond debt}_{f,t-1}$, with $\bar{P}_{f,t}$ defined in Equation (2). Premiums exclude those for deposit-type life insurance in (10). Premium weights in columns (2), (3), (5) and (7) to (10) are given by $w_{i,f,t-1} = \mathbb{I}(\text{Investor}_{i,f,t-(1:8)})CB_{i,t-1}$; and in (4) and (6), by $w_{i,f,t-1} = \kappa_{i,f,t-1}CB_{i,t-1}$, with $\kappa_{i,f,t-1}$ defined as the lagged portfolio weight within the corporate bond portfolio. Baseline controls are the same firm and insurer characteristics as in Table 4 and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects. Additional controls are earnings volatility, z-score, and lagged size, asset growth, stock return, SA index, deferred taxes, tangibility, and an indicator of whether the firm paid dividends in the past 4 quarters. Insurance supply controls are the 4 lags of a firm's potential investors' return on equity, investment yield, P&C and life insurance profitability, and life insurance fee income and commissions. Insurer investment yield and profitability bins are based on the quartiles of the first two principal components of the current value and 4 lags of the investment yield and insurance profitability of the firm's potential investors, respectively. SIC1 refers to the 1-digit SIC industry classification. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$									
	OLS	IV								
Instrumented variable:		Bond purchases (sec) / Bond debt$_{t-1}$	Bond purchases (ex issuances) / Bond debt$_{t-1}$	Bond purchases / Bond debt$_{t-1}$						
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	2.85***			7.42***	8.22***	24.87	6.19***	7.35***	5.80***	6.07***
	[21.43]			[4.73]	[2.93]	[1.16]	[3.78]	[3.70]	[4.34]	[4.63]
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$		7.79***								
		[6.12]								
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$		3.99***								
		[7.21]								
$\frac{\text{Bond purchases (ex issuances)}}{\text{Bond debt}_{t-1}}$			6.30***							
			[5.03]							
Baseline controls	Y	Y	Y	Y	Y		Y	Y	Y	Y
Additional controls							Y			
Insurance supply controls									Y	
Baseline FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE							Y			
SIC1-State-Time FE								Y		
Insurer inv yield-Time FE									Y	
Insurer profitability-Time FE									Y	
First stage										
ΔINVPremiums$^{>0}$		0.080***	0.082***				0.074***	0.070***	0.084***	
		[10.6]	[12.2]				[3.8]	[3.1]	[4.2]	
ΔINVPremiums (PF weights)				0.062***						
				[4.5]						
INVPremiums					0.001**					
					[2.5]					
INVPremiums (PF weights)						0.406				
						[1.1]				
ΔINVPremiums$^{>0}_{\text{ex dep-type}}$										0.100***
										[4.8]
F Statistic		528.4	630.4	48.9	26.0	2.4	33.5	27.2	39.9	59.3
No. of obs.	15,767	15,767	15,767	15,767	15,767	15,767	15,767	13,681	15,767	15,767
No. of firms	876	876	876	876	876	876	876	789	876	876

Table IA.16. Corporate bond and commercial paper debt and insurers' bond demand.
This table reports estimated coefficients from specifications of the following form:

$$\frac{\Delta \text{Debt}_{d,f,t}}{\text{Bond debt}_{f,t-1}} = \alpha \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} \times 1\{\text{Bond}_d\} + \xi' D_{d,f,t} + \zeta_{d,f,t}$$

at the debt type-by-firm-by-quarter level. Debt type d is either bond or commercial paper debt. The dependent variable is the change in the stock of a firm's bond or commercial paper debt relative to lagged bond debt. The main explanatory variable interacts a dummy for bonds with the instrumented total volume of insurers' purchases of the firm's bonds. The sample comprises firms with commercial paper debt in at least four quarters from 2010q1 to 2018q4 in columns (1) to (3) and in at least 50% of quarters in (4) and (5). $D_{d,f,t}$ is a vector of fixed effects. t-statistics are shown in brackets and based on standard errors clustered at the firm and debt type-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			$\frac{\Delta \text{Debt}}{\text{Bond debt}_{t-1}}$		
Sample:	CP issuers			Frequent CP issuers	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times 1\{\text{Bond}\}$	7.50**	8.48**	8.69***	10.37*	10.84**
	[2.52]	[2.08]	[3.19]	[1.78]	[2.30]
Firm-Time FE		Y	Y	Y	Y
Firm-Debt type FE	Y	Y	Y	Y	Y
Debt type-Time FE	Y	Y	Y	Y	Y
Instrument:					
ΔINVPremiums$^{>0}$	Y	Y		Y	
ΔINVDisasters$^{>0}$			Y		Y
First-stage F Statistic	17.4	17.4	52.0	10.9	25.4
No. of obs.	4,250	4,250	4,250	3,280	3,280
No. of firms	133	133	133	108	108

Table IA.17. Total corporate investment and insurers' bond demand: Robustness.

This table reports estimated coefficients for the effect of insurers' bond purchases on the firm's total investment following the specification in column (1) in Table 5. 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 excludes primary market purchases in column (1), and it excludes bonds issued in the same quarter t in column (2). Baseline controls are the same firm and insurer characteristics as in Table 5 and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects. Alternative instruments, control variables, and fixed effects are defined as in Table IA.15. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	$\frac{\text{Total Investment}}{\text{Bond debt}_{t-1}}$							
Instrumented variable:	Bond purchases (sec) / Bond debt$_{t-1}$	Bond purchases (ex issuances) / Bond debt$_{t-1}$	Bond purchases / Bond debt$_{t-1}$					
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$	7.04***							
	[4.67]							
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$	-0.54							
	[-1.05]							
$\frac{\text{Bond purchases (ex issuances)}}{\text{Bond debt}_{t-1}}$		6.47***						
		[4.52]						
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$			6.23***	7.13***	5.53***	6.25***	4.59**	4.77***
			[3.28]	[2.66]	[3.83]	[4.03]	[2.32]	[3.81]
Baseline controls	Y	Y	Y	Y	Y	Y	Y	Y
Additional controls			Y					
Insurance supply controls					Y			
Baseline FE	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE			Y					
SIC1-State-Time FE				Y				
Insurer inv yield-Time FE					Y			
Insurer profitability-Time FE					Y			
First stage								
ΔINVPremiums$^{>0}$	0.080***	0.082***	0.074***	0.070***	0.088***			
	[10.58]	[12.23]	[3.8]	[3.08]	[4.45]			
ΔINVPremiums$^{>0}$ (PF weights)						0.062***		
						[4.54]		
INVPremiums							0.001**	
							[2.52]	
ΔINVPremiums$^{>0}_{\text{ex dep-type}}$								0.100***
								[4.83]
F Statistic	528.4	630.4	33.5	27.2	43.5	48.9	26.0	59.3
No. of obs.	15,767	15,767	15,767	13,681	15,767	15,767	15,767	15,767
No. of firms	876	876	876	789	876	876	876	876

Table IA.18. Robustness to alternative clustering of standard errors.

This table reports estimated coefficients for the effect of insurers' bond purchases following the specifications in Tables 4 and 5 with standard errors clustered at the firm and time levels. t-statistics are shown in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$			$\frac{\text{Total Investment}}{\text{Bond debt}_{t-1}}$		$\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$	$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	6.14***	6.27***	1.96	6.30***	4.51**	3.91***	0.91***
	[4.77]	[3.64]	[0.77]	[3.77]	[2.47]	[2.76]	[3.71]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ UW			5.88**				
			[2.43]				
Firm controls	Y		Y	Y		Y	Y
Insurer controls	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 characteristics-Time FE	Y	Y	Y	Y	Y	Y	Y
Insurer economy-Time FE	Y	Y		Y	Y	Y	Y
UW-Time FE			Y				
First stage							
$\Delta\text{INVPremiums}^{>0}$	0.085***			0.085***		0.085***	0.085***
	[4.38]			[4.38]		[4.38]	[4.38]
$\Delta\text{INVDisasters}^{>0}$		0.019***			0.019***		
		[4.05]			[4.05]		
F Statistic	53.3	36.4		53.3	36.4	53.3	53.3
No. of obs.	15,767	15,514	4,871	15,767	15,514	15,767	15,767
No. of firms	876	864	492	876	864	876	876

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