Investor-Driven Corporate Finance: Evidence from Insurance Markets*

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This version: November 5, 2024.
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Abstract

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

*I thank Alex Barbu, Tobias Berg, Michele Dathan, Andrew Ellul, Nathan Foley-Fisher, Thomas Geelen, Robin Greenwood, Helmut Gründl, Maximilian Günnewig, Peter Hoffmann, Johan Hombert, Kilian Huber, Hyeyoon Jung, Anastasia Kartasheva, Mitsuru Katagiri, Stas Nikolova, Ralph Koijen, Luc Laeven, Lira Mota, Borghan Narajabad, Martin Oehmke, Marco Pagano, Loriana Pelizzon, Simon Rother, Farzad Saidi, Christian Schlag, Sebastian Schlütter, Ishita Sen, Mila Sherman, Yannick Timmer, Moto Yogo, Qifei Zhu, and seminar participants at the 2023 FIRS meeting, 2023 Chicago Fed Workshop on NBFIs, 2023 ASSA, 2023 ECB-NY Fed Workshop on NBFIs, and 2023 DVfVW and 2022 Australasian Finance & Banking conferences, Copenhagen Business School, Erasmus University Rotterdam, ESCP Business School, ECB, EIOPA, Frankfurt School of Finance and Management, Goethe University Frankfurt, Hebrew University of Jerusalem, Norwegian School of Economics, University of Amsterdam, University of Bonn, University of Mannheim, University of Mississippi, University of Naples Federico II, and Utrecht University for valuable comments and suggestions. I thank Lukas Motz and Elena Sponga for excellent research assistance. I gratefully acknowledge support from an Argelander Grant provided by the University of Bonn, from the International Center for Insurance Regulation at Goethe University Frankfurt, and from the research cluster ECONtribute at the University of Bonn, funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy – EXC 2126/1 – 390838866. The views expressed in this paper are the author's and do not necessarily reflect those of the European Central Bank or the Eurosystem.

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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 would have no significant impact on firms' financing costs and decisions. Recent studies challenge this view by documenting the importance of investors in times of financial stress, such as the 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 micro-level data that allow differentiating between 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, such as amount, price, and date. By merging these regulatory data with information about bond issuers, my sample encompasses nearly 1,500 insurers and 871 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 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 approximately \$1.7 trillion annually. I document that insurers respond to inflows of insurance premiums by purchasing corporate bonds mostly in the secondary market, consistent with opportunity costs of holding cash. Second, insurers focus on specific bond issuers, with insurers that are past bondholders being 16.6 times more likely to invest in the same firm's bonds.[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 the insurance sector's 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, 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 that an insurer invests in. Supporting the identifying assumption, I find that firm-specific shocks do not explain the larger bond purchases by a firm's potential investors 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 1.8% of a firm's outstanding bonds. Supporting the identification strategy, such shifts in bond demand significantly increase bond prices. Using potential investors' premiums as an instrument, I estimate that bond returns in the secondary market increase by up to 87 basis points (bps) when insurers

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

purchase an additional 1% of the issuer's outstanding bonds. This price impact corresponds to an 17 bps decrease in yields and its 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.

Bonds issued by the same issuer are close substitutes, suggesting that demand shifts in the secondary market can influence firms' financing costs in the primary market. Supporting this reasoning, 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.

The main analysis focuses on firms' response to investor demand shifts. The extent and nature of this response are not obvious, as they depend on the elasticity of both the secondary and primary markets as well as firms' ability to exploit benign financing conditions.

The first set of results shows that premium-driven bond purchases accelerate the growth in firms' bond debt. This 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). 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 (or 0.3 standard deviations) faster. Demand shifts also increase bond *relative* to commercial paper debt growth for the same firm and at the same time, which rules out uniform firm-specific shocks as an alternative explanation.[3] Notably, the identifying variation stems from insurers' bond purchases in the *secondary* market, highlighting the role of their price impact rather than primary market activity.

Firms' strong response naturally raises the question of how managers become aware of shifts in investor demand. My analysis reveals that bond underwriters are a valuable source of information. 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 demand shifts when underwriters are well

[3] Firms often use commercial paper as start-up financing for new investment (Kahl et al., 2015).

connected.

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

The second set of results documents the impact of bond demand shifts on firms' investment decisions. I estimate that when insurers additionally purchase 1% of a firm's outstanding bonds, acquisition and capital expenditures increase by 3.9 ppt and 1.2 ppt, respectively, relative to outstanding bonds. These dynamics are 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 differ with tighter financial constraints, indicating similar levels of firm opportunism. Nonetheless, investment activities show a stronger response for more financially constrained firms, 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 for firms in the intermediate financial constraints tercile but not for the most constrained firms. 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.

My findings offer new insights into the relationship between nonbank financial intermediaries and the real economy. They emphasize that investors significantly influence corporate decisions through their price impact without directly interacting with firms. Therefore, the results carry important implications 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 generally.[4] Moreover, 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.[5] 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.[6] 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 among frictions in financial markets during normal times, investor preferences, and firms' ability to exploit favorable financing conditions.[7]

My analysis also complements studies on flow-induced trading by bond funds (Chernenko and Sunderam, 2012; Zhu, 2021).[8] Zhu (2021) finds that fund flows affect corporate decisions through

[4] U.S. nonfinancial firms' bond debt as a share of total debt increased from below 40% in the 1980s to more than 55% in 2020 (see Appendix Figure IA.11).

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

[6] 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).

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

[8] Equity fund flows also affect corporate decisions (Edmans et al., 2012; Khan et al., 2012) as managers learn about

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. Moreover, because investment performance drives fund flows (Goldstein et al., 2017), an identification concern is that these flows may correlate with the (expected) fundamentals of bond issuers. My empirical approach based on insurance premium flows alleviates this concern because premiums are driven by demand for insurance rather than investment and thus do not respond to insurers' investment performance (Darmouni et al., 2024). Detailed information on insurance customers also enables me to filter out flows that more likely correlate with issuer fundamentals, thereby isolating the effects from potential confounders.

Moreover, this paper contributes to understanding of how the distinct economic frictions of insurance companies interact with the corporate bond market. This 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.[9] I also document that bond issuers 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, contributing to 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 and that insurers, unlike funds, do not expand their portfolio proportionally in response to inflows, suggesting that they are more sensitive to bond market frictions.

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 in 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.

[9] 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 for 31% of joint high-yield holdings, on average, from 2010 to 2018.

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% of GDP. Premiums come mainly from noncommercial insurance business (see Figures IA.1 and IA.2) and are insurers' main financing sources, as reserves account for about three-quarters of insurers' total liabilities (see Figure IA.12).

On the other hand, insurers invest premiums in financial assets. The total invested assets of the U.S. insurance sector (excluding cash) were \$6.7 trillion in 2019, which emphasizes the importance of insurers as investors.[10] Corporate bond holdings account for 36% of these assets (see Figure IA.12). 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., at or above BBB- (see Figure IA.14).

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 only 7 states.[11]

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

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

[11] For simplicity, by *states*, I mean the 50 U.S. states, the District of Columbia, and the 5 U.S. territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands). Figure IA.16 depicts the distribution of the number of states in which insurers are active.

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 funds (see Figures IA.13 and IA.14).

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 with a joint offering amount of $1 billion. Investment banks operate as dealers in the secondary market and as underwriters in the primary market. As underwriters, they 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 micro-level 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.13 and IA.14 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, transaction price, and counterparty. Combining this information, I reconstruct end-of-quarter holdings from 2009q4 to 2018q4. I use par values, removing the impact of issuer fundamentals on market values.

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 then flagged as actual purchases, 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, 62% of insurers' corporate bond purchases (by par value) are in the secondary market, and this share is very stable over time (see Figure IA.15). In an average quarter from 2010 to 2018, U.S. insurers jointly purchased corporate bonds with a total par value of $84.5 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 1,487 insurers. In insurer-level analyses, after dropping singletons, the sample includes 1,450 insurers, with average corporate bond holdings of $1.2 billion and purchases of $51 million per quarter (see Table 1). Unless indicated otherwise, I exclude commercial premiums and adjust premiums by the lagged net-to-gross premium ratio (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), 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 \$2.6 million, with wide variation. The probability that an insurer purchases a firm's bonds is 0.44%, 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 is below zero or exceeds total assets. To strengthen the data quality, I require that the total debt reported in Capital IQ and Compustat does 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 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 market-to-book ratio.

The final baseline sample includes 871 firms and spans from 2010q2 to 2018q4. Since all firms in the sample have access to the bond market, they are relatively large, with total assets of \$4.4 billion at the median, and jointly account for 64% of the total assets of U.S. nonfinancial firms in Compustat.[12] Bond debt ranges from 29% to 100% of total debt at the 5th and 95th percentiles.

[12]To provide context for the external validity of my analysis, in Appendix A.5, I compare the cross-sectional distribution of firm characteristics for my sample with that for all firms in Compustat. They closely resemble each

On average, the insurance sector holds 23% and purchases 1% 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 comprehensive database of publicly offered bonds.[13] 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.[14] 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 $1.4 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. Due to the absence of a common identifier, I match underwriters from FISD with the counterparties in insurers' bond transactions using a combination of fuzzy string merging and manual matching. This creates uniquely detailed data about the investor–underwriter–firm network, connecting 68% of insurers' corporate bond purchases to underwriters in FISD.[15] 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 (as detailed in Section 6.4). This measure ranges from 9% to above 70% at the 5th and 95th percentiles, revealing substantial heterogeneity in the ties between underwriters and investors.

Secondary market data are retrieved from the Trade and Reporting Compliance Engine (TRACE),

other, with the main difference being that the firms in my sample are larger and have higher leverage.

[13] 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.

[14] 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.

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

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, $(\Delta\text{Price}_{t+x} + \Delta\text{Accrued Interest}_{t+x} + \text{Coupon payments}_{t+x})/(\text{Price}_{t-1} + \text{Accrued Interest}_{t-1})$. I drop observations with a current or lagged total trade volume below \$100,000. After merging with the baseline sample, 2,560 bonds issued by 368 firms are left in the sample, with an average quarterly transaction volume of \$53 million.

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 demand and supply. For example, larger bond issuances may be absorbed by larger bond purchases. Second, omitted variables might simultaneously affect firm outcomes and bond demand. For example, an increase in the firm's investment opportunities might raise 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 that they previously invested in.

Total weighted premium inflows capture variation in bond demand:

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

Here, weights $w_{i,f,t-1}$ reflect investment preferences, and $P_{i,f,t}$ are the noncommercial insurance premiums written in quarter t by insurer i in states other than that in which firm f is located scaled by i's lagged total assets (the construction is detailed in Appendix A.1). Excluding commercial and local premiums removes the impact of shocks to the firm's economic environment on $\bar{P}_{f,t}$.

The mutual fund literature uses $\bar{P}_{f,t}$ based on lagged portfolio weights ($w_{i,f,t-1}$) and fund flows ($P_{i,f,t}$) to elicit demand shifts by funds (e.g., Zhu, 2021). I tailor this instrument to the unique institutional characteristics of insurance companies as follows. First, insurance premiums are very persistent over time as policyholders frequently roll over their insurance contracts: the correlation between $\log \bar{P}_{f,t}$ and $\log \bar{P}_{f,t-1}$ exceeds 95% (with the weights defined in Equation 3). Consider a stylized insurer whose policyholders permanently roll over their insurance contracts, generating premium inflows. Because premiums reflect expected insurance claims, premium inflows approximately offset insurance claims, generating a net cash flow close to zero and a stable balance sheet. For this stylized insurer, bond purchases are not driven by premium levels but premium *increases* (formally shown in Appendix B.1). Consistently, bond purchases load positively on the current level and negatively on the lagged level of premiums (see Table IA.15). Furthermore, when the instrument is based on premium levels, firm–insurer sorting on persistent premiums may threaten the identification and thereby lead to biased estimates.[16] For these reasons, I construct an instrument based on premium growth instead of levels.

Second, the use of lagged portfolio weights in prior studies is motivated by the observation that funds proportionally expand or liquidate existing holdings in response to flows. I test whether

[16] Although instrument 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.

insurers behave similarly by regressing the percentage change in bond holdings on premium inflows in column (6) of Table 3 (following Lou, 2012). A coefficient close to one would indicate that insurers hold portfolio weights constant when investing new premiums. Instead, the estimated coefficient is 0.39. Whereas flows do not affect optimal portfolio choices in frictionless markets, the estimate suggests that insurers dynamically adjust their investment allocation to frictions in the corporate bond market. Furthermore, lagged portfolio weights may reflect expectations about firm fundamentals and, thus, may challenge the identification (see Section 4.2). For these reasons, I construct instrument weights based on the persistent component of the investment universe of insurers. This is captured by the dummy variable $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$, which is equal to one if insurer i ever held bonds issued by firm f in the prior eight quarters and zero otherwise. To take heterogeneity in the composition of insurers' total assets into account, $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is multiplied by insurer i's lagged corporate bond portfolio size, $CB_{i,t-1}$:

$$w_{i,f,t-1} = \mathbb{I}(\text{Investor}_{i,f,t-(1:8)})\ CB_{i,t-1}. \tag{3}$$

Then, focusing on bond purchases rather than sales, I use premium increases, $\max(\Delta \log \bar{P}_{f,t}, 0)$, which I multiply by the lagged ownership share of the insurance sector, $h_{f,t-1}$, to identify premium-induced shifts in bond demand:

$$\Delta\text{INVPremiums}^{>0}_{f,t} = h_{f,t-1} \times \max(\Delta \log \bar{P}_{f,t}, 0). \tag{4}$$

$h_{f,t-1}$ reflects insurers' lagged holdings of firm f's bonds, whereas $\Delta \log \bar{P}_{f,t}$ reflects funding shocks of *potential investors*, i.e., insurers with $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) = 1$. As a result, $\Delta\text{INVPremiums}^{>0}_{f,t}$ captures the growth in bond holdings due to premium inflows. In Appendix B.1, I show that $\Delta\text{INVPremiums}^{>0}_{f,t}$ is equal to the amount of bond purchases if potential investors maintain a persistent average portfolio weight and pass-through of premiums to assets, for which I also provide empirical evidence. The relevance of $\Delta\text{INVPremiums}^{>0}_{f,t}$ is supported by a large t-statistic and F statistic in first-stage regressions. In addition, I document the robustness to alternative instrument constructions, incorporating lagged portfolio weights or using premium levels.

The following sections provide empirical support for the identification strategy by documenting the relationship between premium inflows and bond purchases, the determinants of insurers' investment choices, and 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

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.[17]

Reinsurance and the timing of premium payments affect the actual 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 measure 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 to direct premiums written ("net-to-gross premium ratio"), unless indicated otherwise. Appendix A.1 details the variable construction.

Insurance premiums are insurers' main financing source. 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,

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

i.e., inflows, as I show in column (2). The estimate implies that 85 cents of every dollar increase in premiums pass through to an insurer's investments. In contrast, the effect of premium decreases is close to zero and statistically insignificant. The latter result suggests that insurers prevent their balance sheets from immediately contracting with premium decreases, consistent with the asset insulator view of insurers (Chodorow-Reich et al., 2021).[18]

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 20 cents' worth of corporate bonds.[19] 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 they previously invested in (161 on average), the estimate suggests that insurers purchase 0.1 cents of an average firm's bonds (= 0.20/161) 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 may lead to significant shifts in bond demand.

Furthermore, when I use solely bond purchases in the secondary market as the dependent variable, the coefficient on premium increases decreases only slightly, from 0.20 to 0.16 (column 5). This suggests that 80% 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.[20] Consistent with this result, premium inflows are associated with purchases of old rather than newly issued bonds (see Table IA.15).

[18]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.15).

[19]The results are robust to using bond purchases net of sales as the dependent variable (see Table IA.15).

[20]This is a lower bound for the actual share of premium-driven secondary market purchases because approximately 10% of bond purchases are neither assigned to the primary nor secondary market (see Figure IA.15).

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. For example, 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 instrument 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.[21]

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 instrument weights. Thus, a potential identification concern is that weights $w_{i,f,t-1}$ 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 (see Table IA.8), consistent with stable preferences, e.g., due to due diligence costs (Zhu, 2021) or mandates (Koijen and Yogo, 2019).[22] To capture the persistent component of insurers' investment

[21] 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 $h_{f,t-1}$.

[22] Persistence in portfolio allocations is more pronounced for more opaque (younger and more volatile) firms,

universe, I define as the firm's potential investors insurers that ever held the firm's bonds in the previous eight quarters, denoted by $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$. 69% of the variation in $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is time invariant, whereas changes in firm characteristics explain only 1% (see Table IA.9). The baseline specifications use $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ to weight premiums, as in Equation (3). 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.[23] 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 16.6 times more likely to purchase a firm's bonds if they previously invested in the same firm (t-statistic: 19.75).

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

consistent with the presence of due diligence costs, and it is partly explained by insurer-by-firm characteristic fixed effects, which absorb time-invariant investment preferences (see Table IA.10). For example, life insurers prefer firms with better credit ratings and longer-term bonds, matching the long duration of life insurance contracts, and larger insurers prefer larger firms, consistent with minimizing transaction costs (see Table IA.11).

[23] On average, a firm's bonds are held by 69 insurers, corresponding to 5% of all insurers in the sample. Despite of fragmented bond ownership, insurers are reasonably diversified. Insurers invest in 161 different issuers, on average (see Table IA.14), and in multiple industries and locations (see Figures IA.7 and IA.8). Larger insurers invest in more bond issuers (see Figure IA.6).

compared to 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 f's bonds on $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$, premium increases, and their interaction.[24] The coefficient on the interaction term shows that potential investors invest significantly more of their premium inflows in a given firm's bonds than other insurers. A firm's potential investors respond to a \$1 premium inflow by purchasing approximately 0.08 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. For instance, insurance premiums might respond to changes in firm characteristics that affect insurers' investment returns (Knox and Sørensen, 2024). In contrast, 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 instead of to invest in financial assets, which is an important difference to fund flows. Moreover, I show that my results are robust to controlling for insurers' investment returns 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 (see Table IA.4). Sorting may interfere with the identifying assumption only if it implies that premiums and firm outcomes are exposed to a common factor, such as the local business cycle. In contrast, Table IA.5 shows that insurers are not more likely to invest in firms located in close proximity or with a larger 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

[24]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.

employment share in insurance customers' locations. Moreover, I find that the premium inflows of insurers with different characteristics are similarly exposed to aggregate shocks (see Table IA.6), and that insurers do not systematically sort into firms that share a similar exposure to aggregate factors (see Table IA.7).

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

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] Disasters increase the salience of underlying risks and boost insurance demand (Gallagher, 2014; Hu, 2022). However, heat and storm events have no significant impact on life insurers' payouts as the number of fatalities is small compared with insurers' customer base.[26] This is an important difference from P&C insurers, which suffer net outflows rather than inflows after disasters (Liu et al., 2021). I exclude P&C insurers in this analysis to focus on net bond purchases rather than sales.

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 significantly increase premium inflows in disaster-affected states but not insurance payouts (see Table IA.12). This results in larger bond

[25]Heat and storms are more frequent and widespread than other hazards. They jointly affect almost all U.S. states, providing wide variation (see Figures IA.9 and IA.10). 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]Hurricane Katrina, the costliest disaster in the U.S. to the present day, had only a moderate effect on life insurers' expenses (source: *Hurricane Katrina – Analysis of the Impact on the Insurance Industry* by Towers Watson, 2013).

purchases (see Table 2). I aggregate the exposure to disaster fatalities across a firm's potential investors and substitute the resulting variable for premiums $\overline{P}_{f,t}$ into Equation (4), which yields the alternative instrument $\Delta\text{INVDisasters}_{f,t}^{>0}$ (Appendix B.5 provides further details).

$\Delta\text{INVDisasters}_{f,t}^{>0}$ identifies bond demand shifts if insurers do not sort into firms that are exposed to the same disasters. To rule out 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. Then, because disaster occurrence is plausibly exogenous to firm characteristics, using $\Delta\text{INVDisasters}_{f,t}^{>0}$ relaxes the identifying assumption.

5 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.

5.1 Secondary market

The secondary bond market is a natural starting point for the analysis since insurers purchase bonds mostly in the secondary market in response to premium inflows. I follow prices over time at the bond level, eliminating time-invariant differences across bonds. The empirical specification is at the bond-by-quarter level and compares the bond returns of firms that face large premium-driven bond purchases with those of similar bonds from other firms:

$$\begin{aligned}\text{Bond return}_{b,t}^{-1:x} =& \alpha_x \frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} + \Gamma_x' C_{b,t} + u_{b,x} + v_{\text{Maturity,Rating},t,x} \\ &+ w_{\text{Industry},t,x} + y_{\Delta\text{Rating},x} + \varepsilon_{b,t,x},\end{aligned} \tag{8}$$

where firm f is the issuer of bond b and bond purchases are instrumented by $\Delta\text{INVPremiums}_{f,t}^{>0}$ in quarter t (I discuss the first-stage estimates in Section 6). Bond $\text{return}_{b,t}^{-1:x}$ 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 firm and insurer characteristics listed in Table 5. Bond fixed effects, $u_{b,x}$, capture time-invariant heterogeneity at the bond level. Maturity bucket-by-credit rating-by-time fixed effects, $v_{\text{Maturity,Rating},t,x}$, capture differences in return trajectories driven by remaining time to maturity and credit rating. Additional fixed effects control for heterogeneity across industries (2-digit SIC), $w_{\text{Industry},t,x}$, 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 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).[27]

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 60 bps (up to 87 bps) when insurers additionally purchase 1% of the firm's outstanding bonds. The result is robust across different empirical specifications and it implies a decrease in yields of approximately 10 to 17 bps, both when using the median bond duration and the estimate from Equation (8) as well as when using yield spread changes as dependent variable (see Table IA.16). Using the most conservative estimate from Table IA.16 for the price impact at $x = 3$, the implied elasticity of bond demand is $-1/(52/100) = -1.9$, 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.

[27] 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 by analyzing demand shifts at a higher level of aggregation and by instrumenting bond transactions using insurance premium flows. This, as well as different characteristics of insurers and funds, e.g., in their sophistication as bond traders, may explain why I find a significant price impact.

5.2 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. Below, I investigate this channel. 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 with smaller premium-driven purchases:

$$\text{Yield spread}_{f,t} = \alpha \log(\text{Bond purchases}_{f,t}) + \Gamma' C_{f,t} + u_{\text{Maturity},t} + \varepsilon_{f,t}. \tag{9}$$

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, 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 from 1 for AAA, 2 for A+, 3 for BBB+ to 6.67 for CCC-). Standard errors are clustered at the firm and region-by-time levels.

Table 4 reports the estimated coefficients. The coefficient on insurers' instrumented bond purchases is significantly negative (column 1). The estimate implies that yield spreads decrease by 0.42 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 0.53 bps. It is also robust to using potential investors' natural disaster exposure as an alternative instrument (column 5). Moreover, in Table IA.17, I show that the estimate is robust to using alternative instrumental variables based on lagged portfolio weights as instrument weights in Equation (3) or that based on the level of potential investors' premiums.

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 ($178 million and $5.4 billion, respectively, in the sample of Table 4). The estimate implies that yields decrease by 11 to 14 bps when insurers additionally purchase 1% of outstanding bonds. This magnitude is economically significant as it corresponds to approximately half of the difference between the issuance yield spreads of issuers with a BBB+ and AAA- credit rating and 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 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 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 or 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.

6 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.

6.1 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.[28] 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 level absorb fluctuations in aggregate and local macroeconomic conditions. Industry-by-time fixed effects absorb industry-wide (2-digit 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, reflecting 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

[28] 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.18).

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 variation in the local economic environment of potential investors, alleviating the concern that insurers might invest in firms with common economic exposure.

6.2 Baseline results

Panel A in Table 5 reports the estimated coefficients for different specifications. 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. This finding is consistent with survey evidence (Graham, 2022) and with anecdotal evidence that I collected from a large nonfinancial firm and underwriter, emphasizing the ability of issuers to swiftly react to changing market conditions. The first-stage (Cragg-Donald Wald) F statistic, which is well above 20, suggests that the estimate is not contaminated by weakness of the instrument. The instrument also enters with a significantly positive coefficient in the corresponding reduced-form regression (see Table IA.18).

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. Consistently, I also find a stronger response for firms whose bonds exhibit a lower liquidity in the secondary market (see Table IA.18).

The point estimate in the most refined specification (column 3) implies that the growth in bond debt is 6.64 ppt (0.3 standard deviations) faster when insurers additionally purchase 1% of a firm's outstanding bonds.[29] In combination with the estimates from Section 5, the results suggest that a 10 bps reduction in financing costs is associated with approximately 4.7 ppt faster bond debt growth. The magnitude of this semi-elasticity 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 ($= 0.33/0.42 \times 0.1$).[30]

For firms with average insurer ownership, the first-stage coefficient in column (3) implies that insurers purchase an additional 0.5% of outstanding bonds ($= 0.07 \times 0.23 \times 0.34$) in response to a 1 standard deviation higher premium growth $\Delta \log \bar{P}$ (which is 0.34). This effect increases to 1.8% 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 0.09 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 0.6 cents larger bond debt growth, highlighting the significant elasticity of bond supply.

[29]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).

[30]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 semi-elasticity 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).

6.3 Alternative specifications

I assess the robustness of the baseline results in two ways. First, in Tables IA.18 and IA.19, I estimate a battery of 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 use fixed effects based on the social connectedness between a firm's and potential investors' locations to absorb common shocks due to unobserved economic ties. Furthermore, the results are robust to using alternative definitions of the instrument which use the level of premiums or lagged portfolio weights or hypothetical weights of an equal-weighted portfolio (following Koijen and Yogo, 2019) as instrument weights in Equation (3).[31] The results are also robust to defining potential investors based on a 10-quarter time horizon and to excluding premiums from the states neighboring a firm's location, premiums for deposit-type contracts (which households might use for investment), or premiums from states where a firm's suppliers and customers are located.

Second, I compare bond debt growth to commercial paper debt growth. Like bonds, commercial paper is publicly traded debt and an important component of firms' capital structure (Kahl et al., 2015). Owing to its short maturity, long-term investors such as insurance companies barely invest in commercial paper. Therefore, it is reasonable to assume that insurance premium flows are uncorrelated with commercial paper market outcomes. Then, premium-driven demand shifts are expected to affect bond debt *relative* to commercial paper growth *within* a given firm. Table IA.20 reports estimates for the effect of instrumented bond purchases on debt growth. The results show that demand shifts increase bond debt growth significantly more than commercial paper debt growth. The magnitude of the differential effect is consistent with the baseline results. An important difference between this specification and the baseline specification is that it allows the

[31] The instrument is less powerful when it is based on the level of premiums and the second-stage coefficient becomes insignificant when the instrument uses the level of premiums and lagged portfolio weights. This is consistent with the institutional characteristics of insurers highlighted in Section 4 and supports the construction of the baseline instrument based on premium growth.

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-specific shocks.

6.4 Underwriter channel

Why are firms so responsive to investor demand? According to anecdotal evidence, investors typically do not communicate demand shifts directly to firms. Instead, investors have close ties with investment banks, which act as dealers in the bond market. They 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. On average, 73% of insurers' annual bond purchases are from the same dealers from whom they made purchases in the previous year.[32] Similarly, 74% of bond issuance volumes involve underwriters that the issuer used in the previous year.

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:

$$\%\text{UW}_{f,t} = \frac{\sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \sum_u \sum_{k=1}^{4} \mathbb{I}(\text{Underwriter}_{u,f,t-(1:4)})\text{Bond purchases}_{i,u,t-k}}{\sum_i \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \sum_u \sum_{k=1}^{4} \text{Bond purchases}_{i,u,t-k}}, \tag{10}$$

where $\text{Bond purchases}_{i,u,t-k}$ 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 0.25) and zero otherwise. Since the measure relies on the subset of bond purchases with identified counterparties, the number of firms in the sample

[32] Hendershott et al. (2020) propose a model in which insurers build relationships with dealers to mitigate search frictions in the bond market. Figure IA.17 displays the cross-sectional distribution of persistence in firm–underwriter and insurer–dealer relationships.

decreases to 489.

To test the underwriter channel, I interact insurers' instrumented bond purchases with $\text{UW}_{f,t}$ in Panel B in Table 5. 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 would be 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 $\text{UW}_{f,t}$-by-time fixed effects, which directly absorb time-varying differences across firms with more- and less-connected underwriters.

I hypothesize that underwriters are relevant because they disseminate information about investor demand. In this case, one would expect underwriter connectedness to become more important when information about investors is more difficult to gather. 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, $\text{UW}_{f,t}$, 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, respectively, 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.

6.5 Role of financial conditions

Corporate opportunism may be amplified by the presence of financial constraints, which hinder firms from pursuing profitable projects, and alleviated by loose financial conditions, which lower average financing costs. To explore heterogeneity in financial constraints, I use the size–age (SA) index of Hadlock and Pierce (2010).[33] Additionally, I examine heterogeneity across firm size, profitability (measured by cash flow), and credit rating.

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

I sort firms into bins based on cross-sectional terciles of firm characteristics and ratings and then estimate separate coefficients on instrumented bond purchases for each bin following specification (3) in Table 5. Additionally, I include tercile (or rating) fixed effects, which control for different average bond debt growth across firms. Columns (5) to (8) in Table 6 show significant differences in the sensitivity of insurers' bond purchases in the first-stage regressions. Insurers purchase significantly more bonds of larger than smaller firms upon premium inflows. Moreover, bond purchases are particularly large for BBB-rated firms, consistent with Acharya et al. (2024)'s finding that investors subsidize firms with a BBB rating.

On the other hand, the second-stage regressions in columns (1) to (4) suggest that financial conditions have little effect on the responsiveness of firms' bond debt growth. The results indicate that firms with more financial slack are more responsive; however, with no statistically significant differences. Credit ratings have no monotonic impact. Instead, the coefficient is large for firms with a AAA-A or high-yield credit rating but smaller for those with a BBB rating. A potential reason is that BBB-rated firms already benefit from large investor demand, on average, and therefore respond less markedly to additional demand.

Overall, the results suggest that firms' opportunistic financing behavior is not amplified by weak financial conditions. Instead, differently constrained firms tend to find it equally attractive

[33] 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.

to exploit favorable financing conditions. A potential reason for this result is that firms with bond market access are, on average, relatively unconstrained (Cantillo and Wright, 2000).

6.6 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 longer-term bonds.[34] 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, excluding observations without bond issuances. The coefficient in column (1) of Table 7 is significantly positive and implies that new bond issuances are 2 ppt more likely to exhibit a long maturity in response to insurers purchasing 1% of the firm's outstanding bonds. Nonetheless, firms might also respond with a time lag to demand shifts. Column (2) examines the bond issuances in the four quarters following demand shifts. The estimate implies a 7 ppt higher probability of issuances having long maturities in response to insurers purchasing 1% of the firm's outstanding bonds. The effect is economically significant as it amounts to 15% of the unconditional probability of bond issuances having long maturities.

Moreover, I exploit that life insurers, owing to long-term life insurance contracts, have a stronger preference for long-term bonds than P&C insurers. This implies a greater incentive for firms to increase bond maturities when bond demand is driven by life insurers. I construct a dummy variable, *Life INV*, which equals 1 when 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 approximately twice

[34] I compare fund and insurer bond holdings in Figure IA.14.

as likely as other firms to issue long-term bonds in response to demand shifts. These results are also robust to using the average maturity of future bond issuances as dependent variable (see Table IA.17).

Second, firms may cater to insurers' preference for high credit ratings by increasing their efforts to avoid downgrades.[35] I define by $1\{\text{Downgrade}_{f,t+1}\}$ an indicator that equals 1 if firm f's lowest 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 after demand shifts from insurers (column 4). In addition to catering, this result might also reflect the impact of lower financing costs on credit risk more generally. To rule out this alternative interpretation, 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 significantly more likely to avoid downgrades compared to better-rated firms in response to demand shifts (column 5). These findings point to significant catering of firms to the distinct investment preferences of insurance companies.

7 Corporate investment and bond demand

7.1 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.[36] Additionally, I explore the growth in firms' property, plant, and equipment (PPE) and total assets.

[35] 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. More generally, credit rating agencies are 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.

[36] 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.

The empirical specification is analogous to that in Panel A in Table 5.

Panel A in Table 8 reports the estimated coefficients. The main result implies that investment increases by 6.82 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 (see Table 5), suggesting that opportunistic bond financing mostly funds 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 1.7% of assets.[37]

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 1.2 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 the response of PPE and total asset growth (columns 7 and 8). Consistent with the prior results, the coefficient on instrumented bond purchases is significantly positive for PPE growth. In contrast, it is not precisely estimated for total asset growth, despite a sizable t-statistic and a coefficient close to that for total investment.

These results are robust to a variety of alternative empirical specifications reported in Tables IA.21 to IA.23. In particular, the coefficients of total investment, acquisition expenditures, and capital expenditures are similar in magnitude and significance to the baseline results when I exclude

[37] To compare the results, I scale the coefficient in column (1) of Panel A in Table 8 by the average ratio of bond debt to lagged total assets (24.4%), which yields 1.66 ($= 6.82 \times 0.244$).

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

7.2 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. Columns (1) to (4) in Panel B of Table 8 report firms' investment response separately for firms in the lower, intermediate, and upper cross-sectional terciles of the SA index. To ensure that the coefficients do not capture cross-sectional differences in average investment, I include fixed effects for each SA tercile. The results display a stronger investment response of more financially constrained firms. The difference between firms in the top and bottom SA terciles is significant at the 5% level for total investment and acquisitions and at the 10% level for PPE growth.[38]

The observation that less financially constrained firms respond less in terms of investment but similarly in terms of bond debt growth 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 t as

[38]The low average level of financial constraints of firms with bond market access 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.

a proxy for changes in their (expected) profitability. Column (6) shows that stock returns respond significantly negatively to demand shifts for less-constrained firms and, especially, for those in the intermediate SA tercile. In contrast, there is no significant response for the most constrained firms, i.e., those in the upper SA tercile.

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 larger investment activity, but the significantly negative stock market reaction suggests that these investments are unprofitable, consistent with free cash flow problems. Finally, the least financially 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.

8 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 bond investor demand shifts affect corporate financing and investment decisions through their price impact in the secondary bond market.

To identify nonfundamental bond 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. These liquidity inflows increase insurers' bond purchases in the secondary market and, therefore, raise bond prices. I document that this price impact also affects firms' bond financing costs.

Firms respond opportunistically 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 elasticity of corporate decisions to bond demand emphasizes the importance for economic analyses to explicitly consider investors and their price impact. The findings suggest 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.
The 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 (8). 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.

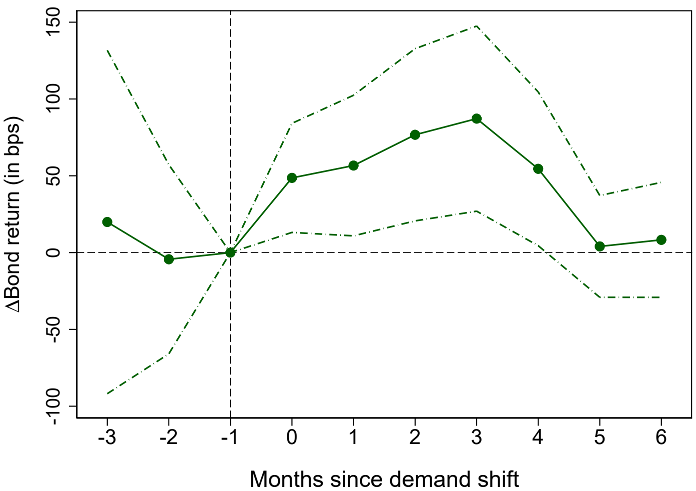

Table 1. Summary statistics.

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 (1,450 insurers)						
Bond holdings (bil USD)	45,014	1.21	5.70	0.00	0.03	4.98
Bond purchases (mil USD)	45,014	51.33	257.47	0.00	1.36	209.87
Bond purchases/Total assets$_{t-1}$ (%)	45,014	1.63	2.39	0.00	0.83	6.28
Bond purchases (Prim)/Total assets$_{t-1}$ (%)	45,014	0.42	0.82	0.00	0.00	2.01
Bond purchases (Sec)/Total assets$_{t-1}$ (%)	45,014	1.09	1.93	0.00	0.33	4.80
Premiums (mil USD)	45,014	114.25	501.42	0.02	7.49	425.83
ΔPremiums/Total assets$_{t-1}$ (%)	45,014	0.12	1.42	-1.86	0.00	2.54
$100 \times \Delta$Disasters$^{>0}$	15,848	0.60	1.38	0.00	0.05	3.16
Insurer-by-firm level						
$100 \times \mathbb{I}$(Investor)	33,066,183	5.27	22.34	0.00	0.00	100.00
$100 \times 1\{$Purchase$\}$	33,066,183	0.44	6.63	0.00	0.00	0.00
Bond purchases (sec; mil USD)	146,073	2.64	7.35	0.00	0.33	12.12
Firm level (871 firms in the baseline sample)						
Bond debt/Total debt (%)	15,695	76.88	23.90	29.01	84.85	100.00
ΔBond debt/Bond debt$_{t-1}$ (%)	15,697	3.07	21.20	-12.61	0.00	31.71
Insurer ownership (%)	15,697	22.91	23.56	0.42	14.10	75.64
Bond purchases/Bond debt$_{t-1}$ (%)	15,697	0.96	2.52	0.00	0.11	4.45
ΔINVPremiums$^{>0}$ (%)	15,697	1.19	2.79	0.00	0.09	5.78
ΔINVDisasters$^{>0}$ (%)	15,438	9.67	18.00	0.00	1.16	48.67
Total investment/Bond debt$_{t-1}$ (%)	15,697	12.58	22.81	0.73	5.34	46.25
Acquisitions/Bond debt$_{t-1}$ (%)	15,697	4.24	16.86	0.00	0.00	21.32
CapEx/Bond debt$_{t-1}$ (%)	15,697	7.81	10.86	0.64	4.15	27.81
ΔTotal assets/Bond debt$_{t-1}$ (%)	15,697	9.24	43.55	-36.50	2.65	75.45
ΔPPE/Bond debt$_{t-1}$ (%)	15,697	2.53	12.48	-8.22	0.41	20.04
%UW (%)	4,842	41.10	17.96	9.27	41.37	69.60
$100 \times 1\{$Downgrade$_{t+1}\}$	12,920	4.06	19.75	0.00	0.00	0.00
Issuance level: Primary market						
Yield spread (%)	650	2.53	1.94	0.42	1.85	6.38
Offering amount (bil USD)	650	1.39	2.21	0.25	0.70	5.00
$100 \times 1\{$LT bond$\}$	650	46.77	49.93	0.00	0.00	100.00
Coupon (%)	650	4.70	1.94	1.75	4.50	8.25
Bond level: Secondary market (2,560 bonds)						
Bond return (%)	28,851	0.32	3.60	-5.38	0.18	6.64
Transaction volume (mil USD)	28,851	53.28	86.91	1.17	24.65	196.46

Table 2. Insurance premiums, natural disasters, and insurers' bond purchases.
Each column presents 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)
$\frac{\Delta\text{Premiums}}{\text{Total assets}_{t-1}}$	0.56***					
	[11.51]					
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$		0.85***	0.20***	0.20***	0.16***	
		[11.71]	[5.60]	[5.47]	[5.26]	
$\frac{\Delta\text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$		0.08	-0.09**	-0.09**	-0.09***	
		[1.09]	[-2.35]	[-2.40]	[-2.77]	
ΔDisaster fatalities$^{>0}$						0.07***
						[3.52]
ΔDisaster fatalities$^{<0}$						-0.00
						[-0.18]
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.	45,014	45,014	45,014	45,014	45,014	15,846
No. of insurers	1,450	1,450	1,450	1,450	1,450	501
Standardized coefficients						
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$		0.20	0.09	0.09	0.09	
$\frac{\Delta\text{Disasters}^{>0}}{\text{Total assets}_{t-1}}$						0.05
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) present 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) present 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) presents the OLS estimate from a specification of the following form:

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

at the insurer-by-firm-by-quarter level, where u_i and v_t are insurer and time fixed effects, respectively. The table also reports the implied relative effects of $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ and its interaction with a 1-standard-deviation increase in insurance premium increases, which are computed as the respective estimated coefficient scaled by $\mathbb{E}[1\{\text{Purchase}\}|\mathbb{I}(\text{Investor})=0]$ in columns (1) and (2) and by $\mathbb{E}[\frac{\text{Bond purchases (sec)}}{10^{-6}\cdot\text{Total assets}_{t-1}}|\mathbb{I}(\text{Investor})=0]$ 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)
$\mathbb{I}(\text{Investor})$	0.03***	0.03***	9.67***	9.89***	9.06***	
	[19.75]	[19.62]	[10.03]	[10.35]	[9.74]	
$\frac{\Delta\text{Premiums}^{>0}}{10^{-3}\cdot\text{Total assets}_{t-1}}$			0.00			0.39***
			[0.44]			[3.70]
$\mathbb{I}(\text{Investor}) \times \frac{\Delta\text{Premiums}^{>0}}{10^{-3}\cdot\text{Total assets}_{t-1}}$			0.79***	0.81***	0.82***	
			[5.55]	[5.67]	[5.73]	
Firm FE		Y	Y	Y		
Firm-Time FE	Y				Y	
Insurer-Time FE	Y	Y		Y	Y	
Insurer FE			Y			Y
Time FE						Y
No. of obs.	33,066,183	33,066,183	33,066,183	33,066,183	33,066,183	1,450,300
No. of firms	870	870	870	870	870	870
No. of insurers	1,483	1,483	1,483	1,483	1,483	1,476
Relative effect of $\mathbb{I}(\text{Investor})$	16.58	16.49	3.25	3.32	3.05	
Relative effect of $\mathbb{I}(\text{Investor}) \times sd\left(\frac{\Delta\text{Premiums}^{>0}}{10^{-3}\cdot\text{Total assets}_{t-1}}\right)$			2.89	2.93	3.00	
$\mathbb{E}[1\{\text{Purchase}\}\|\mathbb{I}(\text{Investor})=0]=0.002$, $\mathbb{E}[\frac{\text{Bond purchases (sec)}}{10^{-6}\cdot\text{Total assets}_{t-1}}\|\mathbb{I}(\text{Investor})=0]=2.97$						

Table 4. Primary market prices and insurers' bond demand.

This table presents estimated coefficients from specifications as in Equation (9) 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) 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 by log-transformed potential investors' disaster exposure in (5). 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 5. 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)	-0.42***	-0.47***	-0.53***	-0.44***	-0.42**	-0.35**
	[-3.46]	[-3.53]	[-3.36]	[-3.04]	[-2.04]	[-2.59]
$\log(1 + \text{Bond purchases (prim)})$				0.03		
				[0.81]		
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						
$\Delta\widetilde{\text{INVPremiums}}$	0.313***	0.298***	0.258***	0.259***		0.313***
	[8]	[5.9]	[6.6]	[8]		[8]
$\Delta\widetilde{\text{INVDisasters}}$					0.279***	
					[5.6]	
F Statistic	103.9	68.1	58.2	108.7	59.8	103.9
No. of obs.	650	650	650	650	439	650
No. of firms	342	342	342	342	276	342
Effect of purchasing 1% of outstanding bonds	-0.11	-0.12	-0.14	-0.12	-0.11	-0.09

Table 5. Corporate bond debt and insurers' bond demand.

This table presents 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* presents 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		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	5.99***	6.46***	6.64***	9.34***	6.00***	1.35	3.88	4.54*
	[3.63]	[4.06]	[4.10]	[3.25]	[5.44]	[0.58]	[1.59]	[1.67]
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$					-2.57			
					[-1.36]			
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW}$						7.25***	5.20*	4.00
						[3.32]	[1.79]	[1.33]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW} \times \text{Dispersed INV}$							8.65*	
							[1.94]	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW} \times \text{Many INV}$								10.15**
								[2.31]
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								
$\Delta\text{INVPremiums}^{>0}$	0.070***	0.074***	0.071***		0.100***			
	[5.14]	[5.34]	[5.14]		[7.97]			
$\Delta\text{INVDisasters}^{>0}$				0.013***				
				[3.89]				
F Statistic	71.0	74.6	67.8	30.9	497.4			
No. of obs.	15,697	15,697	15,697	15,405	15,697	4,842	4,842	4,842
No. of firms	871	871	871	857	871	489	489	489
Effect of 1sd change in $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.15	0.16	0.17	0.24	0.15			

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 5. Each column corresponds to one regression, with coefficients for each firm 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	6.30**	-21.94	1.00	8.41***	0.08***	0.00	0.05	0.07**
	[2.37]	[-0.43]	[0.24]	[2.71]	[3.35]	[0.32]	[1.53]	[2.41]
Terc2 / BBB	5.35***	8.71***	6.63***	3.94***	0.07***	0.09***	0.07***	0.12***
	[2.87]	[3.51]	[3.04]	[2.67]	[3.22]	[4.77]	[2.82]	[4.66]
Terc3 / AAA-A	9.14***	6.30***	5.34**	16.63**	0.06***	0.17***	0.06***	0.03*
	[3.70]	[3.22]	[1.98]	[2.01]	[2.82]	[4.99]	[2.82]	[1.91]
p-value for H0: Same coefficient on								
Terc1/HY & Terc2/BBB	0.75	0.55	0.24	0.19	0.81	0.00	0.58	0.21
Terc1/HY & Terc3/AAA-A	0.38	0.57	0.39	0.28	0.65	0.00	0.77	0.23
Terc2/BBB & Terc3/AAA-A	0.18	0.43	0.68	0.13	0.83	0.04	0.67	0.00

Table 7. Catering to insurers' investment preferences.

This table presents 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; and, in (4) and (5), a dummy for a credit rating downgrade from quarter end t to $t+1$. The main explanatory variable in (1) to (3) is the logarithm of insurers' bond purchases, instrumented by log-transformed increases in potential investors' premiums, and that in (4) and (5) 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) and (3), observations with at least one issuance in the following four quarters; and in (4) and (5), 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. 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)
Dependent variable:	1{LT bond}	1{LT bond$_{t+(1:4)}$}		1{Downgrade$_{t+1}$}	
log(Bond purchases)	0.09***	0.17***	0.10***		
	[3.88]	[7.04]	[3.03]		
log(Bond purchases) × Life INV			0.11***		
			[2.99]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$				-1.13*	1.46
				[-1.81]	[1.14]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \leq$ BBB rated					-3.21**
					[-2.25]
Firm controls		Y	Y	Y	Y
Time FE	Y	Y			
Life INV-Time FE			Y		
Rating-Time FE				Y	Y
Firm-Seasonality FE				Y	Y
First stage					
$\Delta\widetilde{\text{INVPremiums}}$	0.497***	0.514***	0.617***		
	[13.94]	[12.84]	[10.31]		
ΔINVPremiums				0.105***	0.106***
				[6]	[2.9]
F Statistic	305.3	288.7	94.3	98.9	46.1
No. of obs.	650	786	784	12,920	12,920
No. of firms	342	340	340	699	699
Effect of purchasing 1% of outstanding bonds	0.02	0.07	0.04		

Table 8. Corporate investment and insurers' bond demand.

Each column presents 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 5. 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 cross-sectional 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:	$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$		$\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$		$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$		$\frac{\Delta\text{PPE}}{\text{Bond debt}_{t-1}}$	$\frac{\Delta\text{Assets}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	6.82***	7.85***	3.86**	2.82*	1.16***	2.89**	2.25***	5.04
	[3.65]	[3.14]	[2.60]	[1.66]	[3.00]	[2.35]	[2.71]	[1.55]
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$^{>0}$	0.071***		0.071***		0.071***		0.071***	0.071***
	[5.14]		[5.14]		[5.14]		[5.14]	[5.14]
ΔINVDisasters$^{>0}$		0.013***		0.013***		0.013***		
		[3.89]		[3.89]		[3.89]		
F Statistic	67.8	30.9	67.8	30.9	67.8	30.9	67.8	67.8
No. of obs.	15,697	15,405	15,697	15,405	15,697	15,405	15,697	15,697
No. of firms	871	857	871	857	871	857	871	871
Standardized coefficient	0.75	0.88	0.58	0.43	0.27	0.68	0.46	0.29

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
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$ × SA:Terc1	4.07*	2.00	0.94*	0.95	-3.54**	-1.50*
	[1.77]	[1.01]	[1.97]	[0.77]	[-2.14]	[-1.76]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$ × SA:Terc2	4.83*	1.28	1.14*	2.23**	-1.03	-2.67**
	[1.97]	[0.68]	[1.76]	[2.33]	[-0.62]	[-2.39]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$ × SA:Terc3	14.51***	10.90***	1.53**	4.56***	-0.38	0.37
	[3.01]	[2.88]	[2.06]	[2.68]	[-0.22]	[0.24]
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.	15,697	15,697	15,697	15,697	4,897	15,697
No. of firms	871	871	871	871	355	871
p-value for H0: Same coefficient for						
Terc1 and Terc3	0.05	0.04	0.50	0.07	0.21	0.29
Terc2 and Terc3	0.08	0.03	0.69	0.23	0.80	0.09

Internet Appendix for

Investor-Driven Corporate Finance: Evidence from Insurance Markets

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This version: November 5, 2024.

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A Data and sample construction

Table IA.1: Variable definitions and data sources.

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

Variable	**Definition**
Insurer level	
Bond holdings	Par value of corporate bonds (*Source: NAIC*)
Bond purchases	Par value of corporate bond purchases (*Source: NAIC*)
Premiums	Noncommercial insurance premiums adjusted by the net-to-gross premium ratio (*Source: NAIC*)
Unadjusted premiums	Direct noncommercial insurance premiums written, not adjusted by the net-to-gross premium ratio (*Source: NAIC*)
Net-to-gross premium ratio	4-quarter trailing average ratio of total net premiums collected to total direct premiums written (*Source: NAIC*)
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 credit 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*)
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 ($h_{f,t-1}$)	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*)

Continued on next page

Table IA.1 – *Continued from previous page*

Variable	**Definition**
ΔINVPremiums$^{>0}$	Maximum of zero and ΔINVPremiums defined in Equation (4) (*Sources: Capital IQ, NAIC*)
ΔINVDisasters$^{>0}$	Maximum of zero and ΔINVDisasters 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 6.4 (*Sources: NAIC, Mergent FISD*)
1{Downgrade}	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*)
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) one quarter when used as a dependent variable in the main analysis and (2) the previous year when used as control variable (*Source: CRSP*)

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Table IA.1 – *Continued from previous page*

Variable	**Definition**
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 × operating income + sales + 1.4 × retained earnings + 1.2 × (current assets − current liabilities))/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	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	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	Industry categories based on 2-digit SIC if not stated otherwise
Insurer characteristics	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*)

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Table IA.1 – *Continued from previous page*

Variable	**Definition**
Consumption	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	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*)
Social connectedness	Average social connectedness index between the firm's and its potential investors' locations (at the state level) weighted by potential investors' total insurance premiums. I define social connectedness dummies based on the cross-sectional quartiles of this variable (*Sources:* `https://dataforgood.fb.com/`, *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}	Bond with at least 10 years remaining to maturity at issuance (*Source: Mergent FISD*)
Coupon	Coupon rate on new bond issuances (*Source: Mergent FISD*)
Rating	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*)
Maturity	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*)

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Table IA.1 – *Continued from previous page*

Variable	**Definition**
Bond level: Secondary market	
Bond return	Relative change in end-of-quarter 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 quarter (*Source: TRACE*)
Rating	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*)
ΔRating	Change in rating (in notches) between the current and previous quarters (*Source: Mergent FISD*)
Maturity	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 non-commercial insurance at the insurer–quarter level (it is not available at the insurer–state–quarter

[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*.

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).

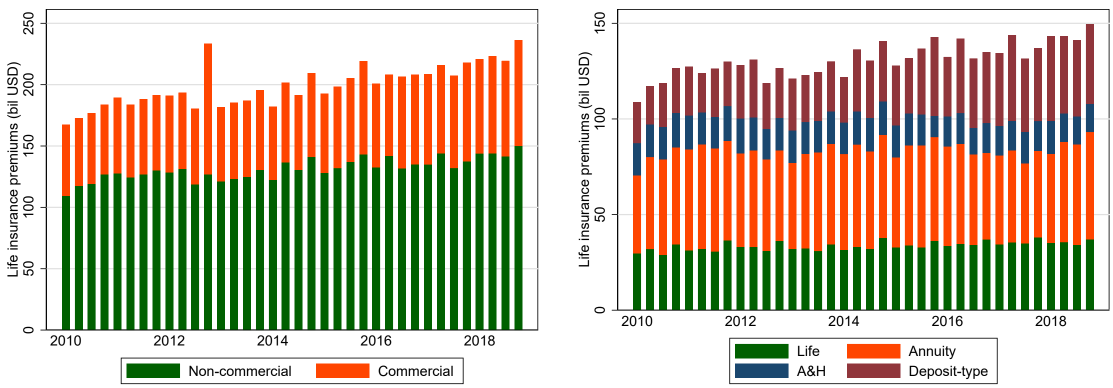
I follow S&P Global Market Intelligence's classification in defining the share of noncommercial P&C insurance as the sum of direct premiums written for farmowners' and homeowners' multiple peril insurance (which provides property and liability coverage for homes and farms) and private auto physical damage 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.

[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.

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

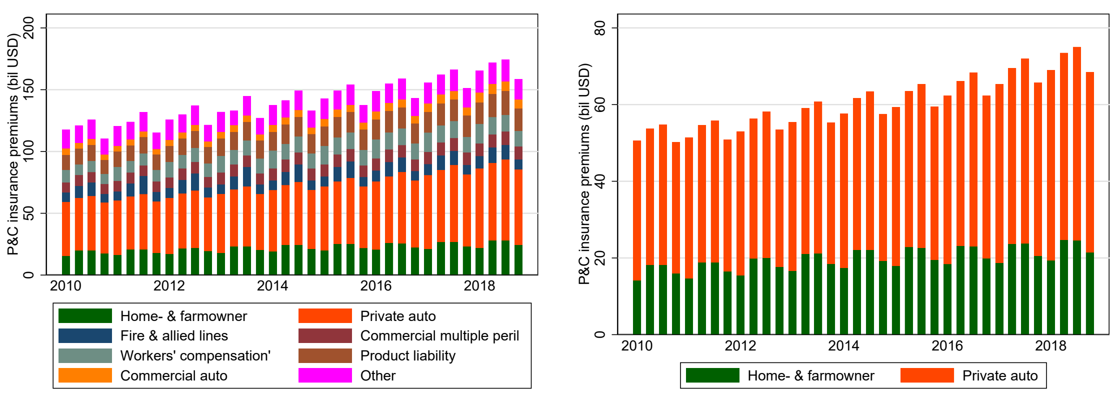
Figure (a) depicts the total direct life insurance premiums written by the U.S. insurance industry by quarter and type. Noncommercial premiums are for individual life insurance, individual annuities, individual accident and health contracts, and deposit-type contracts. Commercial premiums are the residuals 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.

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:

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

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 written in locations other than firm f's location (which is not observable since $\text{noncommercial}_{i,t}$ 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 might be endogenous to the insurer's investment opportunities, I rely on the lagged net-to-gross premium 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

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

and $\text{Premiums}_{i,t}$ 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.

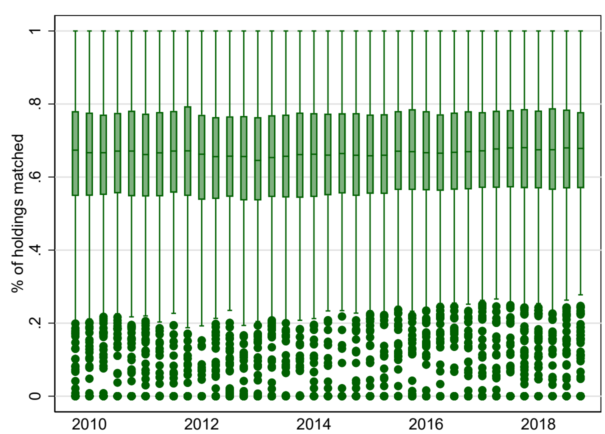
Table IA.2. Matching corporate bond investments to Capital IQ and Compustat.

The table depicts the number of observations for all insurer–security–quarter–level corporate bond holdings (and the total par value across insurers and quarters in parentheses) from Schedule D filings and the share matched to Capital IQ and Compustat. "Matched by: Capital IQ link" uses the Capital IQ link table. "Matching by: Ticker (TRACE & Compustat)" indicates observations 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)	16,126,058 ($ 68,109 bil)
% matched by: Capital IQ link	86.85% (79.74%)
% matched by: Ticker (TRACE & Compustat)	0.01% (0.01%)
% matched by: 6-digit CUSIP (Compustat)	0.90% (2.04%)
% copied from: same issuer ID (Mergent)	0.02% (0.03%)
% copied from: same 6-digit CUSIP	0.51% (1.19%)
% matched (par value)	88.28% (83.02%)
Total matched (par value)	14,236,565 ($ 56,542 bil)
Holdings: Compustat match	
% matched (par value)	58.35% (51.56%)
Total matched (par value)	9,410,266 ($ 35,115 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)	1,129,430 ($ 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.

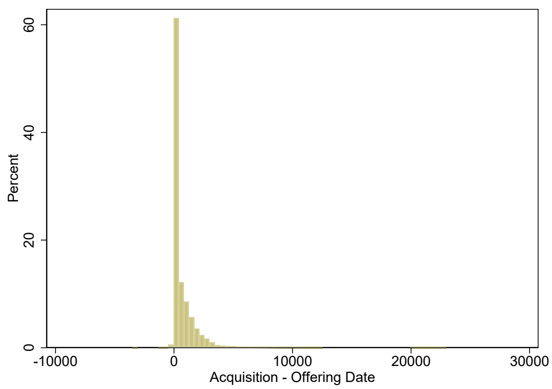
Several observations support this classification strategy:

- Fewer than 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.

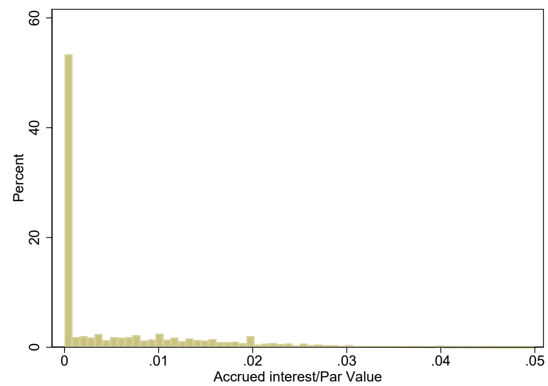
[3] Previous studies usually rely on a narrower classification. For example, Nikolova et al. (2020) define bond purchases as primary market trades only if they occur on the offering date and are from a bond issue's underwriter.

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

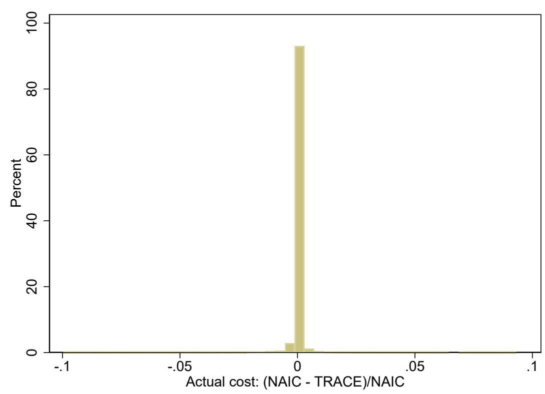
Figure (a) illustrates the distribution of the time (in days) between the offering and purchase dates at the transaction level. Figure (b) illustrates the distribution of accrued interest paid scaled by par value at the transaction level. Figure (c) illustrates the distribution of the relative difference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



(a) Time lag between purchase and offering date.



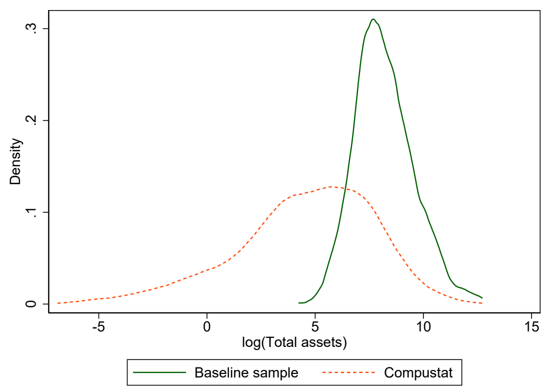
(b) Accrued interest.



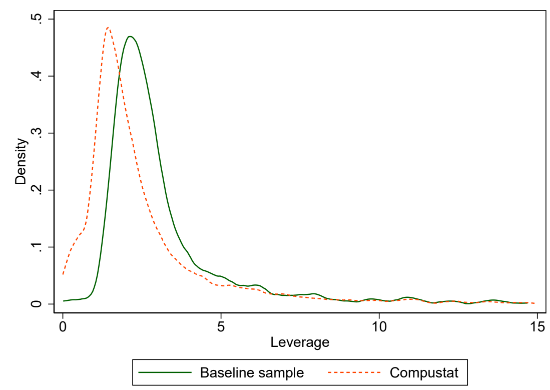
(c) Relative difference between TRACE and NAIC bond price.

A.5 Comparison with Compustat firms

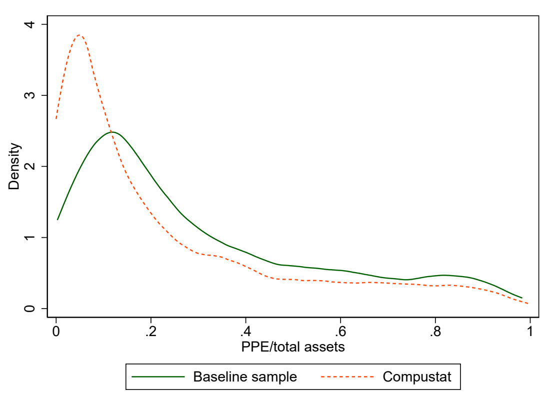
Figure IA.5. Comparison of firm characteristics with those of all nonfinancial firms in Compustat. The figures depict kernel densities for the cross-sectional distribution of average firm characteristics (from 2010q2 to 2018q4) for firms in my sample compared with those of all nonfinancial firms in Compustat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



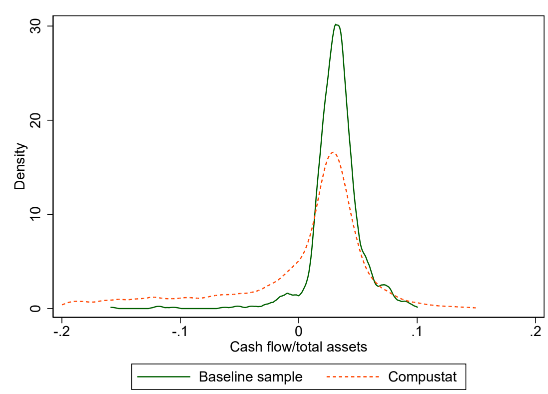
(a) Size.



(b) Leverage.



(c) PPE.



(d) Cash flow.

B Instrument derivation and validity

B.1 Insurers' bond investments and insurance premiums

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 ΔINVPremiums 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 $\kappa_{i,f,t}$ 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 91% and $\Omega_{f,t-1}$ explaining 82% 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.

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

$$\frac{\text{Bond purchases}_{f,t}}{\text{Bond debt}_{f,t-1}} \tag{IA.10}$$

$$= \frac{\Omega_{f,t}\bar{P}_{f,t} - \Omega_{f,t-1}\bar{P}_{f,t-1}}{\text{Bond debt}_{f,t-1}} \tag{IA.11}$$

$$= \frac{\Omega_{f,t-1}\Delta\bar{P}_{f,t} + \bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} \tag{IA.12}$$

$$= \frac{\Omega_{f,t-1}\bar{P}_{f,t-1}\frac{\Delta\bar{P}_{f,t}}{\bar{P}_{f,t-1}} + \bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} \tag{IA.13}$$

$$\approx \frac{\Omega_{t-1}\bar{P}_{f,t-1}\Delta\log\bar{P}_{f,t}}{\text{Bond debt}_{f,t-1}} + \frac{\bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} \tag{IA.14}$$

$$= \frac{\frac{\sum_i \kappa_{i,f,t-1}CB_{i,t-1}}{\bar{P}_{f,t-1}}\bar{P}_{f,t-1} \times \Delta\log\bar{P}_{f,t}}{\text{Bond debt}_{f,t-1}} + \frac{\bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} \tag{IA.15}$$

$$= \frac{\sum_i \kappa_{i,f,t-1}CB_{i,t-1}}{\text{Bond debt}_{f,t-1}} \times \Delta\log\bar{P}_{f,t} + \frac{\bar{P}_{f,t}\Delta\Omega_{f,t}}{\text{Bond debt}_{f,t-1}} \tag{IA.16}$$

$$= \Delta\text{INVPremiums}_{f,t} + \Delta\Omega_{f,t}\frac{\bar{P}_{f,t}}{\text{Bond debt}_{f,t-1}}. \tag{IA.17}$$

Thus, if $\Omega_{f,t} = \Omega_{f,t-1}$, then bond purchases coincide with $\Delta\text{INVPremiums}_{f,t}$. Therefore, the strong persistence observed in $\Omega_{f,t}$ suggests that $\Delta\text{INVPremiums}_{f,t}$ may serve as a relevant instrument for bond purchases, which is supported by the first-stage regressions in Table 5. Nonetheless, importantly, 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 (see Tables 2 and IA.15). I find that this is in particular the case when $\Delta\text{INVPremiums}_{f,t} < 0$ and, thus, the analysis focuses on variation in $\max(\Delta\text{INVPremiums}_{f,t}, 0)$.

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*

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

Proof. It holds that

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

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

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

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

The first equality follows from the definition of $\Delta\text{INVPremiums}_{f,t}^{>0}$. 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 $\bar{P}_{f,t}$. $\square$

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

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

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 instrument 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 instrument 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:

$$\begin{aligned}
&\mathbb{E}\left[\sum_{f,t}h_{f,t-1}1\{\Delta\bar{P}_{f,t}>0\}\left(\frac{\sum_i w_{i,f,t-1}P_{i,f,t}}{\sum_i w_{i,f,t-2}P_{i,f,t-1}}-1\right)\ \varepsilon^{\perp}_{f,t}\right] && \text{(IA.31)}\\
&=\sum_{f,t}\mathbb{E}\left[h_{f,t-1}1\{\Delta\bar{P}_{f,t}>0\}\frac{\sum_i w_{i,f,t-1}P_{i,f,t}}{\sum_i w_{i,f,t-2}P_{i,f,t-1}}\ \varepsilon^{\perp}_{f,t}\right]\\
&\quad-\sum_{f,t}\mathbb{E}\left[h_{f,t-1}1\{\Delta\bar{P}_{f,t}>0\}\ \varepsilon^{\perp}_{f,t}\right] && \text{(IA.32)}\\
&=\sum_{f,t}\mathbb{P}\left(\Delta\bar{P}_{f,t}>0\right)\mathbb{E}\Bigg[h_{f,t-1}\underbrace{\mathbb{E}\left[\overline{\frac{P_{f,t}}{P_{f,t-1}}}\frac{\overline{w}_{f,t-1}}{\widetilde{w}_{f,t-2}}\varepsilon^{\perp}_{f,t}\mid\{\Delta\bar{P}_{f,t}>0\},h_{f,t-1}\right]}_{=0}\mid\Delta\bar{P}_{f,t}>0\Bigg]\\
&\quad-\sum_{f,t}\mathbb{P}(\Delta\bar{P}_{f,t}>0)\underbrace{\mathbb{E}\left[h_{f,t-1}\varepsilon^{\perp}_{f,t}\mid\Delta\bar{P}_{f,t}>0\right]}_{=0}=0, && \text{(IA.33)}
\end{aligned}$$

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 5, it is useful to rewrite the key component of the instrument as follows:

$$\begin{aligned}
\Delta\log\bar{P}_{f,t}&=\log\frac{\sum_i w_{i,f,t-1}P_{i,f,t}}{\sum_i w_{i,f,t-2}P_{i,f,t-1}} && \text{(IA.34)}\\
&=\log\frac{\hat{w}_{f,t-1}\sum_i\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})\text{Premiums}_{i,f,t}}{\hat{w}_{f,t-2}\sum_i\mathbb{I}(\text{Investor}_{i,f,t-1-(1:8)})\text{Premiums}_{i,f,t-1}}, && \text{(IA.35)}
\end{aligned}$$

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 premium 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 instrument weight scaled by lagged total assets, with $w_{i,f,t-1}$ defined in Equation (3). For a constant average instrument 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:

$$Y^F_{i,t} = \beta X^I_{i,t} + u_t + \varepsilon_{i,t}$$

at the insurer-by-quarter level from 2010q1 to 2018q4. u_t are time fixed effects. $Y^F_{i,t}$ is the characteristic of the average bond issuer that insurer i has previously invested in, i.e., with $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) = 1$. $X^I_{i,t}$ 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	-0.084***	0.167***	-0.033	0.035***
	[-3.25]	[6.38]	[-1.61]	[2.76]
Insurer size	0.363***	-0.489***	0.217***	-0.055***
	[15.36]	[-26.50]	[13.64]	[-4.39]
log(Insurer RBC ratio)	-0.102***	0.082***	-0.083***	-0.006
	[-5.33]	[3.92]	[-6.13]	[-0.40]
Insurer leverage	0.218***	-0.311***	0.131***	-0.021**
	[10.85]	[-15.27]	[9.80]	[-2.35]
Insurer %equity	0.032	0.057**	0.040**	0.007
	[1.21]	[2.14]	[2.25]	[0.46]
Life insurer	0.550***	-0.784***	0.351***	-0.055**
	[11.93]	[-17.63]	[10.85]	[-2.22]

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					
	[-1.55]					
1{Same region}		-0.00				
		[-0.41]				
Social connectedness			-0.00			
			[-0.52]			
Social connectedness: Terc2				-0.00		
				[-0.66]		
Social connectedness: Terc3				-0.00		
				[-0.73]		
%Employed same industry					-0.03	
					[-0.46]	
%Employed same industry: Terc2						0.00
						[0.66]
%Employed same industry: Terc3						0.00
						[0.07]
Insurer-Time FE	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y
No. of obs.	37,460,595	37,460,595	37,460,595	37,460,595	37,460,595	37,460,595
No. of firms	871	871	871	871	871	871
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	-0.003	-0.004	-0.006	-0.002
	[-0.82]	[-1.20]	[-1.03]	[-0.24]
Insurer size × Factor	0.001	0.004	-0.001	-0.015***
	[0.35]	[1.05]	[-0.14]	[-2.79]
log(Insurer RBC ratio) × Factor	-0.001	0.005	0.008	-0.003
	[-0.22]	[0.97]	[1.09]	[-0.42]
Insurer leverage × Factor	0.000	0.004	-0.003	-0.013***
	[0.13]	[1.26]	[-0.97]	[-2.74]
Insurer %equity × Factor	0.003*	0.002***	-0.006*	-0.012*
	[1.72]	[4.81]	[-1.71]	[-1.92]
Life insurer × Factor	-0.003	0.012	0.005	-0.015
	[-0.30]	[1.10]	[0.40]	[-0.97]
(B) ΔPremiums				
Insurer rating × Factor	-0.011	-0.006	0.006	0.007
	[-1.09]	[-0.57]	[0.54]	[0.69]
Insurer size × Factor	0.005	0.012	-0.005	-0.013*
	[0.75]	[1.65]	[-0.69]	[-1.95]
log(Insurer RBC ratio) × Factor	0.005	0.009	-0.010	-0.012
	[0.63]	[0.97]	[-1.21]	[-1.64]
Insurer leverage × Factor	-0.001	0.019***	-0.005	-0.013*
	[-0.14]	[2.69]	[-0.66]	[-1.97]
Insurer %equity × Factor	0.005	-0.001	-0.010**	-0.005
	[1.08]	[-0.28]	[-2.01]	[-0.90]
Life insurer × Factor	0.011	0.060**	-0.019	-0.043**
	[0.42]	[2.59]	[-0.85]	[-1.97]

Table IA.7. Sorting of insurers across firms based on aggregate factors.
Each column presents the estimated coefficient γ from specifications of the 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				
β^I(ΔGDP)	-0.039			
	[-1.36]			
β^I(ΔVIX)		-0.013		
		[-0.58]		
β^I(10Y rate)			0.036	
			[1.07]	
β^I(Term spread)				0.000
				[0.01]
(B) ΔPremium				
β^I(ΔGDP)	-0.075**			
	[-2.34]			
β^I(ΔVIX)		-0.025		
		[-0.80]		
β^I(10Y rate)			-0.010	
			[-0.43]	
β^I(Term spread)				-0.011
				[-0.46]

Figure IA.6. Diversification of insurers' bond portfolios across issuers.

The figure relates the number of bond issuers in an insurer's portfolio to the insurer's size, measured by total assets. The bin scatter plot is based on the means in 50 bins of total assets, pooled across insurer-by-quarter observations, and also includes the line of best fit from an OLS regression.

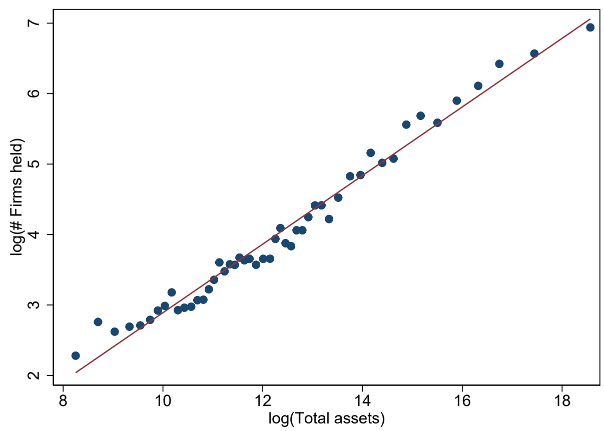
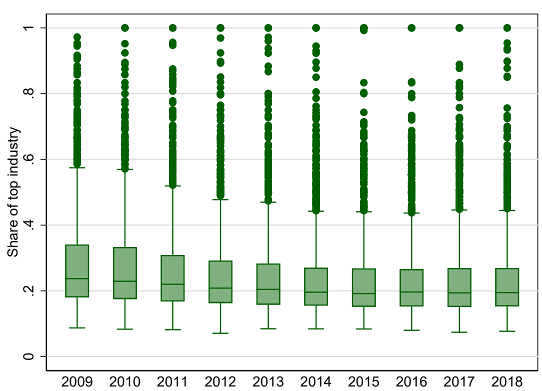
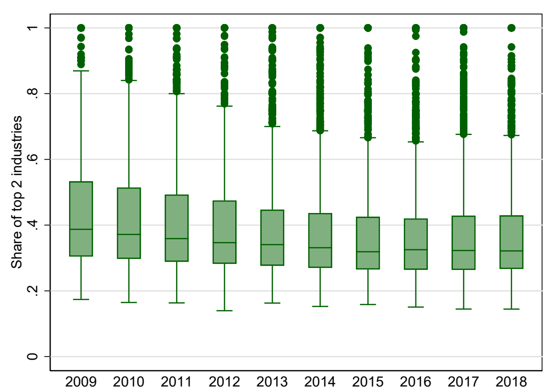


Figure IA.7. Concentration of bond holdings across issuer industries.

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.



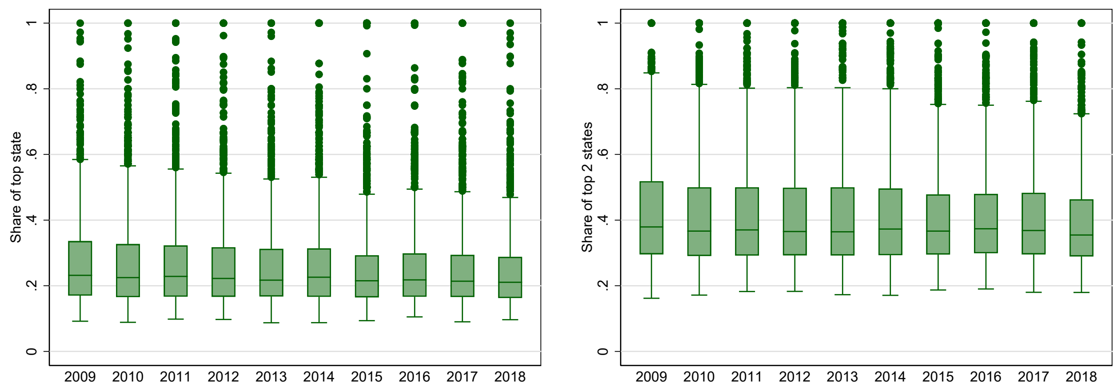
(a) Top 1 industry.



(b) Top 2 industries.

Figure IA.8. 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 of the set of firms invested in.

The 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	93.0%	93.0%	93.0%	93.2%	93.2%	93.2%	93.2%	93.3%	93.3%	93.3%
2	93.7%	93.8%	93.8%	94.0%	94.0%	94.0%	94.1%	94.1%	94.1%	94.1%
3	92.9%	93.0%	93.1%	93.3%	93.3%	93.4%	93.4%	93.5%	93.5%	93.5%
4	93.1%	93.3%	93.3%	93.5%	93.5%	93.6%	93.6%	93.6%	93.6%	93.7%
5	93.5%	93.5%	93.6%	93.7%	93.8%	93.8%	93.9%	93.9%	93.9%	93.9%
6	93.4%	93.5%	93.6%	93.8%	93.8%	93.9%	93.9%	94.0%	94.0%	94.0%
7	93.7%	93.8%	93.9%	94.1%	94.2%	94.2%	94.3%	94.4%	94.4%	94.4%
8	94.8%	94.9%	95.0%	95.2%	95.2%	95.3%	95.4%	95.4%	95.5%	95.5%
9	95.3%	95.5%	95.6%	95.8%	95.8%	95.9%	95.9%	96.0%	96.0%	96.0%
10	96.3%	96.4%	96.6%	96.7%	96.8%	96.8%	96.9%	96.9%	97.0%	97.0%

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

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

Fixed Effects:	None	Firm & Insurer-Time	Firm-Time & Insurer-Time	Insurer-Firm	Insurer-Firm & Firm-Time	Insurer-Firm & Firm-Time & Insurer-Time
SD(Residuals)	0.20	0.18	0.18	0.11	0.11	0.11
R^2		0.20	0.21	0.69	0.70	0.71
Adj. R^2		0.20	0.21	0.68	0.69	0.70

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	0.005**						
	[2.41]						
$\mathbb{I}$(Investor) × Insurer size:Quint2	0.009***						
	[5.46]						
$\mathbb{I}$(Investor) × Insurer size:Quint3	0.010***						
	[8.00]						
$\mathbb{I}$(Investor) × Insurer size:Quint4	0.023***						
	[11.72]						
$\mathbb{I}$(Investor) × Insurer size:Quint5	0.048***						
	[18.41]						
$\mathbb{I}$(Investor)		0.026***	0.032***	0.030***	0.027***	0.026***	0.019***
		[15.17]	[19.42]	[18.71]	[18.44]	[16.51]	[14.97]
$\mathbb{I}$(Investor) × log(Bond debt)		0.014***					
		[8.91]					
$\mathbb{I}$(Investor) × Firm age		-0.007***					
		[-6.23]					
$\mathbb{I}$(Investor) × Firm volatility		0.004***					
		[3.11]					
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.	33,066,183	33,066,183	33,066,183	33,066,183	33,066,183	33,066,183	33,066,183
No. of firms	870	870	870	870	870	870	870
No. of insurers	1,483	1,483	1,483	1,483	1,483	1,483	1,483
Relative effect of $\mathbb{I}$(Investor)			16.03	14.96	13.23	12.96	9.45
Difference in α relative to baseline:			-0.03	-0.10	-0.20	-0.22	-0.43

Table IA.11. Investment preferences of different types of insurers.

Each column presents OLS estimates for the effect of insurer and firm characteristics 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. 1{Life insurer} is an indicator for life insurers. 1{Investment grade} is an indicator for a firm having an investment grade credit rating (BBB- or better). 1{Unrated} is an indicator for a firm having no credit rating. Time to maturity is the average time to maturity of a firm's outstanding bonds (in years) weighted by offering amount. Insurer size × Firm size is the interaction of a firm's 1-quarter-lagged log total assets and an insurer's 1-quarter-lagged log total assets. 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)
Dependent variable:	$\mathbb{I}$(Investor)			
1{Life insurer} × Time to maturity	0.02***			
	[7.93]			
1{Life insurer} × 1{Investment grade}		0.12***		
		[14.55]		
1{Life insurer} × 1{Unrated}			-0.07***	
			[-12.82]	
Insurer size × Firm size				0.01***
				[21.09]
Insurer-Time FE	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y
No. of obs.	30,929,836	37,460,595	37,460,595	37,283,049
No. of firms	819	871	871	871
No. of insurers	1,451	1,451	1,451	1,451

B.5 Natural disaster exposure

This section details the construction of the natural disaster–based instrument. I retrieve information 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) and winsorize the observations 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,

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

where n_i is the number of dates with nonmissing observations for insurer i.

Column (6) 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.12).

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

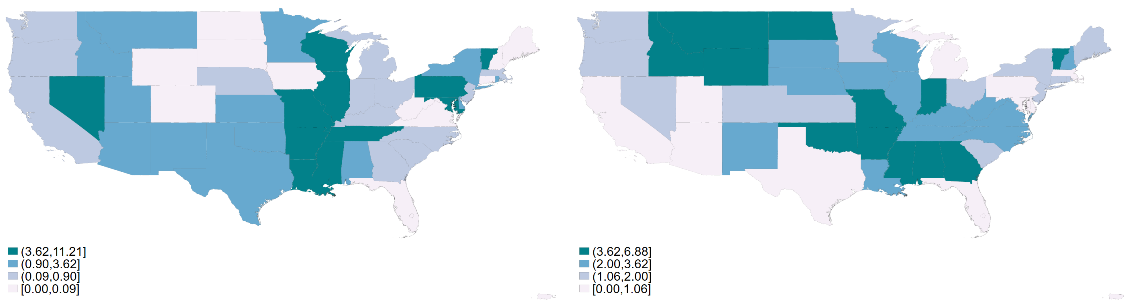
$$\overline{D}_{f,t} = \sum_{\text{Life insurers } i} \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \times \frac{CB_{i,t-1}}{A_{i,t-1}} \times \text{Distant disaster fatalities}_{i,f,t-1}, \qquad \text{(IA.38)}$$

where $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \times \frac{CB_{i,t-1}}{A_{i,t-1}}$ are the instrument weights analogous to Equation (3) and $A_{i,t-1}$ denotes insurer i's total assets at time $t-1$. I use $\overline{D}_{f,t}$ as a substitute for premiums $\overline{P}_{f,t}$ in Equation (4) to define an alternative instrument denoted $\Delta\text{INVDisasters}^{>0}_{f,t}$:

$$\Delta\text{INVDisasters}^{>0}_{f,t} = h_{f,t-1} \times \max\left(\Delta \log \bar{D}_{f,t}, 0\right). \qquad \text{(IA.39)}$$

Figure IA.9. Geographic variation in natural disasters.

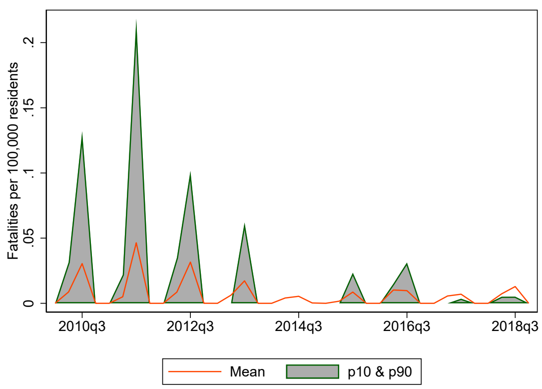
The figures depict the state-level standard deviation of fatalities per 100,000 residents caused by (a) heat and (b) storms from 2010q1 to 2018q4, multiplied by 100 for readability and winsorized at 1/99%.



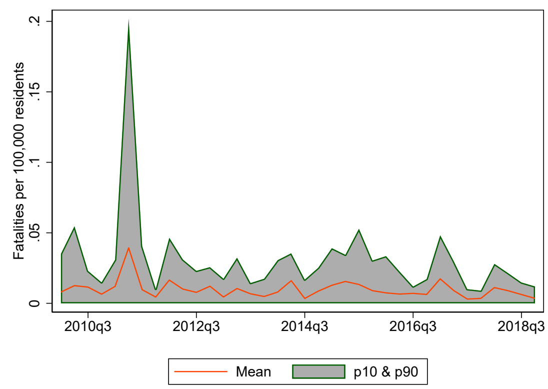
(a) Heat. (b) Storms.

Figure IA.10. 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.12. Natural disasters, insurance premiums, and insurers' balance sheet.
Column (1) presents estimated coefficients from specifications of the form:

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

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

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

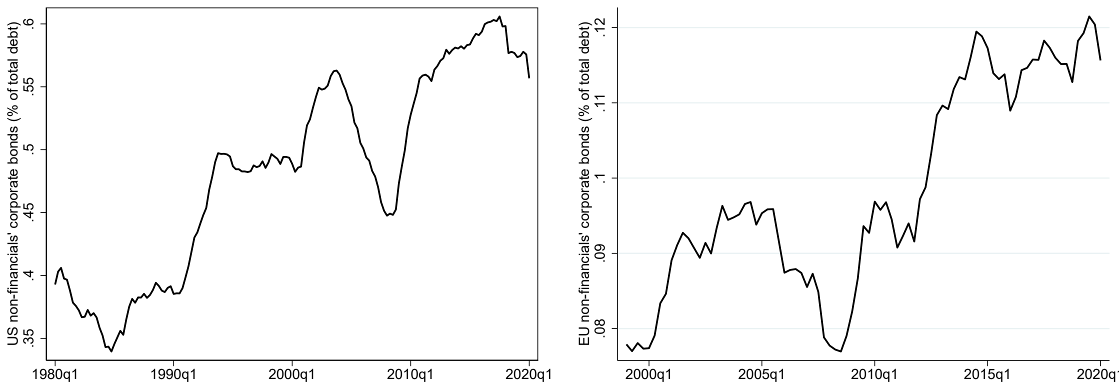
at the insurer-by-quarter level, where $u_{i,\text{quarter}(t)}$ are insurer-by-calendar quarter (seasonality) fixed effects and v_t are time fixed effects. Disaster fatalities$_{i,t-1}$ is the sum of Disaster fatalities$_{i,s,t-1}$ across states. The dependent variable in columns (2) and (3) is the logarithm of total direct noncommercial insurance premiums written. 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 column (1) and at the insurer and region-by-time levels in columns (2) to (6). The sample includes only life insurers. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Level:	Insurer-State	Insurer				
Dependent variable:	log(Direct Premiums Written)			log(Benefits)	$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$	
Disaster fatalities	3.61***	1.21***	1.18***	0.14		
	[4.35]	[3.19]	[3.17]	[0.46]		
ΔDisaster fatalities$^{>0}$					0.07***	0.07***
					[3.12]	[2.87]
Insurer controls			Y			Y
Insurer FE		Y	Y	Y	Y	
Insurer-Time FE	Y					
Insurer-State-Seasonality FE	Y					
Insurer-Seasonality FE						Y
Time FE		Y	Y	Y	Y	Y
No. of obs.	598,627	15,789	15,789	15,247	15,789	15,789
No. of insurers	451	501	501	495	501	501

C Additional figures

Figure IA.11. Bond debt share.

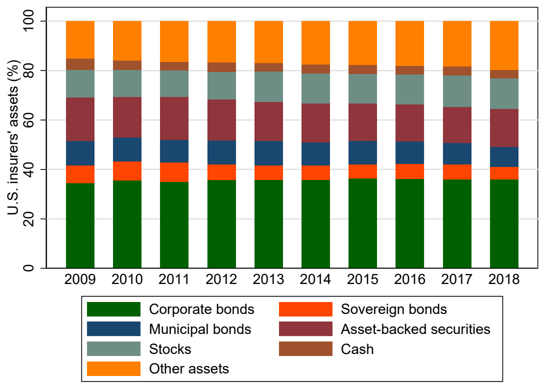
The figures depict the volume of nonfinancial firms' corporate bond debt relative to their total debt. Total debt is measured as the sum of debt securities and loans. (a) Data are retrieved from the Z.1 Financial Accounts of the United States. (b) Corporate bonds are measured by total debt securities.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



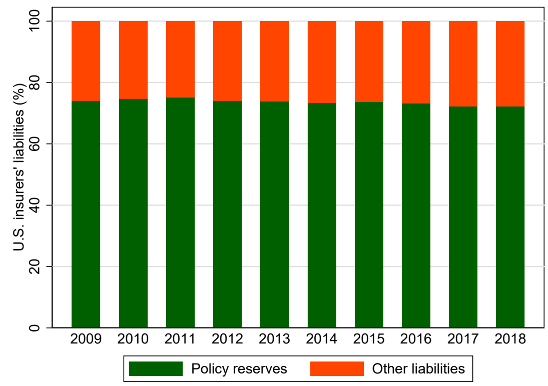
(a) U.S. (b) E.U.

Figure IA.12. 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.13. Corporate bond holdings by investor type.

The 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.

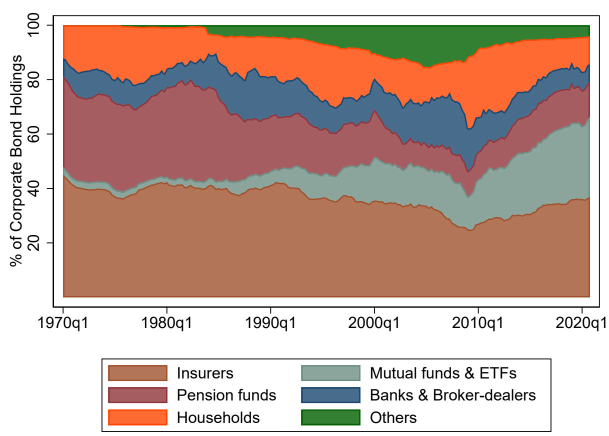
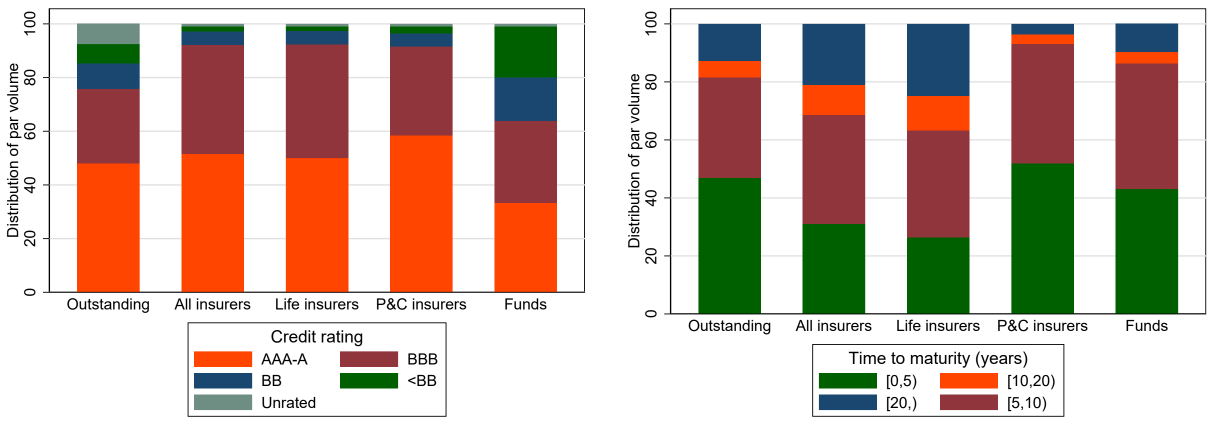


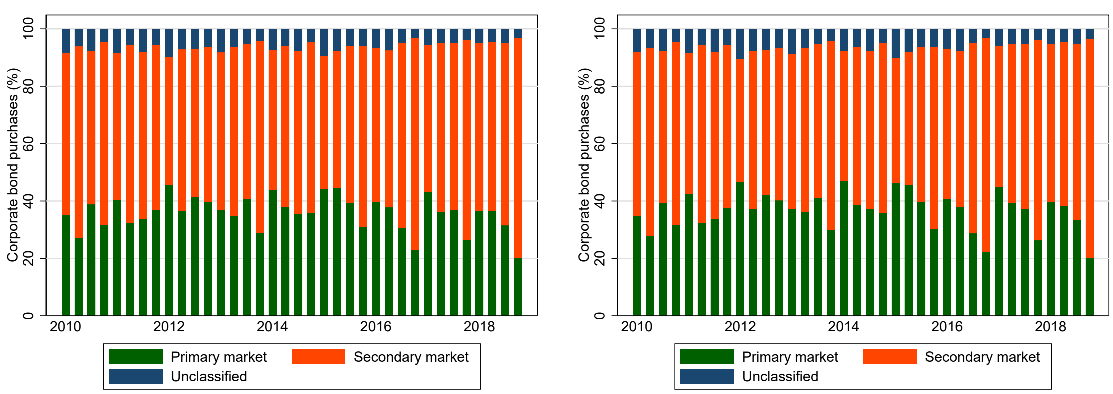
Figure IA.14. Comparing the corporate bond holdings of insurers and funds.
The figures depict the distribution of (1) the amount outstanding of all corporate bonds that are held by at least one fund or insurer, (2) the par value of all corporate bonds held by all P&C and life insurers, (3) the par value 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.15. Insurers' corporate bond purchases by market.
The figures depict the breakdown of insurers' corporate bond purchases (by par value) into those in the primary market, those in the secondary market, and unclassified purchases for (a) all insurers and (b) the insurers in the baseline sample.



(a) All insurers.

(b) Insurers in the sample.

Figure IA.16. Geographic distribution of insurance premiums.

Histogram of the number of jurisdictions (50 U.S. states, D.C., and 5 U.S. territories) in which an insurer writes positive insurance premiums, pooled across insurers and year–quarter observations from 2010q1 to 2018q4 for insurers in the baseline sample.

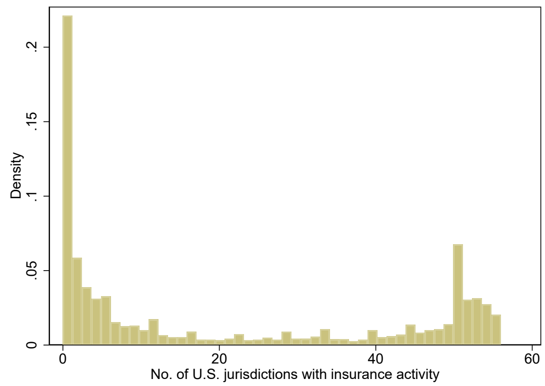
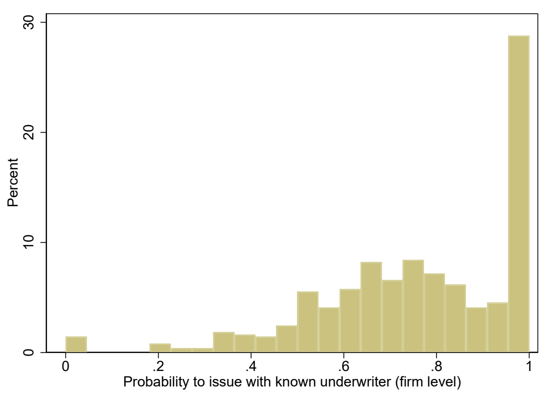
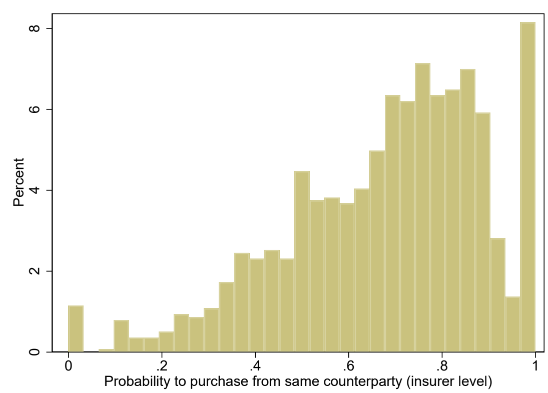


Figure IA.17. Underwriter relationships.

Figure (a) depicts the histogram across firms of the firm-level share of bond issuances involving an underwriter that the firm worked with in the previous 4 quarters. Figure (b) depicts the histogram across insurers of the insurer-level share of purchases (at the quarter level) involving a dealer from which the insurer purchased corporate bonds in the previous 4 quarters.



(a) Firm–underwriter relationship.



(b) Insurer–dealer relationship.

D Additional tables

D.1 Summary statistics

Table IA.13. Additional summary statistics for insurer, issuance, and bond characteristics.
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	45,014	0.36	0.48	0.00	0.00	1.00
ΔInvestments/Total assets$_{t-1}$ (%)	45,014	0.85	4.52	-5.64	0.68	7.57
Bond purchases (New)/Total assets$_{t-1}$ (%)	32,381	0.78	1.16	0.00	0.38	3.01
Bond purchases (Old)/Total assets$_{t-1}$ (%)	32,381	1.56	2.34	0.00	0.74	5.99
Return on equity	45,014	4.42	160.48	-28.41	4.75	33.00
Investment yield	45,014	3.13	1.57	0.72	2.98	5.71
# Firms held	45,014	160.98	272.12	4.00	61.00	693.00
P&C insurance profitability	29,022	5.38	5.20	-0.58	4.68	15.53
Life insurance profitability	15,992	9.29	31.19	-33.92	4.85	68.70
Life insurance fee income	15,992	1.85	4.99	0.00	0.00	13.24
Issuance level: Primary market						
Time to maturity (yrs)	650	10.47	6.02	4.17	9.17	23.86
Duration	650	7.34	2.75	3.83	6.84	13.29
Offering price	650	99.87	1.01	99.03	99.91	100.00
AA-AAA rated	650	0.04	0.20	0.00	0.00	0.00
A rated	650	0.19	0.39	0.00	0.00	1.00
BBB rated	650	0.34	0.47	0.00	0.00	1.00
High yield	650	0.42	0.49	0.00	0.00	1.00
Unrated	650	0.01	0.09	0.00	0.00	0.00
Bond level: Secondary market						
Time to maturity (yrs)	28,851	9.35	8.75	1.05	6.13	28.48
AA-AAA rated	28,851	0.11	0.31	0.00	0.00	1.00
A rated	28,851	0.32	0.47	0.00	0.00	1.00
BBB rated	28,851	0.45	0.50	0.00	0.00	1.00
High yield	28,851	0.12	0.33	0.00	0.00	1.00
Unrated	28,851	0.00	0.03	0.00	0.00	0.00
Duration	28,823	6.37	4.49	0.97	5.20	15.61

Table IA.14. Additional summary statistics for firm characteristics.
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						
Total assets (bil USD)	15,697	13.28	30.80	0.74	4.38	49.52
$\log$ Total assets$_{t-1}$	15,697	8.50	1.29	6.60	8.37	10.79
ΔTotal assets$_{t-1}$/Bond debt$_{t-1}$ (%)	15,697	7.83	38.17	-36.69	2.91	67.71
Sales$_{t-1}$/Bond debt$_{t-1}$ (%)	15,697	149.32	193.59	16.91	86.03	526.88
Cash flow$_{t-1}$/Bond debt$_{t-1}$ (%)	15,697	20.22	23.66	1.02	14.25	59.30
ΔCash$_{t-1}$/Bond debt$_{t-1}$ (%)	15,697	0.36	20.17	-29.79	0.11	30.09
Cash$_{t-1}$/Bond debt$_{t-1}$ (%)	15,697	62.93	86.14	1.67	30.45	239.80
PPE$_{t-1}$/Bond debt$_{t-1}$ (%)	15,697	172.35	190.62	13.06	114.49	531.81
Deferred Taxes$_{t-1}$/Bond debt$_{t-1}$ (%)	15,697	-0.01	3.87	-5.35	0.00	5.25
Market-to-book$_{t-1}$	15,697	1.79	0.93	0.92	1.52	3.80
Leverage$_{t-1}$	15,697	3.69	4.28	1.58	2.53	8.88
Age (yrs)	15,697	29.83	14.98	7.25	27.75	53.50
Stock return (%)	15,697	16.28	38.79	-42.69	13.67	83.18
SA index	15,697	-4.12	0.43	-4.63	-4.17	-3.35
Z-score	15,697	0.81	0.68	-0.33	0.85	1.84
Dividend payer	15,697	0.61	0.49	0.00	1.00	1.00
Earnings volatility	15,697	0.49	0.01	0.48	0.49	0.51
Commercial paper/Total debt (%)	2,634	8.14	10.72	0.00	3.75	30.39
ΔCommercial paper/Bond debt$_{t-1}$ (%)	2,437	0.21	10.75	-15.94	0.00	16.59
Firm level: Insurer characteristics						
Growth in potential investors' premiums ($100 \times \Delta \log \overline{P}$)	15,697	3.71	33.78	-20.82	1.68	33.14
Growth in potential investors' disaster exposure ($100 \times \Delta \log \overline{D}$)	15,438	-0.73	116.93	-246.64	24.56	151.04
# Investors	15,697	68.80	94.65	1.00	30.00	270.00
%Life insurers (%)	15,697	69.64	19.32	35.00	71.13	100.00
Insurer $\Delta \log$ total assets$_{t-1}$ (%)	15,697	-0.89	18.23	-23.58	0.80	17.69
Insurer return on equity$_{t-1}$ (%)	15,697	8.23	5.14	0.22	8.07	16.78
Insurer investment yield$_{t-1}$	15,697	4.27	0.71	3.12	4.28	5.33
Insurer P&C profitability (%)	15,697	4.67	2.04	0.00	5.01	7.46
Insurer life profitability (%)	15,697	11.62	11.64	-2.46	9.17	33.13
Insurer life fee income (%)	15,697	3.28	2.21	0.03	3.12	7.21
Insurer rating	15,690	2.77	0.55	1.80	2.83	3.45
Insurer log # firms held	15,697	6.12	0.56	5.16	6.17	6.97

D.2 Insurance premiums

Table IA.15. Insurance premiums and insurer balance sheets: Additional evidence.
Each column presents estimated coefficients from a specification of the 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 premium 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***	0.05***						
	[4.72]	[6.80]						
$\frac{\text{Premiums}_{t-1}}{\text{Total assets}_{t-1}}$		-0.03***						
		[-3.86]						
$\frac{\Delta\text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$			0.28***	0.05***	0.15***		0.34***	0.08***
			[6.05]	[2.90]	[4.48]		[10.81]	[5.05]
$\frac{\Delta\text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$			-0.14***	-0.01	-0.07*		-0.07**	-0.04***
			[-2.99]	[-0.82]	[-1.91]		[-2.57]	[-2.70]
$\frac{\Delta\text{Unadj. Premiums}^{>0}}{\text{Total assets}_{t-1}}$						0.67***		
						[11.52]		
$\frac{\Delta\text{Unadj. Premiums}^{<0}}{\text{Total assets}_{t-1}}$						0.79***		
						[12.85]		
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.	45,014	44,954	31,975	31,975	45,014	45,014	45,014	45,014
No. of insurers	1,450	1,450	1,365	1,365	1,450	1,450	1,450	1,450
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.16. Secondary market prices and insurers' bond demand: Robustness.
This table presents estimated coefficients from a specification of the form:

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

at the bond-by-quarter level, where f is the issuer of bond b. The dependent variable in columns (1) to (3) is the relative difference in end-of-month prices and accrued interest of bond b in the secondary market between the last month of quarter $t-1$ and the first month of quarter $t+1$ (in %), corresponding to $x = 3$ in Figure 1. The dependent variable in column (4) is the change in the average yield spread of bond b in the secondary market between the last month of quarter $t-1$ and the first month of quarter $t+1$ (in ppt). 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 potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$. $C_{b,t}$ is a vector of control variables and fixed effect dummies. It includes lagged insurer ownership, $h_{f,t-1}$, in each column. Maturity dummies are based on the remaining time to maturity in bins $(0, 3.5], (3.5, 7], (7, 15], (15, \infty)$. Rating dummies identify the credit rating categories AAA-AA, A, BBB, BB, B, CCC, and unrated. ΔRating dummies are based on the end-of-quarter rating change from $t-1$ to t. Other control variables and fixed effects are defined as in Table 5. The *Implied yield impact of purchasing 1% of outstanding bonds* is the change in the yield (in ppt) upon an increase in bond purchases by 1% of a firm's outstanding bonds implied by the estimated coefficient and the median duration. 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)
Dependent variable:		Bond return		ΔYield spread
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	51.68**	58.22**	87.22**	-11.19**
	[2.16]	[2.04]	[2.39]	[-2.21]
Insurer controls		Y	Y	Y
Firm controls			Y	Y
Bond FE	Y	Y	Y	Y
Rating-Maturity-Time FE	Y	Y	Y	Y
ΔRating FE	Y	Y	Y	Y
Industry-Time FE			Y	Y
First stage				
$\Delta\text{INVPremiums}^{>0}$	0.075***	0.069**	0.059***	0.059***
	[2.74]	[2.52]	[2.81]	[2.81]
F Statistic	112.9	93.0	67.4	67.3
No. of obs.	28,851	28,851	28,851	28,849
No. of bonds	2,560	2,560	2,560	2,560
No. of firms	368	368	368	368
Effect of 1sd change in $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	1.11	1.26	1.88	-0.24
Implied yield impact of purchasing 1% of outstanding bonds	0.10	0.11	0.17	

Table IA.17. Primary market prices, catering, and insurers' bond demand: Robustness.
This table presents estimates for the effect of insurers' bond purchases on primary market bond yield spreads and time to maturity at issuance analogously to Tables 4 and 7. The dependent variable in columns (4) and (5) is the average residual maturity of new bond issuances in the following four quarters, weighted by offering amounts. Bond purchases are instrumented in column (1) by the growth in potential investors' premiums using instrument weights $w_{i,f,t-1} = \kappa_{i,f,t-1} \times CB_{i,t-1}$, where $\kappa_{i,f,t-1}$ is the lagged portfolio weight within the corporate bond portfolio; in (2) and (3), by the log-transformed level of potential investors' premiums; and in (4) and (5), by the log-transformed growth in potential investors' premiums, defined analogously to Tables 4 and 7. 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)
Dependent variable:		Yield spread		$\text{Maturity}_{t+(1:4)}$	
log(Bond purchases)	-0.42***	-0.27*	-0.37*	1.69***	0.98**
	[-2.91]	[-1.68]	[-1.97]	[6.23]	[2.52]
log(Bond purchases) × Life INV					1.35**
					[2.59]
Issue controls	Y	Y	Y		
Firm controls			Y		
Insurer controls			Y		
Time FE				Y	
Maturity-Time FE	Y	Y	Y		
Rating-Time FE					
Industry FE			Y		
Life INV-Time FE					Y
First stage					
$\Delta\widetilde{\text{INVPremiums}}$ (PF weights)	0.256***				
	[6.1]				
$\widetilde{\text{INVPremiums}}$		0.609***	0.646***		
		[8.7]	[7.6]		
$\Delta\widetilde{\text{INVPremiums}}$				0.548***	0.676***
				[13.7]	[11.7]
F Statistic	48.1	131.1	85.2	340.5	102.9
No. of obs.	426	650	650	786	784
No. of firms	255	342	342	340	340
Effect of purchasing 1% of outstanding bonds	-0.11	-0.07	-0.10	0.66	0.38

Table IA.18. Corporate bond debt and insurers' bond demand: Robustness.

Each column presents estimates for the effect of insurers' bond purchases on the growth in the stock of a firm's bond debt analogously to Table 5. The main explanatory variable in columns (1) and (5) to (9) is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It is net of sales in column (3) and excludes primary market purchases in column (4). Bond purchases are instrumented in columns (3) and (4), by increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$,; in (5), by the growth in potential investors' premiums using instrument weights $w_{i,f,t-1} = \kappa_{i,f,t-1} \times CB_{i,t-1}$, where $\kappa_{i,f,t-1}$ is the lagged portfolio weight within the corporate bond portfolio; in (6), by the growth in potential investors' premiums using instrument weights for a hypothetical equal-weighted portfolio $w_{i,f,t-1} = \frac{\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})}{1+\sum_k \mathbb{I}(\text{Investor}_{i,k,t-(1:8)})} \times CB_{i,t-1}$; in (7), by the level of potential investors' premiums, $\bar{P}_{f,t}/\text{Bond debt}_{f,t-1}$; and, in (8), by the level of potential investors' premiums, $\bar{P}_{f,t}/\text{Bond debt}_{f,t-1}$, using instrument weights $w_{i,f,t-1} = \kappa_{i,f,t-1} \times CB_{i,t-1}$, where $\kappa_{i,f,t-1}$ is the lagged portfolio weight within the corporate bond portfolio. In (9), bond purchases are interacted with dummy variables for the cross-sectional terciles of the lagged transaction volume–weighted average illiquidity of the firm's bonds, measured based on daily absolute returns in the secondary market following Amihud (2002). 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)
Dependent variable:					$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$				
	OLS		IV						
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	4.06***				8.09***	7.72***	13.13***	77.04	
	[25.91]				[4.76]	[4.33]	[3.28]	[0.52]	
$\Delta\text{INVPremiums}^{>0}$		0.47***							
		[3.98]							
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$			6.45***						
			[4.04]						
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$				7.35***					
				[5.83]					
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$				4.50***					
				[7.50]					
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ ILLIQ:Terc1									6.06***
									[2.72]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ ILLIQ:Terc2									6.34***
									[2.65]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times$ ILLIQ:Terc3									8.03***
									[2.93]
Firm controls	Y	Y	Y	Y	Y	Y	Y		Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y		Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer characteristics-Time FE	Y	Y	Y	Y	Y	Y	Y		Y
Insurer economy-Time FE	Y	Y	Y	Y	Y	Y	Y		Y
ILLIQ-Time FE									Y
First stage									
$\Delta\text{INVPremiums}^{>0}$			0.074***	0.082***					0.106***
			[5.3]	[9.8]					[3.7]
ΔINVPremiums (PF weights)					0.047***				
					[5.3]				
ΔINVPremiums (EW weights)						0.069***			
						[5.3]			
INVPremiums							0.001***		
							[2.7]		
INVPremiums (PF weights)								0.115	
								[.5]	
F Statistic			74.0	561.2	58.1	61.7	22.2	0.4	21.7
No. of obs.	15,697	15,697	15,697	15,697	15,577	15,697	15,697	15,697	12,703
No. of firms	871	871	871	871	865	871	871	871	737

Table IA.19. Corporate bond debt and insurers' bond demand: Additional Robustness.

Each column presents estimates for the effect of insurers' bond purchases on the growth in the stock of a firm's bond debt analogously to 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. Bond purchases are instrumented by increases in potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, excluding premiums from the firm's headquarters state and additionally (column 5) deposit-type life insurance, (column 6) states neighboring the firm's headquarters, and (column 7) customer and supplier states based on (Barrot and Sauvagnat, 2016). In column (4), the definition of potential investors is based on the previous 10 quarters. Baseline controls are the firm and insurer characteristics and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects as in Table 5. Additional firm characteristics 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. Additional insurer characteristics are the average potential investor's rating and logarithm of the number of issuers invested in. 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 bins are based on the quartiles of the first three principal components of the current value and 4 lags of the investment yield of the firm's potential investors. Insurer profitability bins are based on the quartiles of the first three principal components of the current value and 4 lags of the insurance profitability of the firm's potential investors. Social connectedness bins are based on the quartiles of Bailey et al. (2018)'s social connectedness index between a firm's and its potential investors' location. SIC1 and SIC2 refer to the 1-digit and 2-digit SIC industry classifications, respectively. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:				$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$			
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	7.30***	8.79***	6.52***	7.66***	6.91***	6.16***	6.05***
	[3.67]	[3.42]	[4.34]	[4.18]	[4.11]	[3.86]	[3.57]
Baseline controls	Y	Y	Y	Y	Y	Y	Y
Additional controls	Y						
Insurance supply controls			Y				
Baseline FE	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE	Y						
Insurer location-Social connectedness-Time FE	Y						
SIC1-State-Time FE		Y					
Insurer inv yield-Time FE			Y				
Insurer profitability-Time FE			Y				
First stage							
$\Delta\text{INVPremiums}^{>0}$	0.059***	0.052***	0.077***				
	[4]	[3.4]	[5.4]				
$\Delta\text{INVPremiums}^{>0}_{1:10}$				0.072***			
				[5.1]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$					0.075***		
					[5.4]		
$\Delta\text{INVPremiums}^{>0}_{\text{ex neighbors}}$						0.070***	
						[5.3]	
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$							0.059***
							[4.8]
F Statistic	42.4	31.3	61.8	66.2	72.9	71.3	53.4
No. of obs.	15,689	13,614	15,579	15,697	15,686	15,673	15,685
No. of firms	871	786	871	871	870	871	871

Table IA.20. Corporate bond and commercial paper debt and insurers' bond demand.
This table presents estimated coefficients from specifications of the form:

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

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	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times 1\{\text{Bond}\}$	7.62***	8.35**	12.08***	8.20**	13.79***
	[2.71]	[2.19]	[3.61]	[2.13]	[2.95]
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
First stage					
$\Delta\text{INVPremiums}^{>0} \times 1\{\text{Bond}\}$	0.142**	0.142**		0.161**	
	[2.55]	[2.46]		[2.38]	
$\Delta\text{INVDisasters}^{>0} \times 1\{\text{Bond}\}$			0.030***		0.027***
			[3.37]		[3.01]
F Statistic	23.9	23.9	49.1	23.9	29.0
No. of obs.	4,252	4,252	4,252	3,282	3,282
No. of firms	133	133	133	108	108

Table IA.21. Total corporate investment and insurers' bond demand: Robustness.

Each column presents estimates for the effect of insurers' bond purchases on the firm's total investment analogously to column (1) in Table 8. The main explanatory variables are, in column (1), the total volume of insurers' secondary market purchases and, in (2) to (10), the total volume of insurers' purchases of firm f's bonds in quarter t, both scaled by lagged bond debt. Baseline controls are the firm and insurer characteristics and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects as in Table 8. Alternative instruments, control variables, and fixed effects are defined as in Tables IA.18 and IA.19. 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:	$\frac{\text{Total Investment}}{\text{Bond debt}_{t-1}}$									
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$	6.41***									
	[4.10]									
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$	-0.16									
	[-0.30]									
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$		7.74***	7.60**	6.08***	7.35***	5.71***	6.40***	7.20***	8.07***	6.42**
		[2.75]	[2.50]	[2.96]	[3.63]	[3.60]	[3.55]	[3.48]	[4.10]	[2.36]
Baseline controls	Y	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								
State-Time FE		Y								
Insurer location-Social connectedness-Time FE		Y								
SIC1-State-Time FE			Y							
Insurer inv yield-Time FE				Y						
Insurer profitability-Time FE				Y						
First stage										
$\Delta\text{INVPremiums}^{>0}$	0.082***	0.054***	0.052***	0.062***						
	[9.8]	[3.6]	[3.37]	[4.21]						
$\Delta\text{INVPremiums}^{>0}_{1:10}$					0.072***					
					[5.07]					
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$						0.075***				
						[5.38]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex neighbors}}$							0.070***			
							[5.06]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$								0.059***		
								[4.81]		
$\Delta\text{INVPremiums}^{>0}$ (PF weights)									0.047***	
									[5.3]	
INVPremiums										0.001***
										[2.75]
F Statistic	561.2	34.9	31.3	40.4	66.2	72.9	71.3	53.4	58.1	22.2
No. of obs.	15,697	15,688	13,614	15,530	15,697	15,686	15,673	15,685	15,577	15,697
No. of firms	871	871	786	869	871	870	871	871	865	871

Table IA.22. Corporate acquisitions and insurers' bond demand: Robustness.

Each column presents estimates for the effect of insurers' bond purchases on the firm's acquisition expenditures analogously to column (3) in Table 8. The main explanatory variables are, in column (1), the total volume of insurers' secondary market purchases and, in (2) to (10), the total volume of insurers' purchases of firm f's bonds in quarter t, both scaled by lagged bond debt. Baseline controls are the firm and insurer characteristics and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects as in Table 8. Alternative instruments, control variables, and fixed effects are defined as in Tables IA.18 and IA.19. 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:	$\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$									
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$	3.73***									
	[2.87]									
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$	0.36									
	[0.76]									
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$		4.81**	4.26*	3.33*	4.19***	2.99**	3.94***	3.81**	4.69***	1.23
		[2.22]	[1.80]	[1.90]	[2.62]	[2.39]	[2.78]	[2.40]	[2.98]	[0.61]
Baseline controls	Y	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								
State-Time FE		Y								
Insurer location-Social connectedness-Time FE		Y								
SIC1-State-Time FE			Y							
Insurer inv yield-Time FE				Y						
Insurer profitability-Time FE				Y						
First stage										
$\Delta\text{INVPremiums}^{>0}$	0.082***	0.054***	0.052***	0.062***						
	[9.8]	[3.6]	[3.37]	[4.21]						
$\Delta\text{INVPremiums}^{>0}_{1:10}$					0.072***					
					[5.07]					
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$						0.075***				
						[5.38]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex neighbors}}$							0.070***			
							[5.06]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$								0.059***		
								[4.81]		
$\Delta\text{INVPremiums}^{>0}$ (PF weights)									0.047***	
									[5.3]	
INVPremiums										0.001***
										[2.75]
F Statistic	561.2	34.9	31.3	40.4	66.2	72.9	71.3	53.4	58.1	22.2
No. of obs.	15,697	15,688	13,614	15,530	15,697	15,686	15,673	15,685	15,577	15,697
No. of firms	871	871	786	869	871	870	871	871	865	871

Table IA.23. Corporate capital expenditures and insurers' bond demand: Robustness.
Each column presents estimates for the effect of insurers' bond purchases on the firm's capital expenditures analogously to column (5) in Table 8. The main explanatory variables are, in column (1), the total volume of insurers' secondary market purchases and, in (2) to (10), the total volume of insurers' purchases of firm f's bonds in quarter t, both scaled by lagged bond debt. Baseline controls are the firm and insurer characteristics and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects as in Table 8. Alternative instruments, control variables, and fixed effects are defined as in Tables IA.18 and IA.19. 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:	$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$									
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$	1.05***									
	[3.37]									
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$	-0.18									
	[-1.64]									
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$		0.74	1.01*	1.13**	1.24***	1.12***	0.93**	1.39***	1.42***	2.67*
		[1.44]	[1.76]	[2.18]	[3.01]	[3.36]	[2.51]	[2.97]	[3.40]	[1.97]
Baseline controls	Y	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								
State-Time FE		Y								
Insurer location-Social connectedness-Time FE		Y								
SIC1-State-Time FE			Y							
Insurer inv yield-Time FE				Y						
Insurer profitability-Time FE				Y						
First stage										
$\Delta\text{INVPremiums}^{>0}$	0.082***	0.054***	0.052***	0.062***						
	[9.8]	[3.6]	[3.37]	[4.21]						
$\Delta\text{INVPremiums}^{>0}_{1:10}$					0.072***					
					[5.07]					
$\Delta\text{INVPremiums}^{>0}_{\text{ex dep-type}}$						0.075***				
						[5.38]				
$\Delta\text{INVPremiums}^{>0}_{\text{ex neighbors}}$							0.070***			
							[5.06]			
$\Delta\text{INVPremiums}^{>0}_{\text{ex cust/sup}}$								0.059***		
								[4.81]		
$\Delta\text{INVPremiums}^{>0}$ (PF weights)									0.047***	
									[5.3]	
INVPremiums										0.001***
										[2.75]
F Statistic	561.2	34.9	31.3	40.4	66.2	72.9	71.3	53.4	58.1	22.2
No. of obs.	15,697	15,688	13,614	15,530	15,697	15,686	15,673	15,685	15,577	15,697
No. of firms	871	871	786	869	871	870	871	871	865	871

F Additional analysis: Insurance premiums and socioeconomic characteristics

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

Table IA.24 reports the results of regressions of log insurance premiums on these characteristics. I absorb time-invariant heterogeneity in insurers' activity across states by including insurer-by-state fixed effects and both aggregate and region-specific shocks by including region-by-time fixed effects. Thus, the coefficients are identified from local variation in socioeconomic characteristics. In an additional specification, I also include insurer-by-time fixed effects, which absorb any insurer-specific shocks, such as to insurers' financial strength or investment success.

I find that socioeconomic characteristics significantly correlate with insurance premiums. Income is particularly important for P&C insurance, as a 1% increase in income is associated with an approximately 1% increase in insurance premiums. Insurance premiums for annuities correlate most with education and family status, suggesting that households are more inclined to save for retirement when their members are more educated or married without children. The presence of children significantly reduces annuity premiums, consistent with a higher opportunity cost of retirement saving. Insurance premiums for pure life insurance are most strongly correlated with a greater share of seniors, consistent with the higher mortality risk in this age group.

Table IA.24. Insurance premiums and socioeconomic characteristics.
Each column presents estimates from a specification of the form:

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

at the insurer-by-state-by-quarter level, where $C_{i,s,t}$ is a vector of fixed effect dummies. The sample includes U.S. states from 2011q1 to 2018q4. The dependent variable is the log total volume of direct noncommercial insurance premiums written for (columns 1-2) P&C insurance, (columns 3-4) annuities, and (columns 5-6) pure life insurance. The explanatory variables are the log total income per capita in the lagged 4 quarters and the share of the population with a bachelor's degree, aged at least 65 years, married, and divorced, and the share of households with children - which are all lagged by one calendar year. Columns (2), (4), and (6) include only insurers that are active in at least two states at a given point in time. t-statistics are shown in brackets and based on standard errors clustered at insurer and state-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	log Insurance premiums					
Type:	P&C		Annuity		Pure life	
log Income	0.99***	1.01***	-0.12	0.22	0.23**	0.21**
	[5.14]	[5.74]	[-0.42]	[0.98]	[2.30]	[2.36]
% Bachelor	1.09*	0.68	1.64**	1.72**	0.75**	0.66**
	[1.96]	[1.27]	[1.98]	[2.14]	[2.55]	[2.24]
% $\geq$ 65 yrs	-0.03	-0.78	0.85	1.04	1.98**	1.78**
	[-0.02]	[-0.47]	[0.38]	[0.53]	[2.40]	[2.29]
% Married	1.31*	0.87	1.48*	1.28	0.03	0.02
	[1.85]	[1.26]	[1.66]	[1.51]	[0.08]	[0.05]
% Married w/ kids	-1.03	-0.54	-1.93*	-1.97**	-0.24	-0.32
	[-1.24]	[-0.71]	[-1.80]	[-1.98]	[-0.55]	[-0.73]
% Divorced	-2.26**	-1.81*	-0.59	-0.26	-0.67	-0.63
	[-2.32]	[-1.93]	[-0.43]	[-0.20]	[-1.37]	[-1.27]
Insurer-State FE	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y
Insurer-Time FE		Y		Y		Y
No. of obs.	354,023	344,544	233,993	232,114	485,304	483,482
No. of insurers	949	652	388	330	482	420

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