

Investor-Driven Corporate Finance: Evidence from Insurance Markets *

Christian Kubitza

European Central Bank

christian.kubitza@ecb.europa.eu

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Abstract

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

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

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Abstract

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

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1 Introduction

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

Investors commonly purchase bonds in the secondary market, which boasts a total daily trading volume of nearly \$40 billion in par value.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 one to differentiate between demand shifts in secondary markets and the outcomes of primary market offerings. The U.S. insurance sector serves as an ideal laboratory due 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.

Insurance companies heavily rely on the secondary market to purchase corporate bonds, which accounts for 62% of their purchases. To identify shifts in insurers' bond demand, I use two charac-

¹*Source:* FINRA TRACE Fact Book 2022.

teristics of their investment behavior. First, insurance premiums serve as insurers' primary source of financing, totaling approximately \$1.7 trillion annually. Insurers respond to inflows of insurance premiums by purchasing corporate bonds 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 nearly 14 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 remove the effects of potential home bias in insurers' investments, the instrument is based only on the premiums paid by households located outside a firm's state.

The identification strategy rests on the assumption that unobserved determinants of a firm's investment opportunities do not *differentially* affect insurance markets depending on whether insurers are past bondholders. Intuitively, it seems unlikely that a firm's investment opportunities correlate relatively more with households' insurance demand when insurers previously invested in the firm. Supporting the identifying assumption, I find that firm-specific shocks do not explain the larger bond purchases by a firm's potential investors in response to higher insurance premium growth, suggesting as-good-as-random matching of firms and insurers. Moreover, all results are robust to including granular fixed effects and control variables, which absorb variation in firm and insurer characteristics and the local economic environment. Finally, in robustness analyses, I exploit variation in households' life insurance demand driven by natural disasters to relax the identifying assumption.

For firms with substantial bond ownership by insurers, a 1 standard deviation (16.6 ppt) higher growth in potential investors' premiums is associated with the insurance sector additionally purchasing 1% of a firm's outstanding bonds. Supporting the identification strategy, such shifts in bond demand have a significantly positive impact on bond prices. Using potential investors' premiums as an instrument, I estimate that bond returns in the secondary market increase by 54 basis

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

points (bps) when insurers purchase an additional 1% of the issuer's outstanding bonds; which corresponds to a 10 bps decrease in yields. This elasticity is similar to estimates in the asset pricing literature. Subsequently, bond prices revert back to their initial level, providing strong evidence 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 yield spreads of new bond issues 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 market 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 remains robust even after controlling for firm and insurer characteristics, and is consistent with firms timing capital markets to issue securities (Baker et al., 2003; Greenwood et al., 2010; Ma, 2019). The point 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 0.29 standard deviations) faster. This magnitude is consistent with prior studies and suggests that firms' bond debt is highly responsive to investor demand. Demand shifts also raise 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 bond underwriters as a valuable source of information. I exploit persistent underwriter relationships of firms and insurers to measure how strongly connected

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

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 connected. This effect strengthens when information about investors is more difficult to gather, emphasizing the role of underwriters in disseminating information about investor demand to firms.

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 expenditures and capital expenditures increase by 3 ppt and 1 ppt, respectively, both relative to outstanding bonds. These dynamics are accompanied by faster growth in property, plant, and equipment, as well as total assets.

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 flow problems that allow 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 across more and less financially constrained firms, 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 other firms. Together, these results suggest that, on the one hand, positive bond demand shifts 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 Papoutsis, 2022) 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 existing studies by documenting the impact of investor demand shifts within the secondary bond market on nonfinancial firms' financing and investment decisions. Whereas a large literature examines the role of demand shifts for asset prices in secondary markets (Ellul et al., 2011; Kojien and Yogo, 2019; Bretscher et al., 2022; Gabaix and Kojien, 2022; Jansen, 2023), relatively little is known about the interaction between the secondary and primary market and nonfinancial firms. The most closely related paper is Siani (2022), who estimates a structural model of segmented bond markets, focusing on the impact of investor heterogeneity on bond issuance. I complement her analysis by providing reduced-form evidence on the transmission of demand shifts from the secondary to the primary market and their impact on financing and investment decisions.

Existing evidence on the importance of investor demand for firms often stems from times of financial stress. For example, Coppola (2022) documents that the relatively stable bond demand by insurers compared to mutual funds mitigated adverse consequences of fire sales during the Global Financial Crisis. Aslan and Kumar (2018) and Massa and Zhang (2021) investigate fire sales during the Global Financial Crisis and after hurricane Katrina, respectively.⁵ I extend these studies by focusing on the impact of investor demand shifts in normal times when financial markets are more liquid and firms face fewer constraints. Thus, my results shed light on firms' permanent financial constraints and their ability to exploit benign financing conditions rather than their ability to withstand adverse shocks.⁶

⁴U.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.12).

⁵Liu et al. (2021) examine fire sales of municipal bonds by hurricane-affected P&C insurers.

⁶Binsbergen and Opp (2019) emphasize the importance of disinvestment costs, suggesting that investment responds more strongly to positive than negative funding shocks.

The related literature on bond fund flows documents that these correlate with bond issuance and corporate investment (Chernenko and Sunderam, 2012; Zhu, 2021). Due to the low-frequency reporting of fund holdings, delineating the specific mechanism behind these effects – namely funds’ participation in primary market offerings versus their secondary market price impact – is challenging. In contrast, by exploiting transaction-level data from insurance companies, this paper isolates and quantifies the impact of secondary market demand shifts. Whereas prior studies suggest that fund flows affect firms through funds’ primary market activity (Zhu, 2021), my results emphasize investors’ impact on secondary market prices as an important factor shaping firm decisions.

In addition to the availability of uniquely detailed data, another advantage of focusing on insurers is that their funding is driven by households’ demand for insurance, rather than investment, which mitigates performance-chasing (Goldstein et al., 2017) as an alternative explanation.⁷

Furthermore, my analysis extends studies on the role of underwriters within the primary bond market (Yasuda, 2005; Nikolova et al., 2020; Nagler and Ottonello, 2022), revealing underwriters as an information source for firms about investor demand in the secondary market. This result provides a novel perspective in the debate on managers’ abilities to time securities markets (Jenter et al., 2011) and resembles order flow leakage to brokers’ investor clients (Barbon et al., 2019).

In studying the real effects of financial intermediation, this paper also relates to work on bank lending (Khwaja and Mian, 2008; Chodorow-Reich, 2014; Huber, 2018). Banks affect borrowers’ decisions through monitoring (Holmstrom and Tirole, 1997) and retention of control rights (Rajan, 1992). In contrast, investors in the secondary bond market affect corporate decisions through their price impact, without necessarily interacting with firms.

Finally, the related literature on equity mispricing investigates the role of equity fund flows (Edmans et al., 2012), which builds on managers learning from equity prices about investment opportunities (Bakke and Whited, 2010). The substantial differences between equity and debt,

⁷In investigating how insurance market outcomes affect insurers’ investment behavior, I also contribute to a growing literature that links insurers’ funding structure and investment behavior (Chodorow-Reich et al., 2021; Knox and Sørensen, 2023; Kubitza et al., 2023).

e.g., in their information sensitivity (Dang et al., 2020), investor behavior (Choi et al., 2020), and as a signaling device (Leland and Pyle, 1977), suggest that it is important to separately investigate equity and bond markets and investors.

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.⁸ Premiums come mainly from noncommercial insurance business (see Appendix Figures IA.1 and IA.2) and are insurers' main financing source, as reserves account for about three-quarters of insurers' total liabilities (see Appendix Figure IA.13).

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.⁹ Corporate bond holdings account for 36% of these assets (see Appendix Figure IA.13). 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 Appendix 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:

⁸Insurers distinguish between *direct* premiums, which is the actual cash flow from insurance customers, and *net* premiums, which are net of reinsurance premiums. If not noted otherwise, by *premiums*, I mean direct premiums, as these are unaffected by insurers' reinsurance policies.

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

The median insurer is active in only 7 states.¹⁰

2.2 Corporate bond market

U.S. nonfinancial companies' corporate bond debt was nearly \$6 trillion in 2019, corresponding to 27% of U.S. GDP (source: Z.1 Financial Accounts of the U.S.). The majority of corporate bonds are issued by investment-grade borrowers (Berg et al., 2021). Institutional investors (insurers and pension, mutual, and other funds) dominate the corporate bond market and jointly hold approximately 80% of bonds outstanding (see Appendix Figure IA.15).

The secondary bond market is an over-the-counter market. Previous literature highlights significant market frictions, such as costly search (Friewald and Nagler, 2019) and market power (O'Hara et al., 2018). To mitigate these 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 serve both as dealers in the secondary market and underwriters in the primary market. As underwriters, they provide placement services to firms and allocate bonds to investors. The bilateral nature of trading gives rise to persistent relationships of both firms and investors with underwriters (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 Appendix Tables IA.10 and IA.11 present those for additional variables.

¹⁰For 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). Appendix Figure IA.17 depicts the distribution of the number of states in which insurers are active.

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 of insurers’ annual filings provides detailed information on bond holdings, acquisitions, and disposals in the general account at the security level, including 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 instead of market values to remove the mechanical impact of issuer fundamentals.

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, and 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 Appendix Figure IA.16). 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 their 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 those with less than \$100,000 invested in corporate bonds (at par) or noncommercial insurance premiums below \$50,000 or below 10% of total premiums in the median quarter from 2009q4 to 2018q4, respectively. Additionally, I exclude inactive insurers by dropping observations without positive direct premiums written or missing insurer characteristics (such as investment yield), which leaves 1,487 insurers. In insurer-

level analyses, after dropping singletons, the sample includes 1,455 insurers, with average corporate bond holdings of \$1.2 billion and purchases of \$51 million per quarter (see Table 1). Average non-commercial insurance premiums written are \$142 million, and quarterly premium growth ranges from -4.1% to 5.5% 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 0.45%, 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 the total debt in Capital IQ to match the total debt in Compustat.

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 quarter. 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 on 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.¹¹ Bond debt ranges from 29% to 100% of total debt at the 5th and 95th percentiles. 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, offering yields, and credit ratings are from Mergent FISD, a comprehensive database of publicly offered bonds.¹² I calculate the offering yield spread as the difference between the offering yield and the contemporaneous yield on the nearest-maturity treasury bond and drop yankee, convertible, putable, and asset-backed bonds, bonds in foreign currency, and bonds with a floating coupon or enhancement.¹³ Issuances are aggregated to the firm-by-quarter level using the total offering amount and the offering amount-weighted average yield spread. After merging with the baseline sample, nearly half of the firms remain in the sample. The average offering amount is \$1.4 billion, and the average offering yield spread is 2.4% across all firm-by-quarter observations with issuance activity.

I also retrieve information about firms’ bond underwriters 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

¹¹To provide context on 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 other, with the main differences being that the firms in my sample are larger and have higher leverage.

¹²Credit ratings are from S&P, Moody’s, or Fitch. Following Becker and Ivashina (2015), I use the minimum rating if two ratings are available and the middle rating if three ratings are available.

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

a uniquely detailed data set about the investor–underwriter–firm network, which connects 68% of insurers’ corporate bond purchases to underwriters in FISD.¹⁴ I define underwriter connectedness, denoted %UW, as the ratio of the bond purchases by a firm’s potential investors from that firm’s underwriters to those from all underwriters (as detailed in Section 6.5). This measure ranges from 9% to above 69% 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), which records the near universe of U.S. corporate bond transactions. The data are cleaned of primary market trades and cancellations, corrections, and reversals following Dick-Nielsen (2014) and aggregated to the bond-by-month level. Bond returns are given by 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 bond–month observations with a current or lagged total trade volume below \$100,000. After merging with the firm-level baseline sample, 2,612 bonds issued by 372 firms are left in the sample, with an average quarterly transaction volume of \$52 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 lagged bonds outstanding:

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

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

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

demand and supply. Second, omitted variables may simultaneously affect firm outcomes and bond purchases. For example, an increase in the firm’s investment opportunities might raise both bond supply and demand.

I overcome these identification challenges by proposing an instrument for bond demand shifts that relies on two characteristics of insurers. First, I exploit that premium inflows raise insurers’ demand for bonds in the secondary bond market. Second, I document that insurers persistently invest in the same small subsets of firms. Combining these characteristics, the sum of insurance premiums collected by those insurers that previously invested in a firm’s bonds captures firm-specific variation in bond demand:

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

Here, $\text{Premiums}_{i,f,t}$ are the total noncommercial insurance premiums collected in quarter t by insurer i in states other than that in which firm f is located (Appendix A.1 details the variable construction). Excluding commercial premiums and those written in the firm’s location alleviates the impact of shocks to the firm’s economic environment on $\bar{P}_{f,t}$. $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ is an indicator variable for whether insurer i has ever held bonds issued by firm f in the previous eight quarters; if it has, I call i a *potential investor* of f . Cross-sectional variation in $\bar{P}_{f,t}$ stems from the fragmentation of potential investors across firms.

Because the main analyses focus on flow variables and bond purchases, in particular, I calculate positive changes in potential investors’ premiums and multiply them by the lagged share of the firm’s bonds held by insurers:

$$\Delta \text{INVPremiums}_{f,t}^{>0} = \max(\Delta \log \bar{P}_{f,t}, 0) \times \% \text{Held by insurers}_{f,t-1}. \quad (3)$$

Appendix B.1 presents a stylized model that demonstrates that $\Delta \log \bar{P}_{f,t}$ represents the premium-driven percentage change in the insurance sector’s holdings of firm f ’s bonds in the hypothetical

scenario where the firm’s bonds are held only by potential investors and with the same portfolio weight. Therefore, if insurers’ investment behavior does not deviate by too much from this hypothetical scenario, $\Delta \text{INVPremiums}_{f,t}^{>0}$ can be used as an instrumental variable for insurers’ bond purchases relative to the firm’s total bonds outstanding. To ease the interpretation of the first-stage coefficients, %Held by insurers $_{f,t-1}$ is scaled by its unconditional mean (22.82%).

From Equation (2), it is apparent that the exclusion restriction holds if insurance premiums are random. Importantly, however, this is not a necessary condition. Instead, the identification strategy requires that unobserved determinants of a firm’s investment opportunities do not *differentially* affect the noncommercial insurance premiums collected by the firm’s potential investors, relative to other firms’ potential investors. Specifically, insurers must not sort into firms exposed to the same shocks as their insurance customers. Insurance market outcomes are driven primarily by households’ desire to insure against adverse events. In particular, households are typically not even aware of the fact that insurers invest their premiums in financial markets, let alone of which firms an insurer invests in. Therefore, intuition suggests that the determinants of a firm’s investment opportunities do not differentially affect the household insurance premiums of insurers that have previously invested in the firm, relative to other insurers. The following sections provide empirical support by investigating the relation between premiums and bond purchases, the determinants of insurers’ investment choices, and a within-firm estimator. Moreover, I include granular controls in the main regressions and, in robustness analyses, isolate spikes in life insurance demand after natural disasters, which relaxes the identifying assumption.

4.1 Insurance premiums

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 premiums is sizable, with an aver-

age absolute quarterly change in premiums of 18% at the insurer level.¹⁵ Determinants of insurance premiums include local socioeconomic characteristics (see Appendix F) and risk salience after natural disasters (see Section 4.3).

Because premiums are insurers' main financing source, they determine insurers' size and, in turn, their investment behavior. Guided by a stylized model of insurers' balance sheet dynamics (see Appendix B.1), I empirically establish this channel by regressing either an insurer's growth in total financial investments and cash or 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 and cash. This effect is driven by premium *increases* (column 2). The estimate implies that 42 cents of every dollar increase in premiums pass through to an insurer's investments. Instead, 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) and similar to the liquidity management by bond mutual funds (Choi et al., 2020).¹⁶

Insurers have a strong incentive to invest their premiums, especially due to their relatively long-term liabilities. Consistent with this rationale, columns (3) to (5) document a significant relationship between higher premium growth and larger bond purchases. Specifically, for every dollar increase in insurance premium growth, insurers purchase 6 cents' worth of corporate bonds.¹⁷ 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.

Importantly, the aggregate volume of premium-driven bond purchases is substantial, amounting

¹⁵The variation in premiums is not driven by small insurers or seasonality.

¹⁶Consistent with this interpretation, insurers actively compensate for premium decreases by raising more equity capital and reducing the share of insurance passed on to reinsurers (see Appendix Table IA.12).

¹⁷The results are robust to using bond purchases net of sales as the dependent variable (see Appendix Table IA.12).

to approximately \$861 million in an average quarter (computed as $\hat{\alpha} \sum_i \Delta \text{Premiums}_{i,t}^{>0}$). Therefore, premium increases that concentrate among a firm’s potential investors can create significant shifts in demand for that firm’s bonds.

Furthermore, when I solely use bond purchases in the secondary market as the dependent variable in column (5), the coefficient on premium increases decreases only slightly, from 0.06 to 0.05. Consistent with this result, additional regressions show that premium inflows are associated with purchases of existing rather than newly issued bonds (see Appendix Table IA.12). Therefore, insurers respond to premium inflows by purchasing bonds almost entirely in the secondary market. This result enables the use of premium inflows to construct an instrument for secondary market demand shifts.

4.2 Insurers’ investment universe and instrument validity

Corporate bond ownership is highly fragmented. A firm’s bonds are held by 69 insurers on average, which corresponds to only 5% of all insurers in the sample. Thus, the bonds of different firms are held by different insurers.¹⁸

The set of firms that an insurer invests in, i.e., its investment universe, is very persistent over time. More than 90% of the firms currently held by a given insurer were held by the same insurer in previous quarters (see Appendix Table IA.4). Prior studies document a similarly persistent investment universe at the bond level (Bretscher et al., 2022) and for bond mutual funds and equity investors (Kojien and Yogo, 2019; Zhu, 2021). A persistent investment universe is consistent with stable investment preferences, e.g., due to predetermined investment mandates (Kojien and Yogo, 2019), and due diligence costs associated with investing in new firms (Zhu, 2021).¹⁹ To

¹⁸Despite their fragmented bond ownership, insurers are reasonably diversified. Insurers invest in 161 different issuers, on average (see Appendix Table IA.11), and in multiple industries and locations (see Appendix Figures IA.7 and IA.8). Larger insurers invest in more bond issuers (see Appendix Figure IA.6).

¹⁹Persistence in portfolio allocations is more pronounced for more opaque (younger and more volatile) firms, 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 Appendix Table IA.6). For example, life insurers prefer firms with a better credit rating and longer-term bonds, matching the long duration of life insurance contracts, and larger insurers prefer larger firms, consistent with minimizing transaction costs (see Appendix Table IA.8).

capture the persistent component of the investment universe, for each firm, I define as the firm’s potential investors those insurers that ever held its bonds in the previous eight quarters, denoted by $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$. More than 70% 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 Appendix Table IA.5), suggesting that $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ indeed captures insurers’ investment preferences.

To explore the effect of insurers’ past investment allocation on current bond purchases, I construct an insurer-by-firm-by-quarter-level data set that includes all possible pairs of firms and insurers that are included in the baseline sample in a given quarter. I estimate the following linear probability model:

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

where the indicator variable $1\{\text{Purchase}_{i,f,t}\}$ equals one if insurer i purchases firm f ’s bonds in quarter t and zero otherwise. Insurer-by-time fixed effects, $u_{i,t}$, absorb insurer-specific demand shocks. Firm-by-time fixed effects, $v_{f,t}$, absorb the effect of any firm characteristics that might correlate with bond purchases, such as a firm’s investment opportunities. Column (1) in Table 3 reports the results. The estimated coefficient implies that insurers are 13.7 times more likely to purchase a firm’s bonds if they previously invested in the same firm. The coefficient is highly significant with a t-statistic of 17.9. Consistent with this evidence at the extensive margin, I also find that insurers allocate a larger share of purchases to firms with a larger share in the existing portfolio (see Appendix Figure IA.9). Thus, insurers’ past bond holdings are a significant determinant of the allocation of new bond purchases.

Following the banking literature, I examine whether unobserved firm characteristics correlate at the insurer level. Under regularity assumptions, the difference in the point estimate for α in Equation (4) between regressions including and excluding the firm-by-time fixed effects $v_{f,t}$ reflects the amount of bias due to unobserved firm-level variables (Khwaja and Mian, 2008; Chodorow-Reich, 2014). To facilitate this comparison, column (2) in Table 3 includes firm instead of firm-

by-time fixed effects. The difference between the estimated coefficients in columns (2) and (1) is neither economically nor statistically significant, suggesting an absence of firm-level confounders.

Columns (3) to (5) consider the amount of bond purchases in the secondary market as a dependent variable, capturing both the extensive and intensive margin of purchases. Specifically, 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. The coefficient on $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ remains significantly positive. The point estimate in column (5) implies that, in the absence of premium increases, a firm's potential investors purchase 2.5 times more of the firm's bonds than other insurers.²⁰ The coefficient on the interaction term with premium increases is also positive and significant. Thus, potential investors purchase more bonds than other insurers, especially in the presence of large premium inflows. Taken together, the estimated coefficients imply that potential investors that experience a 1 standard deviation increase in premium growth purchase 4.8 times more of the firm's bonds than other insurers.

If unobserved insurer or firm characteristics were correlated with insurers being potential investors or their premiums, then the point estimates would change to reflect the omitted variables when including granular fixed effects. For example, if improvements in a firm's economic environment raised both insurance demand and bond purchases for potential investors or motivated potential investors to increase premium inflows to purchase bonds, the inclusion of firm-by-time fixed effects would reduce the estimated coefficients on the interaction term between $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ and premium increases to reflect this bias. However, the point estimates are almost identical and not significantly different when insurer-by-time or firm-by-time fixed effects are included in columns (4) and (5). These findings provide validation of as-good-as-random matching of firms and insurers.

Consistent with these results, I also find that insurers are *not* more likely to invest in firms that are economically more connected, e.g., through geographic proximity, social connectedness (Bailey

²⁰Because 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.

et al., 2018), or industry-level employment (see Appendix Table IA.7). Hence, insurers' investment preferences are not driven by economic connections with firms but by other dimensions (such as risk appetite and liability duration), which is consistent with diversification motives and with insurers' strong reliance on unaffiliated asset managers (Carelus, 2018).

4.3 Alternative instrument based on natural disasters

An important concern is that part of the variation in insurance premiums is endogenous to firm characteristics, e.g., if insurance prices responded to insurers' investment opportunities. I alleviate this concern by showing that the results are robust to including granular fixed effects, which absorb shocks in industry-wide and aggregate macroeconomic conditions (such as credit spreads), and control variables for insurers' (expected) investment return and insurance supply.²¹ To provide further evidence, in additional robustness analyses, I narrow the focus to natural disasters as plausibly exogenous shocks to life insurance demand, using state-level variation in the number of fatalities caused by heat and storms.²²

Natural disasters increase the salience of underlying risks and subsequently boost insurance demand (Gallagher, 2014; Hu, 2022), consistent with salience theory (Bordalo et al., 2012). However, heat and storm events have no significant impact on life insurers' payouts, which is intuitive since the number of fatalities is typically small compared to the customer base of life insurers.²³ This is an important difference from P&C insurers, which suffer *outflows* rather than inflows after disasters (Liu et al., 2021). I exclude P&C insurers in this analysis to focus on insurers' resulting bond purchases rather than (fire) sales. In an average year between 2009 and 2018, storms were

²¹Knox and Sørensen (2023) document that stable insurance funding allows insurers to take more investment risk and, therefore, earn higher investment returns and reduce insurance prices. Following Knox and Sørensen (2023), I use underwriting profitability to control for insurance prices and net investment yield to control for expected investment returns, both parametrically and, in robustness analyses, nonparametrically.

²²Heat and storms are more frequent and widespread than other hazards. They jointly affect almost all U.S. states, providing wide variation (see Appendix Figures IA.10 and IA.11).

²³Even hurricane Katrina, the costliest disaster in the U.S. to the present day, only had a moderate effect on life insurers' expenses (source: *Hurricane Katrina – Analysis of the Impact on the Insurance Industry* by Towers Watson, 2013).

associated with a total of 162 fatalities and heat with 105 fatalities in the U.S.

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 all states s in which insurer i is active of fatalities per 100,000 residents in s at $t - 1$ multiplied by the average share of insurer i 's premiums written in s . Disaster fatalities significantly raise life insurers' premium inflow in disaster-affected states but not insurance payouts (see Appendix Table IA.9). This results in larger bond purchases (see Table 2). A 1 standard deviation increase in disasters affects bond purchases to a similar extent as a 1 standard deviation increase in insurance premiums, consistent with the rich variation in heatwaves and storms. I aggregate the exposure to disaster fatalities across a firm's potential investors and substitute the resulting variable for premiums $\bar{P}_{f,t}$ into Equation (3), which yields the alternative instrument $\Delta\text{INVDisasters}_{f,t}^{>0}$ (Appendix B.3 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, I exclude, for each firm, disasters in the state in which the firm is located and all of its 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 correlation from disaster seasonality. Conditional on these fixed effects, the identifying variation stems from differences in potential investors' disaster exposure, with firms' disaster exposure held constant. Because disasters are plausibly exogenous to firm characteristics, using $\Delta\text{INVDisasters}_{f,t}^{>0}$ relaxes the identifying assumption and, in particular, rules out opportunistic insurance pricing as a potential confounder. Furthermore, it illustrates one source of plausibly exogenous variation in insurance premiums.

5 Bond prices and bond demand

Before presenting the paper's main results, in this section, I investigate the price impact of insurers' bond demand. This analysis is useful because it 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 almost entirely in the secondary market upon an increase in premiums. 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 return of firms that face large premium-driven bond purchases with that of similar bonds from other firms:

$$\text{Bond return}_{b,t}^{-1:x} = \alpha_x \frac{\text{Bond purchases}_{f(b),t}}{\text{Bond debt}_{f(b),t-1}} + \Gamma'_x C_{b,t} + u_{b,x} + v_{\text{Maturity,Rating},t,x} + w_{\text{Industry},t,x} + y_{\Delta\text{Rating},x} + \varepsilon_{b,t,x}, \quad (5)$$

where firm $f(b)$ is the issuer of bond b and insurers' bond purchases are instrumented by increases in potential investors' premiums, $\Delta\text{INVPremiums}_{f,t}^{>0}$ in quarter t (I discuss the first-stage estimates in Section 6). Bond return $\text{Bond return}_{b,t}^{-1:x}$ 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 control variables containing the 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 depending on bonds' remaining time to maturity (with bins separated at 5, 10, and 15 years) and credit rating. Additional fixed effects control for cross-industry differences at the 2-digit SIC level, $w_{\text{Industry},t,x}$, and for credit rating changes, $y_{\Delta\text{Rating},x}$, which may correlate with insurers' investment behavior due to regulation (Ellul et al., 2011). Standard errors are clustered at the firm and firm region-by-time levels.

Figure 1 displays the estimated coefficients α_x , varying the time horizon of bond returns, x , on the x-axis. Bond returns increase by 54 bps when insurers additionally purchase 1% of the firm's outstanding bonds (which is close to the average amount of quarterly bond purchases). This magnitude is equivalent to a decrease in yields of 10 bps ($=0.54/5.19$), based on the median bond duration, and it is robust across different empirical specifications (see Appendix Table IA.13). Prices

start to revert to their initial level in the quarter following a demand shift. These price dynamics are consistent with prior studies (e.g., Ellul et al., 2011) and with models of price pressure, e.g., due to search-and-bargaining frictions (Duffie et al., 2007). Moreover, the figure shows that prices *before* an increase in demand do *not* significantly differ across firms. These results strongly support the identification strategy. They are consistent with as-good-as-random matching of firms and insurers and rule out a firm-driven increase in bond supply as an alternative explanation.

The estimate from Equation (5) can be used to approximate the price elasticity of demand for bonds. Using the peak price impact at $x = 3$, $\alpha_x = 54$, the implied elasticity is $-1/(\alpha_x/100) = -1.9$. This estimate for the elasticity of corporate bond demand is similar to that in the literature (e.g., Bretscher et al., 2022). It is larger (in absolute value) than most estimates for the stock market and smaller than those for government bonds, consistent with the respective differences in these assets' substitutability.²⁴

5.2 Primary market

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. 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 that face smaller purchases:

$$\begin{aligned} \text{Yield spread}_{f,t} = & \alpha \log(\text{Bond purchases}_{f,t}) + \Gamma' C_{f,t} + u_{\text{Maturity},t} \\ & + v_{\text{Rating},y(t)} + w_{\text{Broad industry},y(t)} + \varepsilon_{f,t}. \end{aligned} \quad (6)$$

To accommodate the log-linear relation between yield spreads and bond purchases, I log-transform the instrument for $\log(\text{Bond purchases}_{f,t})$ as follows: $\widetilde{\Delta \text{INVPremiums}}_{f,t} = \log(1 + \Delta \text{INVPremiums}_{f,t}^{>0})$

²⁴Koijen et al. (2021) and Jansen (2023) estimate an elasticity for government bonds of between -3.21 and -4.11, and Koijen and Yogo (2019) estimate the elasticity for stocks to be approximately -1.

$\times \text{Bond debt}_{f,t-1}$). Maturity bucket-by-quarter fixed effects, $u_{\text{Maturity},t}$, absorb time-varying differences in yield spreads across issuances with a different remaining time to maturity. Credit rating-by-year, $v_{\text{Rating},y(t)}$, and 1-digit SIC industry-by-year fixed effects, $w_{\text{Broad industry},y(t)}$, account for differential trends of firms with different credit ratings or in different industries, respectively. These are at the yearly level (denoted by $y(t)$) to maintain meaningful variation in the dependent and explanatory variables. $C_{f,t}$ is a vector of control variables that includes the logarithm of bonds' time to maturity and the firm and insurer characteristics listed in Table 5. Standard errors are clustered at the firm and region-by-time levels.

The first column of Table 4 provides estimates for the model in Equation (6) including only control variables and maturity- and rating-level fixed effects. I find a large, negative and significant (at the 1% level) coefficient on insurers' instrumented bond purchases. The point estimate implies that issuance yield spreads decrease by 0.39 bps when insurers' bond purchases increase by 1%. Columns (2) and (3) enrich the specification by including additional control variables and industry-by-year fixed effects, which have a negligible impact on the estimated coefficient and its significance. Column (5) further underscores robustness by using potential investors' disaster exposure as an alternative instrument.

To compare the price impact to that in the secondary market, I 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 (\$198 million and \$5.6 billion, respectively, in the sample of Table 4). The estimate implies that yields decrease by 10 to 12 bps when insurers additionally purchase 1% of the firm's outstanding bonds. This magnitude closely matches the price impact in the secondary market. To narrow the focus to the transmission from insurers' secondary market purchases to the primary market, in column (4), I additionally control for insurers' primary market purchases. However, this does not meaningfully reduce the estimate for α , which remains significantly positive. Thus, the impact on issuance yields is driven by demand shifts in the secondary but not in the primary market.

The yield impact of approximately 10 bps associated with insurers’ average bond purchases (of 1% of a firm’s bonds) is also economically significant. For example, it corresponds to approximately half of the difference between the issuance yield spreads of issuers with a BBB+ and AAA- credit rating and to a similar magnitude as the impact of purchases by the Fed’s corporate credit facilities in 2020 (Boyarchenko et al., 2022).

6 Bond financing and bond demand

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

6.1 Baseline specification

To examine the effect of insurers’ premium-driven bond purchases 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.²⁵ The empirical specifications include granular fixed effects and controls. Firm-seasonality fixed effects absorb time-invariant firm characteristics and seasonality in bond issuance and insurance premiums by interacting firm dummies with calendar quarter dummies. Fixed effects at the region-by-time level absorb changes in a firm’s local economic environment (which is either the U.S. Mid-Atlantic, Midwest, Northeast, Southeast, Southwest, or West) as well as fluctuations in aggregate macroeconomic conditions. Industry-by-time fixed effects absorb industry-wide shocks at the 2-digit SIC level. Firm-level control variables capture traditional determinants of corporate finance, namely, current sales and cash flow to control for 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 to control for financial slack.

²⁵Because not all bond purchases can be clearly identified as either primary or secondary market purchases (see Appendix A.4), I use total bond purchases as main explanatory variable. The results are robust to instead using secondary market purchases as the main explanatory variable.

Additionally, I control for the characteristics and economic environment of a firm’s potential investors. All regressions include $\%Held\ by\ insurers_{f,t-1}$ to control for insurers’ investment preferences relative to other investor types. Moreover, for each firm–quarter, I calculate the average potential investor’s P&C and life insurance profitability, life insurance fee income, investment yield, return on equity and size, and the share of life insurers among potential investors. These variables capture variation in insurance supply, insurers’ investment success and profitability, and insurer 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 the share of lagged insurance premiums written by line of business and by U.S. region). Thus, the estimate compares firms with potential investors that exhibit similar characteristics.

Finally, I compute dummy variables based on the level of employment in the firm’s industry and consumption at the location of potential investors’ customers (for a detailed description, see Appendix Table IA.1). Fixed effects based on the interaction of these dummies with time dummies (referred to as *insurer economy-time fixed effects*) absorb time-varying differences between firms that correlate with consumption or employment patterns in potential investors’ location. Including these fixed effects further ensures that the estimate compares firms whose potential investors’ customers face a similar economic environment, alleviating the concern that insurers might invest in firms with local or other economic ties.

6.2 Baseline results

Panel A in Table 5 reports the estimated coefficient for different specifications. Column (1) includes firm-seasonality, industry-by-time, and region-by-time fixed effects. In columns (2) and (3), I successively add the additional fixed effects and controls described above. As a robustness check, in column (4), I use potential investors’ disaster exposure as an alternative instrument. In all specifications, the coefficient on insurers’ instrumented bond purchases is significantly positive at

the 1% level. This positive response by firms is consistent with survey evidence that corporate managers aim to time the market (Graham, 2022) and with anecdotal evidence that I collected from a large nonfinancial firm and underwriter that emphasizes the ability of bond issuers to swiftly react to changes in market conditions. Saturating the specification with controls and fixed effects has a negligible effect on the point estimate and its significance, supporting the identification strategy. The large first-stage F-statistic, which is well above 20, suggests that the estimate is not contaminated by weakness of the instrument.

The point estimate in the most refined specification, specification (3), implies that the growth in bond debt is 5.99 ppt (or 0.15 standard deviations) faster when insurers additionally purchase 1% of a firm’s outstanding bonds. In combination with the estimates from Section 5, the result suggests that a 10 bps reduction in financing costs is associated with an approximately 6 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 ($= 0.33/0.42 \times 0.1$) per 10 bps reduction in yield.²⁶

The coefficient on bond purchases jointly reflects the elasticity of bond debt to prices and that of prices to insurers’ bond purchases: the larger insurers’ price impact, the stronger are firms’ incentives to increase bond issuance. In columns (5) and (6), I additionally control for insurers’ primary market purchases, which has little effect on the estimated coefficient. This result provides further evidence that the estimate is driven by insurers’ price impact in the *secondary* market.²⁷

²⁶The 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) and securitization (Berg et al., 2022).

²⁷Investor segmentation (Siani, 2022) and secondary market illiquidity (Goldstein et al., 2019) contribute to primary market elasticity and, therefore, may elevate firms’ response. Moreover, issuance volumes are typically lumpy due to

The identification exploits variation in potential investors' premium growth $\Delta \log \bar{P}$. To interpret the first-stage results, it is useful to recall that the instrumental variable is scaled by the average bond ownership by insurers, which is 22.82%. For firms with average bond ownership by insurers, the coefficient in the preferred specification (3) thus implies that the insurance sector purchases an additional 0.4% of outstanding bonds ($= 0.024 \times 0.1665$) in response to a 1 standard deviation (16.65 ppt) higher growth in potential investors' premiums. For firms with the 5% largest bond ownership by insurers (75.64%), the insurance sector purchases an additional 1.3% of outstanding bonds ($= 0.024 \times 0.1665 \times 75.64\%/22.82\%$). The magnitude is similar for the instrument based on natural disasters, as a 1 standard deviation higher growth in disaster-driven fatalities $\Delta \log \bar{D}_{f,t}$ (which is 1.15) is associated with bond purchases of 0.46% of outstanding bonds ($= 0.004 \times 1.15$) for firms with an average bond ownership by insurers and with purchases of 1.5% of outstanding bonds ($= 0.004 \times 1.15 \times 75.64\%/22.82\%$) for firms with the 5% largest bond ownership by insurers. In both cases, the identification thus relies on coarse, yet rich variation in insurers' bond demand.

6.3 Alternative specifications

I assess the robustness of the baseline results in two ways. First, in Appendix Table IA.14, 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 credit rating-by-time fixed effects. I also use fixed effects based on the social connectedness between a firm's location and the location of its potential investors' customers as a proxy for unobserved economic ties across regions, such as trade or common cultural values (Bailey et al., 2018). Furthermore, the results are robust to using alternative definitions of the instrument or of a 10-quarter (instead of an 8-quarter) time horizon to define potential investors and to the exclusion of insurance premiums from the states neighboring a firm's location, of insurance premiums for deposit-type contracts (which households might use for investment), or of insurance premiums fixed issuance costs (Bolton et al., 2013).

from states in which a firm’s suppliers and customers are located (Barrot and Sauvagnat, 2016).

Second, I compare bond to commercial paper debt growth. Similar to bonds, commercial paper is publicly traded debt. It is an important component of firms’ capital structure and is often used as start-up financing for new investment (Kahl et al., 2015). The share of commercial paper relative to total debt is 8.2% on average and ranges up to 30.5% at the 95th percentile (see Appendix Table IA.11). In contrast to corporate bonds, commercial paper has short maturities of 45 days on average (Ou et al., 2004). For this reason, long-term investors such as insurance companies are barely active in this market, investing less than 1% of their assets in commercial paper (source: Z.1 Financial Accounts of the U.S.). Therefore, it is reasonable to assume that cross-sectional variation in commercial paper demand is uncorrelated with insurance premiums. Building on this assumption, I estimate the effect of insurers’ instrumented bond purchases on firms’ bond *relative* to their commercial paper debt growth at the debt type-by-firm-by-quarter level:

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

where d denotes the debt type (either corporate bonds or commercial paper), $\Delta\text{Debt}_{d,f,t}$ is the quarterly change in debt outstanding of type d , and $1\{\text{Bond}_d\}$ is an indicator for corporate bond debt. Bond purchases are instrumented with $\Delta\text{INVPremiums}_{f,t}^{>0}$. The important difference between this and the baseline specification is the inclusion of firm-by-time fixed effects, $u_{f,t}$, which absorb any uniform firm-specific shocks, e.g., stemming from changes in a firm’s investment opportunities. Thus, α is identified from variation *within* the same firm at the same point in time. I also include debt type-by-firm fixed effects, $v_{f,d}$, which absorb time-invariant heterogeneity in firms’ debt structure, and debt type-by-time fixed effects, which absorb debt type-specific shocks, such as aggregate shocks to the commercial paper or corporate bond market. Standard errors are clustered at the firm and debt type-by-time levels. To estimate Equation (7), I consider only the subsample of firms for which commercial paper is a relevant source of corporate finance, defined as those with positive commercial paper debt in at least one quarter from 2010q1 to 2018q4.

The first column of Panel B in Table 5 estimates Equation (7) without firm-by-time fixed effects. The point estimate for the coefficient on insurers’ bond purchases is significantly positive with a magnitude similar to that in the baseline results in Panel A. Column (2) additionally includes firm-by-time fixed effects, which have a modest impact on the coefficient. This rules out firm-specific shocks as an alternative explanation. Confirming the robustness of the result, column (3) uses potential investors’ disaster exposure as an alternative instrument, which slightly elevates the coefficient of interest, similarly as in Panel A. Finally, columns (4) and (5) focus on the subsample of firms with positive commercial paper debt in at least 50% of quarters. In all specifications, the coefficient is highly significantly positive with a magnitude close to that in Panel A.

6.4 The role of financial conditions

Positive bond demand shifts motivate firms to exploit favorable financing conditions, which is a form of *corporate opportunism*. This opportunism may be amplified by the presence of financial constraints, which prevent firms from pursuing all desired projects, and alleviated by loose financial conditions, which lower average financing costs. To explore such cross-sectional heterogeneity, I use several proxies for financial conditions. Hadlock and Pierce (2010) propose the size–age (SA) index as a measure of financial constraints, which loads negatively on firm age and positively on squared size.²⁸ Additionally, I examine heterogeneity across firm size, profitability (measured by cash flow), and credit rating.

Observing insurers’ actual bond purchases allows me to disentangle heterogeneity in firms’ response to an increase in bond demand (second stage) from heterogeneity in insurers’ reaction to premium inflows (first stage). This approach differs from that in previous studies that do not observe bond 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).

²⁸Hadlock and Pierce (2010) evaluate the use of their index to measure financial constraints based on qualitative evidence from SEC filings.

I first sort firms into bins based on cross-sectional terciles of firm characteristics and rating categories and then estimate separate coefficients on insurers' instrumented bond purchases for each bin following specification (3) in Panel A in Table 5. Additionally, I include tercile (or rating) fixed effects, which control for heterogeneity across firms with different characteristics. Table 6 reports the estimated coefficients. There are significant differences in the sensitivity of insurers' bond purchases in the first-stage regressions in columns (5) to (8). Insurers purchase significantly more bonds of larger than smaller firms upon premium increases. Consistent with Acharya et al. (2022)'s finding that investors subsidize firms with a BBB rating, the effect of premiums on bond purchases is particularly large for these firms.

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 differences across firms with different financial constraints, size, or profitability are statistically insignificant. Consistent with these results, credit ratings also do not have a monotonic effect on firms' responsiveness. Instead, the coefficient is particularly large for firms with a very high (AAA-A) or low (high-yield) credit rating but significantly smaller for those with an intermediate (BBB) rating. A potential reason for this difference is that firms with an intermediate rating already benefit from high levels of investor demand on average (Acharya et al., 2022) and therefore might respond less markedly to additional demand shifts.

Overall, the results suggest that opportunistic bond issuance is not amplified by weak financial conditions. Instead, differently constrained firms tend to find it equally attractive to exploit the favorable financing conditions resulting from an increase in insurers' bond demand. A potential reason for this result is that firms with bond market access are, on average, relatively unconstrained (Cantillo and Wright, 2000).

6.5 The underwriter channel

Why are firms so responsive to investor demand? According to anecdotal evidence that I collected from a large nonfinancial firm and investment bank, investors typically do not communicate demand shifts directly to firms. Instead, investors have close ties with investment banks, which inform firms about investor demand and help firms set issuance prices in their role as underwriters.

Consistent with this anecdotal evidence, I first document that firm–underwriter relationships are highly persistent. On average, 74% of the bond issuance volumes in my sample involve bond underwriters with which a firm has worked in the previous year. An average issuance involves approximately 4 underwriters.

Bond underwriters are investment banks, which also act as dealers in the secondary bond market. Insurer–dealer relationships are similarly persistent. On average, 73% of insurers’ bond purchases (at par value at the insurer–quarter level) are from dealers that they worked with in the previous year. The insurer–dealer network is highly fragmented, as insurers work with 17 dealers on average.²⁹

I use the overlap between a firm’s relationship underwriters and potential investors’ relationship dealers as a measure of how connected a firm’s underwriters are with potential investors. 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. Then, I measure the connectedness of the firm’s underwriters with potential investors as the share of potential investors’ bond purchases from the firm’s underwriters in the previous 4 quarters:

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

where $\text{Bond purchases}_{i,u,t-k}$ represents insurer i ’s total bond purchases from underwriter u in quarter $t-k$. Finally, I define $UW_{f,t}$ as an indicator of high connectedness of underwriters with potential

²⁹Hendershott et al. (2020) propose a model in which insurers build relationships with dealers to mitigate search frictions in the bond market. Appendix Figure IA.18 displays the cross-sectional distribution of persistence in firm–underwriter and insurer–dealer relationships.

investors, which equals one if $\%UW_{f,t}$ 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 drops to 489.

To test the underwriter channel, I regress the growth in firms' bond debt on the interaction of insurers' instrumented bond purchases and $UW_{f,t}$. Column (1) in Table 7 reports the results. The coefficient on the interaction term is large and significant. Thus, consistent with the hypothesis, firms respond significantly more strongly to bond demand shifts when their underwriters are well connected with potential investors.

A possible alternative explanation for the result is that firms with well-connected underwriters differ along other dimensions. To the extent that such differences are time invariant or seasonal, they are absorbed by controlling for $UW_{f,t}$ and including firm-seasonality fixed effects. Column (2) additionally controls for firm and insurer characteristics, and column (3) includes $UW_{f,t}$ -by-time fixed effects, which absorb time-varying differences across firms with more- and less-connected underwriters. Both modifications have a modest effect on the coefficient of interest. Column (4) shows that the underwriter effect is concentrated around the two lowest quintiles of $\%UW_{f,t}$. Thus, the marginal effect of underwriter connectedness is decreasing with its level.

Finally, I provide further evidence on the mechanism behind the underwriter channel. The hypothesis states that underwriters are relevant because they disseminate information about investor demand to firms. In this case, one would expect underwriter connectedness to become more important when information is more difficult to gather. I use the dispersion of a firm's investors, measured as the negative of the Herfindahl–Hirschman index of insurers' holdings of the firm's bonds, and the number of a firm's potential investors as proxies for information barriers. To test the relevance of information barriers, I expand the regression model with a triple interaction term of insurers' instrumented bond purchases, $UW_{f,t}$, and a dummy variable for strong information barriers, which flags the upper tercile of the cross-sectional distribution of investor dispersion or number of potential investors. The model also includes all related two-way interactions and the

variables themselves. The coefficient on the triple interaction term is large and significantly positive for both proxies for information barriers (see columns (5) and (6)), consistent with the hypothesis. These results emphasize the role of underwriters in facilitating corporate opportunism.

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.³⁰ Additionally, I explore the growth in firms' property, plant, and equipment (PPE) and total assets. The empirical specification is analogous to that in Panel A in Table 5.

Panel A in Table 8 reports the baseline results. The main result in column (1) shows a significantly positive coefficient on insurers' instrumented bond purchases for firms' total investment. The estimate implies that investment increases by 5.93 ppt relative to outstanding bonds when insurers additionally purchase 1% of the firm's outstanding bonds. The magnitude of this effect is similar to that on bond debt growth (Table 5), suggesting that a considerable fraction of opportunistic bond issuance proceeds fund investment activities. The result is 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 (2022) estimates that increasing insurer ownership of a firm's bonds by 50 ppt is associated with an increase in total investment of about 2 to 3% of assets during the Global Financial Crisis, as it alleviates fire sale effects. His estimate slightly exceeds the estimated impact of insurers purchasing 1% of bonds on total investment implied by column (1), which is 1.5% of assets.³¹

³⁰Acquisition 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.

³¹To compare the results, I scale the coefficient in column (1) of Panel A in Table 8 by the average ratio of assets to bond debt (24.6%), which yields 1.46 ($= 5.93 \times 0.246$).

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 about 3 ppt and capital expenditures increase by about 1 ppt, both relative to outstanding bonds. The strong response of acquisition expenditures is consistent with the fact that firms with bond market access are relatively mature (Cantillo and Wright, 2000). Again, the results are robust to using potential investors' disaster exposure as an alternative instrument. Finally, I also document a significant increase in PPE and total asset growth in columns (7) and (8). The estimated response of total asset growth is close to that of total investment, consistent with balance sheet dynamics.

I confirm the robustness of the results using a variety of alternative empirical specifications in Appendix Tables IA.15 to IA.17. In particular, the coefficients on total investment, acquisition expenditures, and capital expenditures are similar in magnitude and significance to the baseline results when I use alternative definitions of the instrument or include granular controls for insurers' investment success and profitability and fixed effects at the state-by-time and state-by-industry-by-time levels. Moreover, consistent with the previous findings, the results are robust to controlling for insurers' primary market activity, emphasizing the role of secondary market demand shifts.

7.2 Underinvestment vs. free cash flows

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

First, I explore the role of financing frictions, using Hadlock and Pierce (2010)'s SA index to measure the level of financial constraints. Columns (1) to (4) in Panel B in 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, the empirical specification includes fixed effects for each SA tercile. The results consistently display a stronger response of more financially constrained firms, namely, a larger increase in total investment, acquisition and capital expenditures and PPE growth. The difference between firms in different SA index terciles is close to being significant, with p-values close to 10% for total investment and acquisition expenditures and a p-value of 8% for PPE growth.³²

The observation that less financially constrained firms respond less in terms of investment but similarly in terms of net bond issuance suggests that they substitute other financing sources. Consistent with this interpretation, column (5) shows that firms in the lowest SA tercile reduce “other debt” in response to positive 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 respond significantly.

Second, I investigate firms’ quarterly stock return (between end-of-quarter prices at $t - 1$ and t) as a proxy for changes in their (expected) profitability. Column (6) reveals that stock returns respond significantly negatively to premium-driven bond purchases for firms in the second SA index tercile while the response is muted in terms of economic and statistical significance for firms with tighter or looser financial constraints.

Overall, 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 significantly raise investment, 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 raise investment to a lesser extent and, instead, significantly substitute other sources of financing, accompanied by an insignificant stock

³²The low average level of financial constraints of firms with bond market access likely weakens the statistical power of these 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.

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 through what channels. These questions are particularly relevant and, moreover, nontrivial in the context of the secondary bond market, which accounts for a large share of investors’ activity. Motivated by these considerations, this paper provides causal 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, at the same time, can amplify free cash flow problems for mildly constrained firms.

The significant elasticity of corporate decisions to bond demand emphasizes the importance for economic analyses to explicitly consider investors and their price impact. The findings sug-

gest significant spillovers of financial regulations, such as capital requirements, through investors' 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 following the specification in Equation (5). 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.

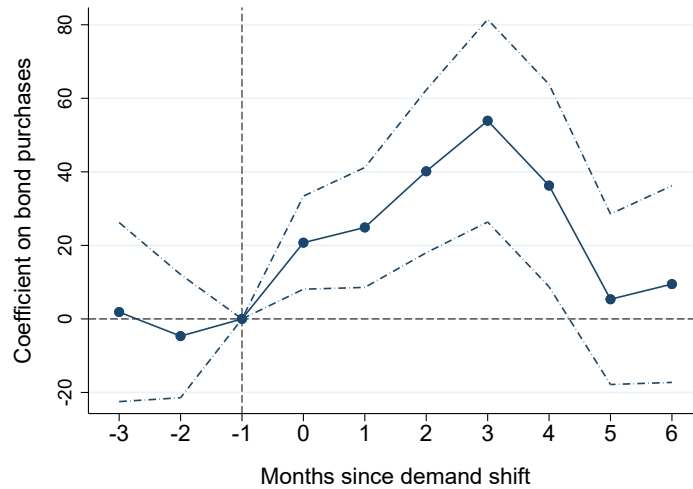


Table 1. Summary statistics.

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 (1,455 insurers)						
Bonds held (bil USD)	45,203	1.21	5.69	0.00	0.03	4.98
Bond purchases (mil USD)	45,203	51.35	257.51	0.00	1.38	209.86
Bond purchases/Total assets _{t-1} (%)	45,203	1.63	2.38	0.00	0.83	6.27
Bond purchases (Prim)/Total assets _{t-1} (%)	45,203	0.42	0.82	0.00	0.00	2.02
Bond purchases (Sec)/Total assets _{t-1} (%)	45,203	1.09	1.93	0.00	0.33	4.79
Premiums (mil USD)	45,203	142.22	650.89	0.28	14.38	520.96
Δ Premiums/Total assets _{t-1} (%)	45,203	0.24	3.39	-4.07	0.00	5.46
$100 \times \Delta$ Disasters ^{>0}	15,996	0.60	1.37	0.00	0.05	3.14
Insurer-by-firm level						
$100 \times \mathbb{I}(\text{Investor})$	22,550,017	6.17	24.06	0.00	0.00	100.00
$100 \times \mathbb{1}\{\text{Purchase}\}$	22,550,017	0.45	6.66	0.00	0.00	0.00
Bond purchases (sec; mil USD)	100,456	2.61	7.24	0.00	0.35	12.00
Firm level (871 firms)						
Bond debt/Total debt (%)	15,763	76.91	23.85	29.39	84.85	100.00
Δ Bond debt/Bond debt _{t-1} (%)	15,765	3.11	21.32	-12.58	0.00	31.82
%Held by insurers (%)	15,765	22.82	23.55	0.39	14.00	75.64
Bond purchases/Bond debt _{t-1} (%)	15,765	0.96	2.53	0.00	0.11	4.45
Δ INVPremiums ^{>0} (%)	15,765	3.94	9.35	0.00	0.31	18.87
Δ INVDIsasters ^{>0} (%)	15,487	38.28	70.28	0.00	4.67	191.90
Total investment/Bond debt _{t-1} (%)	15,765	12.50	22.48	0.73	5.32	46.22
Acquisitions/Bond debt _{t-1} (%)	15,765	4.23	16.74	0.00	0.00	21.37
CapEx/Bond debt _{t-1} (%)	15,765	7.78	10.80	0.64	4.13	27.72
Δ Total assets/Bond debt _{t-1} (%)	15,765	9.37	43.78	-36.47	2.66	75.45
Δ PPPE/Bond debt _{t-1} (%)	15,765	2.53	12.46	-8.16	0.41	20.04
%UW	4,843	41.01	17.94	9.08	41.28	69.46
Issuance level: Primary market (399 firms)						
Yield spread (%)	1,017	2.41	1.87	0.49	1.63	6.28
Offering amount (bil USD)	1,017	1.35	2.20	0.23	0.60	5.00
Bond level: Secondary market (372 firms, 2,612 bonds)						
Bond return (%)	29,699	-0.05	3.13	-5.33	0.03	5.29
Transaction volume (mil USD)	29,699	52.28	86.10	1.09	23.88	193.71

Table 2. Insurance premiums, natural disasters, and insurers' bond purchases.
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 variable in columns (1) and (2) is the quarterly growth in insurer i 's invested assets (including cash) scaled by lagged total assets, in columns (3) and (4) the par value of insurer i 's corporate bond purchases scaled by lagged total assets, and in columns (5) and (6) the par value of insurer i 's 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 column (6) exposure to disaster fatalities. Column (6) only includes life insurers. The regressions distinguish between increases and decreases in premiums and disaster fatalities X , 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.

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline					Life
	$\frac{\Delta \text{Investments}}{\text{Total assets}_{t-1}}$		$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$		$\frac{\text{Bond purchases (Sec)}}{\text{Total assets}_{t-1}}$	
Sample:						
Dependent variable:						
$\frac{\Delta \text{Premiums}}{\text{Total assets}_{t-1}}$	0.25***					
$\frac{\Delta \text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$	[10.14]	0.42***	0.06***	0.06***	0.05***	
$\frac{\Delta \text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$		[11.94]	[3.76]	[3.81]	[3.57]	
$\Delta \text{Disaster fatalities}^{>0}$		-0.04	0.01	0.01	0.00	
$\Delta \text{Disaster fatalities}^{<0}$		[-1.10]	[0.44]	[0.33]	[0.33]	0.07***
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.	45,203	45,203	45,203	45,203	45,203	15,994
No. of insurers	1,455	1,455	1,455	1,455	1,455	505
Standardized coefficients						
$\frac{\Delta \text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$		0.23	0.07	0.07	0.07	
$\frac{\Delta \text{Disasters}^{>0}}{\text{Total assets}_{t-1}}$						0.05
p-value for H0: Same coefficient on decreases and increases		0.00	0.07	0.05	0.06	0.04

Table 3. Persistence of insurers' portfolio allocation.

Each column presents OLS estimates from a specification of the form:

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

at the insurer-by-firm-by-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 allocation of bond purchases 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 both scaled by insurers' lagged total assets. 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5)
	1{Purchase}		$\frac{\text{Bond purchases (sec)}}{10^{-6} \cdot \text{Total assets}_{t-1}}$		
$\mathbb{I}(\text{Investor})$	0.03*** [17.85]	0.03*** [17.77]	7.66*** [8.45]	7.91*** [8.76]	7.17*** [8.40]
$\frac{\Delta \text{Premiums}^{>0}}{10^{-3} \cdot \text{Total assets}_{t-1}}$			0.00 [0.73]		
$\mathbb{I}(\text{Investor}) \times \frac{\Delta \text{Premiums}^{>0}}{10^{-3} \cdot \text{Total assets}_{t-1}}$			0.28*** [4.41]	0.28*** [4.35]	0.29*** [4.49]
Firm FE		Y	Y	Y	
Firm-Time FE	Y				Y
Insurer-Time FE	Y	Y		Y	Y
Insurer FE			Y		
No. of obs.	22,550,017	22,550,017	22,550,017	22,550,017	22,550,017
No. of firms	871	871	871	871	871
No. of insurers	1,474	1,474	1,474	1,474	1,474
Relative effect of $\mathbb{I}(\text{Investor})$	13.73	13.68	2.61	2.70	2.45
Relative effect of $\mathbb{I}(\text{Investor}) \times sd\left(\frac{\Delta \text{Premiums}^{>0}}{10^{-3} \cdot \text{Total assets}_{t-1}}\right)$			2.32	2.32	2.38
$\mathbb{E}[1\{\text{Purchase}\} \mathbb{I}(\text{Investor}) = 0] = 0.002$, $\mathbb{E}[\frac{\text{Bond purchases (sec)}}{10^{-6} \cdot \text{Total assets}_{t-1}} \mathbb{I}(\text{Investor}) = 0] = 2.93$					

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

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

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

at the firm-quarter level. The sample includes all firm-quarter observations with issuance activity and positive bond purchases by insurance companies. The dependent variable is the average offering yield spread (in %) of firm f at time t defined by the difference between the offering yield and the nearest-maturity treasury bond (using the average weighted by offering amount in case of multiple issues within the same firm-quarter). The main explanatory variable is the logarithm of insurers' purchases of firm f 's bonds, $\log(\text{Bond purchases}_{f,t})$. It is instrumented by log-transformed potential investors' premiums, $\Delta \widetilde{\text{INVPremiums}}_{f,t} = \log(1 + \Delta \text{INVPremiums}_{f,t}^{>0} \times \text{Bond debt}_{f,t-1})$, or disaster exposure, $\Delta \widetilde{\text{INVDisasters}}_{f,t} = \log(1 + \Delta \text{INVDisasters}_{f,t}^{>0} \times \text{Bond debt}_{f,t-1})$. $C_{f,t}$ is a vector of control variables and fixed effects, which includes the lagged share of firm f 's bonds held by insurers and the logarithm of bonds' time to maturity in each column. Maturity dummies are based on the remaining time to maturity in bins (0,5], (5,10], (10,15], (15,∞). Rating dummies identify the credit rating categories AAA-AA, A, BBB, BB, B, CCC, and unrated. Broad industry dummies are at the 1-digit SIC level. The definitions of other control variables and fixed effects are 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)
Dependent variable:			Yield spread		
$\log(\text{Bond purchases})$	-0.39*** [-2.91]	-0.42*** [-2.72]	-0.49*** [-3.14]	-0.44** [-2.18]	-0.42*** [-2.79]
$\log(1 + \text{Prim purchases})$				0.05 [1.14]	
$\log(\text{Time to Maturity})$	Y	Y	Y	Y	Y
Insurer controls		Y	Y		
Firm controls			Y		
Maturity-Time FE	Y	Y	Y	Y	Y
Rating-Year FE	Y	Y	Y	Y	Y
Broad industry-Year FE			Y	Y	
First stage					
$\Delta \widetilde{\text{INVPremiums}}$	0.116*** [5.21]	0.098*** [4.93]	0.109*** [4.96]	0.080*** [4.46]	
$\Delta \widetilde{\text{INVDisasters}}$					0.151*** [4.94]
F Statistic	34.4	25.4	29.0	22.7	45.6
No. of obs.	1,017	1,017	1,017	1,017	1,008
No. of firms	399	399	399	399	395
Effect of purchasing 1% of outstanding bonds	-0.10	-0.11	-0.12	-0.11	-0.10

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

Panel A 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 potential investors' premiums, $\Delta\text{INVPremiums}^{>0}$, or disaster exposure, $\Delta\text{INVDisasters}^{>0}$. Each column controls for the lagged share of the firm's bonds held by insurers. 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, lagged return on equity, and lagged 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 the firm's 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' customers' locations.

Panel B 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 positive commercial paper debt in at least one quarter in columns (1) to (3), and 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 (A) firm and region-by-time or (B) firm and debt type-by-time levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:						
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	5.53***	6.03***	5.99***	6.82***	5.64***	7.49**
	[3.49]	[3.95]	[3.96]	[2.76]	[4.93]	[2.32]
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$					-1.99	-4.74
					[-1.02]	[-0.93]
Firm controls		Y	Y	Y	Y	Y
Insurer controls		Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y
Insurer characteristics-Time FE			Y	Y	Y	Y
Insurer economy-Time FE			Y	Y	Y	Y
First stage						
$\Delta\text{INVPremiums}^{>0}$	0.024***	0.025***	0.024***		0.031***	
	[5.45]	[5.56]	[5.76]		[7.97]	
$\Delta\text{INVDisasters}^{>0}$				0.004***		0.003***
				[3.38]		[3.53]
F Statistic	96.8	102.4	89.8	36.2	555.5	81.7
No. of obs.	15,765	15,765	15,765	15,455	15,765	15,455
No. of firms	871	871	871	857	871	857
Effect of 1sd change in $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.14	0.15	0.15	0.17	0.14	0.19

Panel B	(1)	(2)	(3)	(4)	(5)
Dependent variable:			$\frac{\Delta \text{Debt}}{\text{Bond debt}_{t-1}}$		
Sample:	CP issuers		Frequent CP issuers		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times 1\{\text{Bond}\}$	6.93***	7.17***	10.21***	7.09***	10.64***
	[3.41]	[3.31]	[4.02]	[3.46]	[3.16]
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					
$\Delta \text{INVPremiums}^{>0} \times 1\{\text{Bond}\}$	0.049***	0.049***		0.058***	
	[3.92]	[3.37]		[3.22]	
$\Delta \text{INVDistasters}^{>0} \times 1\{\text{Bond}\}$			0.011***		0.010***
			[3.68]		[3.06]
F Statistic	37.9	37.9	86.3	37.0	49.9
No. of obs.	4,664	4,664	4,662	3,312	3,310
No. of firms	157	157	157	112	112

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

Columns (1) to (4) present estimated coefficients from regressions of the growth in the stock of a firm's bond debt on insurers' corporate bond purchases scaled by lagged bond debt, which are instrumented by $\Delta \text{INVPremiums}^{>0}$. The coefficient varies in the cross-section of firms, which is split into terciles by either Hadlock and Pierce (2010)'s SA index for financial constraints, lagged total assets, lagged cash flow scaled by total assets, or credit rating (AAA-A, BBB, or high yield (HY)). Columns (5) to (8) report the corresponding first-stage coefficients. Controls are as in column (3) of Panel (A) in Table 5 and additionally include tercile (or rating) dummies. 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				First Stage			
	Coefficient on $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$				Coefficient on $\Delta \text{INVPremiums}^{>0}$			
Cross-section by	SA index	Size	Cash flow	Rating	SA index	Size	Cash flow	Rating
Terc1 / HY	6.95***	-9.16	5.72*	7.28**	0.03***	0.00	0.02*	0.02**
	[3.14]	[-0.60]	[1.84]	[2.37]	[4.43]	[0.31]	[1.93]	[2.47]
Terc2 / BBB	3.92**	8.35***	5.92*	3.32**	0.02***	0.03***	0.02***	0.04***
	[2.06]	[3.81]	[1.95]	[2.55]	[3.37]	[5.09]	[2.79]	[5.19]
Terc3 / AAA-A	8.17***	6.42***	7.33**	13.10***	0.02***	0.06***	0.02***	0.01**
	[2.91]	[5.08]	[2.31]	[2.64]	[2.63]	[6.19]	[3.04]	[2.37]
p-value for H0: Same coefficient on								
Terc1/HY & Terc2/BBB	0.24	0.26	0.96	0.25	0.20	0.00	0.94	0.08
Terc1/HY & Terc3/AAA-A	0.70	0.31	0.69	0.23	0.11	0.00	0.95	0.54
Terc2/BBB & Terc3/AAA-A	0.17	0.38	0.73	0.05	0.68	0.00	0.99	0.01

Table 7. Corporate bond debt and insurers' bond demand: The underwriter channel.

Each column presents estimated coefficients from regressions of the growth in the stock of a firm's bond debt on insurers' corporate bond purchases scaled by lagged bond debt, which are instrumented by $\Delta \text{INVPremiums}^{>0}$. $\text{UW}_{f,t}$ indicates whether firm f 's underwriters are well connected with potential investors. $\text{UW:Quint } x$ indicates whether the connectedness between underwriters and potential investors is in the x -th quintile. Dispersed INV indicates whether the Herfindahl–Hirschman index of insurers' lagged holdings of a firm's bonds is in the lower tercile of the cross-sectional distribution. Many INV indicates whether a firm's number of potential investors is in the upper tercile of the cross-sectional distribution. Other variables and fixed effects are defined as in Table 5. 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
	$\frac{\Delta \text{Bond debt}}{\text{Bond debt}_{t-1}}$					
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	1.56	1.13	1.02		3.63*	3.94*
	[0.95]	[0.61]	[0.54]		[1.73]	[1.68]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW}$	5.88***	6.11***	6.30***		3.78	2.72
	[3.01]	[3.26]	[3.33]		[1.33]	[0.95]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW:Quint1}$				1.24		
				[0.62]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW:Quint2}$				9.39***		
				[2.91]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW:Quint3}$				9.40***		
				[3.08]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW:Quint4}$				5.16**		
				[2.24]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW:Quint5}$				8.77**		
				[2.35]		
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW} \times \text{Dispersed INV}$					7.43*	
					[1.70]	
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{UW} \times \text{Many INV}$						10.70***
						[2.79]
Omitted interactions					Y	Y
Firm & insurer controls		Y	Y	Y	Y	Y
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y
Industry-Time FE	Y	Y	Y	Y	Y	Y
Insurer characteristics-Time FE			Y	Y	Y	Y
UW FE	Y	Y				
UW-Time FE			Y			
UW quintile-Time FE				Y		
UW-Dispersed INV-Time FE					Y	
UW-Many INV-Time FE						Y
First stage						
$\Delta \text{INVPremiums}^{>0}$	0.066***	0.058***	0.055***	0.080***	0.054**	0.048**
	[2.61]	[3.03]	[3.01]	[3.65]	[2.47]	[2.31]
F Statistic	31.6	34.1	32.4	10.8	15.3	14.3
No. of obs.	4,824	4,824	4,824	4,824	4,824	4,824
No. of firms	489	489	489	489	489	489

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 potential investors' premiums, $\Delta INV Premiums^{>0}$, or disaster exposure, $\Delta INV Disasters^{>0}$. $C_{f,t}$ is a vector of control variables and fixed effects. It includes the lagged share of the firm's bonds held by insurers in each column. Control variables and fixed effects are defined as in Table 5.

Panel A presents average effects on firms' balance sheets and cash flows. The dependent variable in columns (1) and (2) is the firm's total investment (the sum of acquisition and capital expenditures), in columns (3) and (4) the firm's acquisition expenditures, in columns (5) and (6) the firm's capital expenditures, in column (7) the quarterly change in the firm's property, plant and equipment (PPE), in column (8) the quarterly change in the firm's total assets, all scaled by lagged bond debt.

Panel B explores differences between firms with different levels of financial constraints, where SA:Terc1, SA:Terc2, and SA:Terc3 are indicators for the cross-sectional terciles of Hadlock and Pierce (2010)'s SA index. The dependent variable in column (1) is the firm's total investment, in column (2) the firm's acquisition expenditures, in column (3) the firm's capital expenditures, in column (4) the quarterly change in the firm's PPE, in column (5) the quarterly change in the firm's other debt, all scaled by lagged bond debt, and in column (6) the firm's quarterly stock return. The table also reports results from first stage regressions with $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{SA:Terc1}$ as dependent variable.

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:	$\frac{\text{Total investment}}{\text{Bond debt}_{t-1}}$		$\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$		$\frac{\text{CapEx}}{\text{Bond debt}_{t-1}}$		$\frac{\Delta \text{PPE}}{\text{Bond debt}_{t-1}}$	$\frac{\Delta \text{Assets}}{\text{Bond debt}_{t-1}}$
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	5.93*** [3.95]	6.99*** [3.19]	3.25*** [2.68]	2.55* [1.67]	1.31*** [3.87]	2.08** [2.10]	1.88*** [2.94]	4.93* [1.82]
Firm controls	Y		Y		Y		Y	Y
Insurer controls	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	Y
Insurer economy-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
First stage								
$\Delta INV Premiums^{>0}$	0.024*** [5.76]		0.024*** [5.76]		0.024*** [5.76]		0.024*** [5.76]	0.024*** [5.76]
$\Delta INV Disasters^{>0}$		0.004*** [3.38]		0.004*** [3.38]		0.004*** [3.38]		
F Statistic	89.8	36.2	89.8	36.2	89.8	36.2	89.8	89.8
No. of obs.	15,765	15,455	15,765	15,455	15,765	15,455	15,765	15,765
No. of firms	871	857	871	857	871	857	871	871
Standardized coefficient								
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.67	0.80	0.49	0.39	0.31	0.49	0.38	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
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{SA:Terc1}$	4.26*** [2.80]	2.57* [1.94]	1.04*** [2.77]	0.97 [1.35]	-3.93*** [-3.05]	-0.84 [-1.58]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{SA:Terc2}$	5.36** [2.59]	1.93 [1.21]	1.33** [2.48]	2.00** [2.39]	-0.51 [-0.28]	-3.68*** [-3.18]
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}} \times \text{SA:Terc3}$	11.34** [2.52]	7.95** [2.27]	1.86** [2.35]	3.85** [2.33]	-1.57 [-0.86]	-1.14 [-0.69]
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
Industry-Time FE	Y	Y	Y	Y	Y	Y
Region-Time FE	Y	Y	Y	Y	Y	Y
Insurer characteristics- Time FE	Y	Y	Y	Y	Y	Y
Insurer economy-Time FE	Y	Y	Y	Y	Y	Y
SA index tercile	Y	Y	Y	Y	Y	Y
First stage						
$\Delta\text{INVPremiums}^{>0} \times \text{SA:Terc1}$	0.034*** [4.66]	0.034*** [4.66]	0.034*** [4.66]	0.034*** [4.66]	0.048*** [3.69]	0.034*** [4.66]
F Statistic	21.9	21.9	21.9	21.9	11.4	21.9
No. of obs.	15,765	15,765	15,765	15,765	4,895	15,765
No. of firms	871	871	871	871	356	871
p-value for H0: Same coefficient for Terc1 and Terc3	0.13	0.14	0.32	0.08	0.29	0.86
p-value for H0: Same coefficient for Terc2 and Terc3	0.20	0.10	0.58	0.30	0.68	0.18

Internet Appendix for
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Evidence from Insurance Markets*

Christian Kubitza*

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*European Central Bank. E-mail: christian.kubitza@ecb.europa.eu. The views expressed in this paper are the author's and do not necessarily reflect those of the European Central Bank or the Eurosystem.

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	
Bonds held	Par value of corporate bonds (<i>Source: NAIC</i>)
Bond purchases	Par value of corporate bond purchases (<i>Source: NAIC</i>)
Premiums	Direct noncommercial insurance premiums (<i>Source: NAIC</i>)
Δ Investments/Total assets _{<i>t</i>-1}	Quarterly change in the book value of total invested assets (including cash) scaled by lagged total assets (<i>Source: NAIC</i>)
Size	Natural logarithm of total assets (<i>Source: NAIC</i>)
Return on equity	Annualized income after taxes as a percentage of insurer's capital and surplus (<i>Source: NAIC</i>)
Investment yield	Annualized investment return based on invested assets (<i>Source: NAIC</i>)
# Firms held	Number of issuers (identified by 6-digit CUSIP) in an insurer's corporate bond portfolio (<i>Source: NAIC</i>)
P&C insurance profitability	Ratio of the difference between net premiums earned and losses and loss adjustment costs to total liabilities (<i>Source: NAIC</i>)
Life insurance profitability	Ratio of net income to direct insurance premiums written (<i>Source: NAIC</i>)
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 (<i>Source: NAIC</i>)
Rating	Insurer's financial strength credit rating, numeric from 1 to 15 (<i>Source: AM Best</i>)
Insurer-by-firm level	
I(Investor)	Indicator variable for whether in the previous 8 quarters the insurer ever held bonds issued by the firm (<i>Source: NAIC</i>)
1{Purchase}	Indicator variable for whether in the current quarter the insurer has purchased bonds issued by the firm (<i>Source: NAIC</i>)
Bond purchases	Par value of corporate bonds purchased in the current quarter by the insurer issued by the firm (<i>Source: NAIC</i>)
Firm level	
Δ Bond debt/Bond debt _{<i>t</i>-1}	Net bond issuance, measured as the quarterly change in bond debt (the sum of senior and subordinated bonds) scaled by lagged bond debt (<i>Source: Capital IQ</i>)
%Held by insurers _{<i>f,t</i>-1}	Ratio of the lagged total par value of the firm's bonds held by insurers relative to the firm's lagged bond debt (<i>Sources: Capital IQ, NAIC</i>)
Bond purchases/Bond debt _{<i>t</i>-1}	Ratio of the total par value of the firm's bonds purchased by insurers relative to the firm's lagged bond debt (<i>Sources: Capital IQ, NAIC</i>)
Δ INVPremiums ^{>0}	Maximum of zero and Δ INVPremiums defined in Equation (3) (<i>Sources: Capital IQ, NAIC</i>)
Δ INVDisasters ^{>0}	Maximum of zero and Δ INVDisasters defined in Equation (IA.10) (<i>Sources: Capital IQ, NAIC, SHELDUS</i>)

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Table IA.1 – *Continued from previous page*

Variable	Definition
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 (<i>Sources: Capital IQ, Compustat</i>)
Acquisitions/Bond debt _{t-1}	The firm's cash outflow used for acquisitions scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
CapEx/Bond debt _{t-1}	The firm's capital expenditures scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
ΔTotal assets/Bond debt _{t-1}	Quarterly change in the firm's total assets scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
ΔPPE/Bond debt _{t-1}	Quarterly change in the firm's net property, plant and equipment scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
%UW	Share of potential investors' bond purchases from the firm's underwriters in the previous 4 quarters, as defined in Section 6.5 (<i>Sources: NAIC, Mergent FISD</i>)
Size	Natural logarithm of the firm's total assets (<i>Source: Compustat</i>)
Asset growth	Quarterly change in the firm's total assets scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
Cash	The firm's cash and short-term investments scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
Cash growth	Quarterly change in the firm's cash and short-term investments scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
Sales	The firm's sales scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
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 (<i>Sources: Capital IQ, Compustat</i>)
Deferred taxes	The firm's deferred income tax expense scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
Tangibility	The firm's net property, plant and equipment scaled by the firm's lagged bond debt (<i>Sources: Capital IQ, Compustat</i>)
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 the firm's book value of assets (<i>Source: Compustat</i>)
Leverage	Ratio of the book value of the firm's total assets to the firm's book value of equity (<i>Source: Compustat</i>)
Age	Number of years that the firm has been in Compustat (<i>Source: Compustat</i>)
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 (<i>Source: CRSP</i>)
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 <i>size</i> is the log of inflation-adjusted (to 2004) book assets and <i>age</i> the number of years that the firm has been in Compustat (<i>Sources: Compustat, FRED</i>)
Z-score	Modified Altman's z-score, defined by Graham and Leary (2011) as $(3.3 \times \text{operating income} + \text{sales} + 1.4 \times \text{retained earnings} + 1.2 \times (\text{current assets} - \text{current liabilities}))/\text{book assets}$ (<i>Source: Compustat</i>)
Dividend payer	Indicator variable that equals one if the firm ever paid positive dividends in the past four quarters (<i>Source: Compustat</i>)

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Table IA.1 – *Continued from previous page*

Variable	Definition
Earnings volatility	Standard deviation of the trailing 12 quarters of the ratio of the firm’s cash flow to lagged total assets (<i>Source: Compustat</i>)
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 (<i>Source: Mergent FISD</i>)
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. (<i>Source: NAIC</i>)
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 (<i>Sources: BEA Table SAEXP1, U.S. Census, NAIC</i>)
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 (<i>Sources: BEA Table CAEMP25N, U.S. Census, NAIC</i>)

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Table IA.1 – *Continued from previous page*

Variable	Definition
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 (<i>Sources: https://dataforgood.fb.com/, NAIC</i>)
Issuance level: Primary market	
Yield spread	Average difference between offering yield and the contemporaneous yield on its nearest-maturity treasury bond across all bond issues for the same firm–quarter weighted by offering amount (<i>Source: Mergent FISD, FRED</i>)
Offering amount	Total offering amount at the firm-by-quarter level (<i>Source: Mergent FISD</i>)
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 (<i>Source: Mergent FISD</i>)
Maturity	Based on dummies for the time to maturity at issuance according to the following bins: (0,5], (5,10], (10,15], (15,∞) (<i>Source: Mergent FISD</i>)
Bond level: Secondary market	
Bond return	Relative change in end-of-quarter prices and accrued interest plus coupon payments, $(\Delta\text{Price}_t + \Delta\text{Accrued Interest}_t + \text{Coupon payments}_t) / (\text{Price}_{t-1} + \text{Accrued Interest}_{t-1})$ (<i>Source: TRACE, Mergent FISD</i>)
Transaction volume	Total par value of bond transactions in the current quarter (<i>Source: TRACE</i>)
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 (<i>Source: Mergent FISD</i>)
ΔRating	Change in rating (in notches) between the current and previous quarter (<i>Source: Mergent FISD</i>)
Maturity	Based on dummies for the remaining time to maturity at the transaction date according to the following bins: (0,5], (5,10], (10,15], (15,∞). (<i>Source: Mergent FISD</i>)

A.1 Insurance premiums

Schedule T of U.S. insurers’ statutory filings reports the total amount of direct premiums written (excluding reinsurance ceded or assumed) for each U.S. insurer and quarter separately for each U.S. state and territory and Canada. To detect reporting errors, I compare 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 (since it is not available at the insurer-state-quarter level). I define the share of noncommercial life insurance as the sum of direct premiums written covering individual life insurance (which provides financial benefits to a beneficiary upon the death of the insured), individual annuities (which guarantee a stream of annuity payments), individual accident and health contracts, and deposit-type contracts (which do not expose the insurer to any mortality or morbidity risk) relative to all premiums.² These are reported on Exhibit 1 of life insurers' statutory filings. The measure excludes contracts that cover a group of individuals (e.g., the employees of a company or members of an organization), namely, group life insurance, group annuities, 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

¹The 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*.

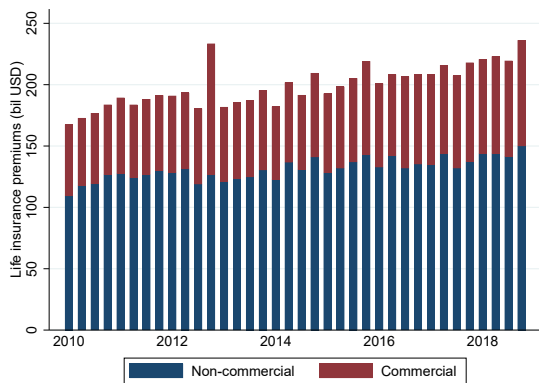
²Robustness analyses exclude premiums for deposit-type contracts because these may be used purely for investment. Definitions of insurers' lines of business come from S&P Global Market Intelligence, https://content.naic.org/consumer_glossary, <https://www.acli.com/industry-facts/glossary>, and the NAIC Statutory Issue Paper No. 50.

insurance contracts.

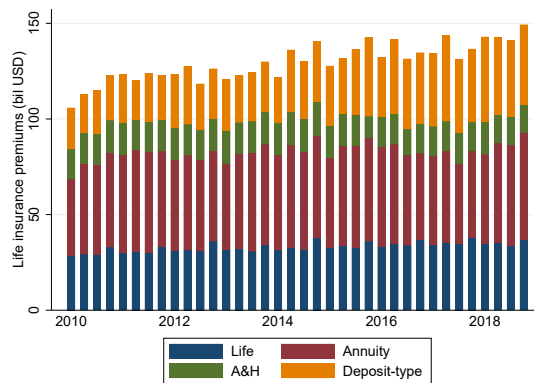
Figures IA.1 and IA.2 illustrate the aggregate dynamics of life and P&C insurance premiums by line of business. Noncommercial insurance is the dominant line of business for both types of insurers. The distribution of noncommercial premiums across more granular lines of business is very stable over time, suggesting no disruptive shifts in the insurance business. Premiums, particularly in P&C insurance, display some seasonality within years, which I account for by including calendar quarter time fixed effects in the main regressions.

Figure IA.1. Life insurance premiums.

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



(a) All U.S. insurers.

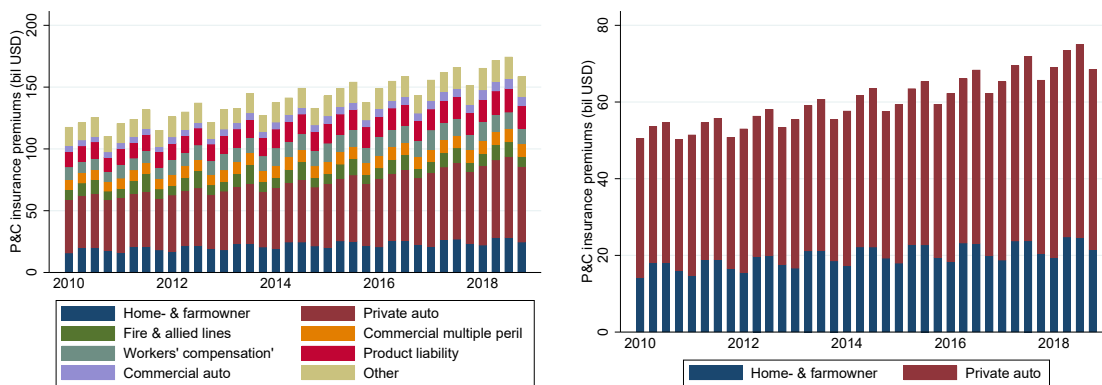


(b) Insurers included in the sample.

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 measure the total noncommercial premiums written by insurer i in quarter t in locations other than firm f 's location by removing all (commercial and

Figure IA.2. P&C insurance premiums.

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



(a) All U.S. insurers.

(b) Insurers included in the sample.

noncommercial) direct premiums written at the firm's location:

$$\text{Premiums}_{i,f,t} = \max \left\{ \sum_s \text{noncommercial}_{i,t} \times \text{DPW}_{i,s,t} - \text{DPW}_{i,\text{location}(f),t}, 0 \right\}, \quad (\text{IA.1})$$

where $\text{DPW}_{i,s,t}$ 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).

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 copy missing *companyids* from observations with the same 6-digit CUSIP. Finally, I match bonds to Mergent FISD and copy missing *companyids* 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.

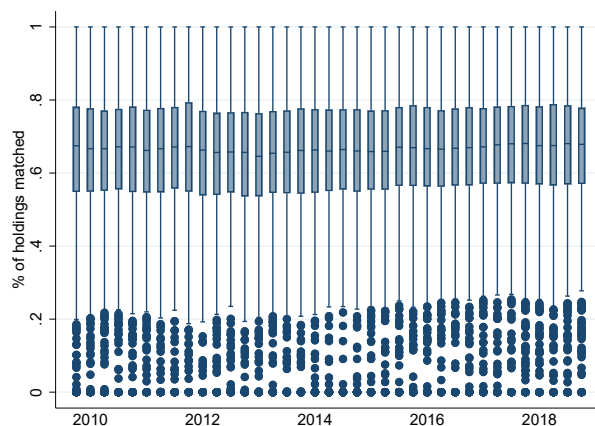
Table IA.2. Matching corporate bond investments to Capital IQ and Compustat.

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 first matched to TRACE by CUSIP, second to Compustat by using the ticker, and third to Capital IQ by using the Capital IQ–Compustat link table. “Matched by: 6-digit CUSIP (Compustat)” indicates observations first matched to Compustat by using the 6-digit CUSIP and second to Capital IQ by using the Capital IQ link table. “Copied from: same issuer ID (Mergent)” indicates observations whose Capital IQ identifier is copied from other observations with the same Mergent FISD issuer ID. “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)	16,125,416 (\$ 68,107 bil)
% matched by: Capital IQ link	86.84% (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)	14,235,883 (\$ 56,540 bil)
Holdings: Compustat match	
% matched (par value)	58.36% (51.56%)
Total matched (par value)	9,410,232 (\$ 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 underwriter 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 93 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 exhibit small price differences between insurer purchases and TRACE transactions after matching to the NAIC transaction for the

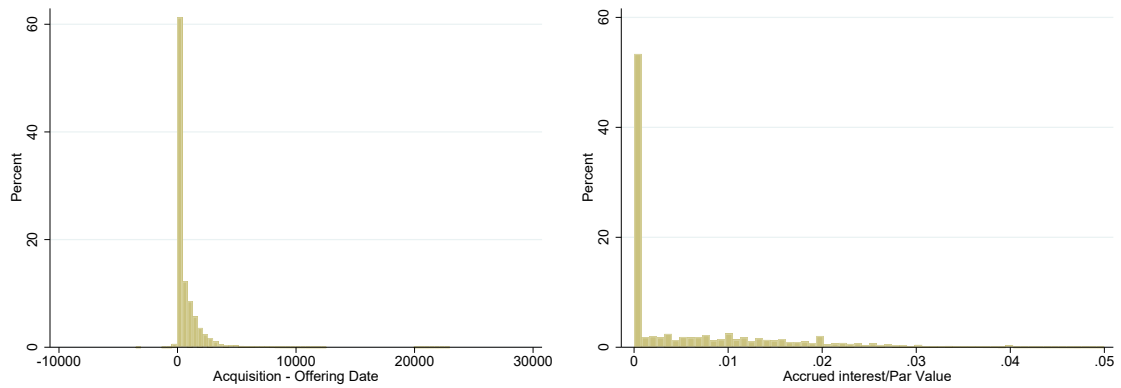
³Previous studies usually rely on a narrower classification. For example, Nikolova et al. (2020) define bond purchases as primary market trades only if they occur on the offering date and are from a bond issue’s underwriter.

same CUSIP on the same or previous day with the smallest price difference.

- 96.9% 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, e.g., because insurers might misreport transaction dates within quarterly filings.

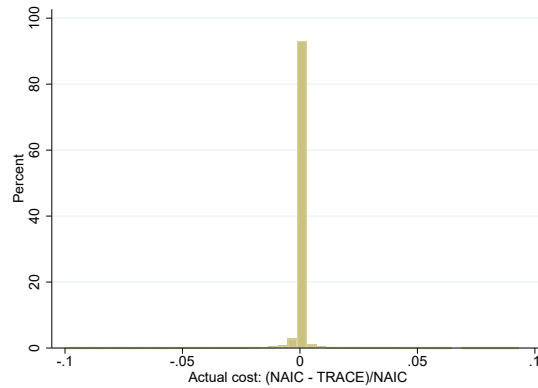
Figure IA.4. Corporate bond purchases and issue characteristics.

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 acquisition and offering date.

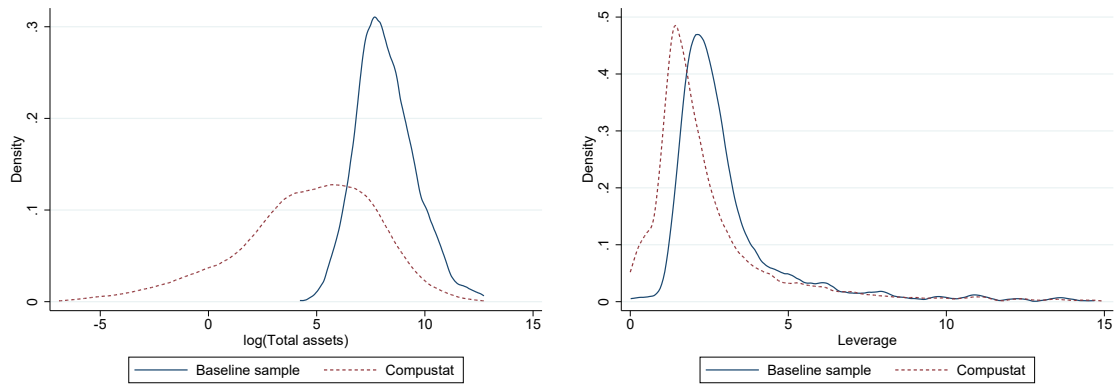
(b) Accrued interest.



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

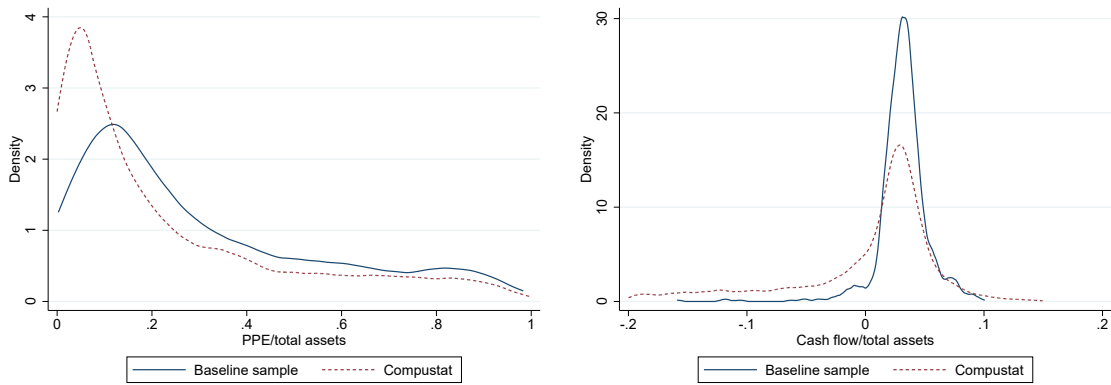
A.5 Comparison with Compustat firms

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 to 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 and to motivate the instrumental variable construction.

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 insured losses $L_{t,j}$ 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

$$\Delta A_t = A_t - A_{t-1} = \int_0^1 P_{t,j} - L_{t,j} dj + R_t, \quad (\text{IA.2})$$

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

$$\Delta A_t = P_t - P_{t-1} + R_t = \Delta P_t + R_t. \quad (\text{IA.3})$$

Therefore, $\frac{\partial \Delta A_t}{\partial \Delta P_t} = 1 + \frac{\partial R_t}{\partial \Delta P_t}$; i.e., premium growth drives asset growth and is potentially compensated by other activities (if $\frac{\partial R_t}{\partial \Delta P_t} < 0$). Consistent with this relationship, the empirical results show that premium increases pass through to insurers' asset growth, i.e., $\Delta A_t \approx \beta \Delta P_t$ if $\Delta P_t > 0$, whereas premium decreases are (temporarily) compensated by raising insurers' financing sources and, thus, R_t , i.e., $\Delta A_t \approx 0$ if $\Delta P_t \leq 0$.

As an implication, an insurer's current insurance premium income is an important determinant

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

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

$$A_t = A_0 + \sum_{\tau=1}^t \Delta A_\tau = P_0 + R_0 + \sum_{\tau=1}^t (\Delta P_\tau + R_\tau) = P_t + \sum_{\tau=0}^t R_\tau. \quad (\text{IA.4})$$

Now, consider the insurance sector's total investment in a firm f 's corporate bonds. I index insurers by i . The insurance sector's holdings of firm f 's bonds is given by

$$\text{held}_{f,t} = \sum_i w_{i,f,t} w_{i,t}^{CB} A_{i,t}, \quad (\text{IA.5})$$

where $w_{i,t}^{CB}$ is the ratio of insurer i 's corporate bond investments relative to its total assets and $w_{i,f,t}$ is the weight of firm f 's bonds in insurer i 's corporate bond portfolio. The insurance sector's total purchases of firm f 's bonds are thus given by the positive value of

$$\text{held}_{f,t} - \text{held}_{f,t-1} = \text{held}_{f,t-1} \frac{\text{held}_{f,t} - \text{held}_{f,t-1}}{\text{held}_{f,t-1}} \quad (\text{IA.6})$$

$$= \text{held}_{f,t-1} \frac{\sum_i (w_{i,f,t} w_{i,t}^{CB} A_{i,t} - w_{i,f,t-1} w_{i,t-1}^{CB} A_{i,t-1})}{\sum_i w_{i,f,t-1} w_{i,t-1}^{CB} A_{i,t-1}}. \quad (\text{IA.7})$$

I consider the hypothetical scenario where all insurers that are the firm's potential investors assign the same portfolio weight to the firm at $t - 1$ and t and all other insurers do not invest in the firm, in which case $w_{i,f,t} w_{i,t}^{CB} \equiv w_f w^{CB} \mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$.⁵ Additionally, following above, I focus on variation in insurers' total investments driven by premiums, hence, approximating $A_{i,t}$ with $P_{i,t}$. Then, the insurance sector's total purchases of firm f 's bonds are approximated by the positive value of

$$\text{held}_{f,t-1} \frac{w_f w^{CB} \Delta \bar{P}_{f,t}}{w_f w^{CB} \bar{P}_{f,t}} \approx \text{held}_{f,t-1} \Delta \log \bar{P}_{f,t}, \quad (\text{IA.8})$$

where $\bar{P}_{f,t}$ are the total insurance premiums collected by a firm's potential investors, as defined

⁵Additionally considering lagged portfolio weights when constructing the instrumental variables yields similar results.

in Equation (2). In the last step, I replace the percentage change in premiums with the log change, which attenuates the impact of large changes in premiums. Hence, $\Delta \log \bar{P}_{f,t}$ represents the premium-driven change in the insurance sector's holdings of firm f 's bonds in the hypothetical scenario where all potential investors assign the same portfolio weight to the firm. The final instrument is scaled by total bonds outstanding, consistent with the scaling of the firm-level dependent variables in the main empirical specifications.

B.2 Insurers' investment preferences

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 binscatter 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.

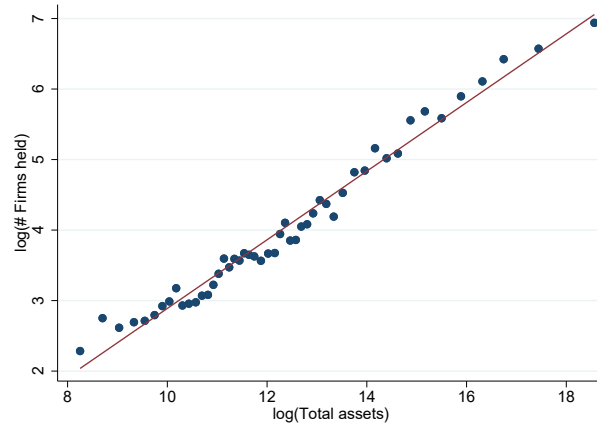
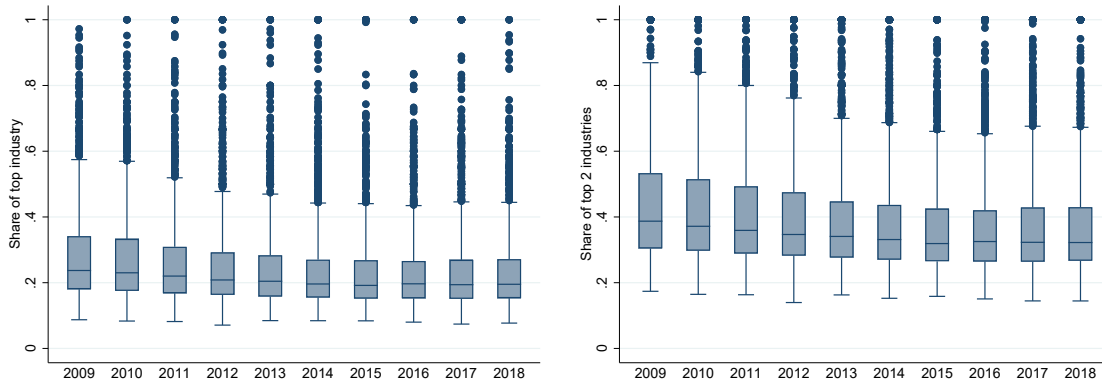


Figure IA.7. Concentration of bond holdings across issuer industries.

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.

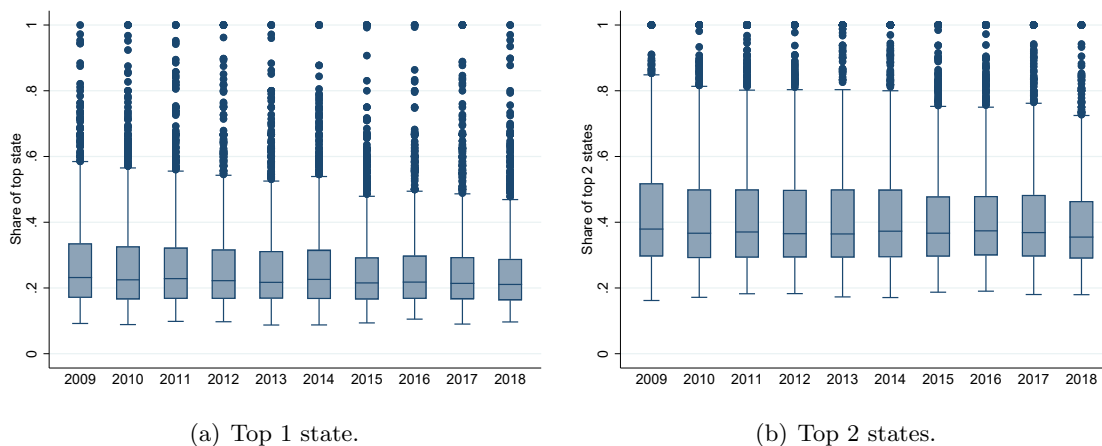


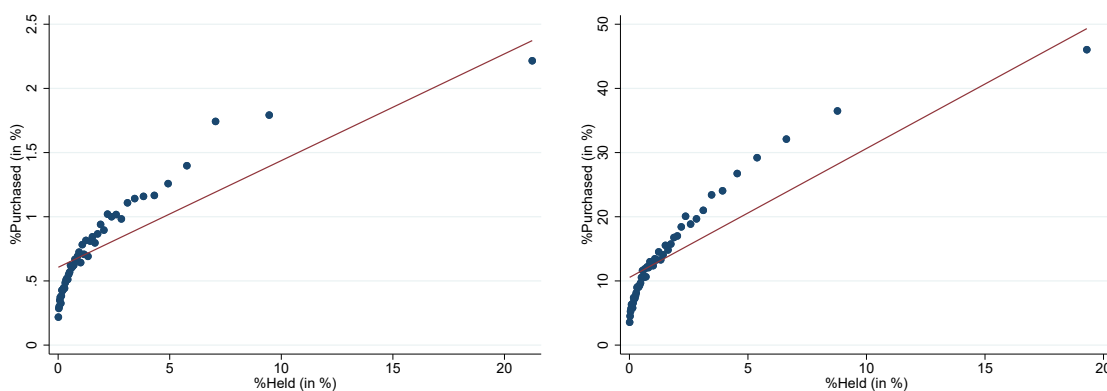
Table IA.4. Persistence of the set of firms invested in.

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	92.9%	92.9%	93.0%	93.1%	93.1%	93.2%	93.2%	93.2%	93.2%	93.2%
2	93.7%	93.8%	93.8%	93.9%	94.0%	94.0%	94.0%	94.1%	94.1%	94.1%
3	92.9%	93.0%	93.1%	93.3%	93.3%	93.4%	93.4%	93.4%	93.5%	93.5%
4	93.1%	93.2%	93.2%	93.4%	93.4%	93.5%	93.5%	93.5%	93.6%	93.6%
5	93.6%	93.6%	93.7%	93.8%	93.9%	93.9%	94.0%	94.0%	94.0%	94.0%
6	93.3%	93.4%	93.5%	93.7%	93.8%	93.8%	93.9%	93.9%	93.9%	94.0%
7	93.7%	93.8%	93.9%	94.1%	94.2%	94.2%	94.3%	94.3%	94.4%	94.4%
8	94.8%	94.9%	95.0%	95.2%	95.3%	95.4%	95.4%	95.5%	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	96.4%	96.5%	96.6%	96.8%	96.8%	96.9%	96.9%	97.0%	97.0%	97.0%

Figure IA.9. Portfolio and purchase shares.

The figures relate the share of a firm’s bonds among an insurer’s total bond purchases, $\%Purchased_{i,f,t} = 100 \times \frac{\text{Bond purchases}_{i,f,t}}{\sum_g \text{Bond purchases}_{i,g,t}}$, to that among total bond holdings, $\%Held_{i,f,t} = 100 \times \sum_{\tau=1}^4 \frac{\text{Bond holdings}_{i,f,t-\tau}}{4 \times \sum_g \text{Bond holdings}_{i,g,t-\tau}}$ averaged across the lagged 4 quarters. The binscatter plots are based on the means in 50 bins of $\%Held_{i,f,t}$, pooled across insurer-by-firm-by-quarter observations with nonzero holdings, $\%Held_{i,f,t} > 0$, and with (a) nonzero total bond purchases, $\sum_g \text{Bond purchases}_{i,g,t} > 0$, and (b) nonzero purchases of the firm’s bonds, $\text{Bond purchases}_{i,f,t} > 0$. Each panel also includes the line of best fit from an OLS regression.



(a) Extensive and intensive margin of purchases.

(b) Intensive margin of purchases.

Table IA.5. 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)	0.24	0.21	0.21	0.12	0.12	0.12
R^2		0.22	0.23	0.74	0.76	0.76
Adj. R^2		0.22	0.23	0.73	0.74	0.75

Table IA.6. 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 mean zero and unit variance. Firm volatility is the idiosyncratic volatility of the firm's equity defined as in Ang et al. (2009) standardized to mean zero 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1{Purchase}						
$\mathbb{I}(\text{Investor}) \times \text{Insurer size: Quint1}$	0.00** [2.36]						
$\mathbb{I}(\text{Investor}) \times \text{Insurer size: Quint2}$	0.01*** [5.33]						
$\mathbb{I}(\text{Investor}) \times \text{Insurer size: Quint3}$	0.01*** [7.22]						
$\mathbb{I}(\text{Investor}) \times \text{Insurer size: Quint4}$	0.02*** [11.29]						
$\mathbb{I}(\text{Investor}) \times \text{Insurer size: Quint5}$	0.04*** [16.86]						
$\mathbb{I}(\text{Investor})$		0.02*** [14.79]	0.03*** [17.75]	0.02*** [16.74]	0.02*** [16.52]	0.02*** [15.14]	0.02*** [13.39]
$\mathbb{I}(\text{Investor}) \times \log(\text{Bond debt})$		0.01*** [7.22]					
$\mathbb{I}(\text{Investor}) \times \text{Firm age}$		-0.01*** [-5.39]					
$\mathbb{I}(\text{Investor}) \times \text{Firm volatility}$		0.01*** [3.84]					
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.	22,556,250	22,556,250	22,556,250	22,556,250	22,556,250	22,556,250	22,556,250
No. of firms	871	871	871	871	871	871	871
No. of insurers	1,474	1,474	1,474	1,474	1,474	1,474	1,474
Relative effect of $\mathbb{I}(\text{Investor})$			13.11	12.07	11.05	11.05	7.49
Difference in α relative to baseline:			-0.05	-0.12	-0.20	-0.20	-0.45

Table IA.7. 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 firm's 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:						
	$\mathbb{I}(\text{Investor})$					
1{Same state}	-0.00 [-1.52]					
1{Same region}		-0.00 [-0.19]				
Social connectedness			-0.00 [-0.30]			
Social connectedness: Terc2				-0.00 [-0.18]		
Social connectedness: Terc3				-0.00 [-0.36]		
%Employed same industry					-0.03 [-0.37]	
%Employed same industry: Terc2						-0.00 [-0.86]
%Employed same industry: Terc3						0.00 [0.33]
Insurer-Time FE	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y
No. of obs.	22,556,626	22,556,626	22,556,626	22,556,626	22,556,626	22,556,626
No. of firms	871	871	871	871	871	871
No. of insurers	1,443	1,443	1,443	1,443	1,443	1,443
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.8. 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. $1\{\text{Life insurer}\}$ is an indicator for life insurers. $1\{\text{Investment grade}\}$ is an indicator for a firm having an investment grade credit rating (BBB- or better). $1\{\text{Unrated}\}$ 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 \times 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:	$\mathbb{I}(\text{Investor})$			
$1\{\text{Life insurer}\} \times \text{Time to maturity}$	0.02*** [7.36]			
$1\{\text{Life insurer}\} \times 1\{\text{Investment grade}\}$		0.11*** [13.29]		
$1\{\text{Life insurer}\} \times 1\{\text{Unrated}\}$			-0.07*** [-10.69]	
Insurer size \times Firm size				0.01*** [21.73]
Insurer-Time FE	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y
No. of obs.	20,764,278	22,556,626	22,556,626	22,553,189
No. of firms	817	871	871	871
No. of insurers	1,443	1,443	1,443	1,443

B.3 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 them 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 premiums written by insurer i in state s , namely,

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

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 Appendix Table IA.9).

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 $_{i,f,t-1}$. Aggregat-

ing across all life insurers that are potential investors yields

$$\bar{D}_{f,t} = \sum_{\text{Life insurers } i} \mathbb{I}(\text{Investor}_{i,f,t-(1:8)}) \times \text{Distant disaster fatalities}_{i,f,t-1}. \quad (\text{IA.9})$$

I use $\bar{D}_{f,t}$ as a substitute for premiums $\bar{P}_{f,t}$ in Equation (3) to define an alternative instrument denoted $\Delta \text{INVDisasters}_{f,t}^{>0}$:

$$\Delta \text{INVDisasters}_{f,t}^{>0} = \max \{ \Delta \log \bar{D}_{f,t} \times \% \text{Held by insurers}_{f,t-1}, 0 \}. \quad (\text{IA.10})$$

Figure IA.10. Geographic variation in natural disasters.

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

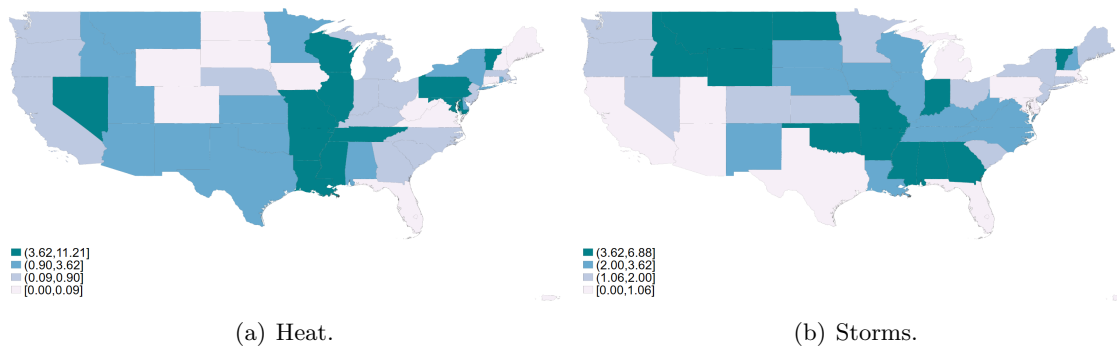


Figure IA.11. Time-series variation in natural disasters.

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%.

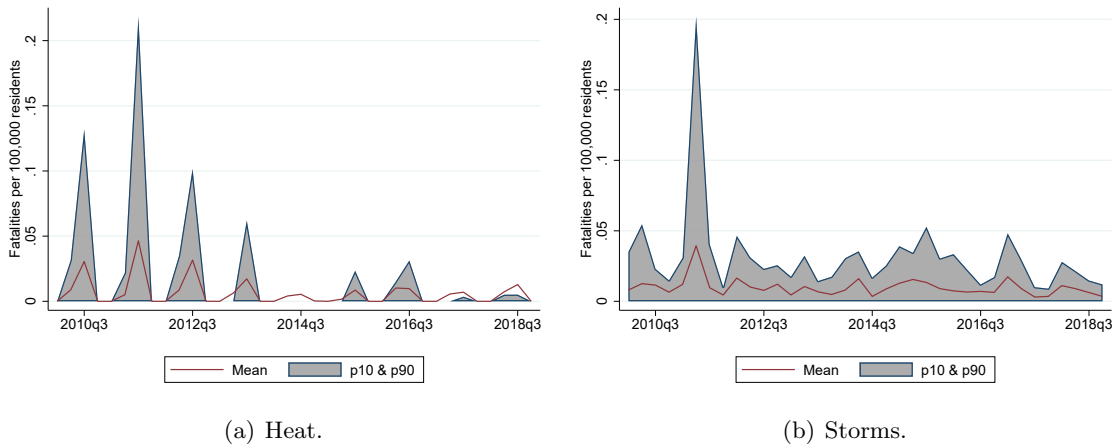


Table IA.9. Natural disasters, insurance premiums, and insurers' balance sheet. Column (1) presents estimated coefficients from specifications of the form:

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

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 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. 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.

Level:	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Insurer-State			Insurer		
	log(Premiums)			log(Benefits)	$\frac{\text{Bond purchases}}{\text{Total assets}_{t-1}}$	
Disaster fatalities	3.61*** [4.35]	1.18*** [3.13]	1.16*** [3.12]	0.11 [0.36]		
Δ Disaster fatalities $^{>0}$					0.07*** [3.11]	0.07*** [2.88]
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	15,923	15,923	15,381	15,923	15,923
No. of insurers	451	505	505	499	505	505

C Additional figures

Figure IA.12. 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.

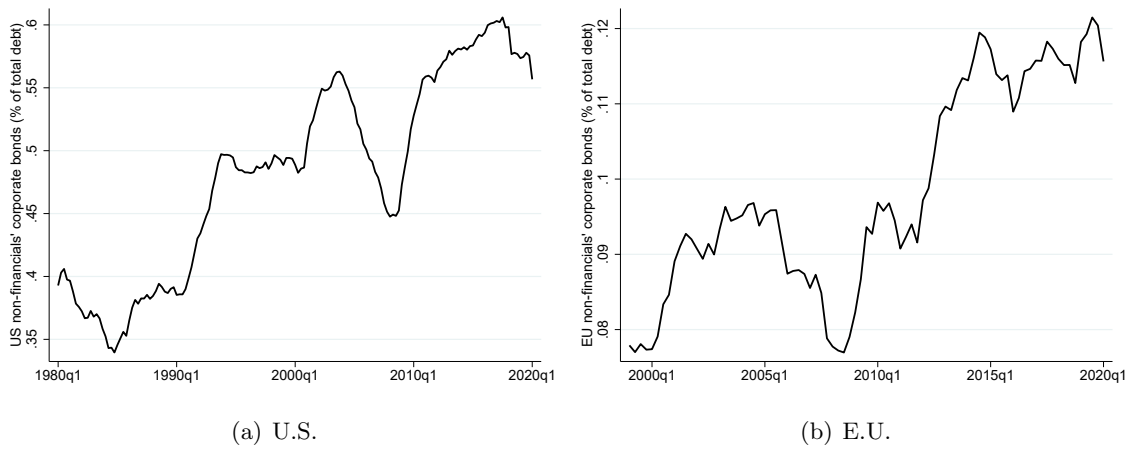
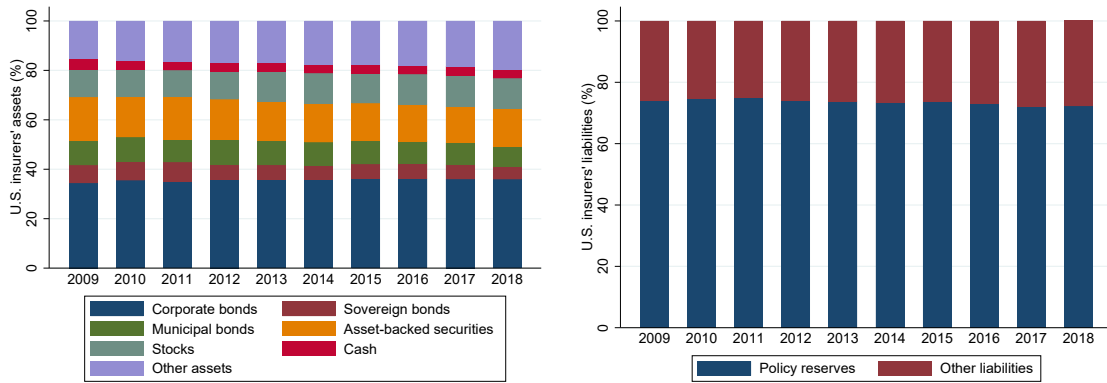


Figure IA.13. Insurers' assets and liabilities.

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.

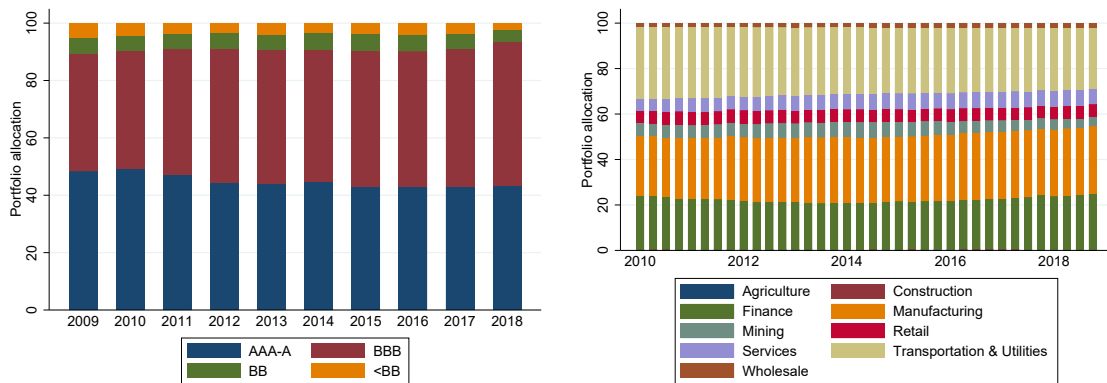


(a) Assets.

(b) Liabilities.

Figure IA.14. Insurers' corporate bond holdings.

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



(a) Credit rating.

(b) Industry.

Figure IA.15. 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.

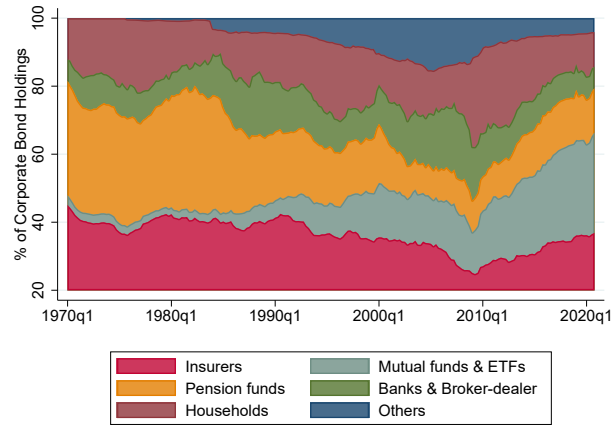
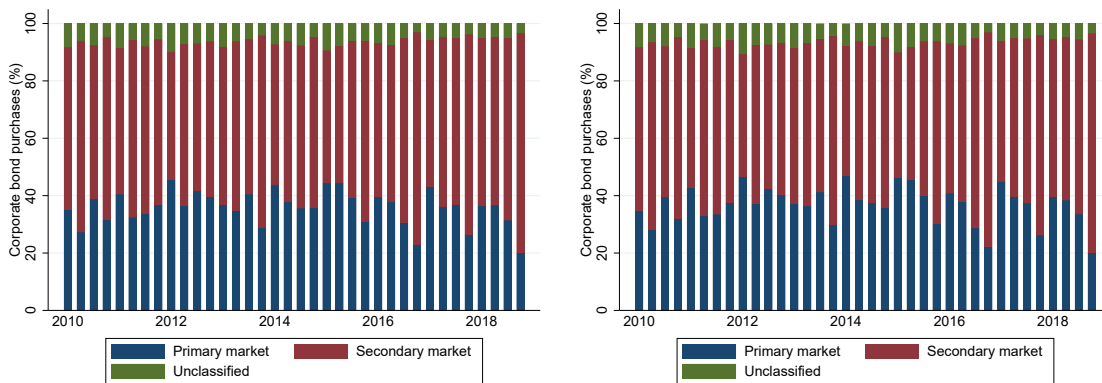


Figure IA.16. Insurers' corporate bond purchases by market.

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.17. 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.

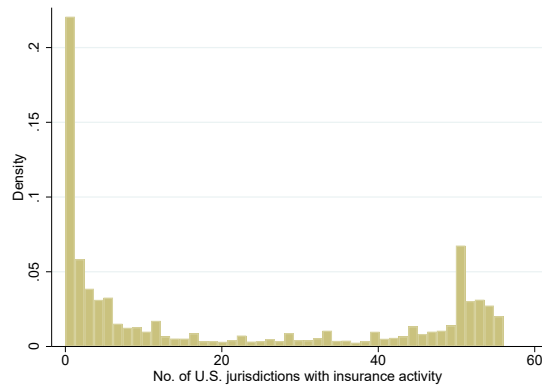
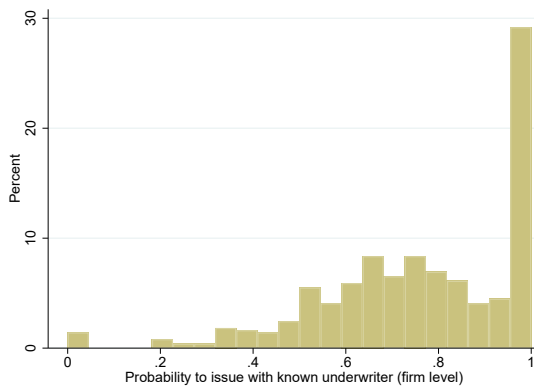
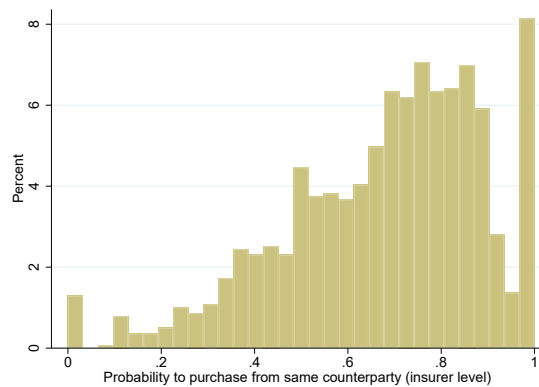


Figure IA.18. Underwriter relationships.

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.10. 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	45,203	0.36	0.48	0.00	0.00	1.00
Δ Investments/Total assets _{t-1} (%)	45,203	0.85	4.55	-5.68	0.68	7.59
Bond purchases (New)/Total assets _{t-1} (%)	32,521	0.78	1.15	0.00	0.39	3.01
Bond purchases (Old)/Total assets _{t-1} (%)	32,521	1.55	2.34	0.00	0.74	5.98
Return on equity	45,203	4.33	20.90	-28.44	4.76	33.24
Investment yield	45,203	3.12	1.57	0.71	2.98	5.71
# Firms held	45,203	160.93	272.04	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	16,181	9.62	32.40	-33.97	4.90	69.15
Life insurance fee income	16,181	1.86	5.04	0.00	0.00	13.15
Issuance level: Primary market						
Time to maturity (yrs)	1,017	10.80	6.22	4.88	10.00	25.02
Duration	1,017	7.60	3.04	4.02	7.00	13.53
Offering price	1,017	99.82	1.25	98.94	99.87	100.00
AA-AAA rating	1,017	0.07	0.25	0.00	0.00	1.00
A rating	1,017	0.22	0.41	0.00	0.00	1.00
BBB rating	1,017	0.37	0.48	0.00	0.00	1.00
High yield	1,017	0.34	0.47	0.00	0.00	1.00
Unrated	1,017	0.00	0.05	0.00	0.00	0.00
Bond level: Secondary market						
Time to maturity (yrs)	29,699	9.32	8.74	1.00	6.12	28.42
AA-AAA rating	29,699	0.10	0.31	0.00	0.00	1.00
A rating	29,699	0.32	0.47	0.00	0.00	1.00
BBB rating	29,699	0.45	0.50	0.00	0.00	1.00
High yield	29,699	0.12	0.33	0.00	0.00	1.00
Unrated	29,699	0.00	0.03	0.00	0.00	0.00
Duration	29,672	6.35	4.50	0.93	5.19	15.59

Table IA.11. 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)	15,765	13.22	30.74	0.73	4.35	49.28
log Total assets _{t-1}	15,765	8.49	1.29	6.59	8.37	10.79
Δ Total assets _{t-1} /Bond debt _{t-1} (%)	15,765	7.82	38.04	-36.69	2.91	67.66
Sales _{t-1} /Bond debt _{t-1} (%)	15,765	148.45	190.87	16.94	85.92	523.85
Cash flow _{t-1} /Bond debt _{t-1} (%)	15,765	20.12	23.52	0.95	14.17	58.67
Δ Cash _{t-1} /Bond debt _{t-1} (%)	15,765	0.36	20.10	-29.85	0.11	30.00
Cash _{t-1} /Bond debt _{t-1} (%)	15,765	63.14	86.30	1.69	30.56	240.65
PPE _{t-1} /Bond debt _{t-1} (%)	15,765	171.49	188.96	12.91	113.83	528.25
Deferred Taxes _{t-1} /Bond debt _{t-1} (%)	15,765	-0.02	3.85	-5.34	0.00	5.22
Market-to-book _{t-1}	15,765	1.80	0.94	0.92	1.52	3.81
Leverage _{t-1}	15,765	3.69	4.28	1.57	2.53	8.91
Age (yrs)	15,765	29.80	14.98	7.25	27.50	53.50
Stock return (%)	15,765	16.27	38.81	-42.69	13.65	83.18
SA index	15,765	-4.12	0.43	-4.63	-4.17	-3.35
Z-score	15,765	0.81	0.69	-0.34	0.85	1.83
Dividend payer	15,765	0.61	0.49	0.00	1.00	1.00
Earnings volatility	15,765	0.49	0.01	0.48	0.49	0.51
Commercial paper/Total debt (%)	2,635	8.23	10.79	0.00	3.79	30.54
Δ Commercial paper/Bond debt _{t-1} (%)	2,439	0.24	10.80	-16.04	0.00	16.71
Firm level: Insurer characteristics						
Growth in potential investors' premiums ($100 \times \Delta \log \bar{P}$)	15,765	3.08	16.65	-15.03	1.46	26.05
Growth in potential investors' disaster exposure ($100 \times \Delta \log \bar{D}$)	15,487	-0.58	115.11	-240.41	25.26	134.25
# Investors	15,765	68.52	94.55	1.00	30.00	269.00
%Life insurers (%)	15,765	69.53	19.48	33.33	71.05	100.00
Insurers' $\Delta \log$ total assets _{t-1} (%)	15,765	-0.82	18.19	-23.36	0.81	17.80
Insurers' return on equity _{t-1} (%)	15,765	8.21	5.14	0.18	8.05	16.76
Insurers' investment yield _{t-1}	15,765	4.27	0.71	3.11	4.27	5.34
Insurers' P&C profitability (%)	15,765	4.67	2.04	0.00	5.01	7.48
Insurers' life profitability (%)	15,765	11.62	11.68	-2.48	9.14	33.26
Insurers' life fee income (%)	15,765	3.27	2.21	0.03	3.11	7.18
Insurers' rating	15,765	2.76	0.52	1.80	2.83	3.46
Insurers' log # firms held	15,765	6.12	0.54	5.16	6.17	6.99

D.2 Insurance premiums

Table IA.12. Insurance premiums and insurers' bond purchases: Additional evidence. Each column presents estimated coefficients from a specification of the form:

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

at the insurer-by-quarter level, where $C_{i,t}$ is a vector of control variables and fixed effects. The dependent variable in column (1) is the par value of insurer i 's corporate bond purchases of old bonds, defined as those issued at least 6 days before purchase, in column (2) of new bonds, defined as those issued less than 6 days before purchases, in column (3) of all bonds net of sales, in column (4) the quarterly change in net reinsurance premiums paid to reinsurers (i.e., reinsurance business ceded less of that assumed), in column (5) the quarterly change in insurance policy reserves, in column (6) the quarterly net equity issuance, measured as the change in insurers' capital and surplus due to changes in issued stock, surplus notes, and reinsurance, all scaled by lagged total assets. The main explanatory variable is the quarterly change in insurer i 's noncommercial insurance premiums scaled by lagged total assets, distinguishing between increases and decreases in premiums. Other variables 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.

Dep. variable:	(1) $\frac{\text{Bond purchases (Old)}}{\text{Total assets}_{t-1}}$	(2) $\frac{\text{Bond purchases (New)}}{\text{Total assets}_{t-1}}$	(3) $\frac{\text{Net purchases}}{\text{Total assets}_{t-1}}$	(4) $\frac{\Delta \text{Reinsurance}}{\text{Total assets}_{t-1}}$	(5) $\frac{\Delta \text{Reserves}}{\text{Total assets}_{t-1}}$	(6) $\frac{\text{Equity issuance}}{\text{Total assets}_{t-1}}$
$\frac{\Delta \text{Premiums}^{>0}}{\text{Total assets}_{t-1}}$	0.11***	0.03***	0.04***	0.67***	0.13***	0.03***
	[5.13]	[3.47]	[3.27]	[11.49]	[9.52]	[4.47]
$\frac{\Delta \text{Premiums}^{<0}}{\text{Total assets}_{t-1}}$	0.00	-0.00	-0.02	0.78***	-0.01	-0.01**
	[0.02]	[-0.43]	[-1.21]	[12.61]	[-1.05]	[-2.21]
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.	32,115	32,115	45,203	45,203	45,203	45,203
No. of insurers	1,370	1,370	1,455	1,455	1,455	1,455
p-value for H0: same coefficient on decreases and increases	0.00	0.03	0.01	0.09	0.00	0.00

E Robustness

Table IA.13. Secondary market prices and insurers' bond demand: Robustness.

This table presents estimated coefficients from a specification of the form:

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

at the bond-by-quarter level, where f is the issuer of bond b . The dependent variable 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 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 the lagged share of firm f 's bonds held by insurers in each column. Maturity dummies are based on the remaining time to maturity in bins (0,5], (5,10], (10,15], (15,∞). 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 . The definitions of other control variables and fixed effects are as in Table 5. The *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)
	Bond return (in %)		
Dependent variable:			
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	52.23***	56.16***	53.90***
	[2.92]	[2.81]	[3.23]
Insurer controls		Y	Y
Firm controls			Y
Bond FE	Y	Y	Y
Rating-Maturity-Time FE	Y	Y	Y
ΔRating FE	Y	Y	Y
Industry-Time FE			Y
First stage			
$\Delta \text{INVPremiums}^{>0}$	0.029***	0.027***	0.028***
	[3.8]	[3.62]	[4.67]
F Statistic	192.9	169.7	184.6
No. of obs.	28,963	28,963	28,951
No. of bonds	2,612	2,612	2,612
No. of firms	372	372	372
Effect of 1sd change in $\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	1.13	1.21	1.16
Yield impact of purchasing 1% of outstanding bonds	0.10	0.11	0.10

Table IA.14. 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) to (7) is the total volume of insurers' purchases of firm f 's bonds in quarter t scaled by lagged bond debt, and in (8) it is the total volume of insurers' net purchases of firm f 's bonds in quarter t scaled by lagged bond debt. Bond purchases are instrumented by potential investors' premiums, $\Delta\text{INVPremiums}_{t-1}^{>0}$, excluding premiums from the firm's headquarters state and additionally (column 5) deposit-type life insurance, (column 6) states neighboring the firm's headquarters, and (column 7) customer and supplier states. In column (4), the definition of potential investors is based on the previous 10 quarters. Additional firm characteristics are earnings volatility, z-score, and lagged size, asset growth, stock return, SA index, deferred taxes, tangibility, and an indicator 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 current value and 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 firm's potential investors' investment yield. Insurer profitability bins are based on the quartiles of the first three principal components of the current value and 4 lags of the firm's potential investors' insurance profitability. 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. The definitions of other control variables and fixed effects are as in Table 5. 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	6.47***	8.21***	7.34***	7.50***	6.91***	6.08***	6.81***	
	[3.08]	[3.57]	[4.44]	[3.83]	[4.85]	[3.81]	[3.72]	
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$								6.99***
								[3.87]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y
Additional controls	Y							
Insurance supply controls			Y					
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer characteristics-Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE	Y							
Insurer economy-Time FE	Y							
SIC1-State-Time FE		Y						
Insurer inv yield-Time FE			Y					
Insurer profitability-Time FE			Y					
First stage								
$\Delta\text{INVPremiums}_{t-1}^{>0}$	0.018***	0.018***	0.023***					0.022***
	[4.1]	[3.5]	[5.4]					[4.7]
$\Delta\text{INVPremiums}_{t-1:10}^{>0}$				0.022***				
				[4.7]				
$\Delta\text{INVPremiums}_{\text{ex dep-type}}^{>0}$					0.025***			
					[6]			
$\Delta\text{INVPremiums}_{\text{ex neighbors}}^{>0}$						0.022***		
						[5]		
$\Delta\text{INVPremiums}_{\text{ex cust/sup}}^{>0}$							0.020***	
							[4.6]	
F Statistic	43.9	44.5	66.5	67.4	99.1	79.4	65.3	73.0
No. of obs.	15,755	13,623	15,574	15,756	15,752	15,726	15,747	15,756
No. of firms	871	783	869	871	870	871	871	871

Table IA.15. 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 (3) in Table 8. The main explanatory variable in columns (1) to (8) is the total volume of insurers' purchases of firm f 's bonds in quarter t scaled by lagged bond debt, and in (9) it is the total volume of insurers' net purchases of firm f 's bonds in quarter t scaled by lagged bond debt. Instruments, control variables, and fixed effects are defined as in Table IA.14. 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	<u>Total Investment</u> <u>Bond debt_{t-1}</u>								
<u>Bond purchases</u> <u>Bond debt_{t-1}</u>	4.82***	6.72***	7.39***	6.50***	6.47***	6.47***	6.47***	6.47***	
	[4.40]	[3.08]	[2.81]	[3.73]	[3.48]	[3.48]	[3.48]	[3.48]	
<u>Bond purchases (prim)</u> <u>Bond debt_{t-1}</u>	-5.71***								
	[-3.28]								
<u>Net bond purchases</u> <u>Bond debt_{t-1}</u>									6.73***
									[3.50]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Additional controls		Y							
Insurance supply controls				Y					
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE		Y	Y	Y	Y	Y	Y	Y	Y
Insurer characteristics- Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE		Y							
Insurer economy-Time FE	Y	Y							
SIC1-State-Time FE			Y						
Insurer inv yield-Time FE				Y					
Insurer profitability-Time FE				Y					
First stage									
$\Delta \text{INVPremiums}_{>0}^0$	0.031***	0.018***	0.018***	0.023***					0.022***
	[8.33]	[4.13]	[3.55]	[5.39]					[4.74]
$\Delta \text{INVPremiums}_{1;10}^{>0}$					0.023***				
					[4.95]				
$\Delta \text{INVPremiums}_{\text{ex dep-type}}^{>0}$						0.023***			
						[4.95]			
$\Delta \text{INVPremiums}_{\text{ex neighbors}}^{>0}$							0.023***		
							[4.95]		
$\Delta \text{INVPremiums}_{\text{ex cust/sup}}^{>0}$								0.023***	
								[4.95]	
F Statistic	531.1	43.9	44.5	66.5	77.5	77.5	77.5	77.5	73.0
No. of obs.	15,765	15,755	13,623	15,574	15,756	15,756	15,756	15,756	15,756
No. of firms	871	871	783	869	871	871	871	871	871

Table IA.16. 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 (5) in Table 8. The main explanatory variable in columns (1) to (8) is the total volume of insurers' purchases of firm f 's bonds in quarter t scaled by lagged bond debt, and in (9) it is the total volume of insurers' net purchases of firm f 's bonds in quarter t scaled by lagged bond debt. Instruments, control variables, and fixed effects are defined as in Table IA.14. 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5) $\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$	(6)	(7)	(8)	(9)
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	2.74***	4.32**	3.75*	3.48**	3.45**	3.45**	3.45**	3.45**	
	[2.95]	[2.47]	[1.92]	[2.42]	[2.40]	[2.40]	[2.40]	[2.40]	
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$	-2.75*								
	[-1.85]								
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$									3.59**
									[2.42]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Additional controls		Y							
Insurance supply controls				Y					
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE		Y	Y	Y	Y	Y	Y	Y	Y
Insurer characteristics-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE		Y							
Insurer economy-Time FE	Y	Y							
SIC1-State-Time FE			Y						
Insurer inv yield-Time FE				Y					
Insurer profitability-Time FE				Y					
First stage									
$\Delta \text{INVPremiums}_{>0}^{>0}$	0.031***	0.018***	0.018***	0.023***					0.022***
	[8.33]	[4.13]	[3.55]	[5.39]					[4.74]
$\Delta \text{INVPremiums}_{1:10}^{>0}$					0.023***				
					[4.95]				
$\Delta \text{INVPremiums}_{\text{ex dep-type}}^{>0}$						0.023***			
						[4.95]			
$\Delta \text{INVPremiums}_{\text{ex neighbors}}^{>0}$							0.023***		
							[4.95]		
$\Delta \text{INVPremiums}_{\text{ex cust/sup}}^{>0}$								0.023***	
								[4.95]	
F Statistic	531.1	43.9	44.5	66.5	77.5	77.5	77.5	77.5	73.0
No. of obs.	15,765	15,755	13,623	15,574	15,756	15,756	15,756	15,756	15,756
No. of firms	871	871	783	869	871	871	871	871	871

Table IA.17. 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 (7) in Table 8. The main explanatory variable in columns (1) to (8) is the total volume of insurers' purchases of firm f 's bonds in quarter t scaled by lagged bond debt, and in (9) it is the total volume of insurers' net purchases of firm f 's bonds in quarter t scaled by lagged bond debt. Instruments, control variables, and fixed effects are defined as in Table IA.14. 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5) $\frac{\text{Acquisitions}}{\text{Bond debt}_{t-1}}$	(6)	(7)	(8)	(9)
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	0.99*** [3.89]	0.85** [1.98]	1.60** [2.46]	1.43*** [3.19]	1.42*** [3.13]	1.42*** [3.13]	1.42*** [3.13]	1.42*** [3.13]	
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$	-1.38*** [-3.53]								
$\frac{\text{Net bond purchases}}{\text{Bond debt}_{t-1}}$									1.48*** [3.11]
Firm controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Additional controls		Y							
Insurance supply controls				Y					
Firm-Seasonality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
SIC2-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE		Y	Y	Y	Y	Y	Y	Y	Y
Insurer characteristics-Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insurer location-Social connectedness-Time FE		Y							
Insurer economy-Time FE	Y	Y							
SIC1-State-Time FE			Y						
Insurer inv yield-Time FE				Y					
Insurer profitability-Time FE				Y					
First stage									
$\Delta \text{INVPremiums}_{>0}^{>0}$	0.031*** [8.33]	0.018*** [4.13]	0.018*** [3.55]	0.023*** [5.39]					0.022*** [4.74]
$\Delta \text{INVPremiums}_{1:10}^{>0}$					0.023*** [4.95]				
$\Delta \text{INVPremiums}_{\text{ex dep-type}}^{>0}$						0.023*** [4.95]			
$\Delta \text{INVPremiums}_{\text{ex neighbors}}^{>0}$							0.023*** [4.95]		
$\Delta \text{INVPremiums}_{\text{ex cust/sup}}^{>0}$								0.023*** [4.95]	
F Statistic	531.1	43.9	44.5	66.5	77.5	77.5	77.5	77.5	73.0
No. of obs.	15,765	15,755	13,623	15,574	15,756	15,756	15,756	15,756	15,756
No. of firms	871	871	783	869	871	871	871	871	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 insurance premiums 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.18 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 retire-

ment saving. Insurance premiums for pure life insurance are most correlated with a higher share of seniors, consistent with the higher mortality risk in this age group.

Table IA.18. 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 noncommercial insurance premiums 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.

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
	log Insurance premiums					
Type:	P&C		Annuity		Pure life	
log Income	0.99*** [5.15]	1.01*** [5.75]	-0.12 [-0.42]	0.22 [0.98]	0.23** [2.30]	0.21** [2.36]
% Bachelor	1.09* [1.95]	0.66 [1.25]	1.64** [1.98]	1.72** [2.14]	0.75** [2.55]	0.66** [2.24]
% ≥ 65 yrs	-0.03 [-0.02]	-0.77 [-0.46]	0.85 [0.38]	1.04 [0.53]	1.98** [2.40]	1.78** [2.29]
% Married	1.34* [1.88]	0.87 [1.26]	1.48* [1.66]	1.28 [1.51]	0.03 [0.08]	0.02 [0.05]
% Married w/ kids	-1.04 [-1.26]	-0.54 [-0.70]	-1.93* [-1.80]	-1.97** [-1.98]	-0.24 [-0.55]	-0.32 [-0.73]
% Divorced	-2.24** [-2.30]	-1.82* [-1.94]	-0.59 [-0.43]	-0.26 [-0.20]	-0.67 [-1.37]	-0.63 [-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.	354,267	344,785	233,993	232,114	485,304	483,482
No. of insurers	951	654	388	330	482	420

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