Internet Appendix for

Investor-Driven Corporate Finance: Evidence from Insurance Markets

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A Data and sample construction

Table IA.1: Variable definitions and main data sources.

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

Variable	**Definition**
Insurer level	
Bond holdings	Par value of corporate bond holdings (*Source: NAIC*)
Bond purchases	Par value of corporate bond purchases (*Source: NAIC*)
Bond purchases (prim)	Par value of corporate bond purchases in the primary market (*Sources: NAIC, TRACE, Mergent FISD*)
Bond purchases (sec)	Par value of corporate bond purchases in the secondary market (*Sources: NAIC, TRACE, Mergent FISD*)
Bond purchases (ex issuances)	Par value of corporate bond purchases excluding bonds issued in the same quarter (*Sources: NAIC, Mergent FISD*)
Premiums	Noncommercial insurance premiums adjusted by the net-to-gross premiums ratio (*Source: NAIC*)
Unadjusted premiums	Direct noncommercial insurance premiums written, not adjusted by the net-to-gross premiums ratio (*Source: NAIC*)
Net-to-gross premiums ratio	4-quarter trailing average ratio of total net premiums collected to total direct premiums written (*Source: NAIC*)
$CB_{i,t-1}$	Lagged total book value of corporate bond holdings (*Sources: NAIC*)
ΔDisasters$^{>0}$	The maximum of zero and Disaster fatalities$_{i,t-1}$ as defined in Equation (IA.38) (*Sources: NAIC, SHELDUS*)
ΔInvestments/Total assets$_{t-1}$	Quarterly change in the book value of total invested assets (including cash) scaled by lagged total assets (*Source: NAIC*)
Size	Natural logarithm of total assets (*Source: NAIC*)
Return on equity	Annualized income after taxes as a percentage of the insurer's capital and surplus (*Source: NAIC*)
Investment yield	Annualized investment return based on invested assets (*Source: NAIC*)
# Firms held	Number of issuers (identified by 6-digit CUSIP) in the insurer's corporate bond portfolio (*Source: NAIC*)
P&C insurance profitability	Ratio of the difference between net premiums earned and losses and loss adjustment costs to total liabilities (*Source: NAIC*)
Life insurance profitability	Ratio of net income to direct insurance premiums written (*Source: NAIC*)
Life insurance fee income	Ratio of income from fees associated with investment management, administration, and contract guarantees from separate accounts to direct insurance premiums written (*Source: NAIC*)
Rating	Insurer's financial strength rating, numeric from 1 to 15 (*Source: AM Best*)
Insurer-by-firm level	
$\mathbb{I}$(Investor)	Indicator variable for whether in the previous 8 quarters the insurer ever held bonds issued by the firm (*Source: NAIC*)
1{Purchase}	Indicator variable for whether in the current quarter the insurer purchases bonds issued by the firm (*Source: NAIC*)

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Table IA.1 – *Continued from previous page*

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

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Variable	**Definition**
Cash flow	The firm's sales net of the cost of goods sold and selling, general, and administrative expenses scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Deferred taxes	The firm's deferred income tax expense scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Tangibility	The firm's net property, plant and equipment scaled by the firm's lagged bond debt (*Sources: Capital IQ, Compustat*)
Market-to-book	Ratio of the book value of the firm's total assets less the book value of equity plus the market value of equity to the firm's book value of assets (*Source: Compustat*)
Leverage	Ratio of the book value of the firm's total assets to the firm's book value of equity (*Source: Compustat*)
Age	Number of years that the firm has been in Compustat (*Source: Compustat*)
Stock return	The firm's stock return over (1) the current quarter when used as a dependent variable in the main analysis and (2) the previous year when used as control variable (*Source: CRSP*)
SA index	Hadlock and Pierce (2010)'s index of firm financial constraints, defined as $-0.737\min\{4.5\times10^3, size\}+0.043\min\{4.5\times10^3, size\}^2-0.04\min\{37, age\}$, where *size* is the log of inflation-adjusted (to 2004) book assets and *age* the number of years that the firm has been in Compustat (*Sources: Compustat, FRED*)
Z-score	Modified Altman's z-score, defined by Graham and Leary (2011) as $(3.3\times \textit{operating income} + \textit{sales} + 1.4\times \textit{retained earnings} + 1.2\times (\textit{current assets} - \textit{current liabilities}))/\textit{book assets}$ (*Source: Compustat*)
Dividend payer	Indicator variable that equals one if the firm ever paid positive dividends in the past four quarters (*Source: Compustat*)
Earnings volatility	Standard deviation of the trailing 12 quarters of the ratio of the firm's cash flow to total assets (*Source: Compustat*)
(Credit) Rating FE	The firm's current end-of-quarter credit rating for categories AAA-AA, A, BBB, BB, B, CCC, CC-D, and unrated. The minimum rating is used if two ratings are available, and the middle rating is used if three ratings are available (*Source: Mergent FISD*)
Region FE	U.S. region in which the firm's headquarters is located: Northeast (CT, ME, MA, NH, RI, VT), Mid-Atlantic (DE, DC, MD, NJ, NY, PA), Southeast (AL, AR, FL, GA, PR, VI), Southeast (MS, NC, SC, TN, VA, WV), Midwest (IA, IN, IL, KS, KY, MI MN, MO, ND, NE, OH, SD, WI), Southwest (CO, LA, NM, OK, TX, UT) or West (AZ, AK, CA, HI, ID MT, NV, OR, WA, WY, AS)
Industry FE	Industry categories based on 2-digit SIC if not stated otherwise

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Table IA.1 – *Continued from previous page*

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

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Table IA.1 – *Continued from previous page*

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

A.1 Insurance premiums

Direct premiums written are defined as the contractually determined amount charged by insurers to the policyholder and, thus, exclude reinsurance ceded or assumed. Schedule T of U.S. insurers' statutory filings reports the total amount of direct premiums written for each U.S. insurer and quarter separately for each U.S. state and territory and Canada. To detect reporting errors, I compare the total premiums at the insurer level (across locations) from Schedule T with the total premiums reported in the overview schedule of the same filing. I exclude insurer–quarter observations if the discrepancy between Schedule T and the overview schedule is larger than both $50,000 and 50% of the average of the two reported total premiums. To cross-check the reliability of my sample of insurance premiums, I compare industry-wide premiums and their geographical distribution with official reports from the NAIC.[1]

To exclude commercial insurance business, I use the share of direct premiums written for noncommercial insurance at the insurer–quarter level (it is not available at the insurer–state–quarter level). I define the share of noncommercial life insurance as the sum of direct premiums written covering individual life insurance (which provides financial benefits to a beneficiary upon the death of the insured), individual annuities (which guarantee a stream of annuity payments), individual accident and health contracts, and deposit-type contracts (which do not expose the insurer to any mortality or morbidity risk) relative to all premiums.[2] These are reported in Exhibit 1 of life insurers' statutory filings. The measure excludes contracts that cover a group of individuals (e.g., the employees of a company or members of an organization), namely, group life insurance, group annuities, group accident and health insurance, and credit life insurance (for which a breakdown into individual and group contracts is not available).

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

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

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

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

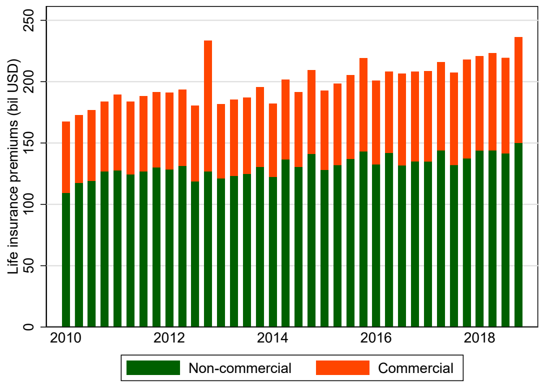
Insurers that focus on commercial insurance business are excluded from the sample; I define these as insurers with noncommercial premiums below \$50,000 or below 10% of total premiums in the median quarter from 2009q4 to 2018q4. For the remaining insurers, I winsorize premiums at the insurer–state–quarter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

$$DPW_{i,f,t}^{unadjusted} = \max\left\{\sum_s noncommercial_{i,t} \times DPW_{i,s,t} - DPW_{i,location(f),t},\, 0\right\}, \tag{IA.1}$$

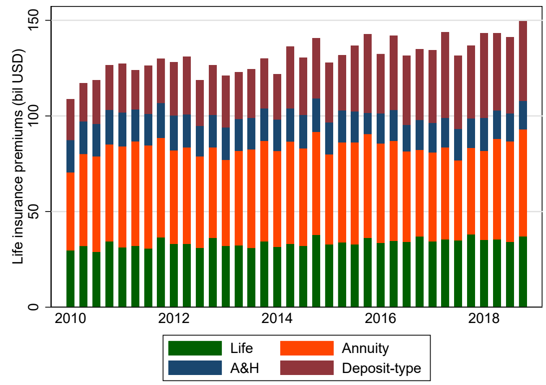
where $DPW_{i,s,t}$ is direct premiums written by insurer i in location s in quarter t and $noncommercial_{i,t}$ is the share of noncommercial premiums written (as defined above). By removing all premiums in the firm's location, the measure is a conservative estimate for the actual noncommercial premiums

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

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



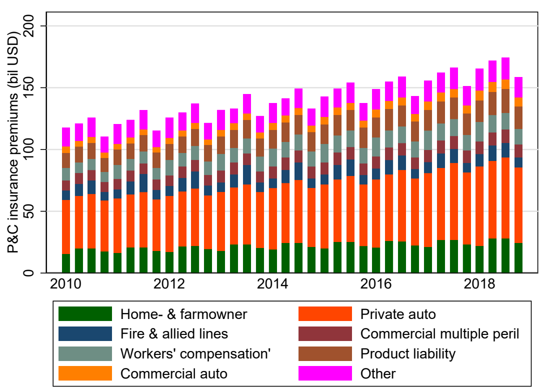
(a) All U.S. insurers.



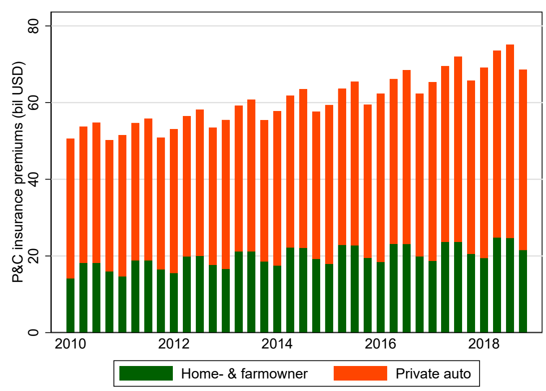
(b) Insurers included in the sample.

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

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



(a) All U.S. insurers.



(b) Insurers included in the sample.

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

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

$$\xi_{i,t-1} = \frac{1}{4}\sum_{\tau=1}^{4}\frac{NPC_{i,t-\tau}}{DPW_{i,t-\tau}}. \tag{IA.2}$$

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

Finally, I define (adjusted) noncommercial premiums as

$$Premiums_{i,f,t} = \xi_{i,t-1} \times DPW_{i,f,t}^{unadjusted}, \tag{IA.3}$$

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

A.2 Corporate bond holdings and transactions

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

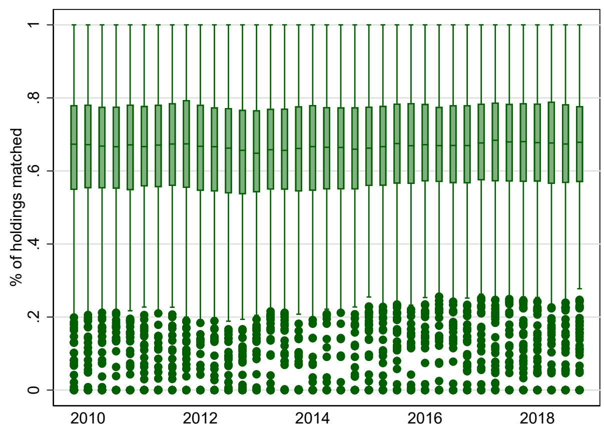
To merge bonds with firm characteristics, I begin with the link table provided by Capital IQ, which matches the security identifiers reported by insurers (CUSIP and ISIN) to the Capital IQ firm-level identifier *companyid*. I supplement the sample by matching (1) the leading six digits of the CUSIP (the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

Table IA.2. Matching corporate bond investments to Capital IQ and Compustat.
This table reports the number of observations for all insurer–security–quarter–level corporate bond holdings (and the total par value across insurers and quarters in parentheses) from Schedule D filings and the share matched to Capital IQ and Compustat. "Matched by: Capital IQ link" uses the Capital IQ link table. "Matching by: Ticker (TRACE & Compustat)" indicates observations matched first to TRACE by CUSIP, second to Compustat by using the ticker, and third to Capital IQ by using the Capital IQ-Compustat link table. "Matched by: 6-digit CUSIP (Compustat)" indicates observations first matched to Compustat by using the 6-digit CUSIP and second to Capital IQ by using the Capital IQ link table. "Copied from: same issuer ID (Mergent)" indicates observations whose Capital IQ identifier is copied from other observations with the same Mergent FISD issuer ID. "Copied from: same 6-digit CUSIP" indicates observations whose Capital IQ identifier is copied from other observations with the same 6-digit CUSIP.

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

Figure IA.3. Share of matched insurers' corporate bond holdings.

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



A.3 Matching insurers' counterparties to underwriters

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

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

Table IA.3. Matching corporate bond purchases to Mergent FISD agents.
The table depicts the (share of the) number (and, in parentheses, of the total par value) of corporate bond purchases whose counterparty is missing and whose counterparty is matched to Mergent FISD.

Purchases: Counterparty match	
% missing counterparty (par value)	19.5% (33.5%)
% matched (par value)	68.4% (57.1%)
Total matched (par value)	1,129,429 ($ 2,815 bil)

A.4 Classifying primary and secondary market bond purchases

I use three criteria to identify secondary market trades. (1) I match NAIC purchases to TRACE secondary market transactions at the CUSIP level. I flag purchases as secondary market trades if they are matched to a TRACE secondary market transaction (with flag "S1") reported for the same or previous day with a transaction volume and total price paid that differ by not more than \$5,000 and with a price difference smaller than 5%. Additionally, (2) purchases made at least 3 days after a bond's offering date and (3) purchases made after the offering date that involve the payment of accrued interest are flagged as secondary market trades.

Purchases are flagged as primary market trades if they are at the offering price, do not involve the payment of accrued interest, and occur within less than 3 days around the offering date. This classification plausibly tends to overclassify primary market trades.[3] If the above methodology categorizes a bond purchase as both a primary and a secondary market trade, I flag it as unclassified.

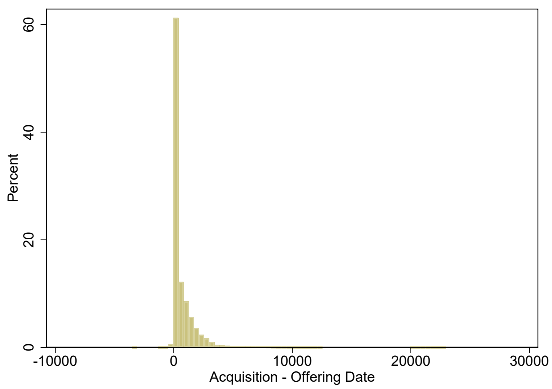
Several observations support this classification strategy:

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

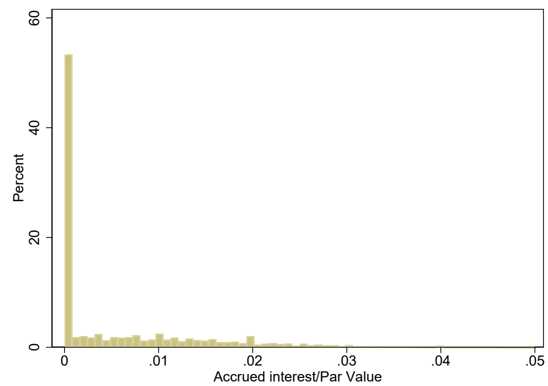
[3]Previous studies usually rely on a narrower classification. For example, Nikolova et al. (2020) define bond purchases as primary market trades only if they occur on the offering date and are from a bond issue's underwriter.

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

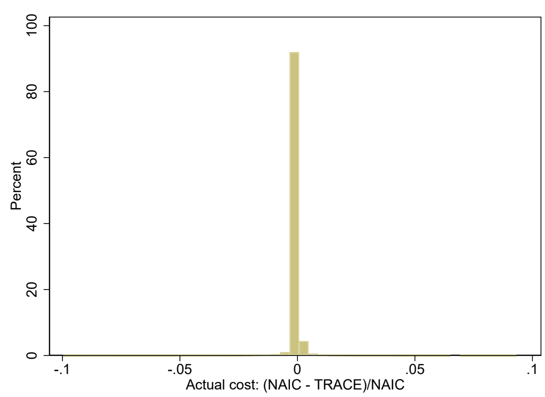
Figure (a) illustrates the distribution of the time (in days) between the offering and purchase dates at the transaction level. Figure (b) illustrates the distribution of accrued interest paid scaled by par value at the transaction level, truncated at 0 and 0.05. Figure (c) illustrates the distribution of the relative difference between TRACE and NAIC cost of purchase for all NAIC acquisitions matched to the NAIC transaction for the same CUSIP on the same or previous day with the smallest price difference, truncated at -0.1 and 0.1.



(a) Time lag between purchase and offering date.



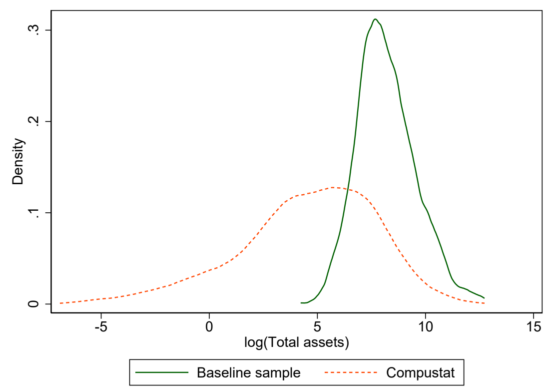
(b) Accrued interest.



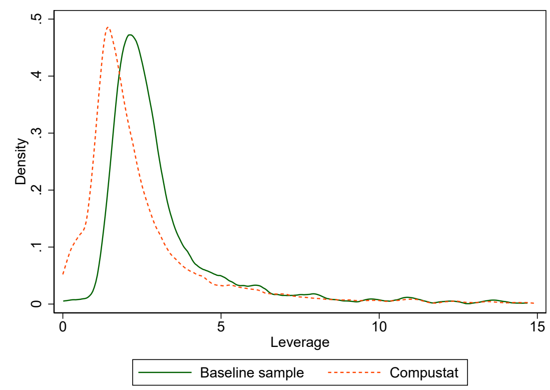
(c) Relative difference between TRACE and NAIC bond price.

A.5 Comparison with Compustat firms

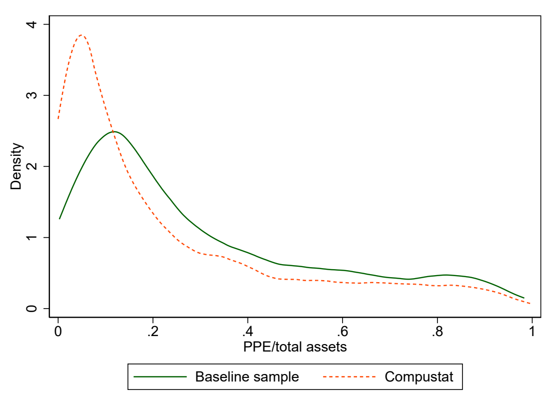
Figure IA.5. Comparison of firm characteristics with those of all nonfinancial firms in Compustat. The figures depict kernel densities for the cross-sectional distribution of average firm characteristics (from 2010q2 to 2018q4) for firms in my sample compared with those of all nonfinancial firms in Compustat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



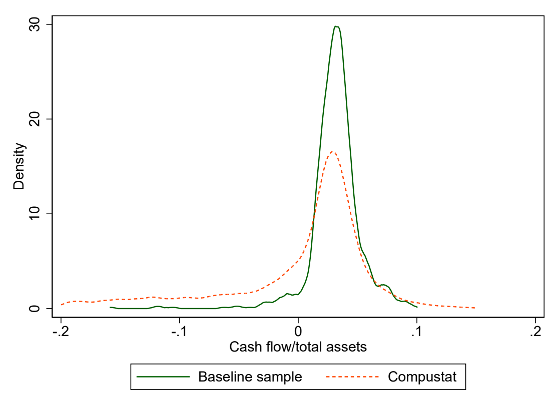
(a) Size.



(b) Leverage.



(c) PPE.



(d) Cash flow.

B Instrument derivation and validity

B.1 Stylized balance sheet dynamics

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

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

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

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

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

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

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

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

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

Motivated by this theoretical insight, I define by

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

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

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

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

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

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

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

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

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

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

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

B.2 Instrument validity

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

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

Proof. It holds that

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

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

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

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

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

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

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

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

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

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

Proof. First, note that

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

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

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

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

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

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

Second, using the law of total probability, it is

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

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

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

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

B.3 Back-of-the-envelope calculation

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

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

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

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

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

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

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

B.4 Insurers' investment preferences

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

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

at the insurer-by-quarter level from 2010q1 to 2018q4. u_t are time fixed effects. $Y^F_{i,t}$ is the characteristic of the average bond issuer that insurer i has previously invested in, i.e., with $\mathbb{I}(Investor_{i,f,t-(1:8)}) = 1$. $X^I_{i,t}$ is the characteristic of insurer i. Each cell corresponds to a separate regression for different characteristics of firms (columns) and insurers (rows), considering size (log of total assets), leverage, and credit rating for both firms and insurers as well as idiosyncratic equity return volatility of firms, defined as in Ang et al. (2009), and the RBC capital ratio, equity investment share (relative to all equity and bond investments), and insurance business type (life or P&C) of insurers. A larger value of the rating variables indicates higher credit risk. All variables except for the life insurance indicator are standardized to zero mean and unit variance. t-statistics are shown in brackets and based on standard errors clustered at the insurer and region-by-time levels. * $p < .1$; ** $p < .05$; *** $p < .01$

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

Table IA.5. Local determinants of potential investors.

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

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

at the insurer-by-firm-by-quarter level, where $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ equals one if insurer i ever held bonds issued by firm f in the previous 1 to 8 quarters and zero otherwise, $u_{i,t}$ are insurer-by-time fixed effects, and $v_{f,t}$ are firm-by-time fixed effects. An insurer's state (region) is the state (region) in which the largest amount of premiums were written in the previous eight quarters. Social connectedness is the logarithm of Bailey et al. (2018)'s social connectedness index between firms' and insurance customers' locations. %Employed same industry is the employment per capita in the firm's industry in insurance customers' locations. *Terc* is the cross-sectional tercile of the respective variable. t-statistics are shown in brackets and based on standard errors clustered at the insurer and firm levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:			$\mathbb{I}$(Investor)			
1{Same state}	-0.00					
	[-1.51]					
1{Same region}		-0.00				
		[-0.30]				
Social connectedness			-0.00			
			[-0.53]			
Social connectedness: Terc2				-0.00		
				[-0.74]		
Social connectedness: Terc3				-0.00		
				[-0.76]		
%Employed same industry					-0.07	
					[-0.90]	
%Employed same industry: Terc2						0.00
						[0.81]
%Employed same industry: Terc3						-0.00
						[-0.32]
Insurer-Time FE	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y
No. of obs.	37,711,991	37,711,991	37,711,991	37,711,991	37,711,991	37,711,991
No. of firms	876	876	876	876	876	876
No. of insurers	1,451	1,451	1,451	1,451	1,451	1,451
Standardized coefficients						
1{Same state}	-0.00					
1{Same region}		0.00				
Social connectedness			-0.00			
Social connectedness: Terc2				-0.00		
%Employed same industry					-0.00	
%Employed same industry: Terc2						0.00

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

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

at the insurer-by-quarter level from 2010q1 to 2018q4. u_t are time fixed effects. The dependent variable is either (A) the level or (B) change in insurance premiums, both scaled by lagged total assets. Each cell corresponds to a separate regression for different insurer characteristics $X_{i,t-1}$, which are lagged credit rating, size (log of total assets), log regulatory capital (RBC) ratio, leverage, equity investment share (relative to all equity and bond investments), and insurance business type (life or P&C), and different macroeconomic factors, which are the change in log GDP and in log VIX as well as the 10-year treasury rate and term spread, defined as the 10-year minus 3-month treasury rate. All variables except for the life insurance indicator are standardized to zero mean and unit variance. t-statistics are shown in brackets and based on standard errors clustered at the insurer and region-by-time levels. * $p < .1$; ** $p < .05$; *** $p < .01$

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

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

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

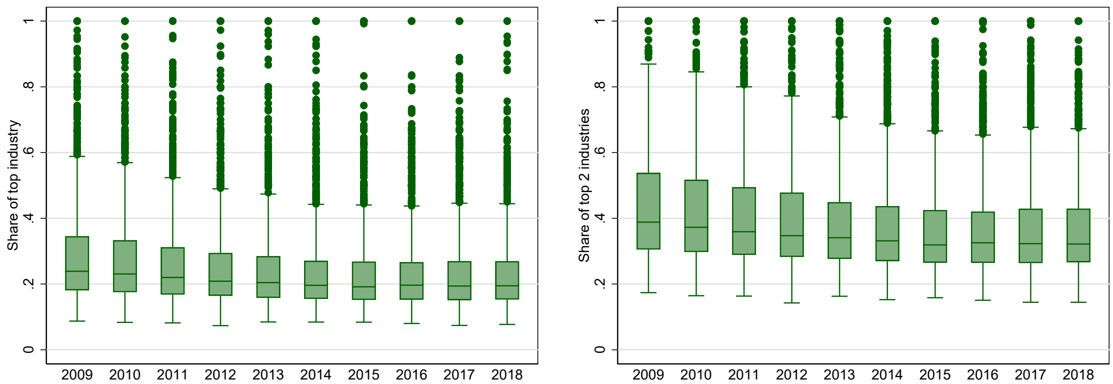
$$\bar{\beta}_i^F = \gamma \beta_i^I + \varepsilon_i$$

at the insurer level. β_i^I is estimated in the regression $Y_{i,t} = \beta_i^I M_t + \varepsilon'_{i,t}$ at quarterly frequency, where M_t is an aggregate factor (change in log GDP and in log VIX as well as the 10-year treasury rate and term spread, defined as the 10-year minus 3-month treasury rate) and $Y_{i,t}$ is either (A) the level or (B) change in insurance premiums, both scaled by lagged total assets. To compute $\bar{\beta}_i^F$, I first estimate β_f^F from regressions $\frac{\Delta Bond\ debt_{f,t}}{Bond\ debt_{f,t-1}} = \beta_f^F M_t + \varepsilon''_{f,t}$. $\hat{\beta}_{i,t}^F$ is the average β_f^F among bond issuers in which insurer i has previously invested, i.e., with $\mathbb{I}(Investor_{i,f,t-(1:8)}) = 1$. $\bar{\beta}_i^F$ is the insurer-specific median of $\hat{\beta}_{i,t}^F$. $\bar{\beta}_i^F$ and β_i^I are truncated at the 1st and 99th percentiles. All variables are standardized to zero mean and unit variance. t-statistics are shown in brackets and based on standard errors clustered at the state-by-insurer type level. * $p < .1$; ** $p < .05$; *** $p < .01$

	(1)	(2)	(3)	(4)
Dependent variable:	Average firm's exposure ($\bar{\beta}^F$)			
Factor:	ΔGDP	ΔVIX	10Y rate	Term spread
(A) Premiums				
$\beta^I(\Delta\text{GDP})$	-0.020			
	[-0.67]			
$\beta^I(\Delta\text{VIX})$		-0.016		
		[-0.63]		
β^I(10Y rate)			0.019	
			[0.67]	
β^I(Term spread)				0.001
				[0.04]
(B) ΔPremium				
$\beta^I(\Delta\text{GDP})$	-0.080**			
	[-2.45]			
$\beta^I(\Delta\text{VIX})$		-0.030		
		[-0.98]		
β^I(10Y rate)			-0.019	
			[-0.84]	
β^I(Term spread)				-0.024
				[-0.82]

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

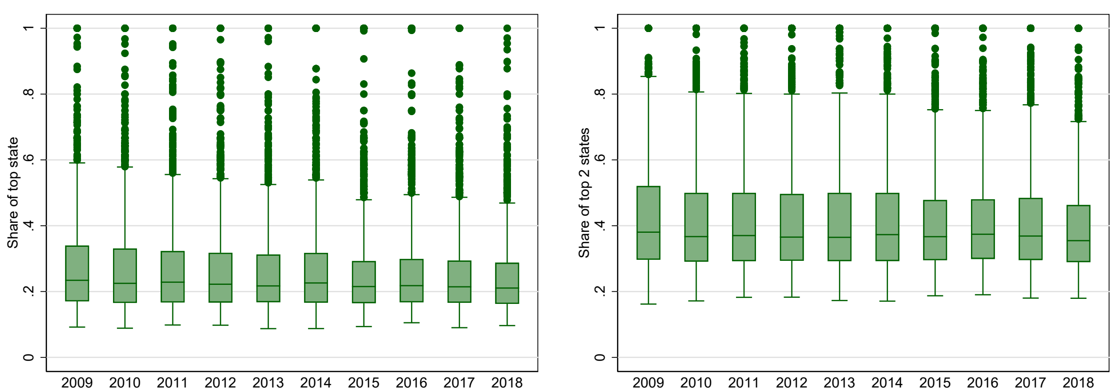
The figures show box plots of the share of insurers' corporate bond holdings in the top (a) 1 and (b) 2 industries (at the 2-digit SIC level) among all industry-matched corporate bond holdings at the insurer level based on end-of-year holdings.



(a) Top 1 industry. (b) Top 2 industries.

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

The figures show box plots of the share of insurers' corporate bond holdings from bond issuers located in the top (a) 1 and (b) 2 U.S. states among all issuer state-matched corporate bond holdings at the insurer level based on end-of-year holdings.



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

Table IA.8. Persistence in the investment universe of insurers.

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

Bond portfolio size decile	Previous quarters									
	1	2	3	4	5	6	7	8	9	10
1	92.4%	92.5%	92.5%	92.7%	92.7%	92.7%	92.7%	92.8%	92.8%	92.8%
2	93.3%	93.4%	93.4%	93.5%	93.5%	93.6%	93.6%	93.6%	93.7%	93.7%
3	92.4%	92.5%	92.6%	92.8%	92.9%	92.9%	93.0%	93.0%	93.1%	93.1%
4	92.7%	92.8%	92.9%	93.0%	93.1%	93.1%	93.2%	93.2%	93.2%	93.3%
5	93.2%	93.3%	93.4%	93.5%	93.6%	93.6%	93.7%	93.7%	93.7%	93.8%
6	92.8%	93.0%	93.2%	93.4%	93.5%	93.5%	93.6%	93.6%	93.7%	93.7%
7	93.2%	93.4%	93.5%	93.7%	93.8%	93.9%	93.9%	94.0%	94.0%	94.0%
8	94.3%	94.4%	94.6%	94.8%	94.9%	95.0%	95.0%	95.1%	95.1%	95.2%
9	95.1%	95.3%	95.4%	95.6%	95.6%	95.7%	95.7%	95.8%	95.8%	95.9%
10	96.1%	96.3%	96.4%	96.6%	96.6%	96.7%	96.7%	96.8%	96.8%	96.9%

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

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

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

Table IA.10. Persistence of insurers' portfolio allocation: Determinants.
Each column presents OLS estimates from a specification of the form:

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

at the insurer-by-firm-by-quarter level, where $\mathbb{I}(\text{Investor}_{i,f,t-(1:8)})$ equals one if insurer i ever held bonds issued by firm f in the previous 1 to 8 quarters and zero otherwise, and $C_{i,f,t}$ is a vector of fixed effect dummies. Insurer size quintiles in column (1) are indicators based on the cross-sectional distribution of insurers' total assets. Firm age is the firm's current age standardized to zero mean and unit variance. Firm volatility is the idiosyncratic volatility of the firm's equity defined as in Ang et al. (2009) standardized to zero mean and unit variance. log Bond debt is the logarithm of the firm's total bond debt. Firm size bins are based on the quintiles of the cross-sectional distribution of firms' total assets. Firm industry is based on the 2-digit SIC classification. Firm rating bins are: unrated, AA-AAA, A, BBB, BB, B, CCC, D-CC. The *difference in α relative to baseline* is the relative difference between the point estimate for α in this table and that in column (2) of Table 3. t-statistics are shown in brackets and based on standard errors clustered at the insurer and firm levels. ***, **, and * indicate significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:				1{Purchase}			
$\mathbb{I}$(Investor) × Insurer size:Quint1	0.006**						
	[2.36]						
$\mathbb{I}$(Investor) × Insurer size:Quint2	0.009***						
	[5.64]						
$\mathbb{I}$(Investor) × Insurer size:Quint3	0.011***						
	[8.33]						
$\mathbb{I}$(Investor) × Insurer size:Quint4	0.025***						
	[11.81]						
$\mathbb{I}$(Investor) × Insurer size:Quint5	0.052***						
	[18.70]						
$\mathbb{I}$(Investor)		0.028***	0.035***	0.033***	0.029***	0.028***	0.021***
		[15.95]	[19.61]	[18.81]	[18.73]	[16.70]	[15.67]
$\mathbb{I}$(Investor) × log(Bond debt)		0.015***					
		[8.94]					
$\mathbb{I}$(Investor) × Firm age		-0.007***					
		[-6.31]					
$\mathbb{I}$(Investor) × Firm volatility		0.005***					
		[3.27]					
Insurer-Time FE	Y	Y	Y	Y	Y	Y	Y
Firm-Time FE	Y	Y	Y	Y	Y	Y	Y
Firm state-Insurer FE			Y				Y
Firm industry-Insurer FE				Y			Y
Firm size-Insurer FE					Y		Y
Firm rating-Insurer FE						Y	Y
No. of obs.	39,003,099	33,210,282	39,003,099	39,003,099	39,003,099	39,003,099	39,003,099
No. of firms	876	874	876	876	876	876	876
No. of insurers	1,484	1,484	1,484	1,484	1,484	1,484	1,484
Relative effect of $\mathbb{I}$(Investor)			18.49	17.41	15.16	14.77	11.00
Difference in α relative to baseline:			-0.03	-0.09	-0.20	-0.22	-0.42

B.5 Natural disaster exposure

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

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

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

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

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

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

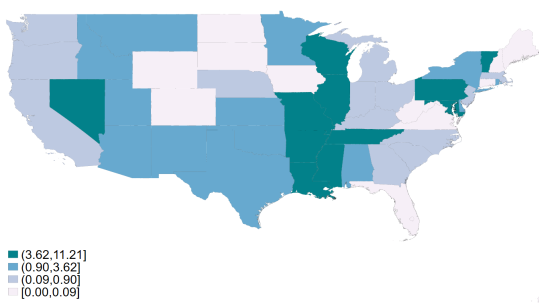
$$\overline{D}_{f,t} = \sum_{Life\ insurers\ i} \mathbb{I}(Investor_{i,f,t-(1:8)}) \times \frac{CB_{i,t-1}}{Total\ assets_{i,t-1}} \times Distant\ disaster\ fatalities_{i,f,t-1}, \tag{IA.39}$$

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

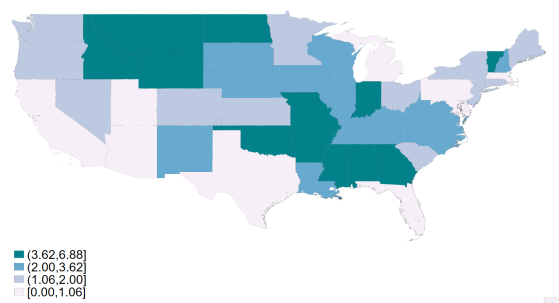
$$\Delta INVDisasters^{>0}_{f,t} = h_{f,t-1} \times \max\left(\Delta \log \bar{D}_{f,t}, 0\right). \tag{IA.40}$$

Figure IA.8. Geographic variation in natural disasters.

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



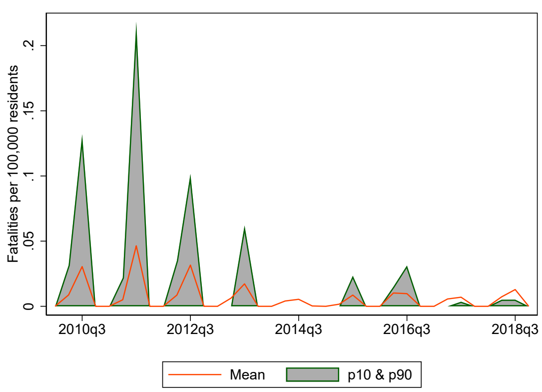
(a) Heat.



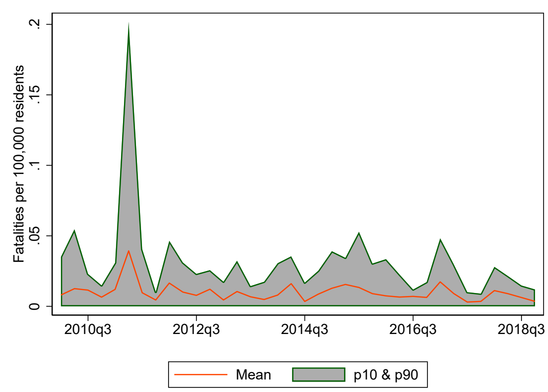
(b) Storms.

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

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



(a) Heat.



(b) Storms.

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

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

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

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

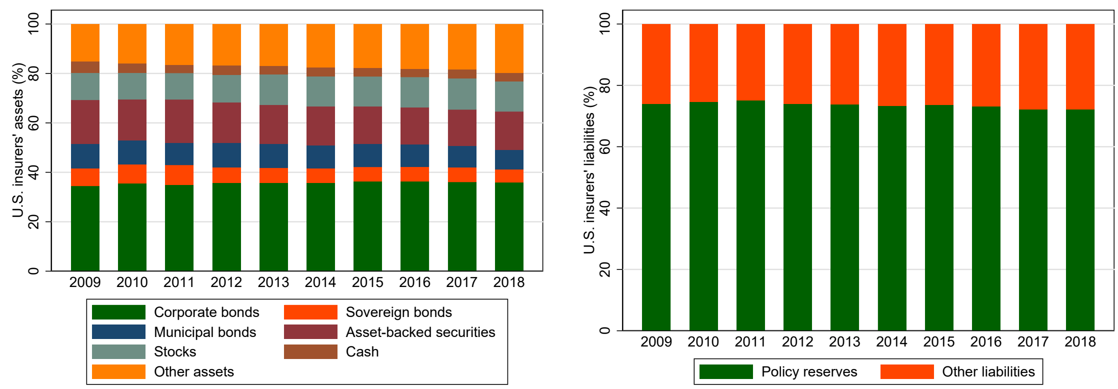
at the insurer-by-quarter level, where $u_{i,season}$ are insurer-by-calendar quarter fixed effects and v_t are time fixed effects. In columns (3), (4), and (6) to (8), the explanatory variable $\textit{Disaster fatalities}_{i,t-1}$ is the sum of $\textit{Disaster fatalities}_{i,s,t-1}$ across states s, and in column (5), the explanatory variable is the unweighted sum of $\textit{Fatalities}_{s,t-1}$ across states s in which insurer i is active (indicated by $DPW_{i,s,t} > 0$). The dependent variable in columns (3) to (5) is the logarithm of total direct noncommercial insurance premiums written, that in column (6) is the logarithm of total life insurance benefits paid to policyholders (i.e., insurance claims), and that in columns (7) and (8) is the total volume of corporate bond purchases in quarter t scaled by lagged total assets. Insurer controls are an insurer's investment yield, life insurance profitability, fee income, rating dummies, and lagged return on equity. t-statistics are shown in brackets and based on standard errors clustered at the insurer and state levels in columns (1) and (2) and at the insurer and region-by-time levels in columns (3) to (8). The sample includes only life insurers.
* $p < .1$; ** $p < .05$; *** $p < .01$

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

C Additional figures

Figure IA.10. Insurers' assets and liabilities.

The figures depict the breakdown of U.S. insurers' aggregate general account assets and liabilities at year-end based on statutory filings. (a) Assets are cash and invested assets. Sovereign bonds include U.S. treasuries and foreign sovereign bonds. Other assets include mortgage loans, real estate, derivatives, and other investments. (b) Policy reserves include contract reserves, interest maintenance reserves, and asset valuation reserves. Other liabilities include reinsurance as well as borrowings, taxes, and other liabilities, excluding separate accounts.



(a) Assets.

(b) Liabilities.

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

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

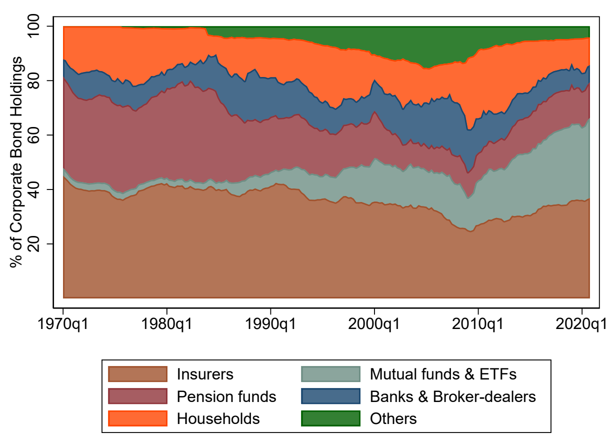
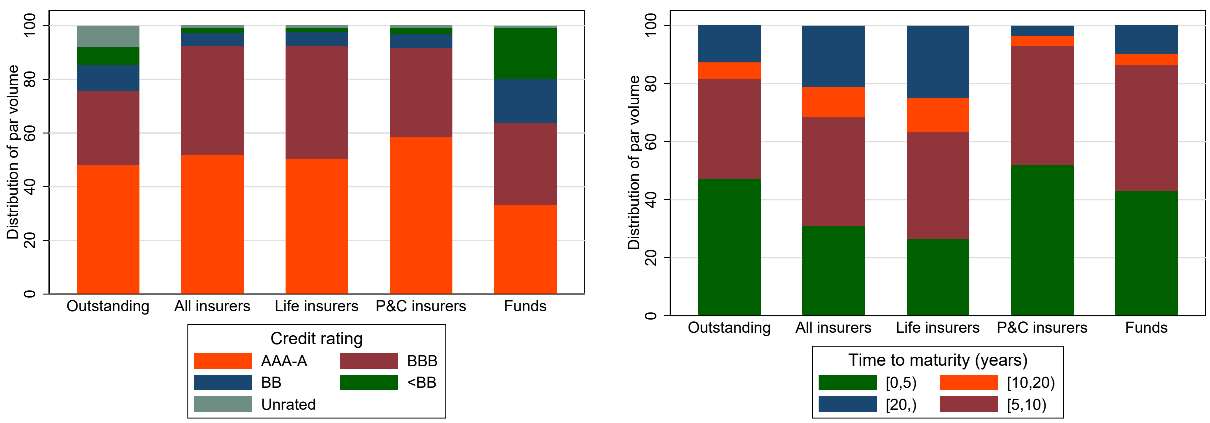


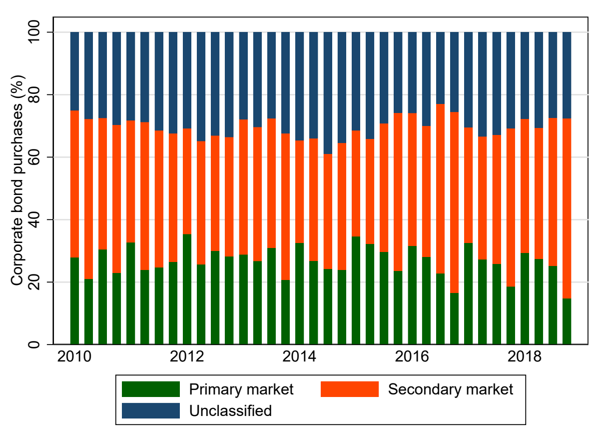
Figure IA.12. Comparing the corporate bond holdings of insurers and funds.
The figures depict the distribution of (1) the amount outstanding of all corporate bonds that are held by at least one fund or insurer, (2) the par value of all corporate bonds held by all P&C and life insurers, (3) the par value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



(a) Credit rating.

(b) Time to maturity.

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



D Additional tables

D.1 Summary statistics

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

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

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

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

	N	Mean	SD	p5	p50	p95
Firm level: Firm characteristics						
Total assets (bil USD)	15,767	13.31	30.76	0.74	4.38	49.80
$\log$ Total assets$_{t-1}$	15,767	8.50	1.29	6.59	8.37	10.79
ΔTotal assets$_{t-1}$/Bond debt$_{t-1}$ (%)	15,767	7.81	38.58	-36.98	2.91	68.12
Sales$_{t-1}$/Bond debt$_{t-1}$ (%)	15,767	150.09	194.69	17.01	86.14	531.43
Cash flow$_{t-1}$/Bond debt$_{t-1}$ (%)	15,767	20.34	23.89	1.07	14.27	60.14
ΔCash$_{t-1}$/Bond debt$_{t-1}$ (%)	15,767	0.36	20.24	-29.89	0.11	30.17
Cash$_{t-1}$/Bond debt$_{t-1}$ (%)	15,767	63.10	86.02	1.69	30.67	240.47
PPE$_{t-1}$/Bond debt$_{t-1}$ (%)	15,767	172.30	189.78	13.21	114.60	528.76
Deferred Taxes$_{t-1}$/Bond debt$_{t-1}$ (%)	15,767	-0.03	3.87	-5.38	0.00	5.23
Market-to-book$_{t-1}$	15,767	1.79	0.93	0.92	1.52	3.79
Leverage$_{t-1}$	15,767	3.67	4.18	1.58	2.53	8.81
Age (yrs)	15,767	29.82	14.95	7.25	27.75	53.50
Stock return (%)	15,767	16.14	38.68	-42.71	13.53	82.97
SA index	15,767	-4.12	0.43	-4.63	-4.17	-3.35
Z-score	15,767	0.82	0.68	-0.32	0.85	1.84
Dividend payer	15,767	0.61	0.49	0.00	1.00	1.00
Earnings volatility	15,767	0.01	0.02	0.00	0.01	0.04
Commercial paper/Total debt (%)	2,633	8.12	10.71	0.00	3.71	30.39
ΔCommercial paper/Bond debt$_{t-1}$ (%)	2,436	0.19	10.76	-16.04	0.00	16.59
Firm level: Insurer characteristics						
Growth in potential investors' premiums ($100 \times \Delta \log \overline{P}$)	15,767	3.44	30.72	-21.18	1.63	32.68
Growth in potential investors' disaster exposure ($100 \times \Delta \log \overline{D}$)	15,539	-0.75	117.39	-248.69	24.80	152.03
# Investors	15,767	69.52	95.10	1.00	31.00	270.00
%Life insurers (%)	15,767	69.37	18.95	36.36	70.59	100.00
Insurer $\log$ total assets$_{t-1}$ (%)	15,767	15.54	1.16	13.58	15.58	17.54
Insurer return on equity$_{t-1}$ (%)	15,767	8.19	5.07	0.20	8.02	16.67
Insurer investment yield$_{t-1}$	15,767	4.26	0.70	3.10	4.26	5.32
Insurer P&C profitability (%)	15,767	4.70	2.01	0.00	5.02	7.44
Insurer life profitability (%)	15,767	11.44	11.25	-2.37	9.22	31.92
Insurer life fee income (%)	15,767	3.28	2.19	0.04	3.11	7.23

D.2 Insurance premiums

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

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

at the insurer-by-quarter level, where $C_{i,t}$ is a vector of control variables and fixed effects. The dependent variables are in columns 1 and 2, the par value of corporate bond purchases; in 3, of old bonds, defined as those issued at least 6 days before purchase; in 4, of new bonds, defined as those issued less than 6 days before purchases; in 5, of all bonds net of sales; in 6, the quarterly change in net reinsurance premiums paid to reinsurers (i.e., reinsurance business ceded less of that assumed); in 7, the quarterly change in insurance policy reserves; and in 8, the quarterly net equity issuance, measured as the change in capital and surplus due to changes in issued stock, surplus notes, and reinsurance, all scaled by lagged total assets. The explanatory variable in columns 1 and 2 is the (lagged) level of noncommercial insurance premiums scaled by lagged total assets. In columns 3 to 8, it is the quarterly change in noncommercial insurance premiums scaled by lagged total assets, distinguishing between increases and decreases in premiums. In column 6, premiums are not adjusted by the lagged net-to-gross premiums ratio. Control variables and fixed effects are defined as in Table 2. t-statistics are shown in brackets and based on standard errors clustered at the insurer and region-by-time levels. * $p < .1$; ** $p < .05$; *** $p < .01$

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

E Robustness

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

This table reports estimated coefficients for the effect of insurers' bond purchases on the growth in the stock of a firm's bond debt following the specification in column 3 in Table 4. The main explanatory variable in columns 1 and 4 to 10 is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It excludes primary market purchases in column 2, and it excludes bonds issued in the same quarter t in column 3. The main explanatory variable is instrumented in columns 2 to 4 and 7 to 10 by increases in potential investors' premiums, $h_{f,t-1}\max(\Delta \log \bar{P}_{f,t}, 0)$, and in 5 and 6 by the level of potential investors' premiums, $\bar{P}_{f,t}/Bond\ debt_{f,t-1}$, with $\bar{P}_{f,t}$ defined in Equation (2). Premiums exclude those for deposit-type life insurance in (10). Premium weights in columns 2, 3, 5 and 7 to 10 are given by $w_{i,f,t-1} = \mathbb{I}(Investor_{i,f,t-(1:8)})CB_{i,t-1}$; and in 4 and 6, by $w_{i,f,t-1} = \kappa_{i,f,t-1}CB_{i,t-1}$, with $\kappa_{i,f,t-1}$ defined as the lagged portfolio weight within the corporate bond portfolio. Baseline controls are the same firm and insurer characteristics as in Table 4 and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects. Additional controls are earnings volatility, z-score, and lagged size, asset growth, stock return, SA index, deferred taxes, tangibility, and an indicator of whether the firm paid dividends in the past 4 quarters. Insurance supply controls are the 4 lags of a firm's potential investors' return on equity, investment yield, P&C and life insurance profitability, and life insurance fee income and commissions. Insurer investment yield and profitability bins are based on the quartiles of the first two principal components of the current value and 4 lags of the investment yield and insurance profitability of the firm's potential investors, respectively. SIC1 refers to the 1-digit SIC industry classification. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. * $p < .1$; ** $p < .05$; *** $p < .01$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	$\frac{\Delta\text{Bond debt}}{\text{Bond debt}_{t-1}}$									
	OLS	IV								
Instrumented variable:		Bond purchases (sec) / Bond debt$_{t-1}$	Bond purchases (ex issuances) / Bond debt$_{t-1}$	Bond purchases / Bond debt$_{t-1}$						
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$	2.85***			7.42***	8.22***	24.87	6.20***	7.35***	5.80***	6.07***
	[21.43]			[4.73]	[2.93]	[1.16]	[3.80]	[3.70]	[4.34]	[4.63]
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$		7.79***								
		[6.12]								
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$		3.99***								
		[7.21]								
$\frac{\text{Bond purchases (ex issuances)}}{\text{Bond debt}_{t-1}}$			6.30***							
			[5.03]							
Baseline controls	Y	Y	Y	Y	Y		Y	Y	Y	Y
Additional controls							Y			
Insurance supply controls									Y	
Baseline FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE							Y			
SIC1-State-Time FE								Y		
Insurer inv yield-Time FE									Y	
Insurer profitability-Time FE									Y	
First stage										
ΔINVPremiums$^{>0}$		0.080***	0.082***				0.074***	0.070***	0.084***	
		[10.6]	[12.2]				[3.8]	[3.1]	[4.2]	
ΔINVPremiums (PF weights)				0.062***						
				[4.5]						
INVPremiums					0.001**					
					[2.5]					
INVPremiums (PF weights)						0.406				
						[1.1]				
ΔINVPremiums$^{>0}_{\text{ex dep-type}}$										0.100***
										[4.8]
F Statistic		528.4	630.4	48.9	26.0	2.4	33.9	27.2	39.9	59.3
No. of obs.	15,767	15,767	15,767	15,767	15,767	15,767	15,767	13,681	15,767	15,767
No. of firms	876	876	876	876	876	876	876	789	876	876

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

$$\frac{\Delta Debt_{d,f,t}}{Bond\ debt_{f,t-1}} = \alpha \frac{Bond\ purchases_{f,t}}{Bond\ debt_{f,t-1}} \times 1\{Bond_d\} + \xi' D_{d,f,t} + \zeta_{d,f,t}$$

at the debt type-by-firm-by-quarter level. Debt type d is either bond or commercial paper debt. The dependent variable is the change in the stock of a firm's bond or commercial paper debt relative to lagged bond debt. The main explanatory variable interacts a dummy for bonds with the instrumented total volume of insurers' purchases of the firm's bonds. The sample comprises firms with commercial paper debt in at least four quarters from 2010q1 to 2018q4 in columns 1 to 3 and in at least 50% of quarters in 4 and 5. $D_{d,f,t}$ is a vector of fixed effects. t-statistics are shown in brackets and based on standard errors clustered at the firm and debt type-by-time levels. * $p < .1$; ** $p < .05$; *** $p < .01$

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

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

This table reports IV estimates for the effect of insurers' bond purchases on the firm's total investment following the specification in column 1 in Table 5. The main explanatory variable is the total volume of insurers' purchases of firm f's bonds in quarter t scaled by lagged bond debt. It excludes primary market purchases in column 1, and it excludes bonds issued in the same quarter t in column 2. Baseline controls are the same firm and insurer characteristics as in Table 5 and baseline fixed effects are firm-seasonality, industry-time, region-time, insurer characteristics-time, and insurer economy-time fixed effects. Alternative instruments, control variables, and fixed effects are defined as in Table IA.15. t-statistics are shown in brackets and based on standard errors clustered at the firm and region-by-time levels. * $p < .1$; ** $p < .05$; *** $p < .01$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	$\frac{\text{Total Investment}}{\text{Bond debt}_{t-1}}$							
Instrumented variable:	Bond purchases (sec) / Bond debt$_{t-1}$	Bond purchases (ex issuances) / Bond debt$_{t-1}$	Bond purchases / Bond debt$_{t-1}$					
$\frac{\text{Bond purchases (sec)}}{\text{Bond debt}_{t-1}}$	7.04***							
	[4.67]							
$\frac{\text{Bond purchases (prim)}}{\text{Bond debt}_{t-1}}$	-0.54							
	[-1.05]							
$\frac{\text{Bond purchases (ex issuances)}}{\text{Bond debt}_{t-1}}$		6.47***						
		[4.52]						
$\frac{\text{Bond purchases}}{\text{Bond debt}_{t-1}}$			6.37***	7.13***	5.53***	6.25***	4.59**	4.77***
			[3.33]	[2.66]	[3.83]	[4.03]	[2.32]	[3.81]
Baseline controls	Y	Y	Y	Y	Y	Y	Y	Y
Additional controls			Y					
Insurance supply controls					Y			
Baseline FE	Y	Y	Y	Y	Y	Y	Y	Y
Rating-Time FE			Y					
SIC1-State-Time FE				Y				
Insurer inv yield-Time FE					Y			
Insurer profitability-Time FE					Y			
First stage								
ΔINVPremiums$^{>0}$	0.080***	0.082***	0.074***	0.070***	0.088***			
	[10.58]	[12.23]	[3.81]	[3.08]	[4.45]			
ΔINVPremiums$^{>0}$ (PF weights)						0.062***		
						[4.54]		
INVPremiums							0.001**	
							[2.52]	
ΔINVPremiums$^{>0}_{\text{ex dep-type}}$								0.100***
								[4.83]
F Statistic	528.4	630.4	33.9	27.2	43.5	48.9	26.0	59.3
No. of obs.	15,767	15,767	15,767	13,681	15,767	15,767	15,767	15,767
No. of firms	876	876	876	789	876	876	876	876

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

This table reports IV estimates for the effects of insurers' bond purchases following the specifications in Tables 4 and 5 with standard errors clustered at the firm and time levels. The instrument in column 3 is $\Delta INVPremiums^{>0}$. t-statistics are shown in brackets. * $p < .1$; ** $p < .05$; *** $p < .01$

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

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