Is Public Debt Arm's Length? Evidence from Corporate Bond Purchases of Life Insurance Companies*

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Abstract

We show that borrower-lender relationship is important for corporate bond financing and this relationship may influence how economic shocks affect borrowing firms. In particular, a life insurance company purchases a larger amount of a new bond issue if it already holds a larger share of that particular issuer's outstanding bonds. Using the drop in bond and stock returns during COVID-19, we find that this relationship dampens the effect of economic shocks on the borrowers that rely more heavily on lending by life insurance companies, consistent with these insurance companies' status as large, long-horizon, and reliable lenders in this market.

Keywords: Corporate bonds, insurance companies, arm's length lending, relationship lending, asset pricing
JEL Classification: G12, G20, G23, G30

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1 Introduction

There is a long history of research documenting the uniqueness of lending relationships between banks and borrowers. Banks are well-informed about their debtors (Leland and Pyle 1977; Allen 1990; Rajan 1992), are better at monitoring (Diamond 1984, 1991; Repullo and Suarez 1998), and benefit borrowers by providing a reliable source of funding (Petersen and Rajan 1994). In contrast, corporate bond market investors are presumed to lend at arm's length, because they rely on public information and are widely dispersed, and therefore face higher costs of monitoring, coordination, and renegotiation. Contrary to this public versus private debt dichotomy, we show that bond financing is more similar to relationship lending than commonly believed, and the borrower-lender relationship in the bond market may benefit the borrower as the bank lending relationship does.

We demonstrate the relationship between bond-issuing corporations and life insurance companies, the largest institutional holders of corporate bonds, by showing that a life insurance company purchases a larger amount of a new bond issue if it already holds a large share of that particular issuer's outstanding bonds. Our analysis employs a comprehensive regulatory database that includes a long time series and covers the whole universe of life insurance companies, and thereby allows us to exploit variation that is both within-bond issuer and within-insurance company. We find that if the share of a particular issuer's outstanding bonds held by an insurance company increases by one percentage point, this insurance company buys 0.17 percentage points more of the next bond issue from the same issuer. This effect is robust to controlling for several characteristics of the newly issued bonds, including rating, duration, and yield. We find an even stronger effect when we take into account that a single parent firm has multiple issuer subsidiaries: a 1 percentage point increase in an insurance company's holdings of a parent firm's bond debt is associated with a 0.23 per-

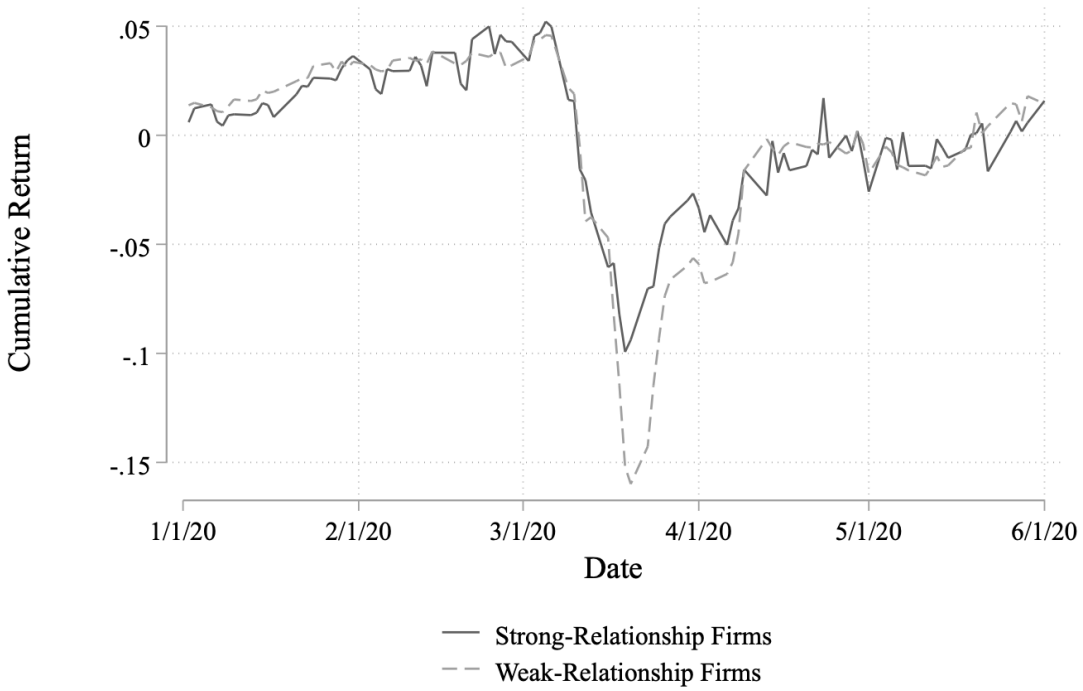
centage point greater purchase in that firm's new issuances. Moreover, the predictability of an insurance company's future primary market corporate bond purchases by its current issuer holdings remains even when we directly account for the possibility that insurance companies specialize in specific industries or maintain relationships with underwriters. Our results therefore provide strong evidence that familiarity with the borrower affects insurance companies' investment decisions in the corporate bond market.

This familiarity-based relationship in the corporate bond market matters if it has economic consequences for the borrowing firms. Life insurance companies hold bonds for the long term and do not alter their investment behavior in response to transitory changes in the market (Chodorow-Reich, Ghent, and Haddad 2021). The incentives of life insurers also differ markedly from other institutional investors, such as corporate bond mutual funds, which are beholden to customers and can experience significant outflows during economic downturns (Chernenko and Sunderam 2014; Falato, Goldstein, and Hortaçsu 2021). Moreover, our relationship lending results show that life insurance companies can be relied upon to extend new capital to firms that they are familiar with through the primary corporate bond market. Therefore, we expect that firms that rely on life insurance companies to purchase their public debt offerings fare better following bad macroeconomic shocks.

The market disruption during the COVID-19 pandemic provides a natural laboratory to test whether firms benefit from a relationship with life insurers. Market reaction to the virus led to a severe fall in bond returns between February 1, 2020, one day after COVID-19 was declared a public health emergency in the United States, and March 20, 2020, the last trading day prior to the Federal Reserve's announcement that it would establish new corporate credit purchasing facilities. However, this negative trend was more subdued for issuers borrowing more heavily from life insurers in the corporate bond market. Figure 1

illustrates this point by presenting the time series of cumulative returns of investment grade corporate bonds, which constitute over 90 percent of the corporate bond holdings of life insurance companies, around this time. The two portfolios in Figure 1 are built using bonds that match in their rating and duration but differ in the importance of life insurers as an investor for the issuing firms' bonds. While both portfolios moved in tandem until early March, the COVID-19 shock led to a smaller decrease in the bonds' value when life insurers were a more important investor.

Figure 1: Firm Relationships with Insurance Companies affect their Bond Returns



Note: Cumulative bond returns are calculated using TRACE daily price data and coupon data from Mergent FISD. We classify the top quintile ("strong-relationship") and bottom quintile ("weak-relationship") of levered firms based on the share of the issuing corporate parent's bonds held by the life insurance sector. We match each bond issued by strong relationship firms with a bond issued by weak relationship firms on propensity score, which is derived using a Probit regression of a strong relationship indicator on rating and duration at the end of 2019.

More specifically, we find that a ten percentage point increase in the share of a firm's bond debt held by life insurers is associated with a 0.8% higher return for that firm's bonds. This result is economically significant; an issuer's bond prices would have fallen about half as much following the COVID-19 shock if that issuer were completely financed by the life insurance sector, a result that is consistent with the recent findings of Coppola (2022).[1] Life insurance companies are unique corporate bond lenders in this regard; while work by Zhu (2021) shows that mutual funds also tend to purchase bonds from familiar issuers, we demonstrate these institutional investors actually amplified the COVID-19 shock for the firms whose bonds they hold.

We conclude by showing that familiarity in the bond market has real economic effects. We find that an issuer's stock value would have dropped 15% less between February 1 and March 20, 2020 if all of its bond issues were completely financed by the life insurance sector. The magnitude of this effect is large. For comparison, the S&P 500 index fell about 30% in the same time period. These stock market results further support the uniqueness of life insurance companies as lenders; we should see no effect of life insurance company bond ownership on firm valuations if life insurers were simply less prone to sell-offs following the COVID-19 shock. Such sell-offs would dampen prices in the secondary bond market, but should not have any effect on firms' real activity. Life insurance companies provide a reliable source of new capital to familiar issuers, and these familiarity-based relationships are thereby reflected in stock prices.

Previous research suggests that familiarity may affect portfolio investment decisions due to both behavioral and rational reasons (Barberis and Thaler 2003; Massa and Simonov 2006;

[1] Coppola (2022) focuses on all insurance companies and their share of holdings of a particular bond, rather than a particular issuer's bonds. He finds that increasing insurer holdings in a bond by 50 percentage points leads to about 20% smaller drawdowns in corporate bond returns during the 2008-2009 Great Recession and COVID-19 crisis.

Van Nieuwerburgh and Veldkamp 2010). For insurance companies, there are also regulatory reasons to believe that familiarity is rationally driven by information costs. Insurance companies' risk-based capital requirement depends on the credit quality and duration of their bond portfolio. In particular, these requirements provide strong incentives for insurers to avoid issues that are at risk of being downgraded (Ellul, Jotikasthira, and Lundblad 2011). For this reason, life insurance portfolio managers need to update their information about the issuers that they hold. Accordingly, life insurance companies face lower total information costs when they invest in new issues from the same issuer instead of the new issues from a less familiar issuer. We find that insurance companies exhibit familiarity-based investment behavior despite the regulations that increase the risk-based capital requirements for underdiversified portfolios (Lombardi 2006), suggesting that the benefit of familiarity exceeds the regulatory cost of underdiversification. In any case, our results about the economic implications of this familiarity-driven lending relationship for the borrowers in the corporate bond market do not depend on the source of the effect of familiarity.

Our results strongly suggest that public debt is not completely arm's length, and that the existence of a relationship between a holder and an issuer of corporate bonds may have important implications for firms' resilience under poor economic conditions. In particular, having access to dependable bond lenders, like life insurance companies, can predict better outcomes for firms that borrow in the public debt market. This fact also raises financial stability concerns, because the importance of life insurance companies in the corporate bond market has been on the decline since the mid-1980s due to the rise of bond market mutual funds (Li and Yu 2022), which may not be as reliable of a funding source in bad economic times due to sudden outflows (Chernenko and Sunderam 2014; Falato, Goldstein, and Hortaçsu 2021).

Our work expands our current knowledge of insurance company investment behavior. The literature has so far focused on the characteristics of the bonds in which insurance companies invest. Life insurance companies reach for yield, skewing their portfolios towards riskier assets within the regulatory constraints prescribed by the National Association of Insurance Commissioners (NAIC), as discussed by Becker and Ivashina (2015). Within this risk-seeking framework, insurance companies also seek to minimize the duration gap between their assets and liabilities, a goal which is complicated by changes in monetary policy and portfolio adjustment costs (Ozdagli and Wang 2020). We contribute to this literature by showing that familiarity with the issuer enters into life insurance companies' investment decision.

Our paper is also related to research that examines the role of insurance companies in propagating financial distress during economic downturns. Ellul, Jotikasthira, and Lundblad (2011) show how regulations that dictate the quality of bonds that insurance companies must hold contribute to fire sales of downgraded bonds, an effect which leads to depressed bond prices and subsequent reversals. Chodorow-Reich, Ghent, and Haddad (2021) show that life insurance companies have the capacity to act as asset insulators, an ability that prevented much of the insurance sector from becoming insolvent during the Great Recession. Our results from the COVID-19 crisis are consistent with this insulator view as we show that life insurance companies can shield their borrowers from economic shocks.

Our findings also complement a burgeoning literature about other institutional investors in the corporate bond market. Goldstein, Jiang, and Ng (2017) document that mutual fund outflows are larger during poor economic times than inflows are during market booms. Falato, Goldstein, and Hortaçsu (2021) corroborate their work and note that these funds experienced significant outflows during the COVID-19 pandemic. Jiang, Li, Sun, and Wang

(2022) consider corporate bond performance in the pandemic as well, and find that corporate bonds associated with more illiquid mutual funds exhibited significant negative returns during the height of the COVID-19 crisis, followed by price reversals after the Federal Reserve intervened in this market. This evidence suggests that life insurance companies are unique investors in their ability to soften the blow of macroeconomic shocks.

Overall, our paper elucidates the need for amending the general understanding of what constitutes arm's length debt, how firms choose their mix of bond issuances and bank loans, and the implications of bond lender-borrower relationships in the financial markets. We argue that a more complete framework of debt markets must acknowledge that bond holders may have stronger relationships with firms than typically thought.

2 Empirical Strategy

2.1 Data

We obtain data on institutional investor bond holdings, as well as bond characteristics and transactions data, for our analysis. First, we obtain insurer bond holdings data from National Association of Insurance Commissioner (NAIC) statutory filings. Filed annually, NAIC Schedule D Part 1 details end-of-year holdings and Part 5 documents bonds that were bought and sold within one year. Filed quarterly, Schedule D Parts 3 and 4 detail the purchases and sales, respectively, of bonds that were held for more than one year. These filings also include the date of transactions. Combining the information in Schedule D, we construct a daily data set of bond holdings for all life insurance companies. We also use quarterly mutual fund bond holding data to create control variables for some of our bond

return regressions. This data comes from Thomson Reuters Lipper eMAXX bond holdings data feed.

Bond characteristics, ratings, and amount outstanding data come from Mergent FISD, while transaction data are obtained from the Trade Reporting and Compliance Engine (TRACE). We clean the TRACE data in accordance with Dick-Nielsen (2009) and Dick-Nielsen (2014).

We follow Jiang, Li, Sun, and Wang (2022) in using TRACE Enhanced to calculate the following bond-level liquidity measures: Amihud illiquidity, imputed round trip costs, and effective bid ask spreads. We also incorporate their publicly available bond-level mutual fund fragility measures in our analysis.

Ratings are assigned numerical values as in Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2016) and Kempf and Tsoutsoura (2021). First, we obtain ratings issued by S&P, Moody's, and Fitch. In accordance with NAIC rules, we assign the lowest rating to a bond if two ratings are available. If the bond is rated by all three agencies, we assign it the median rating. We map safer ratings to lower numbers, with 1 corresponding to AAA.

Life insurance companies are subject to risk-based capital requirements which depend on the ratings of their bond holdings. Corporate bonds are assigned to one of six NAIC categories. The safest category, NAIC 1, includes securities rated AAA, AA, and A, while the riskiest, NAIC 6, comprises bonds rated CC or below. Table A1 details the correspondence between credit agency ratings, our assigned numerical rating, and NAIC category.

COVID-19 period bond returns are calculated using price data from TRACE bond summary and interest payment information from Mergent FISD. Following the literature (Gebhardt, Hvidkjaer, and Swaminathan 2005; Jiang, Li, Sun, and Wang 2022), we use the

formula:

$$Return_t = \frac{(P_t + AI_t) + C_t - (P_{t-1} + AI_{t-1})}{P_{t-1} + AI_{t-1}}, \tag{1}$$

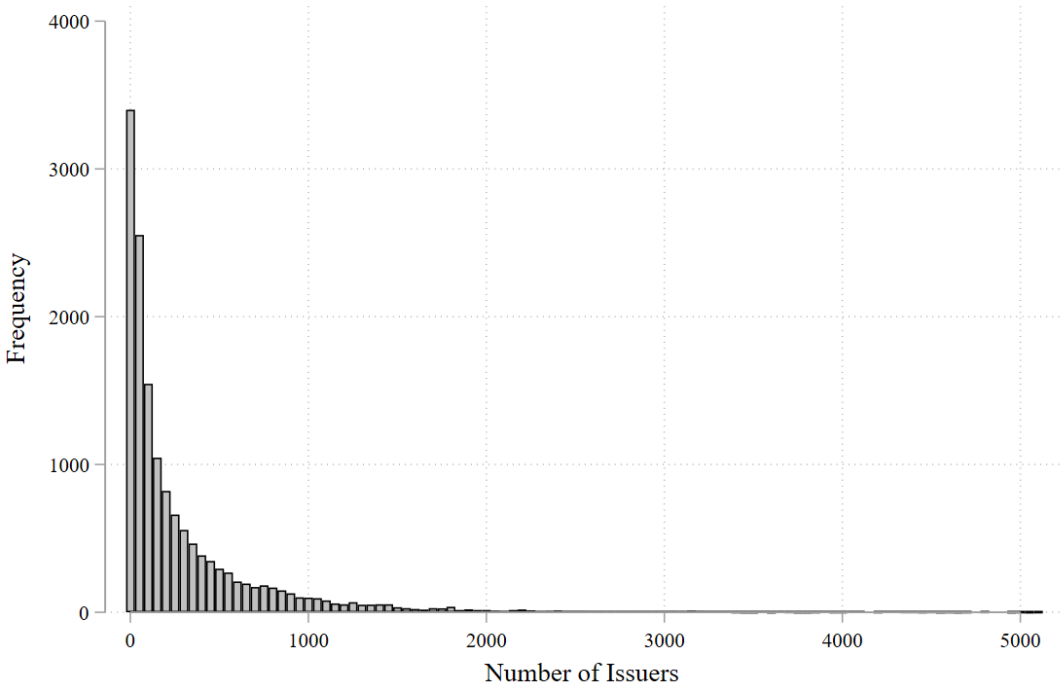
where P_t is the close price on date t, AI_t is the amount of interest accrued on date t, and C_t is the date t coupon payment, if one is paid out.

2.2 Measuring Insurance Company and Bond Issuer Relationships

If corporate public debt is truly arm's length, it should be the case that insurance companies prefer to maintain highly diversified bond portfolios. The incentives for this behavior not only include the mitigation of idiosyncratic portfolio risk, but also the minimization of risk-based capital charges, since NAIC rules prescribe higher charges for life insurers that hold few bond issuers (Lombardi 2006). Figure 2 shows the distribution of the number of issuers, which we identify using CUSIP6, held by different insurance companies. Among the bins of size 50, we see that the mode of the distribution occurs in the smallest bin, and furthermore, that the majority of insurance companies hold less than 150 bond issuers. This evidence suggests that life insurers have incentives to concentrate their corporate public debt investments in a subset of issuers, and that these incentives are strong enough to influence their portfolios despite regulatory requirements.

These observations from Figure 2 motivate our subsequent analysis of the existence of familiarity-based relationships between life insurance companies and firms. Previous work has identified relationships between bank and bond lenders by considering whether borrowers are more likely to use previous lenders when obtaining new loans (Chodorow-Reich 2014). We employ a similar identification strategy to study the lending relationship between life

Figure 2: Number of Issuers Held By Insurance Companies, 2002 – 2019



Note: The figure depicts the distribution of the number of issuers held by individual life insurance companies as reported in NAIC Schedule D Part 1 filings for the years 2002 through 2019. Each bin in the histogram is of size 50.

insurance companies and bond issuers. In particular, we study whether a life insurance company purchases a larger amount of a new bond issue if it already holds a larger share of that particular issuer's outstanding bonds.

Each observation in our regression sample corresponds to the issuance of a new corporate bond. For each data point, we calculate two variables. The first, *New Purchase Percent*$_{i,j,b,t}$, is the percent of the corporate bond b, issued by firm j at date t, that is purchased by insurance company i. The second variable, *Holding Percent*$_{i,j,t-1}$,is the percent of issuer j's total amount of outstanding bonds that are held by insurance company i as of date

$t-1$.[2] This value thereby captures the strength of the relationship between the issuer and the insurance company at the date of the new issue, akin to the Chodorow-Reich (2014) analysis. These variables are given by the following formulae,[3]

$$New\ Purchase\ Percent_{i,j,b,t} = 100 \times \frac{Purchase\ Amount_{i,j,b,t}}{Amount\ Outstanding_{j,b,t}}, \tag{2}$$

$$Holding\ Percent_{i,j,t-1} = 100 \times \frac{Issuer\ Holdings_{i,j,t-1}}{Amount\ Outstanding_{j,t-1}}. \tag{3}$$

From Table 1, we note that there is large amount of variation in *New Purchase Percent* with the 90th percentile being equal to zero, meaning that the average insurance company does not purchase the vast majority of new bond issues. Even when restricting to observations with purchase amounts greater than zero, as in Table 2, we can observe that life insurance companies generally buy a very small fraction of the offering amount of a bond, with more than 50% of purchases being less than 0.5% of the amount of outstanding bonds at issuance. There is a sharp uptick in *New Purchase Percent*, however, above the 90th percentile, with 1% of acquisitions being equal to around 9% or greater of the total amount outstanding of a newly issued bond. This fact is already suggestive of the existence of

[2]We restrict the sample of securities used to calculate *New Purchase Percent* to corporate debentures and corporate medium-term notes, which constitute the core of insurance companies' financial assets (Becker and Ivashina 2015). We identify these bonds using bond_type in Mergent FISD. We also drop preferred securities, convertible bonds, bonds denominated in a foreign currency, variable rate bonds, and bonds issued by a government or agency, in order to keep the assets in our sample more homogeneous. These securities constitute a small fraction of bonds. When calculating *Holding Percent*, we drop issues denominated in a foreign currency, which consititute a negligible portion of outstanding bonds, since these bonds' share in insurers' portfolios fluctuates due to foreign exchange value fluctuations.

[3]We calculate *New Purchase Percent* using the total holding amount of a new bond issue two weeks after the offering date. *Holding Percent* is determined on the day prior to the offering date. While our analysis considers a two-week timeframe, our results are robust to one-week, one-month, two-month, and three-month periods.

relationship lending, as the small number of large purchases are likely motivated by familiarity, while the large number of small purchases might be driven by portfolio diversification incentives.

Table 1: Summary Statistics for Life Insurance Company Issuer-Level Relationship Regressions

	Mean	SD	p1	p10	p50	p90	p99
Purchase Amount	84665	1143060	0	0	0	0	1750000
New Purchase Percent	.01848	.3272	0	0	0	0	.2667
Issuer Holdings	1275639	9389234	0	0	0	500000	30670000
Holding Percent	.02732	.2146	0	0	0	.004002	.6923
Rating	8.462	3.75	1	4	8	15	17
Duration	6.943	3.978	.2782	2.441	6.572	13.55	17.77
Yield	107.1	13326	.9889	2.541	5.12	9.125	17.98
Same State Dummy	.04991	.2178	0	0	0	0	1
Insurer Sector Share	.1205	.4282	.00001384	.0001842	.005652	.2418	2.104
Observations	11518622						

Note: New Purchase Percent, *Holding Percent*, *Duration*, and *Yield* are winsorized at the .5% level.

Table 2: Summary Statistics for Issuer-Level Holdings and Purchases, Conditional on Nonzero Observations

	Mean	SD	p1	p10	p50	p90	p99	Obs.
Purchase Amount	4854542	7194610	25000	200000	2000000	12500000	34800000	200888
New Purchase Percent	1.06	2.244	.003	.02727	.4	2.667	9	200888
Issuer Holdings	10421806	24998362	20000	200000	2545000	25300000	123180000	1409890
Holding Percent	.2232	.5766	.00008874	.001532	.03551	.5613	3.048	1409890

Note: New Purchase Percent and *Holding Percent* are winsorized at the .5% level.

There is similarly significant heterogeneity in *Holding Percent*, particularly when restricting our analysis to holdings greater than zero. While less than half of insurance companies hold any of an issuer's previously sold bonds prior to a new bond issuance, those who do tend to have multi-million dollar stakes in the issuer (*Issuer Holdings*). The aforementioned summary statistics contradict the idea that the corporate bond market is an arm's length lending market; if it were, one would expect that insurance companies would have widely-diversified portfolios, especially given the capital rules that punish lack of diversification. Instead, we see that life insurance companies tend to concentrate their bond holdings in small number of issuers. Nevertheless, this pattern may be driven by the insurance companies' preference to specialize in a specific type of bond, rather than a specific relationship with a borrower. Therefore, the next section focuses a systematic analysis of the relationship between insurance companies and issuers.

3 Relationship in the Bond Market: Empirical Results

We study how the propensity of a life insurance company to purchase a new bond issue is related to its holdings of outstanding bonds previously issued by the same issuer. We estimate the following linear regression model:

$$\begin{aligned} \textit{New Purchase Percent}_{i,j,b,t} = &\beta_0 + \beta_1 \textit{Holding Percent}_{i,j,t-1} + \beta_2' X_{b,t} \\ &+ \beta_3 \textit{Same State Dummy}_{i,j,t} \\ &+ \beta_4 \textit{Insurer Sector Share}_{i,t-1} + \textit{Fixed Effects} + e_{i,j,b,t}, \end{aligned} \tag{4}$$

where *New Purchase Percent* is the share of the new issues of the bond b of the issuer j purchased by the insurance company i, and *Holding Percent* captures the share of the outstanding bonds of the same issuer held by the same insurance company, as discussed in Section 2.2 in more detail. X is a vector of characteristics of the bond b, including rating, duration, and yield. We control for the overall market share of the lender, as in Chodorow-Reich (2014), with the variable *Insurer Sector Share*, which gives the ratio of insurance company i's total bond holdings to the holdings of the entire insurance industry. The other control variables account for the possibility that insurance companies may concentrate in lending to particular types of firms, rather than particular firms. In order to address home bias, *Same State Dummy* is a dummy variable that is equal to one if the issuer and insurance company are headquartered in the same state. Other time-invariant characteristics of the borrower, such as industry and incorporation status, are controlled for with the inclusion of issuer fixed effects. Finally, we include fixed effects for the insurance companies and date of issuance.

Table 3 illustrates our results. Our simplest model includes no fixed effects or controls, and reveals that, on average, life insurance companies purchase a significantly larger share of a new bond issue if they have purchased bonds from the same issuer before. In particular, a one percentage point increase in a life insurance company's holdings of a particular issuer predicts a .29 percentage point increase in future primary market bond purchases from that issuer. This result is unsurprising given our evidence from Section 2.2, in which we observed that the majority of insurance companies have concentrated issuer holdings and that these financial firms are selective in their new corporate bond purchases.

One explanation for why insurance companies tend to concentrate their portfolios in particular corporate bonds might be that life insurers specialize in certain types of firms,

Table 3: The Relationship between Bond Issuers and Insurance Companies, 2002-2019

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holding Percent	0.293***	0.215***	0.215***	0.215***	0.215***	0.213***	0.179***	0.170***
	(10.22)	(8.94)	(8.94)	(8.94)	(8.94)	(8.55)	(8.61)	(8.06)
Rating			-0.00117***	-0.00117***	-0.00117***	-0.00117***	-0.00116***	-0.00134***
			(-5.37)	(-5.37)	(-5.37)	(-5.38)	(-5.36)	(-6.07)
Duration			0.00115***	0.00115***	0.00115***	0.00115***	0.00115***	0.00118***
			(4.81)	(4.81)	(4.81)	(4.81)	(4.80)	(4.83)
Yield				3.17e-09*	3.17e-09*	3.18e-09*	3.67e-09**	-2.29e-08
				(2.49)	(2.49)	(2.48)	(3.00)	(-1.88)
Same State Dummy					-0.000533	-0.000525	0.00109	0.000346
					(-0.37)	(-0.37)	(1.32)	(0.39)
Insurer Sector Share						0.0318	0.0375	0.0294
						(0.78)	(0.89)	(0.89)
Constant	0.0105***							
	(9.90)							
Insurance Company FE	No	Yes	Yes	Yes	Yes	Yes	No	No
Issuer FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer Industry x Insurance Co. FE	No	No	No	No	No	No	Yes	Yes
Underwriter x Insurance Co. FE	No	No	No	No	No	No	No	Yes
R^2	0.0370	0.0542	0.0543	0.0543	0.0543	0.0544	0.0645	0.108
N	11518622	11518622	11518622	11518622	11518622	11518622	11518622	11518622

Note: Each observation in the data corresponds to an offering date and insurance company pair. We run the regression:
$New\ Purchase\ Percent_{i,j,b,t} = \beta_0 + \beta_1 Holding\ Percent_{i,j,t-1} + Control\ Variables + Fixed\ Effects + e_{i,j,b,t}$.
New Purchase Percent is the share of the new issues of the bond b of the issuer j purchased by the insurance company i. *Holding Percent* refers to the percent of the offering issuer's bonds held by the insurance company prior to a new bond issuance. *Rating* is the numerical rating value assigned in accordance with Table A1 and is determined 2 weeks after the offering date. *Duration* and *Yield* are calculated on the offering date. *Same State Dummy* is an indicator for whether the bond issuer and insurance company are incorporated in the same state. *Insurer Sector Share* is the ratio of insurance company bond holdings to the holdings of the insurance sector in percent. *New Purchase Percent*, *Holding Percent*, and *Duration* are winsorized at the 0.5% level. Standard errors are multi-way clustered on insurance company, issuer, and offering date, t statistics in parentheses. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

and thus prefer to diversify their corporate public debt holdings within a particular market segment. This concern is addressed in Model 2, which includes insurance company, bond issuer, and time fixed effects. While our estimate of interest drops, neither the statistical or economic significance is lost. In this model, a 1 percentage point increase in an insurance company's stake in a particular issuer predicts a .215 percentage point increase in the fraction

of a future new issue purchase. Therefore, our results can not be explained away by the idiosyncratic investment strategies of insurance companies, trends over time, or fixed issuer characteristics.

Model 3 controls for the effects of specific bond risk measures through the inclusion of covariates for rating, which captures credit risk, and duration, which measures interest rate risk. Both enter into these models with significant coefficients, a fact which remains true regardless of the regression specification. *Rating* admits a negative estimate, consistent with insurance companies' preference for purchasing higher-rated bonds, a proclivity which is a rational response to the risk-based capital regulations prescribed by NAIC. NAIC regulations penalize insurers that hold securities with a high probability of default by imposing increasingly large capital charges on lower-rated assets. These charges are monotonically increasing and convex, such that the penalty for owning speculative grade bonds is orders of magnitude larger than it is for owning investment grade bonds. As shown by Becker and Ivashina (2015), life insurance companies' portfolios are composed almost entirely of investment grade bonds, with the vast majority of these being rated A or higher. Our regression results corroborate this fact.

The coefficient of *Duration* is positive, a fact in accordance with life insurers preferring longer duration securities. This investment behavior is consistent with a target duration framework, in which insurance companies seek to minimize the duration mismatch between their assets and liabilities (Ozdagli and Wang 2020) because doing so reduces their risk-based capital requirements for interest rate risk (Lombardi 2006) and because the demand for insurance company contracts varies inversely with the health and risk of the provider (Koijen and Yogo 2015). Since life insurance contracts tend to have long maturities, and therefore high duration, it follows that insurance companies should prefer owning securities

with similarly high duration.

Model 4 includes *Yield* to capture any missing source of risk in the corporate bonds, and has no significant effect on purchasing behavior in this specification. It should be noted that regardless of the mix of bond characteristic controls included in our linear model, the coefficient estimate on *Holding Percent* remains effectively unchanged from Model 2. This suggests that publicly available information about new bond issuances falls short in explaining insurance company purchasing behavior, and that familarity with the bond issuer must also be a factor in corporate debt purchasing decisions.

To control for home bias, Model 5 includes *Same State Dummy*. This variable is an indicator for whether the domicile state of an insurance company, as reported in NAIC regulatory filings, is the same as the state of the issuer, as reported by Mergent FISD. Home bias could exist through a few different channels. It is possible that a life insurance company may have specialized knowledge of firms simply based on geographical proximity, a fact which could explain why life insurers tend to own a small number of issuers. It is also possible that, since life insurers are regulated by state governments, these financial institutions might be motivated by state-sponsored incentives to purchase corporate debt from local firms. With its small and insignificant coefficient under all regression specifications, we can rule out the possibility that home bias drives our results. In fact, the inclusion of this variable accounts for zero change in our estimate of β_1, up to at least three decimal figures.

A potential concern is that large life insurance companies hold and purchase the majority of bonds traded, which then drives the predictive relationship between prior holdings and future purchases. We address this by including a size measure variable, *Insurer Sector Share*, in Model 6. This variable takes on values equal to the ratio of insurance company i's aggregate bond holdings to the total life insurance industry's bond holdings, as calculated

from NAIC data. Given that the *Insurer Sector Share* coefficient is insignificant and that the coefficient of *Holding Percent* changes very little, we can reject the story that purchasing persistence is driven by market share of the insurance companies.

In Model 7, we substitute insurance company fixed effects with issuer industry-insurance company effects. In doing this, we directly account for a story in which different insurance companies specialize in different industries, using a control method which is analogous to the one used in the Chodorow-Reich (2014) analysis of bank lending relationships. While the point estimate for the coefficient of interest drops slightly to .179, it does not lose its significance.

Recent research argues that corporate bond investors have strong relationships with underwriters (Chakraborty and MacKinlay 2020). To test that our results in Table 3 are not driven by underwriter familiarity, we augment the Model 7 regression with underwriter-insurance company fixed effects. The estimate of the coefficient on *Holding Percent* is only slightly changed with the additional controls at 0.170, and remains statistically significant. While underwriter-insurance company relationships do explain some of the residual variation from the previous models (R^2 increases from 0.065 to 0.11), it is clear that familiarity between insurance companies and issuers also matters: even within an underwriter-insurance company pair, variation in a life insurer's portfolio weight on a particular issuer has significant explanatory power over its future bond purchases from that issuer.

The results in Table 3 may underestimate the true magnitude of lender-borrower relationship persistence between insurance companies and firms. It is often the case that parent firms offer bonds under different subsidiaries' issuer CUSIP codes. FISD bond issues data provides a mapping which allows us to aggregate issuer holdings to the parent level, a feature

which we exploit to produce the results in Table 4.[4] Under this specification, we see that a one percentage point increase in *Holding Percent* leads to a .228 percentage point increase in *New Purchase Percent*. Additionally, the qualitative observations made at the issuer-level hold uniformly at the parent level, with some differences in magnitude.

One might think that the positive relationship that we document between life insurance companies' bond issuer holdings and future issuer purchases could reflect that life insurers are simply passive long-term investors. Our results in Tables 3 and 4 are not consistent with this interpretation. First, the effects we identify are both within-insurance company and within-issuer. This means that an insurer with many options to purchase bonds with similar characteristics and risk-based capital requirements will tend to purchase new issues specifically from issuers that they already hold, and that this proclivity can not be explained by any time-invariant unobservable qualities of these issuers. Second, we directly control for bond risk characteristics that matter to insurance companies for regulatory purposes, and find that this can not explain insurers' preferences for particular issuers. Finally, we specifically study primary market bond purchases to show that insurance companies are not just trading in familiar issuers in the secondary bond market, but rather extending a reliable source of new funding to familiar firms.

Taken together, we conclude that insurance companies must have a familiarity-based relationship with the issuers of the bonds they hold, and that this familiarity affects their corporate bond investment decisions.

[4]We do not consider the first issuances of bonds at the issuer or parent level because *Holding Percent* can not be measured in these cases. Since issuer is a subset of parent firm, there are fewer first issuances in the issuer-level dataset than in the parent-level dataset. This explains the larger number of observations in Table 4 when compared with Table 3.

Table 4: The Relationship between Parent Firms and Insurance Companies, 2002 - 19

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holding Percent	0.432***	0.305***	0.305***	0.305***	0.305***	0.303***	0.243***	0.228***
	(11.30)	(10.04)	(10.03)	(10.03)	(10.04)	(9.41)	(10.09)	(9.56)
Rating			-0.00117***	-0.00117***	-0.00117***	-0.00117***	-0.00125***	-0.00128***
			(-5.74)	(-5.74)	(-5.74)	(-5.75)	(-6.21)	(-6.35)
Duration			0.00124***	0.00124***	0.00124***	0.00124***	0.00123***	0.00126***
			(5.24)	(5.24)	(5.24)	(5.24)	(5.21)	(5.20)
Yield				6.81e-09***	6.83e-09***	6.83e-09***	7.72e-09***	-5.59e-09
				(3.82)	(3.82)	(3.82)	(5.37)	(-1.10)
Same State Dummy					-0.000888	-0.000885	0.000562	-0.000131
					(-0.56)	(-0.56)	(0.70)	(-0.14)
Insurer Sector Share						0.0236	0.0328	0.0259
						(0.59)	(0.81)	(0.80)
Constant	0.00679***							
	(8.41)							
Insurance Company FE	No	Yes	Yes	Yes	Yes	Yes	No	No
Parent FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Issuer Industry x Insurance Co. FE	No	No	No	No	No	No	Yes	Yes
Underwriter x Insurance Co. FE	No	No	No	No	No	No	No	Yes
R^2	0.0397	0.0528	0.0529	0.0529	0.0529	0.0530	0.0629	0.101
N	12698938	12698938	12698938	12698938	12698938	12698938	12698938	12698938

Note: Each observation in the data corresponds to an offering date and insurance company pair. We run the regression:
$New\ Purchase\ Percent_{i,j,b,t} = \beta_0 + \beta_1 Holding\ Percent_{i,j,t-1} + Control\ Variables + Fixed\ Effects + e_{i,j,b,t}$.
New Purchase Percent is the share of the new issues of the bond b of the parent firm j purchased by the insurance company i. *Holding Percent* refers to the percent of the offering parent firm's bonds held by the insurance company prior to a new bond issuance. *Rating* is the numerical rating value assigned in accordance with Table A1 and is determined 2 weeks after the offering date. *Duration* and *Yield* are calculated on the offering date. *Same State Dummy* is an indicator for whether the bond issuer and insurance company are incorporated in the same state. *Insurer Sector Share* is the ratio of insurance company bond holdings to the holdings of the insurance sector in percent. *New Purchase Percent*, *Holding Percent*, and *Duration* are winsorized at the 0.5% level. Standard errors are multi-way clustered on insurance company, parent firm, and offering date, t statistics in parentheses. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

4 Life Insurers Soften the Blow: Evidence from COVID

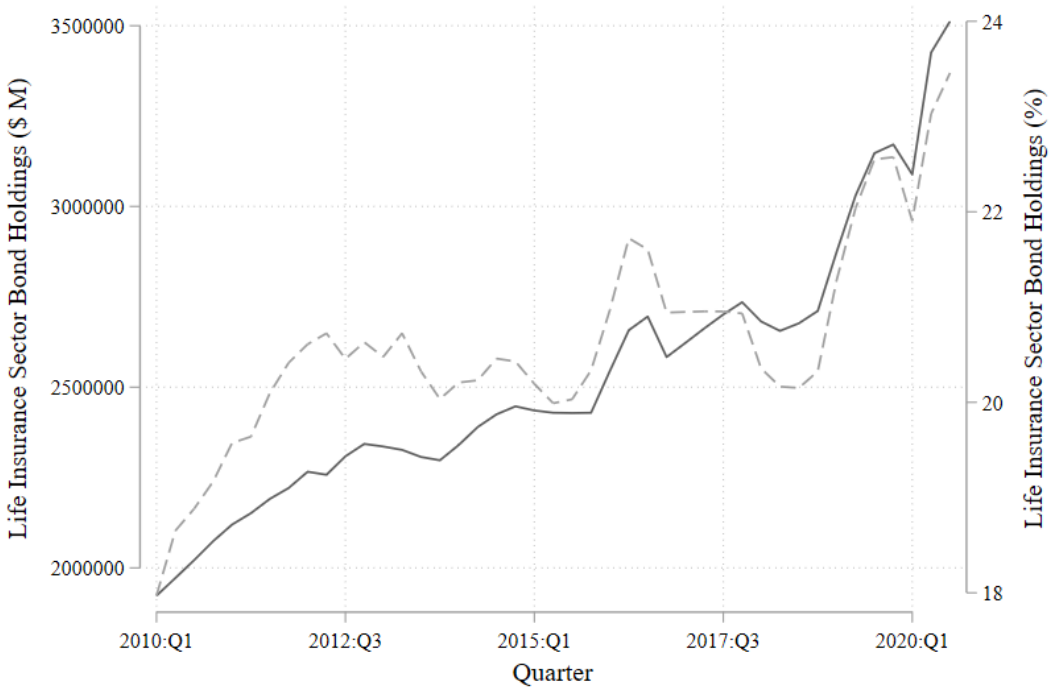
Our results so far reveal that a life insurance company purchases a larger amount of a new bond issue if it already holds a larger share of that particular issuer's outstanding bonds. This familiarity-based relationship in the corporate bond market matters if it has economic consequences for the borrowing firms. Life insurance companies are unique investors in that

they hold corporate bonds for the long term (Chodorow-Reich, Ghent, and Haddad 2021). Since life insurance companies are demonstrably reliable corporate public debt lenders, we would expect that firms that rely on these investors to purchase their bonds should fare better in times of high volatility.

The relationship between life insurance companies and bond-issuing firms is particularly relevant today. While life insurance companies have long been the largest institutional holders of corporate bonds, their presence in this market has grown significantly over the past decade in both relative and absolute terms. As illustrated in Figure 3, between 2010:Q3 and 2020:Q1, the life insurance sector's holdings of all corporate and foreign bonds outstanding increased from 18% to 23.5%. This fact underscores the sizable role of insurance companies as lenders for firms, and thereby further motivates our analysis of the relationship between this sector's investment behavior and firms' balance sheets.

The COVID-19 pandemic provides an opportunity to assess whether life insurers bolster the economic resilience of firms whose bonds they hold. Following the declaration of the virus as a public health emergency by the US Secretary of Health and Human Services, financial markets reacted quickly. Figure 4 shows market trends, with vertical lines denoting the dates of February 1, 2020, one day after COVID-19 was declared a public health crisis, and March 20, 2020, the last trading day prior to the Federal Reserve's announcement of its Primary Market Corporate Credit Facility (PMCCF) and Secondary Market Corporate Credit Facility (SMCCF), programs which would enable the Federal Reserve to purchase investment grade corporate bonds. Investment grade corporate bond returns fell dramatically during this period, dropping 14% on average between February 1 and March 20. The end of this volatile economic period is marked by the stabilization of markets with the news of PMCCF and SMCCF, evidenced by the sudden reversal of investment grade bond cumulative returns.

Figure 3: Life Insurance Sector Corporate and Foreign Bond Holdings: 2010:Q1 – 2020:Q3



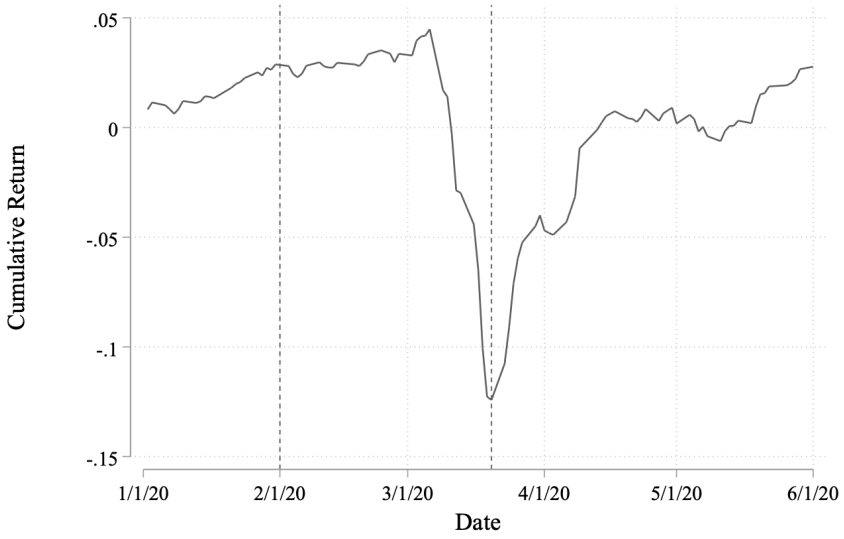
Note: This figure shows the quarterly time series of corporate and foreign bonds held by the life insurance sector in U.S. dollars and as a percent of all corporate and foreign bonds outstanding. Values are obtained from the Financial Accounts of the United States (Flow of Funds) data provided by the Board of Governors of the Federal Reserve System.

To formally test whether bonds issued by firms familiar to life insurers were insulated from the COVID shock, we study the relationship between bond returns and life insurance company holdings. We estimate the following linear model:

$$\begin{aligned} Return_{b,j,t} = \beta_0 + \beta_1 Holding\ Fraction\ of\ Issuer,\ Life\ Insurers_{j,t-1} + \beta_2 Rating_{b,j,t-1} \\ + \beta_3 Duration_{b,j,t-1} + \beta_4' X_{b,j,t-1} + e_{b,j,t}. \end{aligned} \tag{5}$$

where $Return_{b,j,t}$ is the return of bond b (in percent), issued by firm j, calculated for the

Figure 4: Investment Grade Corporate Bond Returns During COVID-19



Note: Above plot shows the times series of investment grade corporate bond returns for the first half of 2020. Vertical lines mark one day following the declaration of COVID-19 as a public health emergency (February 1, 2020) and the last trading day prior to the date that the Federal Reserve established the PMCCF and SMCCF (March 20, 2020). Average cumulative bond returns are calculated using TRACE daily price data and coupon data from Mergent FISD.

period February 1, 2020 through March 22, 2020.[5] The independent variable of interest, *Holding Fraction of Issuer, Life Insurers*$_{j,t-1}$, is the fraction of issuer j's amount outstanding held by all life insurance companies at the end of 2019.[6] $X_{b,j,t-1}$ is a vector of controls. Similar to the independent variable of interest, all explanatory variables are measured as of the end of 2019, unless stated otherwise below.

We evaluate this regression model for the set of investment grade bonds outstanding at the end of 2019. Since over 90% of life insurance companies' corporate bond holdings are investment grade bonds, our analysis covers the majority of corporate public debt securities

[5]We study the same period as Falato, Goldstein, and Hortaçsu (2021).

[6]We use *Holding Fraction* instead of *Holding Percent* to facilitate interpretation of the coefficient estimates in the following tables.

which are held by life insurers. In Table 5, we provide summary statistics for all variables. The severity of the COVID-19 shock is immediately apparent: even the 90th percentile best-performing bond had a negative return between February 1, 2020 and March 22, 2020. Table 5 also shows that the importance of life insurance companies as an investor varies considerably among bonds in our sample. The top 10% of bond issuers with the strongest ties to the life insurance sector have over one third of their public debt outstanding on life insurance company balance sheets. For the bottom 10% of issuers, life insurers hold less than 7.2% of their bonds. If having reliable corporate debt lenders matters for firms' resilience to macroeconomics shocks, then such heterogeneity suggests that the COVID-19 shock must have affected some firms more than others.

The sample exhibits significant variation in all covariates, which allows us to perform a robust analysis of the importance of life insurance companies in mitigating the effect of the COVID-19 shock. There are observations for all investment grade bond ratings. Approximately half of the bonds are rated A- and above (NAIC 1), while the rest are rated BBB (NAIC 2). Our sample also includes both long- and short-duration bonds, with duration ranging from less than 1 year to over 15 years. In some regressions, we include controls for other bond risk characteristics, mutual fund holdings, fragility, and life insurance sector trading behavior. We discuss these at length later in this section, but note now that our sample is representative of many different types of investment grade bonds.

Table 6 details our regression results. When controls are omitted from equation (5), *Holding Fraction of Issuer, Life Insurers* exhibits significant predictive power over COVID-19 period returns for bonds of similar rating and duration. On average, an issuer's investment grade bonds would have exhibited 13% higher returns if that issuer's public debt were owned solely by life insurance companies. This is a strong effect considering that the unconditional

Table 5: Summary Statistics for Issuer-Level Bond Return Regressions

	Mean	SD	p10	p25	p50	p75	p90
Bond Return, COVID-19	-13.770	10.063	-27.372	-19.341	-11.562	-6.281	-2.961
Holding Fraction of Issuer, Life Insurers	0.213	0.117	0.072	0.117	0.197	0.289	0.374
Holding Fraction of Bond, Life Insurers	0.213	0.156	0.032	0.083	0.187	0.311	0.434
Rating	7.528	1.966	5.000	6.000	8.000	9.000	10.000
Duration	6.575	5.375	0.932	2.330	4.849	10.953	15.471
Callable Dummy	0.909	0.288	1.000	1.000	1.000	1.000	1.000
Amihud	0.023	0.034	0.003	0.007	0.014	0.026	0.048
Imputed Round Trip Costs (IRC)	0.172	0.166	0.048	0.075	0.118	0.204	0.351
Effective Bid Ask Spread	0.437	0.459	0.123	0.185	0.293	0.514	0.927
Daily Close Yield	2.731	0.835	1.866	2.076	2.499	3.265	3.892
Holding Fraction of Issuer, Mutual Funds	0.192	0.106	0.077	0.110	0.171	0.260	0.339
Holding Fraction of Bond, Mutual Funds	0.171	0.144	0.047	0.085	0.136	0.207	0.321
Amihud Fragility	0.014	0.003	0.011	0.013	0.014	0.016	0.017
IRC Fragility	0.348	0.064	0.273	0.306	0.358	0.383	0.407
Spread Fragility	0.297	0.065	0.218	0.253	0.301	0.339	0.367
Net COVID Period Trading Fraction, Life Insurers	-0.001	0.008	-0.004	0.000	0.000	0.000	0.002
Holding Fraction of Issuer at Offering	0.249	0.163	0.059	0.112	0.227	0.359	0.475
Observations	4695						

Note: Statistics refer to investment grade observations in Table 6. *Holding Fraction of Issuer, Life Insurers*, *Holding Fraction of Bond, Life Insurers*, *Duration*, *Holding Fraction of Issuer, Mutual Funds*, *Holding Fraction of Bond, Mutual Funds*, *Net COVID Period Trading Fraction*, and *Holding Fraction of Parent at Offering* are winsorized at the 0.5% level.

average return for an investment grade bond during this period is -14% (Table 5); an investment grade firm could have completely insulated itself from any loss to its bonds' value if all of its public debt were held by the life insurance sector.

One concern is the possible existence of a reverse causal relationship between life insurer portfolio holdings and bond returns. Rather than acting as insulators of bond prices during economic shocks, life insurers may have invested more in bonds that are less volatile overall. Since NAIC regulations necessitate that life insurers tilt their asset portfolios towards high rated and long duration securities (Lombardi 2006), our identification strategy includes controlling for rating and duration in all model specifications. While both risk measures have statistically significant and negative effects on bond returns, it is clear that *Holding Fraction of Issuer, Life Insurers* has strong predictive power on COVID-19 returns among

bonds within the same risk profile.

In Model 2, we include controls for additional risk characteristics to further address reverse causality concerns. We include an indicator for whether a bond is callable (*Callable Dummy*) to disentangle the effect of early redemption risk. We also include three measures of illiquidity: *Amihud*, *Imputed Round Trip Costs (IRC)* and *Effective Bid Ask Spread*, calculated as in Jiang, Li, Sun, and Wang (2022). *Callable Dummy* has an insignificant coefficient estimate in this specification. In contrast, high liquidity risk predicts a greater reduction in bond returns during this period. Despite this fact, the coefficient on *Holding Fraction of Issuer, Life Insurers* has barely changed from Model 1 to Model 2, providing further evidence that publicly available bond characteristics do not explain the positive relationship between life insurance company holdings and bond returns during this crisis period.

In Model 3, we control for bond yield at the end of 2019, in order to account for any other risk characteristics that our set of covariates fails to capture.[7] As expected, including this yield in the regression alters the coefficients of previous risk controls, since a bond's yield reflects an amalgam of various risk characteristics. Unsurprisingly, bonds with higher yields, and hence with greater risk, had much more negative returns during COVID-19. Even so, the coefficient on *Holding Fraction of Issuer, Life Insurers* is still economically large: investment grade firms whose publicly held debt was financed completely by life insurance companies would have had 9% higher bond returns. Clearly, the risk profiles of the bonds in our sample do not explain the positive relationship between life insurance company holdings and crisis bond returns.

We also consider the hypothesis that the relationship we observe in Model 3 is not driven

[7]We use the last available close yield up to 30 days prior to December 31, 2019.

Table 6: Investment Grade Bond Returns During COVID-19, Issuer Level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holding Fraction of Issuer, Life Insurers	12.78***	12.05***	8.93***	7.54***	7.54***	7.95***		
	(6.74)	(6.38)	(5.31)	(4.03)	(4.04)	(2.86)		
Holding Fraction of Bond, Life Insurers							3.07***	7.24
							(3.59)	(0.55)
Rating	-1.75***	-1.62***	-0.73***	-0.77***	-0.77***	-0.78***	-0.86**	-0.90**
	(-14.19)	(-13.50)	(-6.90)	(-7.32)	(-7.28)	(-7.07)	(-2.42)	(-2.50)
Duration	-1.19***	-1.13***	-0.44***	-0.44***	-0.44***	-0.43***	-0.83***	-0.84***
	(-45.63)	(-39.52)	(-6.65)	(-6.10)	(-6.08)	(-5.89)	(-14.57)	(-8.83)
Callable Dummy		0.34	-0.70*	-0.51	-0.51	-0.66	-0.70**	-0.57
		(0.59)	(-1.78)	(-1.29)	(-1.29)	(-1.56)	(-2.29)	(-0.89)
Amihud		1.47	-0.23	0.93	0.95	1.57	-5.86	-8.09
		(0.26)	(-0.04)	(0.17)	(0.18)	(0.28)	(-1.23)	(-1.09)
Imputed Round Trip Costs (IRC)		-6.46***	-0.21	-0.07	-0.06	-0.08	-0.18	-0.20
		(-3.19)	(-0.11)	(-0.03)	(-0.03)	(-0.04)	(-0.16)	(-0.12)
Effective Bid Ask Spread		-0.15	1.19**	1.16**	1.16**	1.24**	0.90**	0.81*
		(-0.27)	(2.20)	(2.12)	(2.12)	(2.21)	(2.29)	(1.79)
Daily Close Yield			-6.33***	-6.20***	-6.19***	-6.31***	-2.61***	-2.64***
			(-10.69)	(-10.20)	(-10.17)	(-10.20)	(-6.31)	(-6.14)
Holding Fraction of Issuer, Mutual Funds				-4.08***	-4.08***	-3.58*		
				(-2.65)	(-2.65)	(-1.89)		
Holding Fraction of Bond, Mutual Funds							-1.95***	-1.58
							(-2.78)	(-0.88)
Amihud Fragility				-184.62***	-184.24***	-191.67**	-215.85***	-246.53**
				(-2.59)	(-2.59)	(-2.51)	(-3.00)	(-2.32)
IRC Fragility				-5.26	-5.31	-4.58	-7.42	-4.94
				(-0.94)	(-0.95)	(-0.77)	(-1.62)	(-0.67)
Spread Fragility				7.24	7.28	7.13	5.59	1.43
				(0.90)	(0.90)	(0.80)	(0.86)	(0.11)
Net COVID Period Trading Fraction, Life Insurers					4.86	3.34	-4.23	-4.02
					(0.28)	(0.19)	(-0.31)	(-0.21)
Constant	4.46***	4.15***	10.21***	13.26***	13.26***	13.29***		
	(5.13)	(4.73)	(9.92)	(11.83)	(11.83)	(12.36)		
Issuer Fixed Effects	No	No	No	No	No	No	Yes	Yes
R^2	0.489	0.499	0.552	0.555	0.555	0.556	0.800	0.589
N	4695	4695	4695	4695	4695	4469	4695	4431

Note: Models 1-6 present results for the following regression:

$$Return_{b,j,t} = \beta_0 + \beta_1 Holding\ Fraction\ of\ Issuer,\ Life\ Insurers_{j,t-1} + Control\ Variables + e_{b,j,t}.$$

Models 7-8 replace *Holding Fraction of Issuer* with *Holding Fraction of Bond* and add issuer-level fixed effects. Bond returns are calculated for the period February 1, 2020 through March 22, 2020. *Holding Fraction of Issuer* is equal to the dollar amount of bonds from a particular issuer held by all life insurers or all mutual funds divided by that issuer's total amount outstanding on December 31, 2019. *Callable Dummy* is an indicator for whether a bond is callable. *Amihud*, *IRC*, and *Effective Bid Ask Spread* are illiquidity measures calculated for 2019:Q4. *Fragility Amihud*, *Fragility IRC* and *Fragility Spread* are the amount outstanding weighted averages of bond fragility measures created by Jiang, Li, Sun, and Wang (2022). *Net COVID Period Trading Fraction* is equal to the net purchase amount of a bond between February 1, 2020 and March 22, 2020 divided by the amount outstanding on December 31, 2019. *Holding Fraction of Bond* is the dollar amount of the bond held by all life insurers or all mutual funds divided by that bond's total amount outstanding on December 31, 2019. *Holding Fraction of Issuer, Life Insurers*, *Duration*, *Holding Fraction of Issuer, Mutual Funds*, *Net COVID Period Trading Fraction*, *Holding Fraction of Bond, Life Insurers*, and *Holding Fraction of Bond, Mutual Funds* are winsorized at the 0.5% level. Standard errors are clustered on issuer, t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

by life insurance company insulation of bonds, but rather mutual fund exacerbation of price volatility. Recent research documenting mutual fund susceptibility to outflows in economic downturns (Chernenko and Sunderam 2014; Falato, Goldstein, and Hortaçsu 2021) suggests that fund managers seeking liquidity faced significant selling pressure during the pandemic. To the extent that high life insurance company ownership is correlated with low mutual fund ownership, the significant effect of life insurance company holdings may simply be driven by downward price pressure from mutual fund sales.

In Model 4, we rule out this alternative mechanism by including a control for mutual fund holdings. This covariate, *Holding Fraction of Issuer, Mutual Funds*, is constructed analogously to its life insurer counterpart, except the numerator is equal to the par value of the bond issuer held by all mutual funds in Thomson Reuters Lipper eMAXX at the end of 2019:Q4. In all specifications, higher mutual fund holdings are associated with lower bond returns. Despite the predictive power of this new control, we see that the coefficient on *Holding Fraction of Issuer, Life Insurers* remains large and significant. Among investment grade bonds, firms whose corporate debt is financed 100% by insurance companies would have experienced 7.54% higher bond returns, a value that is almost double the magnitude of the effect of 100% mutual fund financing (-4.08%), which goes in the opposite direction.

Model 4 also incorporates controls to address the concern that it is not the quantity of mutual fund holdings that matter, but rather the quality of these bond-holding funds. Work by Jiang, Li, Sun, and Wang (2022) argues that mutual fund fragility explains the trend in bond returns prior to the Federal Reserve's announcement of the corporate bond purchase facilities. The authors define fragility of a bond as the average of mutual fund portfolio illiquidity weighted by fund holdings of that security. The mechanism they propose is as follows: mutual funds with very illiquid portfolios suffer more from higher outflows in

economic crises, and as a result, these funds have a greater imperative to sell their assets in order to meet redemption demand, thereby pushing prices down. It follows that bonds held by the most illiquid funds have more negative returns in economic downturns.

For a fully robust analysis of the mutual fund effect on COVID-19 period bond returns, the Model 4 specification includes the Jiang, Li, Sun, and Wang (2022) bond-level fragility measures, *Amihud Fragility*, *IRC Fragility*, and *Spread Fragility*. Indeed, these measures explain some of the fall in bond prices during COVID-19 for investment grade bonds. Overall, our results corroborate the Jiang, Li, Sun, and Wang (2022) findings and additionally show that the effect of familiarity-based relationships stemming from life insurers remains very similar after controlling for bond-level fragility.

Since life insurance companies are the largest institutional investors in corporate bonds, one might expect that the largest firms in this sector hold market power. Sen and Sharma (2020) propose that many life insurers cornered new issues of small bonds in the Great Recession, a practice which allowed these insurers to later bolster the reported prices of their assets by exploiting NAIC rules. If life insurers have the ability to affect prices, their incentive to do so is higher when they face a large shock. The dampening effect of life insurance companies on COVID-19 bond returns could therefore be driven by insurers that protect the asset side of their balance sheet through the acquisition of more bonds in which they already have a large portfolio position.

In Model 5, we disentangle this alternative explanation from our familiarity-based relationship lending hypothesis by controlling for COVID-19 period trading. We define *Net COVID Period Trading Fraction, Life Insurers* as the net purchase amount of a bond by the life insurance sector between February 1, 2020 and March 22, 2020 divided by the amount outstanding of that bond on December 31, 2019. The new control has no statistically signif-

icant effect on bond returns. More importantly, the coefficient estimate for *Holding Fraction of Issuer, Life Insurers* remains quantitatively similar to the one in Model 4. Issuer familiarity is still an important component in understanding COVID-19 corporate bond prices.

So far, we have directly addressed the concern of reverse causality by including control variables in our regressions that capture the risk profile of the bonds. Next, we employ an instrumental variable strategy, in order to further alleviate the concern that the results are driven by the possibility that insurance companies choose issuers that are less sensitive to downturns. In particular, we construct an instrumental variable (IV) for each bond, *Holding Fraction of Issuer at Offering*, that is equal to the fraction of all outstanding bonds from that bond's issuer, which are held by the life insurance sector one day before the bond's offering.

The instrumental variable takes advantage of two facts: (i) life insurance companies tend to hold bonds for the long term (Chodorow-Reich, Ghent, and Haddad 2021), and, as shown in Section 3, (ii) life insurance companies tend to purchase the new bond issues of those issuers that they are already holding in their portfolio. These facts mean that for any particular bond, a significant portion of life insurers' 2019 holdings of that bond was acquired at offering. Furthermore, the amount these insurers purchased at the time of offering depended on their holdings of that bond issuer's debt before the bond was even issued. For these reasons, the IV satisfies the relevance condition. This is also clear empirically; in Model 1 of Table A4, we see that the F-statistic for the first stage is 625, and the coefficient estimate for *Holding Fraction of Issuer at Offering* is both economically and statistically significant.

The instrument also satisfies the exogeneity condition. An insurer's holdings of a particular issuer's outstanding bonds before the bond was even issued is unlikely to be correlated with a newly offered bond's responsiveness to macroeconomic downturns many years from

the time of its issue, a horizon that is different both across issuers and across the bonds of the same issuer. This is especially true because a given insurance company can choose many bonds with the same characteristics, including responsiveness to macroeconomic downturns, but it typically holds the bonds from a few number of firms.

The IV estimates in Model 6 remain very similar to their OLS counterparts in Model 5. For the independent variable of interest, *Holding Fraction of Issuer, Life Insurers*, the IV coefficient estimate and the OLS estimate are 7.95 and 7.54, respectively. Overall, the IV evidence supports that, in times of economic distress, life insurance companies' holdings cushion the blow on bond returns of those issuers with whom they have a stronger relationship.

In order to control for all other issuer-level characteristics, we employ a new linear regression in Model 7:

$$\begin{aligned} Return_{b,j,t} = \beta_0 + \beta_1 Holding\ Fraction\ of\ Bond,\ Life\ Insurers_{b,j,t-1} + \beta_2 Rating_{b,j,t-1} \\ + \beta_3 Duration_{b,j,t-1} + \beta_4' X_{b,j,t-1} + \mu_j + e_{b,j,t}. \end{aligned} \tag{6}$$

where $Return_{b,j,t}$ is defined as before. We replace *Holding Fraction of Issuer, Life Insurers*$_{j,t-1}$ in equation (5) with *Holding Fraction of Bond, Life Insurers*$_{b,j,t-1}$, defined as the fraction of bond b's amount outstanding held by all life insurance companies at the end of 2019. We also construct an analogous variable for mutual fund holdings, which we use instead of *Holding Fraction of Issuer, Mutual Funds* in the set of controls. Note that with these replacements, all independent variables are defined at the bond level. As such, we are able to include issuer-level fixed effects μ_j in the regression, and thereby capture all other confounding issuing-firm characteristics that might overturn our hypothesis. We continue to include the

remaining battery of controls introduced in Models 1-5. The identifying assumption here is that any variation in the life insurance sector's holdings of a bond, within a particular bond issuer, that is not explained by our extensive set of controls is exogenous. The estimate of interest may be biased if two bonds issued by the same firm differed in their resilience to the COVID-19 shock, which we believe is unlikely.

We find that a bond owned entirely by life insurers would have experienced 3% higher returns than those held entirely by other investors. Nevertheless, we note that the bond-level holdings variables are imprecise proxies of the familiarity-based relationship between a lender and an issuer: since the lender can hold many different bonds of the same issuer, multiple values of bond-level holdings imply the same level of relationship. Issuer-level holdings, as used in Models 1-5, better measure the relationships between institutional investors and levered firms. For this reason, we interpret the estimate in Model 7 as a lower bound on the effect of familiarity on bond returns.

As a final step, we address the issue with the estimate in Model 7 being a lower bound by using the instrumental variable developed for Model 6 for the regression in Model 7. Recall that this IV captures the life insurance sector's holdings at the issuer level at the date right before the bond's offering. Therefore, this IV addresses the downward bias due to the measurement error caused by using life insurers' bond-level holdings.[8] Model 8 presents the results from the instrumented, fixed effects regression. The coefficient estimate of interest jumps from 3.07 to 7.24, a number much closer to the estimates in Models 5 and 6, although we lose statistical significance due to the lower efficiency of the IV estimator. Overall, we conclude that our various robustness checks confirm that the impact of the COVID-19

[8]Table A4, second column, in the Appendix presents the first stage regression that shows the relevance of this instrument. We note that issuer fixed effects do not absorb this instrument because bonds from the same issuer are issued at different dates, creating a variation in the instrument not completely captured by issuer fixed effects.

crisis has been less drastic for bonds of those issuers who are more favored by life insurance companies due to their familiarity with these issuers.

Since multiple issuers can be mapped to the same parent firm, we also construct a new set of parent-level variables, as we did in the previous section. In particular, we create *Holding Fraction of Parent, Life Insurers*$_{j,t-1}$, which equals the fraction of a parent firm j's outstanding bonds held by all life insurance companies at the end of 2019. We also generate *Holding Fraction of Parent, Mutual Funds*$_{j,t-1}$, which is defined analogously, except that the fraction's numerator is total holdings of the parent by mutual funds. Lastly, we construct the parent-level version of our instrumental variable, *Holding Fraction of Parent at Offering*, which we later use in robustness checks for our results. For a particular bond, this variable is defined as the fraction of all outstanding bonds of that bond's parent firm held by the life insurance sector, calculated one day before the bond's offering. Summary statistics for the parent-level sample are given in Table 7.

In Table 8, we perform the same set of tests as those at the issuer-level, but instead use parent-level life insurance company and mutual fund holding fractions as dependent variables in Models 1-6. With all controls included, estimates from Model 5 in Table 8 show that a parent company, whose publicly traded debt is held entirely by life insurers, would have experienced 8.65 percentage point higher returns. This result is stronger than the corresponding estimate at the issuer level, a fact which corroborates our finding in Section 3 that familiarity-based relationships are stronger at the parent level. In Models 7 and 8, we also see that our results are supported by a bond-level holdings regression which includes parent-level fixed effects, as well as an instrumental variable regression that includes these fixed effects.

Most other qualitative observations hold at the parent level: higher rating, duration,

Table 7: Summary Statistics for Parent-Level Bond Return Regressions

	Mean	SD	p10	p25	p50	p75	p90
Bond Return, COVID-19	-13.716	10.052	-27.323	-19.217	-11.506	-6.220	-2.948
Holding Fraction of Parent, Life Insurers	0.215	0.110	0.083	0.122	0.205	0.287	0.367
Holding Fraction of Bond, Life Insurers	0.216	0.159	0.032	0.083	0.189	0.314	0.440
Rating	7.539	1.958	5.000	6.000	8.000	9.000	10.000
Duration	6.519	5.342	0.904	2.309	4.823	10.767	15.424
Callable Dummy	0.904	0.294	1.000	1.000	1.000	1.000	1.000
Amihud	0.024	0.035	0.003	0.007	0.014	0.027	0.051
Imputed Round Trip Costs (IRC)	0.173	0.166	0.048	0.075	0.118	0.205	0.358
Effective Bid Ask Spread	0.443	0.469	0.122	0.185	0.295	0.520	0.943
Daily Close Yield	2.734	0.835	1.868	2.078	2.503	3.268	3.890
Holding Fraction of Parent, Mutual Funds	0.192	0.097	0.086	0.118	0.168	0.245	0.321
Holding Fraction of Bond, Mutual Funds	0.169	0.143	0.045	0.083	0.134	0.207	0.319
Amihud Fragility	0.014	0.003	0.011	0.013	0.014	0.016	0.017
IRC Fragility	0.349	0.065	0.273	0.307	0.359	0.383	0.409
Spread Fragility	0.298	0.067	0.218	0.253	0.301	0.340	0.368
Net COVID Period Trading Fraction, Life Insurers	-0.001	0.008	-0.004	0.000	0.000	0.000	0.002
Holding Fraction of Parent at Offering	0.267	0.155	0.072	0.145	0.250	0.370	0.480
Observations	4877						

Note: Statistics refer to investment grade observations in Table 8. *Holding Fraction of Parent, Life Insurers*, *Holding Fraction of Bond, Life Insurers*, *Duration*, *Holding Fraction of Parent, Mutual Funds*, *Holding Fraction of Bond, Mutual Funds*, *Net COVID Period Trading Fraction*,and *Holding Fraction of Parent at Offering* are winsorized at the 0.5% level.

yield, and fragility all predict lower returns. One interesting difference is that mutual fund holdings loses its economic and statistical significance in almost all regressions when *Holding Fraction of Parent, Mutual Funds* is used. This result provides further evidence for the uniqueness of life insurance companies as lenders. Overall, the results of Table 8 confirm our findings in Table 6.

Our bond return results demonstrate the uniqueness of life insurance companies. Bond and issuer characteristics are not sufficient to explain away the relationship between the life insurance industry's holdings of a particular firm's debt and the performance of that debt in the securities market. Life insurers lend stability to the issuers of bonds in their portfolios, a fact which has important implications for overall market resilience during economic shocks. Given that our previous findings showed that life insurers maintain familiarity-based

Table 8: Investment Grade Bond Returns During COVID-19, Parent Level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Holding Fraction of Parent, Life Insurers	14.07***	12.99***	9.45***	8.65***	8.65***	7.84***		
	(5.48)	(5.18)	(4.22)	(3.22)	(3.23)	(2.66)		
Holding Fraction of Bond, Life Insurers							2.94***	8.58
							(3.70)	(1.54)
Rating	-1.76***	-1.63***	-0.77***	-0.78***	-0.79***	-0.80***	-0.85***	-0.84***
	(-12.77)	(-12.19)	(-6.74)	(-7.12)	(-7.10)	(-7.31)	(-5.92)	(-5.75)
Duration	-1.18***	-1.12***	-0.47***	-0.47***	-0.47***	-0.47***	-0.85***	-0.89***
	(-43.52)	(-38.18)	(-5.85)	(-5.40)	(-5.43)	(-5.34)	(-14.42)	(-13.51)
Callable Dummy		0.15	-0.72	-0.65	-0.64	-0.61	-0.79**	-0.61
		(0.21)	(-1.53)	(-1.36)	(-1.36)	(-1.37)	(-2.56)	(-1.53)
Amihud		2.64	1.52	3.30	3.32	3.04	-2.72	-5.99
		(0.50)	(0.30)	(0.65)	(0.65)	(0.59)	(-0.66)	(-1.25)
Imputed Round Trip Costs (IRC)		-6.22***	-0.20	-0.08	-0.07	-0.07	0.03	-0.06
		(-3.16)	(-0.10)	(-0.04)	(-0.04)	(-0.03)	(0.03)	(-0.05)
Effective Bid Ask Spread		-0.15	1.05**	1.04**	1.04**	1.11**	0.61	0.53
		(-0.28)	(2.14)	(2.03)	(2.03)	(2.13)	(1.64)	(1.33)
Daily Close Yield			-6.06***	-5.94***	-5.94***	-6.00***	-2.53***	-2.54***
			(-8.57)	(-8.21)	(-8.21)	(-8.24)	(-6.52)	(-6.59)
Holding Fraction of Parent, Mutual Funds				-2.33	-2.33	-2.95		
				(-1.12)	(-1.12)	(-1.44)		
Holding Fraction of Bond, Mutual Funds							-2.52***	-1.53
							(-3.49)	(-1.34)
Amihud Fragility				-184.61**	-184.27**	-197.40**	-229.33***	-234.91***
				(-2.49)	(-2.49)	(-2.57)	(-3.64)	(-3.37)
IRC Fragility				-8.38	-8.44	-8.54	-12.94***	-10.49**
				(-1.39)	(-1.40)	(-1.34)	(-2.68)	(-1.96)
Spread Fragility				10.81	10.87	12.23	13.44**	8.64
				(1.25)	(1.26)	(1.30)	(2.06)	(1.06)
Net COVID Period Trading Fraction, Life Insurers					6.49	5.27	-4.69	0.44
					(0.38)	(0.31)	(-0.36)	(0.03)
Constant	4.21***	4.08***	9.87***	12.49***	12.50***	12.79***		
	(4.62)	(4.23)	(8.55)	(9.30)	(9.30)	(9.50)		
Parent Fixed Effects	No	No	No	No	No	No	Yes	Yes
R^2	0.488	0.497	0.547	0.549	0.549	0.551	0.783	0.579
N	4877	4877	4877	4877	4877	4783	4877	4767

Note: Models 1-6 present results for the following regression:

$$Return_{b,j,t} = \beta_0 + \beta_1 Holding\ Fraction\ of\ Parent,\ Life\ Insurers_{j,t-1} + Control\ Variables + e_{b,j,t}.$$

Models 7-8 replace *Holding Fraction of Parent* with *Holding Fraction of Bond* and add parent-level fixed effects. Bond returns are calculated for the period February 1, 2020 through March 22, 2020. *Holding Fraction of Parent* is equal to the dollar amount of bonds from a particular parent firm held by all life insurers or all mutual funds divided by that parent firm's total amount outstanding on December 31, 2019. *Callable Dummy* is an indicator for whether a bond is callable. *Amihud*, *IRC*, and *Effective Bid Ask Spread* are illiquidity measures calculated for 2019:Q4. *Fragility Amihud*, *Fragility IRC* and *Fragility Spread* are the amount outstanding weighted averages of bond fragility measures created by Jiang, Li, Sun, and Wang (2022). *Net COVID Period Trading Fraction* is equal to the net purchase amount of a bond between February 1, 2020 and March 22, 2020 divided by the amount outstanding on December 31, 2019. *Holding Fraction of Bond* is the dollar amount of the bond held by all life insurers or all mutual funds divided by that bond's total amount outstanding on December 31, 2019. *Holding Fraction of Parent, Life Insurers*, *Duration*, *Holding Fraction of Parent, Mutual Funds*, *Net COVID Period Trading Fraction*, *Holding Fraction of Bond, Life Insurers*, and *Holding Fraction of Bond, Mutual Funds* are winsorized at the 0.5% level. Standard errors are clustered on parent firm, t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

relationships with bond-issuing firms, the bond-price stabilizing effect we have documented is not applied uniformly over issuers. Issuers favored by life insurers have access to reliable, long-term lenders.

5 Real Effects of Relationships in the Bond Market

Our previous results shows that insurance companies are reliable lenders for familiar bond issuers, and that firms with relationships to life insurers were more insulated from the COVID-19 shock in the bond market. We now study whether familiarity-based relationships matter for firm value in times of financial distress. Our analysis is motivated by the vast evidence in the corporate finance and banking literature which shows that financial frictions can affect real activity. Since relationship lenders mitigate financial frictions by providing a reliable source of funding to firms (Petersen and Rajan 1994), we hypothesize that the market value of firms with relationships to life insurers should also be insulated from macroeconomic shocks.

To test this hypothesis, we turn our attention to a study of cumulative stock returns between February 1, 2020 and March 23, 2020, the same time period we studied before. In order to test the importance of familiarity-based relationship lending in bolstering stock returns, we map the same set of investment grade corporate bond issues from Mergent FISD used in our previous regressions to their corresponding firm's stock ticker using the CRSP-TRACE linking file from WRDS.[9] We then map these tickers to firm balance sheet data from Compustat using the CRSP-Compustat database. Cumulative stock returns are calculated using stock market data from CRSP.

[9]We restrict the sample of securities to the same set that is used to construct *New Purchase Percent* in Tables 3 and 4. See footnote 2 for details.

Our approach to estimating the importance of life insurers' familiarity-based relationships in bolstering stock returns is similar to the method employed for bonds. We consider the following linear regression model:

$$\textit{Cumulative Return}_{j,t} = \beta_0 + \beta_1 \textit{Holding Fraction}_{j,t-1} + \beta_2' X_{j,t-1} + e_{j,t}, \tag{7}$$

where $\textit{Holding Fraction}_{j,t-1}$ is the fraction of firm j's outstanding bonds held by life insurance companies at the end of 2019, and $X_{j,t-1}$ include the firm characteristics that are shown the be related to stock returns, including CAPM beta, size, and book-to-market equity.

Table 9 provides the results from this exercise. Model 1 shows that an issuer's stock value would have dropped 15% less during the COVID-19 turmoil if all of its bond issues were completely financed by the life insurance sector, a significant value given that S&P 500 index fell by about 30% during this time period. Controlling for CAPM beta (Model 2) reduces this coefficient to 7%, whereas adding other firm characteristics (Model 3) does not lead to a material change in the results. Since we have significantly fewer stocks in our sample than bonds, one concern may be that our results are driven by some outliers. In order to address this concern, we also run quantile regressions (Models 4–6) and find that accounting for outliers makes our results, if anything, more significant.

Our regression results show that relationships in the bond market have an effect on outcomes in the stock market. Note that these effects are not consistent with a story in which life insurers are passive investors that are simply less prone to fire selling assets after macroeconomic shocks. If this were true, we would find no effect on firm valuations, as fire sales are unrelated to a firm's intrinsic investment opportunities. Our stock market results support the hypothesis that there is a real effect of relationship lending in the bond market

Table 9: Stock Response to COVID-19

	(1)	(2)	(3)	(4)	(5)	(6)
Holding Fraction	15.48***	7.01**	5.42*	18.03***	9.19***	8.35***
	(4.66)	(2.31)	(1.87)	(6.56)	(3.67)	(2.79)
CAPM Beta		-11.40***	-9.15***		-12.18***	-8.96***
		(-8.22)	(-6.97)		(-9.79)	(-7.15)
Size			2.25***			3.02***
			(5.32)			(7.41)
Book-to-Market			-0.14			-0.63
			(-0.37)			(-0.62)
Constant	-44.97***	-30.86***	-84.27***	-46.27***	-31.74***	-104.24***
	(-38.76)	(-17.24)	(-8.16)	(-37.73)	(-18.76)	(-10.22)
R^2	0.026	0.126	0.173			
N	700	700	700	700	700	700

Note: We run the following regression:

$$\textit{Cumulative Return}_{j,t} = \beta_0 + \beta_1 \textit{Holding Fraction}_{j,t-1} + \beta_2' X_{j,t-1} + e_{j,t}.$$

Cumulative Return is the cumulative stock return over the period February 1, 2020 through March 23, 2020. *Holding Fraction* is equal to the dollar amount of bonds held by all life insurance companies divided by the total amount outstanding on December 31, 2019. *CAPM Beta* is measured over the period from January 1, 2019, to December 31, 2019, using daily stock data. *Size* is the logarithm of market value of equity, defined as price (prc) multiplied by shares outstanding (shrout) from CRSP, as of December 31, 2019. *Book-to-Market* is book value of equity from Compustat divided by market value of equity as of end of 2019. Heteroskedasticity-robust t statistics in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

on firms' values. Insurance companies are reliable suppliers of capital, and as we show in Section 3, they prefer to fund familiar issuers. Issuers with familiarity-based relationships with insurance companies thereby benefit from these relationships similarly to how loan borrowers benefit from their relationships with banks (Petersen and Rajan 1994).

Whether we restrict our analysis to bonds or stocks, we find that the preponderance of life insurance company holdings in the corporate public debt markets matter. It is apparent that stock and bond securities prices react differently based on the level of life insurer public-debt lending. Our analysis in Section 3 complements these finding by revealing that life insurance companies show persistence in their purchasing choices, and that they display loyalty to a

particular set of issuers. Taken together, our results suggests that these familiarity-based relationships play a particularly important role in times of economic volatility, like during the COVID-19 pandemic, and that firms with stronger relationships with life insurance companies reap the benefits of insulation from economics shocks.

6 Conclusion

Previous literature makes a distinction between lenders that build relationships with debt-issuing firms and lenders that invest at arm's length. While corporate bond market investors are generally thought to fall in the latter group, we find that this does not hold true in our analysis of life insurance companies. We demonstrate that life insurers are more similar to relationship lenders by documenting two empirical observations. First, we show that these institutional investors tend to purchase bonds from the same issuers over time. This behavior holds true despite NAIC regulations which incentivize issuer diversification, and it can not be explained by investment strategies based on publicly available information, like rating, yield, and duration.

Second, we show that because life insurance companies are reliable lenders in the corporate bond market, firms whose debt is held by life insurance companies are safeguarded from macroeconomic shocks. Unlike other institutional investors (e.g. mutual funds) that are prone to sell-offs in economic downturns, life insurers' investment strategy entails holding bonds for the long term. For this reason, we expect that bond-issuing firms whose public debt is held primarily by life insurers fare better in economic downturns. We use COVID-19 as a natural experiment to show that this hypothesis holds true. While corporate bond and stock returns plummeted during the height of the pandemic, we find that negative returns

were more subdued for those corporations whose bonds are held primarily by life insurers. Life insurance companies show a unique ability to mitigate the effect of macroeconomic shocks to firms, which distinguishes them from other less reliable corporate bond investors.

Taken together, these empirical facts show that life insurance companies should not be considered arm's length lenders. Our paper also challenges the dichotomy between private loans as relationship debt and corporate bonds as arm's length lending.

The results of our paper can be also relevant for macroeconomic policies. For example, since life insurance companies soften the blow of economic shocks to those firms that borrow heavily from them, one would expect that the transmission of monetary policy shocks would be affected by the borrowing firms' dependence on lending by insurance companies. We hope that our results encourage future research in this and related topics.

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Appendix

Table A1: Ratings and NAIC Category Mapping

Moody's	S&P	Fitch	Rating (Numerical)	NAIC Category
Aaa	AAA	AAA	1	1
Aa1	AA+	AA+	2	1
Aa2	AA	AA	3	1
Aa3	AA-	AA-	4	1
A1	A+	A+	5	1
A2	A	A	6	1
A3	A-	A-	7	1
Baa1	BBB+	BBB+	8	2
Baa2	BBB	BBB	9	2
Baa3	BBB-	BBB-	10	2
Ba1	BB+	BB+	11	3
Ba2	BB	BB	12	3
Ba3	BB-	BB-	13	3
B1	B+	B+	14	4
B2	B	B	15	4
B3	B-	B-	16	4
Caa1	CCC+	CCC+	17	5
Caa2	CCC	CCC	18	5
Caa3	CCC-	CCC-	19	5
Ca	CC	CC	20	6
C	C	C	21	6

Note: When multiple rating categories are available, NAIC rules dictate that the second lowest rating should be assigned. We assign numerical ratings to bonds in accordance with this principle, using the three largest credit agencies: Moody's, S&P, and Fitch. This mapping is similar to the one used in Drechsler, Drechsel, Marques-Ibanez, and Schnabl (2016) and Kempf and Tsoutsoura (2021).

Table A2: Summary Statistics for Life Insurance Company Parent-Level Relationship Regressions

	Mean	SD	p1	p10	p50	p90	p99
Purchase Amount	84326	1148813	0	0	0	0	1650000
New Purchase Percent	.01829	.3172	0	0	0	0	.2615
Parent Holdings	4098739	24969060	0	0	0	5000000	91660000
Holding Percent	.02662	.1463	0	0	0	.02337	.6844
Rating	8.68	3.88	1	4	8	15	18
Duration	6.917	3.899	.3966	2.54	6.504	13.43	17.69
Yield	97.77	12692	1	2.594	5.209	9.252	17.5
Same State Dummy	.04977	.2175	0	0	0	0	1
Insurer Sector Share	.1203	.4275	.00001383	.0001846	.00564	.2417	2.078
Observations	12698938						

Note: New Purchase Percent, *Holding Percent*, *Duration*, and *Yield* are winsorized at the .5% level.

Table A3: Summary Statistics for Parent-Level Holdings and Purchases, Conditional on Nonzero Observations

	Mean	SD	p1	p10	p50	p90	p99	Obs.
Purchase Amount	4847212	7264712	25000	200000	2000000	12395000	35000000	220922
New Purchase Percent	1.051	2.167	.002985	.02667	.38	2.667	9.08	220922
Parent Holdings	16233837	47668751	15000	200000	3000000	36761000	222463008	3206243
Holding Percent	.1054	.2765	.00002337	.0003811	.01183	.2616	1.767	3206243

Note: New Purchase Percent and *Holding Percent* are winsorized at the .5% level.

Table A4: First Stage for Investment Grade Bond Return IV Regressions

	Issuer-Level		Parent-Level	
	Model 6	Model 8	Model 6	Model 8
Holding Fraction of Issuer at Offering	0.46***	0.13***		
	(25.00)	(2.85)		
Holding Fraction of Parent at Offering			0.46***	0.25***
			(24.52)	(5.05)
Rating	0.00	-0.00	0.00	-0.00
	(1.53)	(-0.06)	(1.39)	(-0.77)
Duration	0.00***	0.01***	0.00***	0.01***
	(5.36)	(4.98)	(5.10)	(5.14)
Callable Dummy	0.02***	-0.04***	0.02***	-0.04***
	(3.28)	(-3.16)	(4.00)	(-3.01)
Amihud	-0.07	0.47***	-0.06	0.45***
	(-0.99)	(4.93)	(-1.17)	(4.46)
Imputed Round Trip Costs (IRC)	-0.05***	0.08***	-0.04***	0.05**
	(-3.48)	(3.33)	(-3.09)	(2.24)
Effective Bid Ask Spread	0.02***	0.01	0.00	0.02*
	(2.70)	(1.01)	(0.62)	(1.89)
Daily Close Yield	-0.02***	-0.01	-0.02***	-0.01
	(-4.00)	(-0.64)	(-4.01)	(-0.55)
Holding Fraction of Issuer, Mutual Funds	-0.19***			
	(-6.73)			
Holding Fraction of Parent, Mutual Funds			-0.21***	
			(-6.30)	
Holding Fraction of Bond, Mutual Funds		-0.13***		-0.16***
		(-7.95)		(-9.59)
Amihud Fragility	2.35**	5.09*	2.85***	2.01
	(2.06)	(1.94)	(3.04)	(0.79)
IRC Fragility	0.08	-0.41***	0.11	-0.28**
	(1.13)	(-3.33)	(1.58)	(-2.17)
Spread Fragility	-0.10	0.77***	-0.12	0.66***
	(-1.01)	(4.70)	(-1.55)	(4.00)
Net COVID Period Trading Fraction, Life Insurers	0.22	-0.94***	0.28*	-1.06***
	(1.36)	(-4.66)	(1.70)	(-5.65)
Constant	0.10***		0.09***	
	(5.96)		(6.33)	
Issuer/Parent Fixed Effects	No	Yes	No	Yes
R^2	0.63	0.66	0.64	0.60
N	4469	4431	4783	4767

Note: Holding Fraction of Issuer (Parent) at Offering is equal to the life insurance sector's holdings of the bond issuer's (parent's) outstanding bonds prior to issuance. Other variable definitions can be found in Tables 6 and 8. *Holding Fraction of Issuer, Life Insurers*, *Holding Fraction of Parent, Life Insurers*, *Holding Fraction of Bond, Life Insurers*, *Holding Fraction of Issuer at Offering*, *Holding Fraction of Parent at Offering*, *Duration*, *Holding Fraction of Issuer, Mutual Funds*, *Holding Fraction of Parent, Mutual Funds*, *Holding Fraction of Bond, Mutual Funds*, and *Net COVID Period Trading Fraction* are winsorized at the 0.5% level. Standard errors are clustered on issuer in columns 1 and 2 and on parent in columns 3 and 4, t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$