INTERNATIONAL MONETARY FUND

The Insurer Channel of Monetary Policy

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WP/25/54

2025
MAR

WORKING PAPER

 WP/25/54

IMF Working Paper
Research Department

The Insurer Channel of Monetary Policy
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Authorized for distribution by Maria Soledad Martinez Peria
March 2025

ABSTRACT: We study the role of life insurers in the transmission of US monetary policy. Insurers have uniquely long-term liabilities. We posit that they face a trade-off between matching liability duration exposure by investing in long-term government debt and earning higher yields by shifting to risky—but shorter-term—private debt. We show that, due to this tradeoff, long-term risk free rates play a critical role in shaping insurers' demand for risky private debt. Contractionary monetary policy shocks that raise long-term risk-free rates reduce insurers' demand for private debt, raising risk premia. We use granular, high frequency data and regulatory changes to trace how insurers' investment behavior transmits monetary policy shocks to risk premia.

RECOMMENDED CITATION: Kirti, Divya, and Akshat V. Singh (2025). "The Insurer Channel of Monetary Policy," IMF Working Paper No. 25/54 (Washington, DC: International Monetary Fund).

JEL Classification Numbers:	G22, G23, E43, E44, E52
Keywords:	Monetary policy; risk premia; NBFIs; life insurance
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* We thank Tobias Adrian, Sakai Ando, Philip Barrett, Thummim Cho, Giovanni Dell'Ariccia, Rupa Duttagupta, Chris Erceg, Nathan Foley-Fisher, Fulvia Fringuelotti, Benjamin Hebert, Christoph Kaufmann, Rohan Kekre, Philipp Schnabl, Maria Soledad Martinez Peria, Krishna Srinivasan, Borjan Narajabad, Teodora Paligorova (discussant), Joao Santos, Jeremy Stein, Adi Sunderam, Jerome Vandenbussche, TengTeng Xu, Moto Yogo, seminar participants at the European Central Bank, Federal Reserve Board, and International Monetary Fund, and conference participants at the Bank of Italy/IVASS Conference on banking, insurance and financial stability for helpful discussions. Herman Lange provided excellent research assistance.

1. Introduction

Financial intermediaries are central to the transmission of monetary policy to the real economy. A large literature investigates the role of banks in this transmission (Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Drechsler et al., 2017). However, despite their growing importance, comparatively little attention has been paid to the role of non-bank financial intermediaries (NBFIs). Importantly—and unlike banks—key NBFIs like insurers and pension funds have very long-term liabilities that shape their investment behavior (Koijen and Yogo, 2023; Scharfstein, 2018). They may respond to and transmit shifting monetary policy very differently from banks.

We focus on US life insurers, which underpin market-based finance, accounting for over 20 percent of corporate bond holdings. We use detailed data to show that long-term risk free rates play a critical role in shaping insurers' demand for risky private debt. This has important implications for the transmission of monetary policy. Recent work finds that conventional monetary policy affects both the long end of the yield curve (Hanson and Stein, 2015; Hanson et al., 2021; Bauer et al., 2024; Kekre et al., 2024), and risk premia (Palazzo and Yamarthy, 2022; Anderson and Cesa-Bianchi, 2024), and treats these impacts as distinct phenomena. We show they are causally connected: we present granular, high frequency evidence that insurers' investment behavior transmits changes in long-term risk-free yields induced by interest rate shocks to risk premia.

It is challenging for life insurers to match liabilities stretching out decades ahead with assets with sufficiently high duration. They do attempt to extend asset duration by investing in long-term treasuries. And their demand for private debt—relative to other institutional investors—is tilted towards longer maturities. Nevertheless, when discount rates are low, life insurers appear to bear negative net duration exposure.[1]

We posit that life insurers face a tradeoff between further extending asset duration and receiving lower yields on their investments. Insurers could increase allocations to risk-free long-term treasuries—with maturities at issuance up to 30 years—to add to asset duration. But some medium-term private debt—corporate bonds with maturities at issuance typically under 15 years—offers higher overall yields despite lower maturities due to credit risk. Insurers may find it attractive

[1] With low discount rates raising liability duration in recent years, insurer equity returns have been strongly negatively correlated with returns on long-term treasuries (Koijen and Yogo, 2023; Brunetti et al., 2023).

to hold risky debt with higher yields than long-term treasury bonds, even if it offers lower asset duration. Indeed, the sector's overall investment allocation skews more towards medium-term corporate bonds than to long-term treasuries.

We begin by documenting the implications of this tradeoff: long-term risk-free yields shape relative demand from insurers across private bonds. We use transaction-level data from primary bond markets, drawing on close to 400,000 transactions by insurers across more than 3,500 corporate bond issuances from 2014-22. We focus on net purchases by insurers close to issuance—scaled by total supply at issuance—to isolate demand relative to other institutional investors at the bond level, following seminal work by Becker and Ivashina (2015). We examine how yield differentials with long-term risk-free debt shape insurers' relative demand across bonds, controlling for a rich set of bond-level characteristics including duration, default risk, and liquidity as well as market conditions at the time of issuance. We also consider the number of insurers participating in each bond issuance as an alternative measure of demand from the sector that is less sensitive to the behavior of the largest insurers.

Insurers' relative demand for private debt is highly responsive to the extent to which yields exceed those on long-term treasuries. For each percentage point increase in the spread between yields on privately issued bond and long-term risk-free rates, insurers' share of purchases rises by 5.9 percentage points (25 percent of their average purchase share), with 5 additional insurers participating in the issuance. Yield differentials to duration-matched risk free benchmark rates offer no additional information about insurers' relative demand.

How insurers respond to and transmit monetary policy is therefore likely to depend on how long-term risk-free rates react. When long-term yields rise, investing in long-term treasuries becomes more attractive, as the overall return promised on the stock of insurance liabilities is sticky.[2] To the extent that long-term risk-free rates rise, contractionary monetary policy may therefore reduce insurers' demand for privately issued debt.

To study this transmission, we draw on the literature on high frequency impacts of monetary policy announcements (Kuttner, 2001; Bernanke and Kuttner, 2005; Gertler and Karadi, 2015;

[2]Indeed, we find suggestive evidence that insurers' demand for long-term treasuries increases more strongly with long-term risk-free yields than for other institutional investors.

Nakamura and Steinsson, 2018; Bauer et al., 2023). We isolate how monetary policy shocks influence long-term yields by focusing on changes in 30 year risk-free interest rates in a one hour window around monetary policy announcements. Moreover, following Jarociński and Karadi (2020), we restrict attention to interest rate shocks, as opposed to information shocks, by focusing on announcements for which bond yields and stock markets move in opposite directions—again, within a one hour window surrounding announcements. Separating between interest rate and information shocks is important: long-term yields respond systematically to interest rate shocks, but not information shocks. To our knowledge, this stylized fact has not previously been documented.

Contractionary monetary policy shocks do appear to induce insurers to substitute away from privately issued debt. We examine how insurer primary market purchase shares at the rating-quarter level respond to monetary policy shocks. A 10 basis point contractionary monetary policy shock reduces insurers' purchase shares by 8 percentage points (33 percent of insurers' average purchase share), with 8 fewer insurers participating.

Shifting attention from quantities to prices—from how monetary policy shocks shift relative demand to their impact on risk premia—offers much more granularity. Specifically, we can rely on secondary market pricing at high frequencies for a broad set of bonds and examine variation in risk premia within the same bond over time. To allow for illiquidity in fixed income markets, we work at a weekly frequency. Our sample for this analysis covers more than 10,000 bonds for 1.8 million bond-weeks over 2014-22.

We estimate risk premia at the bond-week level to trace the transmission of insurer investment behavior to bond prices. We follow Gilchrist and Zakrajšek (2012) in defining risk premia as yields in excess of duration-matched risk-free benchmark rates that cannot be explained by default risk and other important bond-specific characteristics. Importantly, this measure of risk premia isolates variation in the price of risk, while separating out shifts in the quantity of risk. Our approach incorporates two improvements relative to prior work: first, we use option-adjusted measures of bond duration; and second, we use bond-specific measures of default risk that account for differences in seniority across different claims on the same issuer in the event of default.

Two exercises help us pinpoint the footprint of insurers in transmitting monetary policy shocks—via the long end of the yield curve—to risk premia. First, risk premia respond more strongly to monetary policy shocks when insurers are a more important component of the investor base. Second, risk premia are more sensitive to monetary policy shocks when changes in regulatory treatment lead insurers to respond more strongly to spreads to long-term treasuries.

Within the same bond over time, contractionary monetary policy shocks that raise long-term risk free rates raise risk premia more when insurers account for a larger fraction of holdings in the previous quarter for that bond. A one standard deviation increase in insurer holding shares in the previous quarter is associated with an additional increase of 5 basis points in risk premia in response to a 10 basis point contractionary monetary shock.[3]

We also consider the impact of a 2021 change in risk weights, applicable only to insurers, that shifted the attractiveness of corporate bonds relative to treasuries. The reform removed discontinuities in risk weights as a function of credit risk. To our knowledge, this regulatory change has not previously been studied in academic work.[4]

Shifts in insurers' investment behavior after this regulatory change are reflected in the response of risk premia to monetary policy shocks. Higher risk weights increased the sensitivity of insurer relative demand to yield differentials with long-term treasuries. This in turn strengthened the response of risk premia to monetary policy shocks for bonds facing higher risk weights—again comparing within the same bond over time. A one percentage point increase in risk weights for insurers leads to an additional increase of 9.7 basis points in risk premia given a 10 basis point contractionary monetary policy shock. This differential shift in risk premia is large relative to prior reduced form estimates of the response of risk premia overall to monetary policy: Palazzo and Yamarthy (2022) find that a 10 basis point contractionary shock raises credit default spreads by 2 basis points. These results sharply trace the causal footprint of insurers in the transmission of monetary policy to risk premia.

This paper makes two main contributions to the literature. First, we add to prior work examining insurers' investment behavior. The literature has considered the implications of the long duration of insurer liabilities (Du et al., 2023; Alfaro et al., 2024; Ozdagli and Wang, 2019;

[3]The emphasis of our empirical approach on monetary policy announcements dominated by interest-rate shocks helps rule out concerns about reverse causality.

[4]Prior work highlights problematic implications of the pre-2021 discontinuities (Ellul et al., 2011; Becker and Ivashina, 2015). See Section 3 for a detailed discussion of this shift in regulation.

Chodorow-Reich et al., 2021) and both unconventional and conventional monetary policy (Koijen et al., 2021; Domanski et al., 2017; Kaufmann et al., 2024; Li, 2024) for insurers' investment behavior.[5] We show that insurers' uniquely long-term liabilities make long-term risk-free debt a crucial reference asset that shapes demand relative to other investors.

Second, we add to work examining the impact of conventional monetary policy on financial markets (Kashyap and Stein, 2023). Our paper relates to two strands of this literature: one that examines the impact of monetary policy targeting short-term rates on the long end of the yield curve (Gürkaynak et al., 2005; Hanson and Stein, 2015; Hanson et al., 2021; Bauer et al., 2024; Kekre et al., 2024; Hillenbrand, 2024), and another focused on its impact on risk premia (Palazzo and Yamarthy, 2022; Anderson and Cesa-Bianchi, 2024). Prior work has treated these phenomena as distinct impacts of monetary policy. We show that they are causally connected through the investment behavior of insurers.[6] We isolate the price of risk from changes in the quantity of risk by proposing improvements relative to Gilchrist and Zakrajšek (2012). As in Anderson and Cesa-Bianchi (2024), this allows us to separate credit supply from other channels of transmission of monetary policy.

Closely related to our work, Foley-Fisher et al. (2016) consider the role of insurers in transmitting unconventional monetary policy. They show that quantitative easing raises demand from insurers for corporate bonds—lowering yields and inducing increased issuance activity and supporting investment—focusing on bonds rated A- as these were particularly attractive for insurers prior the 2021 change in risk weights. Our work focuses on how conventional monetary policy is transmitted to the price of risk. We present evidence that sharply pins down the role of insurers in shifting risk premia by considering the full distribution of corporate bonds and combining high frequency evidence with a regulatory reform specific to insurers.

Our findings help better understand how monetary policy is transmitted to the real economy. Well-known patterns that apply to banks (Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Drechsler et al., 2017) do not apply to life insurers due to their long-term liabilities. The extent

[5]Past work also highlights the importance of regulatory constraints for insurers' asset allocation decisions (Ellul et al., 2011; Becker and Ivashina, 2015; Becker et al., 2022; Kirti and Sarin, 2024). We find that a 2021 change to risk weights, which to our knowledge has not previously been studied, significantly shifted their investment behavior.

[6]We also show that monetary policy shocks are transmitted to long-term risk free rates only when interest-rate shocks dominate any informational content.

to which monetary policy targeting short-term rates affects risk premia depends on how long-term rates react, because these shape insurers' investment behavior. Moreover, our work shows that transmission to risk premia is highly heterogeneous across the spectrum of privately issued debt. Across bonds with different levels of risk and different maturities, yield differentials relative to long-term risk free rates are a crucial determinant of the impact of monetary policy on risk premia.

The remainder of this paper is organized as follows: Section 2 discusses the data and Section 3 provides institutional background. Sections 4 and 5 respectively show that insurers respond to yield differentials with long-term risk free rates and transmit monetary policy shocks to risk premia. Section 6 concludes.

2. Data

We assemble the data for our analysis from multiple sources. One key advantage of studying life insurers is the availability of granular, high frequency regulatory data on their bond holdings and transactions. We obtain this data from S&P Capital IQ Pro. Primary market corporate and treasury bond characteristics for primary markets are obtained from Mergent Fixed Income Securities Database and TreasuryDirect, respectively. Secondary market corporate bond information is from Trade Reporting and Compliance Engine (TRACE). High-frequency data on bond yields and stock returns, used to construct monetary policy shocks, is from Bloomberg. We use high frequency data on bond default risk and duration matched treasury spreads from Moody's CreditEdge to construct credit risk premia. Finally, we use insurer stock price data from the Center for Research in Security Prices (CRSP) to estimate net interest-rate exposure. Across all datasets, our sample covers 2014-2022.

We use data on insurers' bond holdings and transactions to gauge their investment behavior. Holdings are reported at a quarterly frequency, while transactions are reported at a daily frequency. We only consider publicly offered, fixed rate bonds. We focus on corporate bonds and treasuries, dropping mortgage backed securities, asset backed securities, and bonds issued by state governments, foreign governments, and financial firms.

Primary bond market investments allow us to isolate insurers' demand relative to other investors. Primary market data on corporate bond characteristics such as bond rating, offering amount, offering yield, industry of issuer, issuer ID, and bond coupon is from Mergent FISD. We use the latest available rating assigned by S&P Global Ratings, Moody's Investors Services, or Fitch Ratings. Following Becker and Ivashina (2015), if a bond is rated by two agencies, we use the lowest rating, and if a bond is rated by all three agencies, we use the median rating. Data on offering amounts and offering yields for Treasuries is from TreasuryDirect.

We also use secondary bond market information to study monetary policy transmission to risk premia at a high frequency. Daily data on corporate bond yields and prices is from TRACE. We use the median yield and duration across all transactions on the last active day in each bond-week. We also use TRACE to construct a bond-week level measure of liquidity following Becker and Ivashina (2015).

We use tick-by-tick data on long-term bond yields from Bloomberg to measure monetary policy driven changes at the long end of the yield curve. Specifically, we construct our monetary policy shock as variation in 30 year treasury yields in a one-hour window around FOMC announcements. A large literature uses shifts in interest rates in short windows after announcements to identify monetary policy shocks (Kuttner, 2001; Bernanke and Kuttner, 2005; Gertler and Karadi, 2015; Nakamura and Steinsson, 2018; Bauer et al., 2023)—we do the same, but focus on shifts in long-term risk free rates. We also separate between interest-rate and information shocks following Jarociński and Karadi (2020).

We combine secondary market information from TRACE with high frequency data on bond default risk and duration matched Treasury spreads from Moody's CreditEdge to estimate credit risk premia. We follow Gilchrist and Zakrajšek (2012) in defining risk premia as excess premia not directly attributable to expected default risk. Our approach incorporates two improvements relative to prior work: we use measures of default risk at the bond-week level that account for differences in seniority across different claims on the same issuer, and option-adjusted spreads. See Appendix A for details.[7]

Table 1 summarizes insurer investment behavior and bonds characteristics in our sample. We

[7]This measure is not available for primary markets. For primary markets, we construct distance to default as in Gilchrist and Zakrajšek (2012).

define insurer purchase share as net purchases by insurers within three months of bond issuance as a fraction of the total issuance amount. On average, this lies between 20 to 25% across years, illustrating the importance of insurers as lenders in the corporate bond market. Primary bond market activity is not restricted to the largest insurers: the average number of insurers investing in a corporate bond within three months of issuance is close to 20. T30 spread denotes the spread between corporate bond yields and 30 year Treasury yields, expressed in percentage points. This has varied significantly over time, ranging from 0.5 to 1.5 percent.[8] The average duration of corporate bonds purchased by insurers is close to 10 years.

Distance to default, which measures the likelihood of default by the bond issuer, decreases significantly in 2020 on account of higher default risk during COVID. Given the sharp change in the risk profile of bonds in 2020 along with a substantial increase in the number of bonds issued, we document the robustness of all results in subsequent analyses with and without the COVID period.

3. Institutional background

Life insurers are the largest institutional holders of corporate bonds in the US. As corporate bonds are the most important source of finance for US firms, insurers' asset allocation decisions have important implications for the borrowing costs of firms, and consequently, for the economy. Figure 1 shows that insurers hold close to 20 percent of outstanding corporate bonds, with corporate bonds constituting more than 50 percent of corporate business debt in the US.

Corporate bonds make up the bulk of insurer assets. Panel (a) of Table 2 shows that corporate bonds make up close to 60 percent of the total value of life insurers' general account bonds, with about 13 percent consisting of Treasuries. Appendix Table D.1 shows that the corporate bond share has remained stable over time.

3.1. Shift in insurer capital regulation in 2021

Life insurers are subject to risk-based capital (RBC henceforth) requirements, which prescribe minimum capital buffers. This RBC framework consists of five distinct components, denoted C0-

[8] Note that bond yields and T30 spreads can move in different directions. Average T30 spreads increased from 0.6 to 1 percentage point from 2014 to 2015 while bond yields were flat at about 3.9 percentage points.

C4, reflecting different types of material risks. These components are then aggregated to determine the total capital requirements. Our focus is on charges applied to bonds based on their exposure to credit risk to safeguard against potential asset losses (C1 RBC requirements).

Prior to 2021, the National Association of Insurance Commissioners (NAIC) classified bonds into six designations according to their credit risk. The safest bonds were rated NAIC-1, with ratings corresponding to Moody's ratings from Aaa to A3. The correspondence for other ratings was as follows: NAIC-2 ranged from Baa1 to Baa3, NAIC-3 from Ba1 to Ba3, NAIC-4 from B1 to B3, NAIC-5 from Caa1 to Caa3, and the NAIC-6 corresponded to the rest. Within the subset of corporate bonds held by insurers, Panel (b) of Table 2 shows that more than 90% are investment grade, belonging to NAIC categories 1 and 2.[9] The riskiest categories of corporate bonds, grouped under NAIC categories 5 & 6, make up less than 1% of all corporate bonds held by insurers.

In 2021, NAIC introduced substantial changes to these risk weights, which had been in place since 2002. Importantly, the granularity of risk weights increased, raising the number of NAIC designations from six to 21, now closely corresponding to the granularity of rating designations of private ratings agencies. Risk weights prior to 2021 were highly discontinuous: uniform for the first seven rating categories, rising significantly for the next three, and rising again thereafter. These discontinuities had significant implications for insurers' investment behavior (Ellul et al., 2011; Becker and Ivashina, 2015). The reform in 2021 made these risk weights more continuous. Importantly, treasuries remained exempt from C1 RBC requirements.

While discussions on new risk weights had taken place over the previous decade, substantive progress was made post 2020. The American Council of Life Insurers (ACLI)—a trade association representing the life insurance industry in the US—and NAIC released a public request for proposal to assess proposed new RBC C1 Bond Factors on October 22 2020. In 2021, Moody's Analytics was commissioned by ACLI and NAIC to recommend new RBC factors for the ACLI proposal. On February 1 2021, they delivered a report with their recommendation on revisions and on April 15 2021, ACLI released their proposed risk weights. Changes to the risk weights were formally adopted by the Life Risk-Based Capital Working Group on June 11 2021. The revised factors came

[9] Appendix Table D.2 shows that this composition of insurers' corporate bond holdings has remained stable over time.

into effect with year-end reporting for 2021.

This reform implied substantial variation in both the magnitude and sign of changes in risk weights across rating categories, which is helpful for our analysis. Figure 2 shows that insurers had substantial holdings in rating categories subject to significant increases in risk weights. This shift helps us sharply identify how insurers transmit monetary policy to risk premia.

4. Tradeoff between asset duration and investment yields

We begin by showing that insurers attempt to extend asset duration relative to other institutional investors, but appear to be only partially successful in matching liability duration. We show that higher yields on medium-term corporate debt than on long-term risk-free debt lead insurers to trade off investment income against further extending asset duration. This makes long-term risk-free debt a crucial reference asset for insurers. Indeed, relative demand from insurers for corporate bonds strongly responds to yield differentials to long-term treasuries.

4.1. Insurers appear to be short duration

Insurers' investment allocations skew towards bonds with longer maturities. Figure 3 shows the share of bonds offerings, classified by issuer type and maturity distribution, that are purchased by insurers in the primary market. Across corporate bonds and treasuries, insurers purchase a significantly larger share of bonds with longer maturities. Insurer purchase shares are larger for corporate bonds.

Despite extending asset maturities—relative to other institutional investors—US life insurers appear to face net negative duration exposure. Specifically, equity returns are negatively correlated with returns on long-term bonds. See Appendix B for analysis following Hartley et al. (2016) and Koijen and Yogo (2023).

4.2. Insurer relative demand driven by yield differentials relative to long-term risk-free rates

Long-term treasuries should be a crucial reference asset for life insurers. Corporate bonds with lower yields than long-term treasuries are simply worse assets to back their liabilities. Put differently, for such bonds there is no tradeoff between duration and investment income.

To isolate insurers' relative demand from other factors including supply and market conditions, we focus on demand from insurers relative to that of other investors in primary bond markets within the same bond. For this analysis, we use transaction-level data for insurers from primary bond markets. This dataset comprises of close to 400,000 transactions by insurers across more than 3,500 corporate bonds issued from 2014-22.

Long-term treasuries do seem important in shaping relative demand from insurers. We find a sharp reduction in relative demand from insurers for corporate bonds with yields close to the long-term treasury yield. Figure 4a plots insurers' relative demand for corporate bonds against yield differentials relative to the 30 year treasury yield (T30 spread henceforth), and shows that the demand is significantly lower for bonds with negative yield differentials. We also find that insurers continue to focus on T30 spreads after issuance. Figure 4b shows insurer holdings of all corporate bonds relative to amounts issued. Insurer holdings jump up once the T30 spread is positive.

Next, we examine how yield differentials to long-term risk-free debt shape insurers' relative demand more generally. We focus on insurers' participation in primary markets at the bond level, using bond-level regressions that include a rich set of controls to account for key bond-level characteristics. We use the following specification to assess the bond-level relationship between insurer relative demand and and yield differentials to long-term treasuries:

$$\text{Purchase Share}_{c,q} = \alpha_i + \delta_{r,q} + \beta_1 \text{T30 Spread}_{c,q} + \text{X}_{c,q} + e_{c,q} \tag{1}$$

where c denotes the bond CUSIP, q denotes the quarter (and year) of bond issuance, α_i denotes issuer fixed effects, δ_q denotes quarter fixed effects, and X is a vector of relevant controls including distance to default of the issuing firm, bond duration, bond liquidity, (log) offering amount, and an indicator variable for bond callability. Importantly, X also includes the yield spread to a duration matched risk-free benchmark. We include issuer and rating × quarter fixed effects to allow for preferences for specific issuers and aggregate market dynamics. Standard errors are double clustered by issuer and time.

Our baseline specification, shown in Column 4 of Table 3, focuses on bonds rated NAIC 1-3 since the bulk of insurer holdings are in the first three categories, and excludes 2020 Q2 to 2020 Q4 so that the results are not driven by the abnormal financial market conditions due to the COVID pandemic. We examine three additional specifications for robustness. The first column includes all bonds issued between 2014 and 2022. The second column excludes the COVID period. Column 3 focuses on the subset of bonds in categories NAIC 1-3. Purchase share and T30 spread are expressed in percentage points (pp).

We find that a 1 pp increase in T30 spread is associated with a 5.88 pp increase in insurer purchase share. As the average insurer purchase share is close to 25%, these estimated magnitudes are quantitatively important. Importantly, duration-matched credit spreads offer no additional information about insurers' relative demand beyond T30 spreads. Insurers view long-term treasuries as the relevant benchmark risk-free asset for all privately-issued bonds, regardless of maturity.

We also consider the number of insurers participating in each bond issuance as an alternative measure of demand to ensure that these results are not driven by the largest insurers. The regression specification is otherwise the same as Equation 1:

$$\mathrm{N}^{ins}_{c,q} = \alpha_i + \delta_q + \beta_1 \mathrm{T30\ Spread}_{c,q} + \mathrm{X}_{c,q} + e_{c,q} \tag{2}$$

where $\mathrm{N}^{ins}_{c,q}$ denotes the number of insurers purchasing a bond c issued in quarter q within three months of issuance. The results are shown in Table 4. Consistent with the results in Table 3, we find that a 1 pp increase in T30 spread is associated with 5 more insurers participating in the bond issuance. Table 1 shows that the average number of insurers participating in issuance of corporate bonds is close to 20. Therefore, T30 spreads significantly affect demand from insurers at the extensive margin. Again, duration-matched credit spreads offer no additional information.

Notably, insurer demand strongly increases with bond duration, even after controlling for other relevant bond characteristics such as credit risk (seen in both Tables 3 and 4). This is consistent with the evidence in Section 4.1 that insurers are short duration and, given the opportunity, seek to extend the duration of their assets. Indeed, Ozdagli and Wang (2019) argue that insurer investment behavior is primarily driven by incentives to match duration rather than reaching for yield.

5. Transmission of monetary policy to risk premia via life insurers

Changes in monetary policy—to the extent that long-term risk free rates move—can shift insurers' demand for privately issued debt. Specifically, as the overall return promised on the stock of outstanding liabilities is sticky, investing in long-term treasuries should be more attractive when long-term yields rise. This should reduce insurers' demand for privately issued debt.[10] As insurers are lynchpin investors in corporate bond markets, this could have a strong impact on risk premia.

5.1. Long-term yields and insurer demand for treasuries

Insurers appear to increase their demand for long-term treasuries when long-term yields rise.

$$\text{Purchase Share}_{c,q} = \delta_q + \beta \text{Yield}_{c,q} + \text{X}_{c,q} + e_{c,q} \tag{3}$$

$\text{Yield}_{c,q}$ refers to the offering yield of treasury c issued in quarter q. Table 5 shows that relative demand from insurers increases in response to treasury yields. In keeping with our focus on long-term risk-free debt, we only include treasuries with maturities greater than or equal to 10 years. Appendix Figure C.1 plots insurers' relative demand for treasuries against their respective yields, showing a strong positive correlation. Importantly, these results show that insurers increase their demand for long-term treasuries *relative to other investors* in response to an increase in the yields.

[10] A negative duration gap also implies that insurers' net worth improves when interest rates rise. In principle this could increase risk appetite and dampen substitution away from private debt. It is therefore an empirical question to assess whether demand for private debt falls. We treat long-term treasury yields as exogenous to shifts in relative demand from insurers. Insurers account for a much smaller share of the investor base for treasuries than for corporate bonds. Results restricting attention to interest-rate shocks, as opposed to information shocks, help address potential concerns about reverse causality.

5.2. Monetary policy and insurer demand for private debt

We now examine of how insurers transmit monetary policy to risk premia, by isolating when monetary policy matters for long-term risk free rates, and tracing its impact on insurer relative demand (quantities) and risk premia (prices). To focus on reactions to variations in long-term treasury yields induced only by monetary policy, we focus on shifts in market pricing in narrow windows around FOMC announcements, as discussed in Section 2.

We also separate between interest rate and information shocks. To ensure that the monetary policy component outweighs the information effect, we follow Jarociński and Karadi (2020) in only including FOMC announcement days when bond yields and the S&P 500 move in the opposite directions in a narrow one-hour window around the announcement in our baseline results.[11] Intuitively, any Fed information effect should be associated with positive co-movement of bond yields and stock prices, while interest rate shocks should generate negative co-movement between bond yields and stock prices.

Doing so is important to understand how conventional monetary policy shifts long-term interest rates. Indeed, Figure 5 shows a strong correlation between variation at the short and the long end of the yield curve—but only when we focus on FOMC announcement days on which the monetary policy component outweighs any information component. To our knowledge, this stylized fact has not been documented in prior work.[12]

To examine how monetary policy shocks—via their impact on long-term risk-free rates—shape insurers' relative demand for private debt, we use the following specification:

$$\Delta \text{Purchase Share}_{r,q} = \beta(\Delta \text{T30 Yield}_{\text{MP},q}) + \text{X}_{r,q} + \epsilon_{r,q} \tag{4}$$

The dependent variable, $\Delta \text{Purchase Share}_{r,q}$, is the quarterly change in insurer purchase share for each rating category r. Specifically, $\Delta \text{T30 Yield}_{\text{MP},q}$ is the change in thirty year treasury

[11] There are 71 FOMC announcements in our sample, of which 37 are included as monetary policy shocks. Jarociński and Karadi (2020) find that structural VAR approaches to isolate monetary policy shocks yield similar aggregate impulse responses.

[12] Potential explanations of strong transmission of conventional monetary policy to long-term risk free rates offered by the literature include mortgage refinancing activity, extrapolative investors, investors reaching for yield, changing perceptions of monetary policy rules, and revaluation of arbitrageur wealth (Gürkaynak et al., 2005; Hanson and Stein, 2015; Hanson et al., 2021; Bauer et al., 2024; Kekre et al., 2024; Hillenbrand, 2024). We leave the incorporation of the specific role for interest-rate shocks into these narratives to future work.

yields in a one hour window around monetary policy announcements. We aggregate these high-frequency monetary policy shocks to the quarterly frequency using a moving average of shocks in the current and previous quarter weighted by the number of days between the shock and the end of current quarter, following Ottonello and Winberry (2020). We control for changes in bond duration, liquidity, default risk, (log) total offering amount, along with their lags and lagged purchase shares. We also include inflation, GDP growth, unemployment rate, VIX index, and indicator variables for each quarter as aggregate controls. Standard errors are double clustered by rating and quarter.

Monetary policy induced increases in long-term rates lower insurers' relative demand for corporate bonds (Table 6). When contractionary monetary policy raises long-term risk-free rates by 10 bp, insurer purchase shares fall by 8 pp. Consistent with the previous evidence, we find that an increase in bond duration leads to higher relative demand from insurers, with an increase in duration by 1 year associated with a 1 pp increase in insurer purchase shares.[13] Appendix Table D.3 shows that we do not find similar effects if we focus on the effect of interest-rate shocks on short-term treasury yields.

We also run a regression using the change in the number of insurers purchasing a newly issued bond of rating category r in quarter q as the dependent variable.

$$\Delta \mathrm{N}^{ins}_{r,q} = \beta(\Delta \mathrm{T30\ Yield}_{\mathrm{MP},q}) + \mathrm{X}_{r,q} + \epsilon_{r,q} \tag{5}$$

Similar to the previous set of results, Table 7 shows that a 10 bp increase in long-term treasury yield results in 8 fewer insurers purchasing a corporate bond within three months of its issuance. A 5 year increase in bond duration is associated with 3 additional insurers. Variation in long-term rates therefore has a strong impact on insurers' demand for risky private debt.

5.3. Transmission to risk premia in secondary market pricing

We now turn to examining implications for risk premia in secondary markets, where we can consider the role of insurers in the transmission of monetary policy with much more granularity. Specifically,

[13] As capital adequacy is only tested at year end, insurer risk appetite appears to fall closer to the end of the calendar year. Specifically, Table 6 shows that insurers' relative demand for corporate bonds is 13.5 pp lower in the fourth quarter than in the first quarter of the year. To our knowledge this pattern has not previously been documented.

we can rely on secondary market pricing at high frequencies for a broad set of bonds and examine variation in risk premia within the same bond over time. We construct risk premia in a way that restricts attention to variation in the price of risk—separating out shifts in the quantity of risk (see Appendix A for details). Our sample for this analysis covers more than 10,000 bonds for 1.8 million bond-weeks over 2014-22.

Two exercises help us pinpoint the footprint of insurers in this transmission of monetary policy shocks—via the long end of the yield curve—to risk premia. First, risk premia respond more strongly to monetary policy shocks when insurers are a more important component of the investor base. Second, risk premia are more sensitive to monetary policy shocks when changes in regulatory treatment lead insurers to respond more strongly to spreads to long-term treasuries.

5.3.1. Bonds with larger insurer footprints in investor base

We use the following specification to assess whether transmission to risk premia is stronger when insurers account for a larger portion of the investor base:

$$\Delta \text{EBP}_{c,w} = \alpha_c + \alpha_w + \beta \; (\text{IE}_{c,q-1} \times \Delta \text{T30 Yield}_{\text{MP},w}) + \text{X}_{c,w} + \epsilon_{c,w} \tag{6}$$

where c denotes the bond CUSIP, α_c denotes bond fixed effects, α_w denotes week fixed effects, T30 $\text{Yield}_{\text{MP},w}$ denotes our measure of monetary policy shock, $\Delta\text{EBP}_{c,w}$ denotes the weekly change in excess bond premia. As illiquidity in corporate bond markets may lead to gradual adjustment of credit risk premia (Palazzo and Yamarthy, 2022), we focus on weekly, not daily, changes in EBP. $\text{IE}_{c,q-1}$ refers to insurer exposure to bond c in the preceding quarter. Insurer exposure is the share of insurer holdings for each bond relative to total par value outstanding in the previous quarter.[14] All specifications also control for bond liquidity and include inflation, GDP growth, unemployment rate, VIX index as aggregate monthly controls. Standard errors are double clustered by issue and week.

Risk premia are more sensitive to monetary policy shocks when insurers account for a larger

[14]This approach is similar in spirit to Foley-Fisher et al. (2016), but considers conventional monetary policy, uses bond-level variation, is not limited to specific rating categories, and focuses on variation specifically in the price of risk rather than yields in general.

share of holdings. Table 8 presents the results. For each percentage point increase in insurer holding shares, a 10 bp increase in long-term treasury yields is associated with a 0.2 bp greater increase in EBP in response to monetary policy. For a one standard deviation increase in insurer holding shares, this tarnslates to a 5 bp larger increase in EBP in response to a 10 bp increase in long-term treasury yields. In Appendix Table D.4, we show that we do not find similar effects if we instead focus on changes in short-term treasury yields induced by monetary policy shocks.[15]

5.3.2. Bonds affected by insurer-specific regulatory reform

To sharpen identification, we isolate insurers' investment behavior by considering a change in capital regulation—specific to insurers—that shifted the attractiveness of corporate bonds relative to treasuries (see Section 3.1). To our knowledge, this regulatory change has not previously been used in academic work.

Higher risk weights reduce the attractiveness of private debt and should therefore lead insurers to respond more strongly to yield differentials to long-term risk-free rates. Before turning to risk premia, we use a triple difference specification following the intuition of Equation 1 to verify this hypothesis. After the reform, the sensitivity of insurer purchase shares to T30 spreads does increase for bonds in rating categories subject to an increase in risk weights (see Appendix Table D.6).

Monetary policy induced variation in long-term treasury yields should have stronger impact on risk premia for bonds subject to an increase in risk weights, given that insurers become more sensitive to yield spreads to long-term risk-free rates. We run the following regression to test this hypothesis:

$$\begin{aligned}\Delta \text{EBP}_{c,w} =& \alpha_c + \delta_w + \beta_1 \Delta \text{RBC}_r + \beta_2 \Delta \text{T30 Yield}_{\text{MP},w} + \beta_3 \Delta \text{RBC}_r \times \Delta \text{T30 Yield}_{\text{MP},w} \\ &+ \beta_4 \Delta \text{T30 Yield}_{\text{MP},w} \times \mathbb{1}_{\text{Post}} + \beta_5 \Delta \text{RBC}_r \times \mathbb{1}_{\text{Post}} \\ &+ \beta_6 \Delta \text{RBC}_r \times \Delta \text{T30 Yield}_{\text{MP},w} \times \mathbb{1}_{\text{Post}} \\ &+ \text{X}_{c,w} + \epsilon_{c,w}\end{aligned} \tag{7}$$

[15] We do find similar results if we use simple credit spreads rather than relying on our measure of risk premia. See Appendix Table D.5.

where the β_6 is the coefficient of interest, ΔRBC_r denotes the change in risk weights associated with a rating category r after the reform, and $\Delta\text{T30 Yield}_{\text{MP},w}$ denotes our measure of monetary policy induced changes in 30-year treasury yields.

We find that higher risk weights for insurers increase the response of risk premia to monetary policy shocks—again focusing only on variation in risk premia over time within the same bond. Table 9 shows the results. One standard deviation increase in risk weights is associated with a 9.7 bp increase in the sensitivity of credit risk premia to a 10 bp variation in the T30 yield. These findings are robust to focusing on all bonds as well as zooming in on the rating groups in which insurers have the largest exposures. Excluding the COVID period strengthens the results. As the reform only applied to life insurers, the change in sensitivity across rating categories can only be explained by a change in the investment behavior of insurers, thus providing sharp evidence for their role in the transmission of monetary policy to credit risk premia.[16]

These results show that insurers play an important role in the transmission of monetary policy to risk premia. The differential shift in risk premia we document is large relative to prior reduced form estimates of the response of risk premia overall to monetary policy shocks at the short end of the yield curve: Palazzo and Yamarthy (2022) find that a 10 basis point contractionary shock raises risk premia by about 2 basis points.

6. Conclusion

This paper presents new facts about insurers' investment behavior and traces their role in the transmission of monetary policy to risk premia. We show that long-term risk-free rates shape insurers' demand for private debt. When monetary policy shifts the long end of the yield curve, this shifts insurers' demand for private debt and therefore changes risk premia.

Prior work on insurers has often focused on insurers' investment decisions within asset classes. We emphasize the tradeoffs they face across asset classes. Across different bonds available as investment options at the same time, yield differentials to long-term risk-free rates are a crucial

[16] Again, we do not find similar results if we focus on how monetary policy shocks shift two-year treasury yields rather than long-term treasury yields (see Appendix Table D.7). Results are similar if we use a simple measure of credit spreads instead of our measure of risk premia (see Appendix Table D.8).

determinant of demand from insurers relative to other institutional investors.

Relatively little attention has been paid to the role of NBFIs in the transmission of monetary policy in prior work. A better understanding of insurers' investment behavior helps us take a step in this direction. The importance of yield differentials to long-term treasuries for insurers leads to stark cross-sectional heterogeneity in the impact of monetary policy on risk premia.

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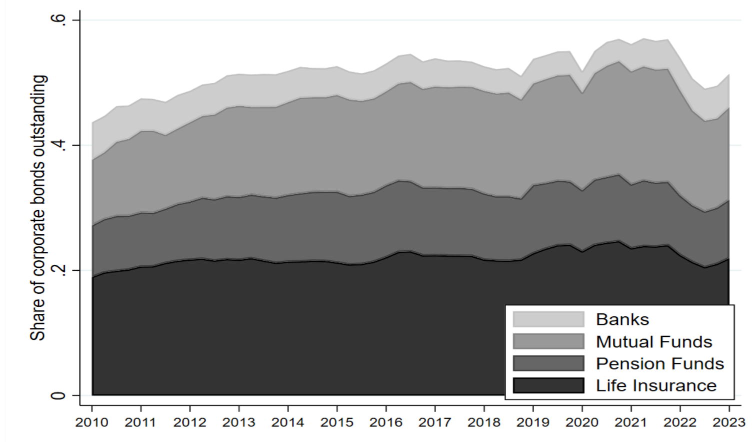
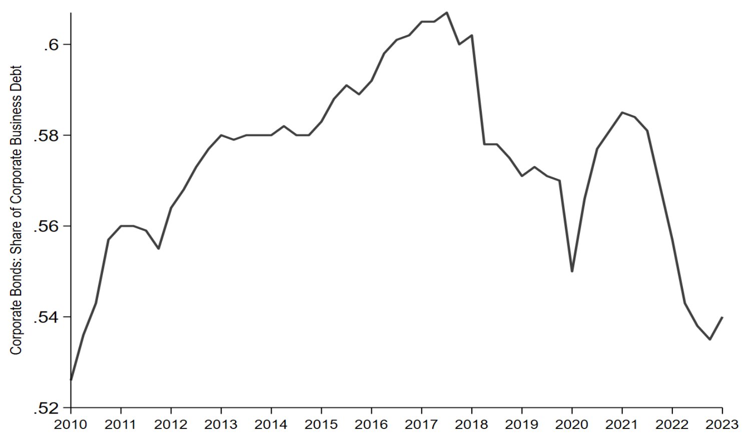
Figure 1. Life insurers are important financial intermediaries

(a) Insurers are the largest institutional holders of corporate bonds

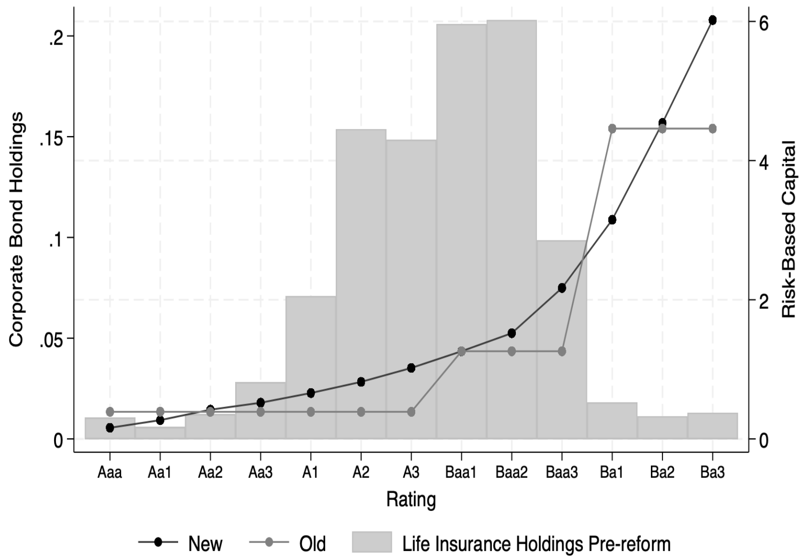


(b) Corporate bonds are a key source of US business debt



Notes: Panel (a) shows the share of outstanding corporate bonds held by major financial institutions: banks, mutual funds, pension funds, and life insurers. Panel (b) shows the total value of corporate bonds as a share of total corporate business debt. Underlying data for both panels is from the Financial Accounts of the United States.

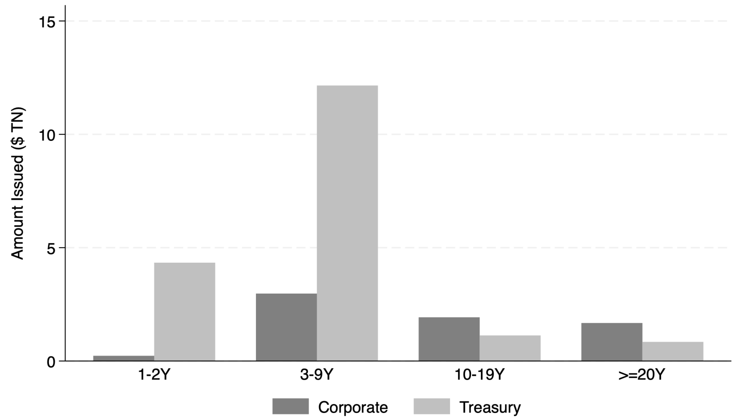
Figure 2. Shift in regulatory treatment of corporate bonds for insurers (2021)



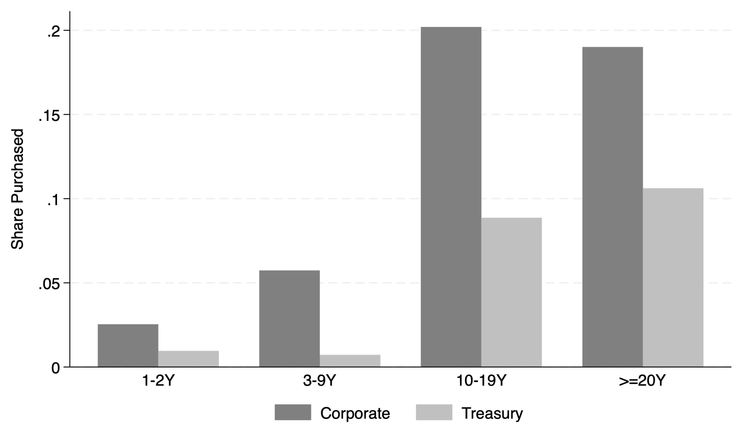
Notes: This figure shows the regulatory change in risk-based capital weights for US life insurers introduced from year-end 2021 onwards. The black and grey dashed lines show the new and old risk weights over bond rating categories, respectively. The bars show the exposure of US life insurers to corporate bonds in different rating categories at the end of the quarter preceding the announcement of the reform (2021 Q2). This exposure is measured as the fair value of corporate bonds in a rating category relative to the total fair value of corporate bonds on an insurer's balance sheet, averaged across all US life insurers.

Figure 3. Bond maturity and insurer relative demand

(a) Amount Issued



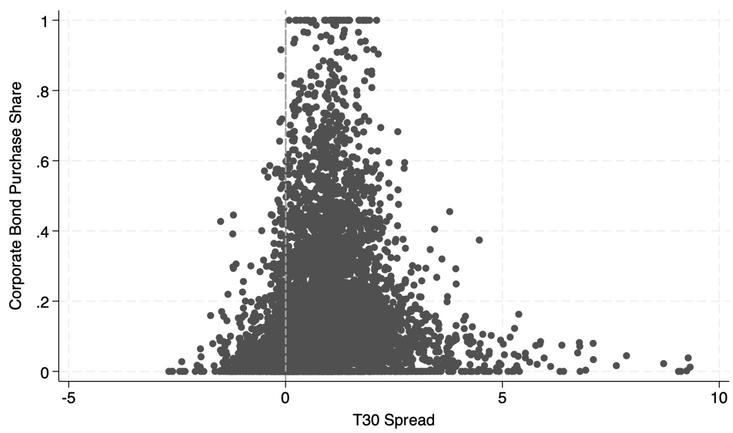
(b) Share of Issuance Amount Purchased by Insurers



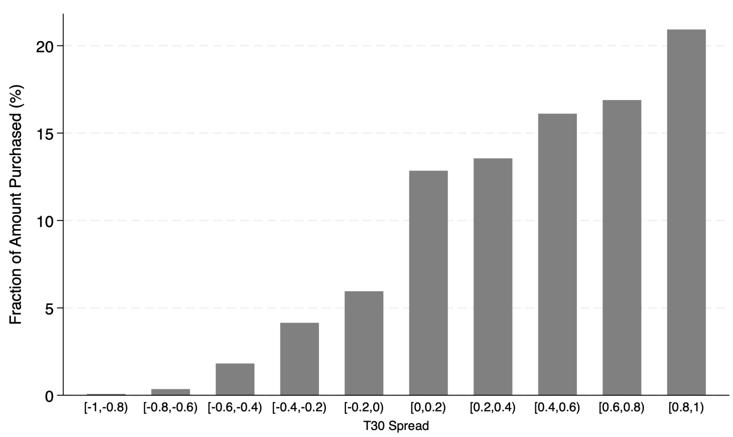
Notes: This figure shows the maturity distribution of the share of corporate bond and treasuries purchased by life insurers from 2014 to 2022. Panel (a) shows the total par value of bonds issued. Panel (b) depicts the purchase share of bonds issued, measured as net insurer purchases within 90 days of bond issuance relative to the total amount issued.

Figure 4. Yield spreads to long-term treasuries and insurer relative demand

(a) Relative demand at the bond level



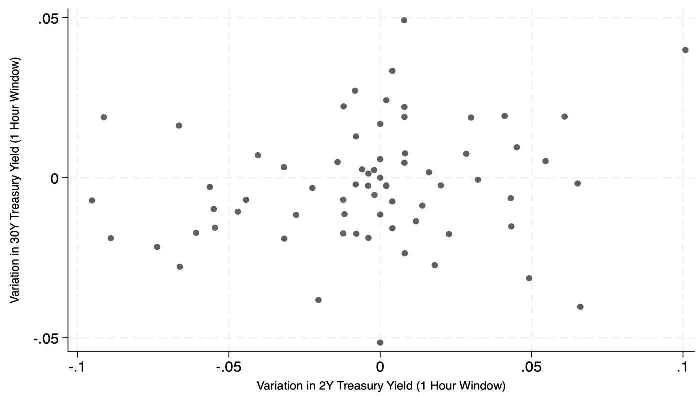
(b) Share of issuance amount purchased by insurers



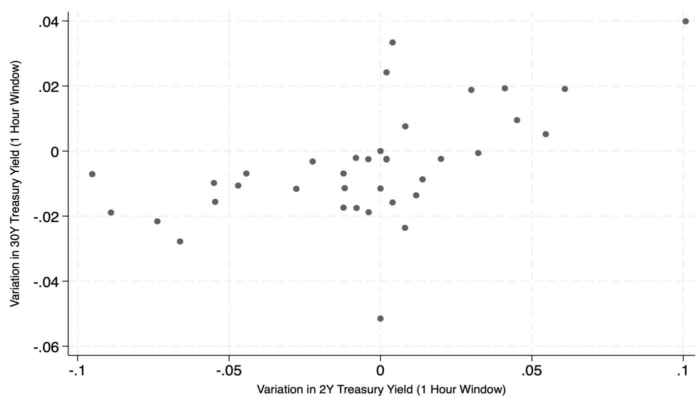
Notes: This figure shows how relative demand for corporate bonds by US life insurers varies with the T30 spread, which is the spread of corporate bond yield over the 30 year Treasury yield. Panel (a) shows the bond-level relative demand for corporate bonds by life insurers on the y axis. Relative demand is measured as the cumulative net purchases of a corporate bond by all US life insurers within 90 days of issuance relative to the total issuance amount. Panel (b) shows the ratio of the total insurer net purchases of corporate bonds over their entire life relative to issuance for buckets categorized by the level of T30 spread.

Figure 5. Monetary policy transmission from short to long rates

(a) All FOMC days



(b) Days with negative correlation between stocks and 30Y yield



Notes: Panel (a) plots changes in the 30 year Treasury yield against changes in the 2 year Treasury yield on FOMC announcement days from 2014 to 2022. There are a total of 71 observations in this sample. In order to cleanly identify the monetary policy component of FOMC announcements, Panel (b) only includes FOMC announcement days when 30 year treasury yields move in the opposite direction to the stock market index in a one-hour window around an announcement. There are 37 observations in this sample.

Table 1. Summary statistics (primary market)

Panel (a): 2014-2018

	2014		2015		2016		2017		2018	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Purchase Share	0.28	0.24	0.29	0.25	0.26	0.24	0.23	0.22	0.25	0.22
Number of Insurers	19.9	11.7	22.6	13.8	22.1	12.7	18.6	10.8	20.5	12.3
T30 Spread	0.64	1.21	1.00	1.38	0.88	1.53	0.79	1.11	1.14	0.84
Yield	3.90	1.19	3.86	1.39	3.50	1.56	3.69	1.11	4.27	0.85
Duration	9.8	4.7	9.6	4.8	9.4	4.9	9.1	5.0	9.4	5.1
Dtdefault	11.8	4.6	10.7	4.7	9.4	4.1	11.5	5.6	9.7	4.1
Offering Amount (BN)	0.66	0.44	0.87	0.71	0.89	0.65	0.79	0.63	0.87	0.93
Observations	408		467		431		440		363	

Panel (b): 2019-2022

	2019		2020		2021		2022	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Purchase Share	0.25	0.20	0.18	0.15	0.24	0.20	0.24	0.23
Number of Insurers	19.4	10.6	19.0	9.4	19.1	10.6	17.0	9.6
T30 Spread	1.06	0.95	1.23	1.34	0.44	0.91	1.37	0.64
Yield	3.51	1.04	2.68	1.34	2.53	0.91	4.52	0.87
Duration	10.4	5.5	10.8	6.0	11.1	6.1	9.6	5.2
Dtdefault	8.6	4.2	5.2	2.9	8.9	3.6	8.4	3.3
Offering Amount (BN)	0.78	0.55	0.99	0.72	0.97	0.76	0.82	0.55
Observations	332		668		386		330	

Notes: This table shows the summary statistics for key corporate bond characteristics in the primary market. Purchase share refers to the net purchases by insurers within three months of bond issuance as a fraction of the total offering amount. Number of insurers measures how many insurers purchase a corporate bond within three months of its issuance. T30 spread denotes the spread of a corporate bond yield over the 30-year Treasury yield, expressed in percentage points. Yield refers to the yield to maturity of a bond and is expressed in percentage points. Duration is expressed in years. Dtdefault denotes distance to default. Offering amount is expressed in billions. Panel (a) shows the statistics for the years 2014-2018 and Panel (b) shows the statistics for the years 2019-2022.

Table 2. Composition of insurer bond holdings

Panel (a): Insurer bond holdings by type

Asset Issuer Type	Share (Unique CUSIPs)	Share (Total Value)
Corporate Bonds	19.5%	58.4%
Government Bonds	18.6%	13.2%
Private MBS	20.5%	15.8%
Agency MBS	31.6%	7.0%
Other	9.8%	5.6%
Total	100%	100%

Panel (b): Insurer corporate bond holdings by NAIC designation

NAIC Category	Share (Unique CUSIPs)	Share (Total Value)
1	41.9%	44.4%
2	42.0%	50.0%
3	7.4%	3.7%
4	4.9%	1.3%
5 & 6	3.8%	0.6%
Total	100%	100%

Notes: Panel (a) classifies insurer holdings of general account bonds based on the type of their issuer at the end of year 2019. Government bonds include Federal and Municipal bonds. Panel (b) classifies insurer holdings of corporate bonds at the end of year 2019 based on their NAIC designations (as defined prior to the regulatory change in 2021). Column 1 shows the share of each category based on the number of bonds held by insurers in our sample. Column 2 shows the share of each category based on the par value of bonds held by insurers in our sample. We focus on holdings in 2019 so as to illustrate the composition prior to COVID in 2020 and an insurer specific regulatory reform in 2021.

Table 3. Insurer relative demand driven by yield differentials to long-term risk-free rates

	All Ratings		NAIC 1-3	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
T30 Spread	5.35**	5.87**	5.35**	5.88**
	(2.33)	(2.45)	(2.33)	(2.45)
Duration-matched Spread	-2.14	-1.06	-2.13	-1.05
	(2.38)	(2.41)	(2.39)	(2.41)
Duration	0.84***	0.70***	0.84***	0.70***
	(0.21)	(0.23)	(0.21)	(0.23)
Dtdefault	0.28	0.47**	0.28	0.47**
	(0.21)	(0.20)	(0.21)	(0.20)
Log(Offering Amount)	-6.24***	-6.36***	-6.25***	-6.37***
	(1.54)	(1.69)	(1.54)	(1.69)
Liquidity	1.18	1.45	1.17	1.44
	(1.54)	(1.56)	(1.54)	(1.56)
1{Callable}	3.22	1.89	3.22	1.89
	(2.58)	(2.15)	(2.58)	(2.15)
Observations	2,610	2,277	2,598	2,268
R^2	0.68	0.69	0.68	0.69
Issuer FE	yes	yes	yes	yes
Rating-Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering	Issuer + Time			

Notes: The dependent variable is net purchases by insurers within three months of bond issuance as a fraction of the total issuance amount. This is expressed in percentage points and winsorized at the 1st and 99th percentiles by rating category. The main independent variable is the T30 spread, which denotes the spread of corporate bond yields over 30 year Treasury yields, expressed in percentage points. Regressions are at the issue level in the primary market and are based on a sample from 2014-2022. We include controls for duration-matched spread, bond duration, default risk, measured as distance to default, liquidity, (log) total offering amount, an indicator variable which takes the value 1 if the bond is callable and 0 otherwise, along with issuer and rating-quarter fixed effects. Standard errors are double-clustered by bond issuer and quarter, and are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4. Insurer relative demand driven by yield differentials to long-term risk-free rates: extensive margin

	All Ratings		NAIC 1-3	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
T30 Spread	4.81^{***}	4.99^{***}	4.81^{***}	4.99^{***}
	(1.21)	(1.25)	(1.21)	(1.26)
Duration-matched Spread	-2.86^{**}	-2.37	-2.62^{*}	-2.18
	(1.35)	(1.41)	(1.33)	(1.41)
Duration	0.29^{***}	0.26^{**}	0.27^{***}	0.24^{**}
	(0.09)	(0.11)	(0.09)	(0.11)
Dtdefault	0.16^{*}	0.14	0.19^{**}	0.17^{*}
	(0.08)	(0.08)	(0.08)	(0.09)
Ln(Offering Amount)	10.49^{***}	10.98^{***}	10.66^{***}	11.13^{***}
	(1.07)	(1.23)	(1.07)	(1.24)
Liquidity	5.09^{***}	5.14^{***}	5.07^{***}	5.13^{***}
	(0.75)	(0.85)	(0.73)	(0.83)
1{Callable}	0.30	0.70	0.63	1.34
	(1.40)	(1.55)	(1.26)	(1.27)
Observations	2,716	2,370	2,645	2,312
R^2	0.59	0.60	0.58	0.60
Issuer FE	yes	yes	yes	yes
Rating-Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering	Issuer + Time			

Notes: The dependent variable is number of insurers participating in the bond sale within three months of issuance. The main independent variable is the T30 spread, which denotes the spread of corporate bond yields over 30 year Treasury yields, expressed in percentage points. Regressions are at the issue level in the primary market and are based on a sample from 2014-2022.We include controls for duration-matched spread, bond duration, default risk, measured as distance to default, liquidity, (log) total offering amount, an indicator variable which takes the value 1 if the bond is callable and 0 otherwise, along with issuer and rating-quarter fixed effects. Standard errors are double-clustered by bond issuer and quarter, and are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5. Insurer relative demand for long-term treasuries increases with yields

	Purchase Share		Extensive Margin	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
Offering Yield	6.57***	6.28***	5.22***	4.75***
	(2.04)	(2.02)	(1.68)	(1.67)
Log(Offering Amount)	7.27*	8.72*	50.17***	52.47***
	(4.19)	(4.59)	(4.60)	(5.06)
Observations	135	130	135	130
R^2	0.64	0.64	0.86	0.86
Time FE	yes	yes	yes	yes
SE Clustering	Time			

Notes: Regressions are at the issue level in the primary market and are based on a sample of Treasury bonds with maturities greater than or equal to ten years issued between 2014 and 2022. The dependent variable in columns 1 and 2 is the net purchases by insurers within three months of bond issuance as a fraction of the total issuance amount. This is expressed in percentage points and winsorized at the 1st and 99th percentiles by rating category. The dependent variable in columns 3 and 4 is the number of insurers participating in the bond sale within three months of issuance. The main independent variable is the offering yield, expressed in percentage points. Regressions include quarter fixed effects. Standard errors are clustered by quarter, and are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6. Monetary policy shifts insurers' relative demand

	All Ratings		NAIC 1-3	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
ΔT30 Yield$_{\text{MP}}$	-0.64***	-0.69***	-0.79***	-0.80**
	(0.18)	(0.22)	(0.26)	(0.29)
ΔYield	-0.40	-0.43	0.58	0.36
	(0.29)	(0.32)	(0.66)	(0.88)
ΔDtdefault	-0.05	0.01	-0.19	-0.10
	(0.16)	(0.15)	(0.17)	(0.17)
ΔDuration	0.83***	1.01***	0.69**	0.87***
	(0.22)	(0.18)	(0.24)	(0.21)
ΔLn(Offering Amount)	-11.46***	-11.32***	-13.22***	-13.05***
	(1.62)	(1.61)	(1.42)	(1.45)
ΔLiquidity	-0.40	-0.36	-0.97	-0.75
	(0.45)	(0.40)	(0.66)	(0.60)
Quarter Two	-3.23***	-3.60***	-3.17***	-3.62***
	(0.85)	(0.97)	(0.84)	(0.97)
Quarter Three	-3.11**	-3.22**	-2.88*	-3.19*
	(1.25)	(1.36)	(1.47)	(1.63)
Quarter Four	-12.06***	-12.28***	-13.20***	-13.65***
	(1.58)	(1.67)	(1.56)	(1.69)
Observations	400	364	329	300
R^2	0.694	0.713	0.746	0.760
SE Clustering	Rating + Time			

Notes: The dependent variable is net purchases of corporate bonds by insurers within three months of bond issuance as a fraction of the total issuance amount, averaged for rating category r. ΔT30 Yield$_{\text{MP}}$ is the main independent variable, denoting the change in 30 year Treasury yield in a one hour window around FOMC announcements. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. We include controls for changes in bond duration, default risk, measured as distance to default, liquidity, (log) total offering amount, along with their lagged values and the lagged value of purchase share. We also include inflation, GDP growth, unemployment rate, VIX index, and indicator variables for each quarter as aggregate controls. Standard errors are double clustered by rating and quarter. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7. Monetary policy shifts insurers' relative demand: extensive margin

	All Ratings		NAIC 1-3	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
ΔT30 Yield$_{\text{MP}}$	-0.59***	-0.60***	-0.86***	-0.78***
	(0.17)	(0.17)	(0.20)	(0.20)
ΔYield	0.48	0.49	2.01***	2.00***
	(0.44)	(0.49)	(0.52)	(0.63)
ΔDtdefault	-0.32**	-0.35***	-0.39***	-0.39***
	(0.11)	(0.12)	(0.11)	(0.12)
ΔDuration	0.64***	0.68***	0.52***	0.57***
	(0.15)	(0.17)	(0.14)	(0.15)
ΔLn(Offering Amount)	10.02***	10.21***	9.10***	9.39***
	(1.31)	(1.35)	(1.15)	(1.20)
ΔLiquidity	0.64	0.66	0.64	0.76
	(0.64)	(0.66)	(0.73)	(0.78)
Quarter Two	-2.30**	-2.13**	-2.59**	-2.32*
	(0.87)	(0.92)	(1.11)	(1.20)
Quarter Three	-2.44***	-2.41***	-2.99**	-2.80**
	(0.57)	(0.74)	(0.99)	(1.13)
Quarter Four	-3.44***	-3.03***	-3.82**	-3.28**
	(0.93)	(0.91)	(1.36)	(1.39)
Observations	400	364	329	300
R^2	0.583	0.589	0.655	0.653
SE Clustering	Rating + Time			

Notes: The dependent variable is number of insurers participating in the bond sale within three months of issuance, averaged for rating category r. ΔT30 Yield$_{\text{MP}}$ is the main independent variable, denoting the change in 30 year Treasury yield in a one hour window around FOMC announcements. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. We include controls for changes in bond duration, default risk, measured as distance to default, liquidity, (log) total offering amount, along with their lagged values and the lagged value of purchase share. We also include inflation, GDP growth, unemployment rate, VIX index, and indicator variables for each quarter as aggregate controls. Standard errors are double-clustered by rating and quarter. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8. Risk premia are more responsive when insurers dominate investor base

	All Ratings		NAIC 1-3	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
Insurer $\text{Exposure}_{c,q-1} \times \Delta\text{T30 Yield}_{\text{MP},w}$	0.03^{**}	0.04^{**}	0.01^{**}	0.02^{***}
	(0.01)	(0.02)	(0.01)	(0.01)
Observations	108,053	100,379	100,221	92,890
R^2	0.233	0.243	0.369	0.385
Issue FE	yes	yes	yes	yes
Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering	Issue + Time			

Notes: Regressions are at the bond level, based on a sample from 2014-2022. The dependent variable is the change in excess bond premia at the weekly frequency expressed in basis points. The main coefficient of interest is for the interaction of $\Delta\text{T30 Yield}_{\text{MP}}$ and Insurer $\text{Exposure}_{c,q-1}$. Insurer $\text{Exposure}_{c,q-1}$ is the fraction of an outstanding bond held by life insurers, expressed in percentage points, for the quarter preceding the FOMC announcement. $\Delta\text{T30 Yield}_{\text{MP}}$ denotes the change in 30 year Treasury yield in a one hour window around FOMC announcements, expressed in basis points. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. All specifications also control for bond liquidity, inflation, GDP growth, unemployment rate, VIX index, along with issue and week fixed effects. Standard errors are double clustered by issue and week.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9. Risk premia are more responsive when higher risk weights increase insurer sensitivity to yield spreads

	All Ratings		NAIC 1-3	
	2019-2022	Excl. COVID	2019-2022	Excl. COVID
$1\{\text{Post}\} \times \Delta\text{RBC}_r \times \Delta\text{T30 Yield}_{\text{MP}}$	1.31^{**}	1.70^{**}	0.65^{**}	0.97^{**}
	(0.53)	(0.69)	(0.28)	(0.33)
Observations	61,320	53,119	58,396	50,615
R^2	0.24	0.27	0.30	0.34
Issue FE	yes	yes	yes	yes
Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering		Issue + Time		

Notes: Regressions are at the bond level, based on a sample from 2019-2022. The dependent variable is the change in excess bond premia at the weekly frequency expressed in basis points. ΔT30 Yield_{MP} denotes the change in 30 year Treasury yield in a one hour window around FOMC announcements, expressed in basis points. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. Post is an indicator variable which takes the value 1 for months after August 2021 and 0 otherwise. ΔRBC_r denotes the change in risk based capital weights for a rating category r. All specifications control for bond liquidity, inflation, GDP growth, unemployment rate, and VIX index. The controls are also interacted with the change in risk-based capital requirements across bond rating categories and the indicator variable 1{Post}. All specifications include issue and week fixed effects. Standard errors are double-clustered by issue and week, and are shown in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix

A. Construction of risk premia

As in Gilchrist and Zakrajšek (2012), we assume a linear relationship between the credit spread and its determinants such as expected default risk, duration, and other characteristics. We use the following specification:

$$\ln S_{c,i,t} = \beta EDF_{c,i,t} + \gamma' Z_{c,i,t} + \epsilon_{c,i,t} \tag{8}$$

where the k denotes the bond, i denotes the firm and t denotes time. EDF refers to the expected default frequency, or the default probability of a bond, S denotes the maturity matched treasury spread, and Z refers to the set of controls including bond duration, coupon, face value, and an indicator variable for bond callability.

While Gilchrist and Zakrajšek (2012) compute a measure of distance to default at the issuer level based on their stock market information, we use bond level estimates that account for differences in seniority in the event of default on different debt claims on the same issuer. We also use option-adjusted measures of bond duration, which is important as most US corporate bonds are callable. We also include industry fixed effects to adjust for permanent differences across industries. The predicted component of the spread can then be derived as:

$$\hat{S}_{c,i,t} = exp\left[\hat{\beta} EDF_{c,i,t} + \hat{\gamma}' Z_{c,i,t} + \frac{\hat{\sigma}^2}{2}\right] \tag{9}$$

The excess bond premium is the residual of the credit spread after eliminating the predicted component:

$$EBP_{c,i,t} = S_{c,i,t} - \hat{S}_{c,i,t} \tag{10}$$

All analyses examining credit risk premia use this measure of excess bond premia.

B. Insurers are short duration

We use a two factor model to examine the exposure of insurers to interest rate risk following Berends et al. (2013), Hartley et al. (2016) and Koijen and Yogo (2023):

$$R_{i,t} = \alpha + \beta R_{m,t} + \gamma R_{10,t} + \epsilon_{i,t} \tag{11}$$

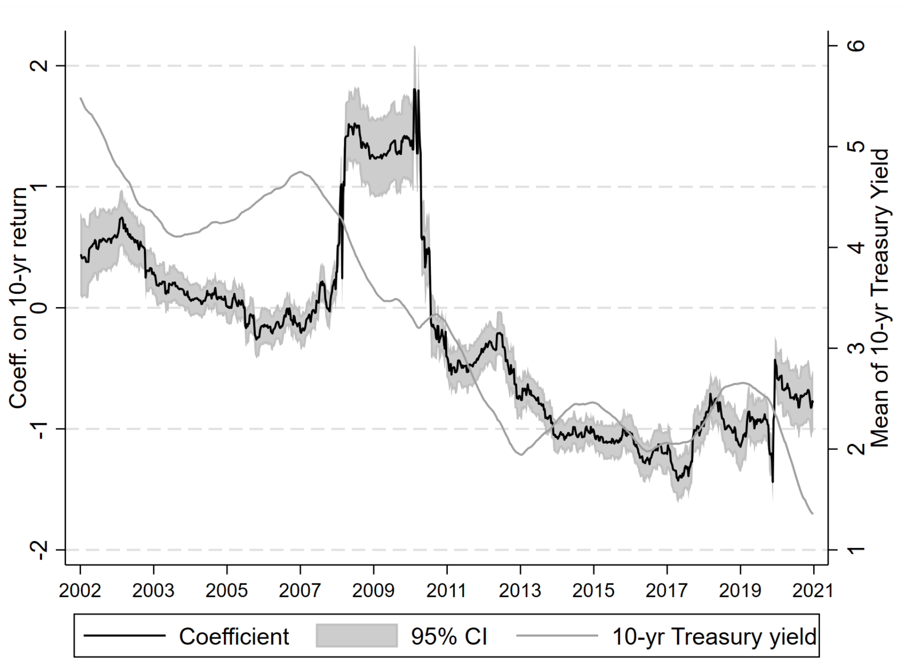
where $R_{i,t}$ refers to the return on a value weighted portfolio of insurer stocks in week t, $R_{m,t}$ is return on value-weighted stock market portfolio in week t, and $R_{10,t}$ is the return on 10 year treasury bond in week t. In Figure B.1, we plot the estimates of the coefficient γ based on rolling regressions with two years of weekly data. We find that during the period characterized by low long-term risk-free rates, life insurers had significant net negative duration exposure.[17] Quantitatively, one percentage point increase in 10 year treasury returns is associated with one percentage point decline in returns of the insurance portfolio.

This approach suggests a duration gap of about 10 years (Koijen and Yogo, 2023). Recent work by Brunetti et al. (2023) using higher frequency data also concludes that life insurers face challenges in matching liability duration exposure but suggests smaller duration gaps.

Kirti (2024) shows that large life insurers are active in interest-rate derivative markets, at times using them to add asset duration equivalent to nearly $200 BN in bonds with the same duration as their bond portfolios. Both limited risk-bearing capacity and regulatory frictions (Sen, 2023) could explain why derivatives do not fully allow insurers to manage high liability duration exposure.

[17] The duration of long-term liabilities significantly increases when rates are low. For instance, the duration of a 40 year liability with a 5 percent yield increases from 17 years to 26 years when discount rates fall from 5 percent to 0.5 percent.

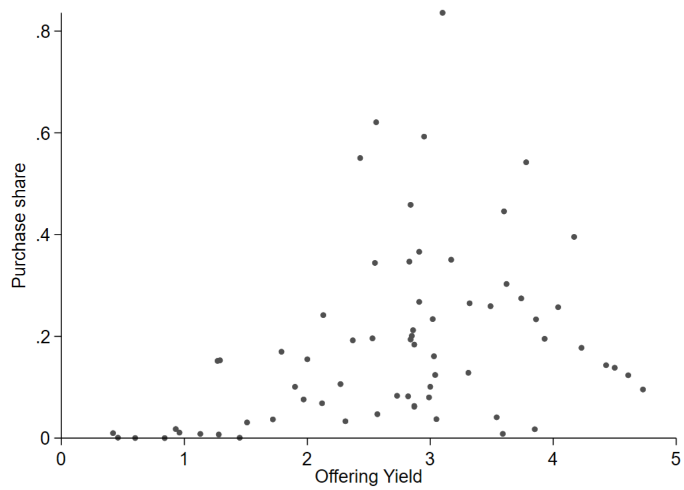
Figure B.1. Life insurers are short duration



Notes: This figure shows exposure of US life insurers to interest rate risk. This exposure is estimated as γ in the following 2 year rolling regression at the weekly frequency: $R_{i,t} = \alpha + \beta R_{m,t} + \gamma R_{10,t} + \epsilon_{i,t}$, where $R_{i,t}$ is the return on insurance portfolio in week t, $R_{m,t}$ is the return on value-weighted stock market portfolio in week t, and $R_{10,t}$ is the return on 10 year treasury bond in week t. The black line represents the estimated coefficeint γ based on rolling weekly regressions using returns for the past two years. The grey band represents the 95 percent confidence intervals based on heteroskedasticity robust standard errors. The grey line is the ten year treasury yield over time.

C. Insurers' demand for long-term Treasury bonds

Figure C.1. Relative demand of long-term Treasury bonds increases with yields



Notes: This figure plots the purchases share, measured as the net purchases by insurers within three months of bond issuance as a fraction of the total issuance amount, against offering yield. Purchase share is expressed in percentage points and winsorized at the 1st and 99th percentiles by rating category. The offering yield is expressed in percentage points. The sample consists of all primary issuances of treasuries between 2014 and 2022.

D. Tables

Table D.1. Insurers' holdings by asset type, over time

Year	Corporate	Govt.	Private MBS	Agency MBS	Other
2014	57.2%	15.8%	15.7%	8.2%	3.1%
2015	57.7%	15.9%	15.2%	7.7%	3.5%
2016	58.0%	16.1%	15.1%	7.6%	3.2%
2017	58.0%	16.1%	14.6%	7.5%	3.9%
2018	57.8%	13.7%	15.3%	7.4%	5.8%
2019	58.4%	13.2%	15.8%	7.0%	5.6%
2020	58.5%	12.4%	16.0%	5.9%	7.3%
2021	58.9%	12.2%	16.5%	4.9%	7.4%
2022	57.0%	11.1%	17.2%	4.1%	10.7%

Notes: This table classifies insurer holdings of general account bonds based on their issuer at the end of each year from 2014 to 2022. Government bonds include Federal and Municipal bonds. The share of each category is based on the par value of bonds for each issuer category relative to the total par value of bonds held.

Table D.2. Insurers' holdings by NAIC rating, over time

Year	NAIC-1	NAIC-2	NAIC-3	NAIC-4	NAIC-5/6
2014	43.7%	47.9%	5.3%	2.3%	0.8%
2015	42.7%	48.9%	5.5%	2.2%	0.8%
2016	42.9%	48.5%	5.5%	2.2%	0.9%
2017	43.8%	48.8%	4.7%	2.0%	0.7%
2018	43.1%	50.8%	4.0%	1.5%	0.6%
2019	44.4%	50.0%	3.7%	1.3%	0.6%
2020	40.8%	52.3%	4.9%	1.4%	0.5%
2021	41.3%	52.8%	4.3%	1.2%	0.4%
2022	42.7%	52.3%	3.5%	1.0%	0.4%

Notes: This table classifies insurer holdings of corporate bonds from 2014 to 2022 based on their NAIC designations (as defined prior to the regulatory change in 2021). The share of each category is based on the par value of bonds for each rating category relative to the total par value of corporate bonds held.

Table D.3. Table 6 using shifts in short-term yields around monetary policy announcements

	All Ratings		NAIC 1-3	
	2014-2022	Exc COVID	2014-2022	Exc COVID
ΔT2 Yield$_{\text{MP}}$	-0.12*	-0.12	-0.12	-0.13
	(0.06)	(0.08)	(0.11)	(0.11)
Δ(Yield)	-0.29	-0.34	0.51	0.25
	(0.27)	(0.30)	(0.70)	(0.88)
Δ(Dtdefault)	-0.01	0.05	-0.16	-0.07
	(0.17)	(0.15)	(0.18)	(0.18)
Δ(Duration)	0.81***	1.00***	0.67**	0.87***
	(0.22)	(0.18)	(0.24)	(0.20)
Δ(Ln(Offering Amount))	-11.47***	-11.23***	-13.15***	-12.90***
	(1.60)	(1.60)	(1.39)	(1.44)
ΔLiquidity	-0.46	-0.39	-0.97	-0.74
	(0.49)	(0.45)	(0.74)	(0.68)
Quarter Two	-3.59***	-3.84***	-3.46***	-3.77***
	(0.89)	(1.01)	(0.95)	(1.17)
Quarter Three	-2.86*	-2.76*	-2.59	-2.72
	(1.38)	(1.48)	(1.68)	(1.80)
Quarter Four	-11.89***	-11.88***	-13.17***	-13.42***
	(1.79)	(2.00)	(1.89)	(2.14)
Observations	390	354	320	291
R^2	0.687	0.706	0.738	0.752
SE Clustering	Rating + Time			

Notes: The dependent variable is net purchases of corporate bonds by insurers within three months of bond issuance as a fraction of the total issuance amount, averaged for rating category r. ΔT2 Yield$_{\text{MP}}$ is the main independent variable, denoting the change in 2 year Treasury yield in a one hour window around FOMC announcements. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. We include controls for changes in bond duration, default risk, measured as distance to default, liquidity, (log) total offering amount, along with their lagged values and the lagged value of purchase share. We also include inflation, GDP growth, unemployment rate, VIX index, and indicator variables for each quarter as aggregate controls. Standard errors are double clustered by rating and quarter.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.4. Table 8 using shifts in short-term yields around monetary policy announcements

	All Ratings		NAIC 1-3	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
Insurer Exposure$_{c,w-1}\times$ ΔT2 Yield$_{\text{MP},w}$	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	154751	132145	143987	122452
R^2	0.176	0.192	0.275	0.320
Issue FE	yes	yes	yes	yes
Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering	Issue + Time			

Notes: Regressions are at the bond level, based on a sample from 2014-2022. The dependent variable is the change in excess bond premia at the weekly frequency expressed in basis points. The main coefficient of interest is for the interaction of ΔT2 Yield$_{\text{MP}}$ and Insurer Exposure$_{r,w-1}$. Insurer Exposure$_{c,q-1}$ is the fraction of an outstanding bond held by life insurers, expressed in percentage points, for the quarter preceding the FOMC announcement. ΔT2 Yield$_{\text{MP}}$ denotes the change in 2 year Treasury yield in a one hour window around FOMC announcements, expressed in basis points. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. All specifications also control for bond liquidity, inflation, GDP growth, unemployment rate, VIX index, along with issue and week fixed effects. Standard errors are double clustered by issue and week.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.5. Table 8 using credit spreads instead of risk premia

	All Ratings		NAIC 1-3	
	2014-2022	Excl. COVID	2014-2022	Excl. COVID
Insurer Exposure$_{c,w-1}\times$ ΔT30 Yield$_{\mathrm{MP},w}$	0.03**	0.04**	0.01**	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	108053	100379	100221	92890
R^2	0.232	0.241	0.363	0.379
Issue FE	yes	yes	yes	yes
Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering	Issue + Time			

Notes: Regressions are at the bond level, based on a sample from 2014-2022. The dependent variable is the change in duration matched treasury spread at the weekly frequency expressed in basis points. The main coefficient of interest is for the interaction of ΔT30 Yield$_{\mathrm{MP}}$ and Insurer Exposure$_{c,w-1}$. Insurer Exposure$_{c,q-1}$ is the fraction of an outstanding bond held by life insurers, expressed in percentage points, for the quarter preceding the FOMC announcement. ΔT30 Yield$_{\mathrm{MP}}$ denotes the change in 30 year Treasury yield in a one hour window around FOMC announcements, expressed in basis points. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. All specifications also control for bond liquidity, inflation, GDP growth, unemployment rate, VIX index, along with issue and week fixed effects. Standard errors are double clustered by issue and week.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.6. Higher risk weights increase sensitivity of insurer relative demand to yield spreads to long-term risk-free rates

	All Ratings		NAIC 1-3	
	2019-2022	Excl. COVID	2019-2022	Excl. COVID
1{Post} × ΔRBC$_r$× T30 Spread	6.58***	8.77***	4.19	8.23*
	(2.23)	(2.44)	(3.99)	(4.32)
Observations	1,573	1,132	1,550	1,119
R^2	0.45	0.45	0.45	0.45
Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering	Issuer + Time			

Notes: The dependent variable is net purchases by insurers within three months of bond issuance as a fraction of the total offering amount. We focus on the coefficient for the triple interaction of ΔRBC$_r$, denoting the change in risk based capital weights for a rating category r after the reform, T30 Spread and $\mathbb{1}$\{Post\}, which is an indicator variable taking the value 1 for quarters post 2021 Q3 and 0 otherwise. The variable RBC$_r$ is expressed in percentage points. T30 spread denotes the spread of corporate bond yields over 30 year Treasury yields, expressed in percentage points. All specifications include the following controls: bond duration, default risk, measured as distance to default, liquidity, (log) total offering amount, and an indicator variable which takes the value 1 if the bond is callable and 0 otherwise, along with quarter fixed effects. The controls are also interacted with RBC$_r$ and $\mathbb{1}$\{Post\}. Standard errors are double-clustered by issuer and quarter, and are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D.7. Table 9 using shifts in short-term yields around monetary policy announcements

	All Ratings		NAIC 1-3	
	2019-2022	Excl. COVID	2019-2022	Excl. COVID
$1\{\text{Post}\} \times \Delta\text{RBC}_r \times \Delta\text{T2 Yield}_{\text{MP}}$	-0.22	-0.22	0.00	0.12
	(0.16)	(0.26)	(0.07)	(0.27)
Observations	93,847	69,717	89,254	64,758
R^2	0.14	0.20	0.24	0.32
Issue FE	yes	yes	yes	yes
Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering	Issue + Time			

Notes: Regressions are at the bond level, based on a sample from 2019-2022. The dependent variable is the change in excess bond premia at the weekly frequency expressed in basis points. $\Delta\text{T2 Yield}_{\text{MP}}$ denotes the change in 2 year Treasury yield in a one hour window around FOMC announcements, expressed in basis points. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. Post is an indicator variable which takes the value 1 for months after August 2021 and 0 otherwise. ΔRBC_r denotes the change in risk based capital weights for a rating category r. All specifications control for bond liquidity, inflation, GDP growth, unemployment rate, and VIX index. The controls are also interacted with ΔRBC_r and $\mathbb{1}\{\text{Post}\}$. All specifications also include issue and week fixed effects. Standard errors are double-clustered by issue and week, and are shown in parentheses.

Table D.8. Table 9 using credit spreads instead of risk premia

	All Ratings		NAIC 1-3	
	2019-2022	Excl. COVID	2019-2022	Excl. COVID
1{Post} × ΔRBC$_r$× ΔT30 Yield$_{\text{MP}}$	1.19*	1.59**	0.64**	1.06**
	(0.58)	(0.72)	(0.30)	(0.35)
Observations	61,320	53,119	58,396	50,615
R^2	0.22	0.26	0.27	0.30
Issue FE	yes	yes	yes	yes
Time FE	yes	yes	yes	yes
Controls	yes	yes	yes	yes
SE Clustering		Issue + Time		

Notes: Regressions are at the bond level, based on a sample from 2019-2022. The dependent variable is the change in duration matched treasury spread at the weekly frequency expressed in basis points. ΔT30 Yield$_{\text{MP}}$ denotes the change in 30 year Treasury yield in a one hour window around FOMC announcements, expressed in basis points. In order to cleanly identify the MP component of FOMC announcements, we only include days when the bond yields move in the opposite direction to stock market prices. Post is an indicator variable which takes the value 1 for months after August 2021 and 0 otherwise. ΔRBC$_r$ denotes the change in risk based capital weights for a rating category r. All specifications control for bond liquidity, inflation, GDP growth, unemployment rate, and VIX index. The controls are also interacted with the change in risk-based capital requirements across bond rating categories and the post dummy. All specifications also include issue and week fixed effects. Standard errors are double-clustered by issue and week, and are shown in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

PUBLICATIONS

The Insurer Channel of Monetary Policy Working Paper No. WP/2025/054