

Long Rates, Life Insurers, and Credit Spreads


Ziang Li

Imperial College London

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Introduction

- ▶ *The corporate bond market* has expanded dramatically in recent years (\$10 tn in 2022)
 - It has become the dominant funding source for US firms (vs. \$2.4 tn bank credit)
 - Credit spreads play an important role in firm borrowing and investment decisions
- ▶ *Life insurers* are the largest institutional investors in the US bond market (>20%) 
 - Since the GFC, US life insurers have sustained large *negative duration gaps*
- ▶ How do life insurers matter for corporate bond pricing? Existing literature:
 1. risk-based capital constraint and fire sales (Ellul et al., 2011; Murray and Nikolova, 2022)
 2. stability in crises (Chodorow-Reich et al., 2021; Coppola, 2024)

This Paper: a new channel through their interest rate risk exposure

The Duration Mismatch Channel

- ▶ After the GFC, life insurers face a new and large *duration mismatch*

- negative duration gap: $D_{\text{asset}} < D_{\text{liability}} \implies D_{\text{net worth}} < 0$

- 1% \uparrow in the 10-year Treasury yield \implies 7.2% \uparrow in insurers' market equity

[▶ Source](#)[▶ Details](#)

- ▶ *The Duration Mismatch Channel*

10-year Treasury yield $\uparrow \implies$ insurers' net worth \uparrow

\implies risk-bearing capacity \uparrow , risky bond demand \uparrow

\implies equilibrium credit spreads \downarrow

- ▶ *This Paper*: *theoretical model* and *empirical evidence* on the duration mismatch channel

Main Results

► An Intermediary Asset Pricing Model:

1. *Analytical insights:* long rate $\uparrow \implies$ credit spread \downarrow when insurers' duration gap < 0
2. *Extensions:* quantitative importance, duration management

► Long Rates and Credit Spreads:

1. *Unconditional co-movement:* $\text{cov}(\text{long rate}, \text{credit spread}) < 0$, esp. in low credit ratings
2. *High-frequency MP shocks:* long rate $\uparrow \implies$ credit spread \downarrow
3. *Bond issuance:* long rate $\uparrow \implies$ HY bond issuance \uparrow relative to IG bond issuance

► The Key Role of Life Insurers:

1. *Risk exposure:* life insurers face severe duration mismatch, rates $\uparrow \implies$ net worth \uparrow
2. *Identification via RDD:* life insurer ownership $\uparrow \implies$ stronger co-movement
3. *Bond transactions:* insurers rebalance towards risky bonds after long rates \uparrow

Road Map

1. A Model of the Bond Market

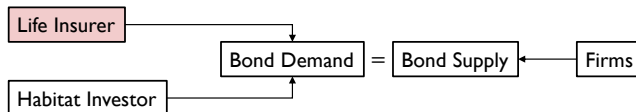
2. The Comovement between Long-term Rates and Credit Spreads

3. The Role of Life Insurers

4. Conclusions

Model Setup

- ▶ I build a model of bond demand from *life insurers*

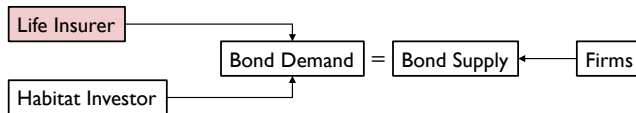


- ▶ Life insurers are the key corporate bond investors in the model

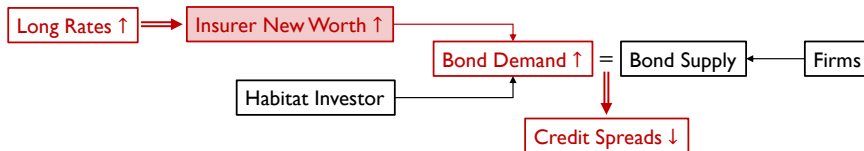
<i>Assets</i>	<i>Liabilities</i>
Corporate Bonds	Annuities
Treasuries	Net Worth

The Duration Mismatch Channel

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- ▶ The *Duration Mismatch Channel*:



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Corporate Bond Ratings

► Corporate bond ratings (Becker and Ivashina, 2015) [► Details](#)

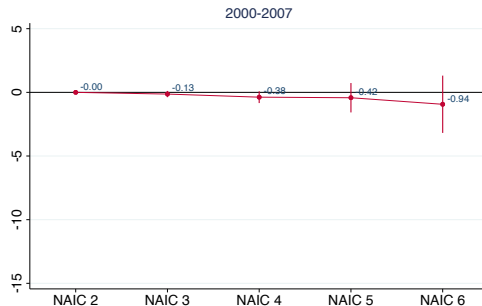
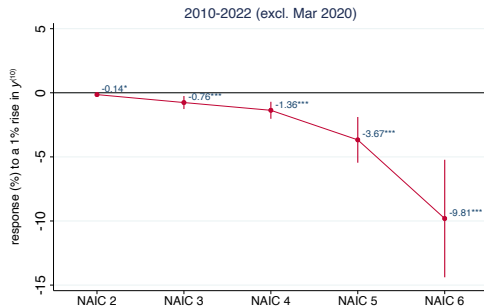
NAIC Category	Credit Ratings	Investment Grade	5-year Default Rate (1990-2010)	Capital Requirement
NAIC 1 (highest)	AAA, AA, A	✓	0.00%, 0.09%, 0.69%	0.3%
NAIC 2	BBB	✓	2.62%	0.96%
NAIC 3	BB	x	6.76%	3.39%
NAIC 4	B	x	8.99%	7.38%
NAIC 5	CCC	x	34.38%	16.96%
NAIC 6 (lowest)	CC, C, D	x	n.a.	19.50%

Long-term Rate and Credit Spreads

- I next estimate comovements between *credit spreads* and 10-year yields ► by maturity

$$\Delta y_{it} = \alpha_i + \alpha_{D(i),t} + \sum_{k=2}^6 \beta_k \cdot \mathbf{1}_{\{\text{NAIC } k\}} \cdot \Delta y_t^{(10)} + \Gamma \mathbf{X}_{it} + \varepsilon_{it}$$

- y_{it} : bond yield α_i : bond FE $\alpha_{D(i),t}$: duration-time FE $y_t^{(10)}$: 10-year yield \mathbf{X}_{it} : controls
- β_k : change in the (NAIC k)–(NAIC 1) spread (%) when $y_t^{(10)}$ increases by 1% ► Merton EDF



High-Frequency Evidence from FOMC Meetings

► *Impulse responses* of spreads to high-frequency $y_t^{(10)}$ shocks ► Yield ► CDS ► News

$$\text{Spread}_{t+h} - \text{Spread}_{t-1} = \alpha_h + \beta_h \left(\Delta y_t^{(10)} \Big|_{\text{FOMC}} \right) + \varepsilon_{t,h}$$

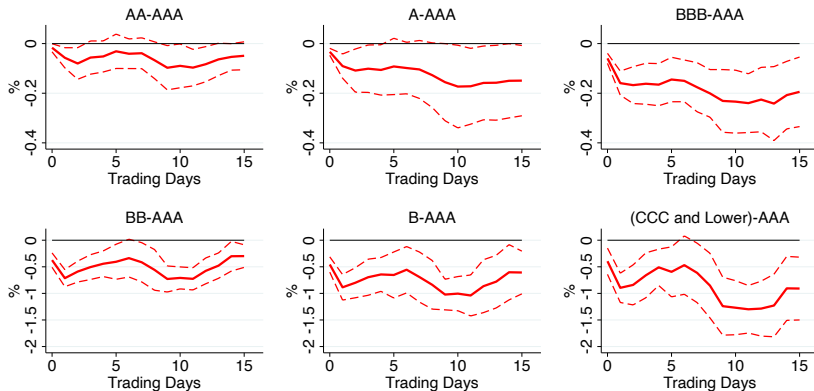


Figure: Cumulative responses to a 1% increase in $y_t^{(10)}$ and 90% confidence intervals (2010-2022)

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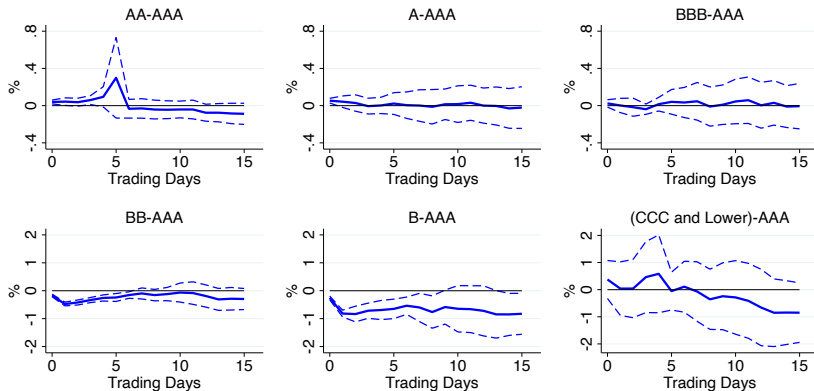


Figure: Cumulative responses to a 1% increase in $y_t^{(10)}$ and 90% confidence intervals (1997-2007)

Credit Spreads and Bond Issuance

- I study how the differential impacts of long rates on the issuance of IG and HY bonds

$$\Delta \text{Issuance Rate}_{k,t} = \alpha_t + \alpha_k + \beta \cdot \mathbf{1}_{\{k=\text{HY}\}} \cdot \Delta y_t^{(10)} + \Gamma \mathbf{X}_{kt} + \varepsilon_{kt},$$

- $k \in \{\text{IG}, \text{HY}\}$, Issuance Rate = 6-month issuance/outstanding
- $\beta = \Delta(\text{HY issuance rate}) - \Delta(\text{IG issuance rate})$ when $y_t^{(10)}$ increases by 1%
- $y_t^{(10)} \uparrow \implies$ credit spreads $\downarrow \implies$ HY yield \downarrow against IG yield $\implies \beta > 0$

	Pre-2007	Post-2009
β	-0.136 [0.712]	0.939** [0.047]
NAIC FE	✓	✓
Time FE	✓	✓
R^2	.589	.725

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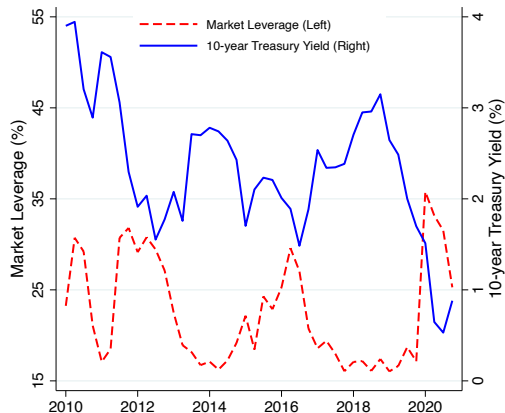
Interest Rate Exposure of Life Insurers

- ▶ After the GFC, the duration of life insurers' liabilities exceeded their assets (e.g., Hartley et al., 2016, Ozdagli and Wang 2020) [▶ Source](#) [▶ \$D_A, D_L\$](#) [▶ Rolling Estimates](#)

$$y_t^{(10)} \uparrow \implies \text{market equity} \uparrow, \text{market leverage} \downarrow$$

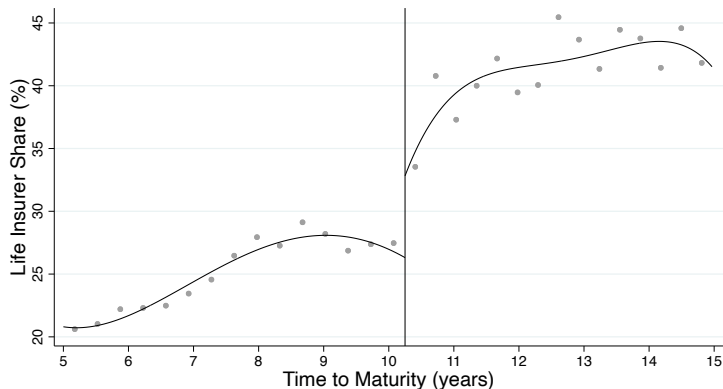
	Pre-2007	Post-2019
$\Delta y_t^{(10)}$	-0.0723 [0.947]	6.008*** [0.000]
S&P 500 Return	✓	✓
$\Delta y_t^{(1m)}$	✓	✓
Observations	260	663

(* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$)



Causal Impact of Life Insurers' Bond Holdings

- ▶ Next, I study causal impact of *life insurers' bond holdings* on the negative comovement
- ▶ Identification: *regression discontinuity design*
 - Many mutual funds are mandated to invest in bonds with maturity ≤ 10 years ▶ Cutoff
 - ⇒ A discontinuity in investor composition



Causal Impact of Life Insurers' Bond Holdings

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- ▶ Identification: *regression discontinuity design*
 - Many mutual funds are mandated to invest in bonds with maturity ≤ 10 years ▶ Cutoff
 - ⇒ A discontinuity in investor composition
- ▶ Specification: interact $y_t^{(10)}$ with life insurer share $\varphi_{it}^{\text{Ins}}$

$$\Delta y_{it} = \alpha_t + (\beta + \gamma \varphi_{it}^{\text{Ins}}) \mathbf{1}_{\{\text{NAIC } 3-6\}} \Delta y_t^{(10)} + \Gamma \mathbf{X}_{it} + \varepsilon_{it}.$$

- β measures comovements between HY-IG spreads and $y_t^{(10)}$ in bonds not held by insurers
- γ measures how life insurers' ownership enhances the comovement
- **RDD**: I use the discontinuity to instrument for insurer share $\varphi_{it}^{\text{Ins}}$

$$\varphi_{it}^{\text{Ins}} = \alpha + \delta \cdot \mathbf{1}_{\{\text{maturity}_{it} > c\}} + \Gamma \mathbf{X}_{it} + \varepsilon_{it}$$

Discontinuity

► First stage

$$\varphi_{it}^{\text{Ins}} = \alpha + \beta \cdot \mathbf{1}_{\{\text{maturity}_{it} > c\}} + \Gamma \mathbf{X}_{it} + \varepsilon_{it}$$

- I test the validity of the discontinuity using the robust bias-corrected method developed by Calonico, Cattaneo, and Titiunik (2014)

Method	δ	p -value	[95% Conf. Interval]
OLS	4.73	0.000	[4.15, 5.32]
RDD, Conventional	4.43	0.000	[2.46, 6.39]
RDD, Bias-corrected	4.52	0.000	[2.55, 6.48]
RDD, Bias-corrected, Robust	4.52	0.000	[2.22, 6.81]

Causal Impact of Life Insurers' Bond Holdings

$$\Delta y_{it} = \alpha_t + (\beta + \gamma \varphi_{it}^{\text{Ins}}) \mathbf{1}_{\{\text{NAIC } 3-6\}} \Delta y_t^{(10)} + \Gamma \mathbf{X}_{it} + \varepsilon_{it}.$$

- **Hypothesis:** $\gamma < 0$ (i.e., insurance ownership $\uparrow \implies$ stronger negative comovements)
- Post-GFC, the negative comovement is stronger in *bonds owned more by life insurers*

	Pre-2007	Post-2009
γ	-1.529 [0.593]	-13.81*** [0.001]
Controls	✓	✓
Time FE	✓	✓
Kleibergen-Paap F -stat	131.927	79.925
Observations	4447	10795

Life Insurers' Bond Transactions

- Next, I examine how insurers adjust *bond transactions* following changes in $y_t^{(10)}$

$$\Delta \left(\frac{\text{Net Purchase}_t^{\text{HY}, h}}{\text{Net Purchase}_t^{\text{Total}, h}} \right) = \alpha + \beta \cdot \Delta y_t^{(10)} + \Gamma \mathbf{X}_t + \varepsilon_t$$

- *Hypothesis* ($\beta > 0$): $y_t^{(10)} \uparrow \implies$ risk-bearing capacity $\uparrow \implies$ more risky bond purchases

	Pre-2007		Post-2009	
	$h = 3m$	$h = 6m$	$h = 3m$	$h = 6m$
β	-0.269 [0.571]	0.562 [0.280]	0.750* [0.071]	2.346*** [0.000]
R^2	.537	.723	.305	.387
Observations	54	54	114	111

Life Insurer Bond Transactions

- ▶ **Variable annuity (VA) insurers** are more exposed than non-VA insurers
 - VAs typically have minimum return guarantees (e.g., 2% for 10 years), which have very high convexity and caused negative duration gaps post-2008 (Kojen Yogo, 2022; Sen, 2022)
- ▶ VA insurers should adjust their bond purchases more in response to long rates

$$\Delta \left(\frac{\text{Net Purchase}_{jt}^{\text{HY}, h}}{\text{Net Purchase}_{jt}^{\text{Total}, h}} \right) = \alpha_j + \alpha_t + \beta \cdot (\text{VA Share})_{j,2009} \cdot \Delta y_t^{(10)} + \Gamma \mathbf{X}_{jt} + \varepsilon_{jt}$$

	$h = 3m$		$h = 6m$	
$(\text{VA Share})_{j,2009} \cdot \Delta y_t^{(10)}$	0.133** [0.016]	0.152** [0.012]	0.926*** [0.000]	0.963*** [0.000]
Insurer FE	✓	✓	✓	✓
Time FE		✓		✓
R^2	.009	.021	.019	.034
Observations	27518	27518	23755	23755

Quantity Purchased and Back-of-the-Envelope Calculations

- How net purchases of HY bonds move relative to net purchases of IG bonds

$$\text{Net Purchase}_t^{\text{NAIC } k, h} = \alpha_t + \sum \beta_k \cdot \mathbf{1}_{\{\text{NAIC } k\}} \cdot \Delta y_t^{(10)} + \Gamma \mathbf{X}_t + \varepsilon_t$$

$$- \beta_k = \Delta(\text{NAIC } k \text{ purchases}) - \Delta(\text{IG purchases}) \text{ if } y_t^{(10)} \uparrow 1\%$$

	Pre-2007	Post-2009
β_3	0.712 [0.855]	6.112** [0.017]
β_4	0.549 [0.892]	6.900** [0.014]
β_{5-6}	0.659 [0.878]	7.268** [0.013]
Time FE	✓	✓
R^2	.162	.108
Observations	270	582

- Excess HY purchase = $6.11 + 6.90 + 7.27 = 20.28$ bn
- Total HY outstanding = 727.6 bn
- Fraction purchased = $20.28 / 727.6 = 2.8\%$
- Active MF elasticity = 0.75 (Darmouni et al., 2025)
- Price impact = $2.8\% / 0.75 = 3.73\%$
- HY bond duration = 4.45 yrs
- Spread impact $\approx 3.73\% / 4.45 = 0.84\%$
- Empirical counterpart: 1.27%

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Conclusions

- ▶ I propose a *duration mismatch channel* where life insurers' interest rate risk exposure affects corporate bond pricing
 - long rates $\uparrow \implies$ net worth $\uparrow \implies$ risk-bearing capacity $\uparrow \implies$ credit spreads \downarrow
- ▶ Consistent with the channel, I find an *empirical shift* in how bond credit spreads co-moves with long rates
 - after the GFC, credit spreads tighten when the 10-year Treasury yield increases
- ▶ In the *cross-section*, the channel is stronger in bonds held more by life insurers
- ▶ Implications for (unconventional) *monetary policy*