What Do $40 Trillion of Portfolio Holdings Say about the Transmission of Monetary Policy?

Chuck Fang (Drexel) Kairong Xiao (Columbia & NBER)

May 2025

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- "*How, in a world of eventually flexible goods prices, is monetary policy able to exert such a powerful influence on long-term real rates?*"

– Jeremy Stein, speech at 2013 Banking, Liquidity and Monetary Policy Symposium

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- "*...our findings suggest that the recruitment channel may not be as strong as Stein (2013) speculates since a portion of the resulting shifts in term premia are transitory...*"

– Hanson, Lucca, and Wright (2021)

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- QE effects concentrate on announcement days and attenuate afterwards

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- Decompose of bond issuance sensitivity to monetary policy
  - Effect from investor "helping hand" is 3x that of risk-free rate change itself

Contributions to the literature

- **The excess sensitivity of long-term interest rates:** Gurkaynak, Sack, and Swanson (2005), Hanson and Stein (2015), Nakamura and Steinsson (2018), Hanson, Lucca, and Wright (2021) – focus on asset prices

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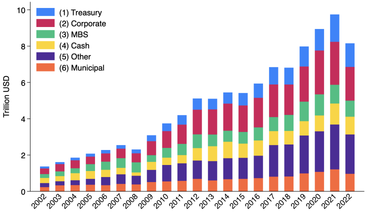
- This paper: captures cross-market substitution through random coefficients

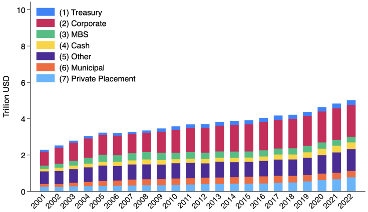
Roadmap

Holdings of debt securities

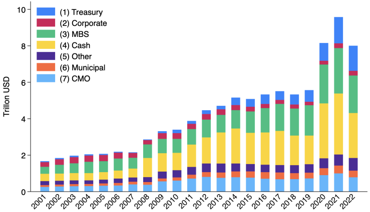
Mutual Funds



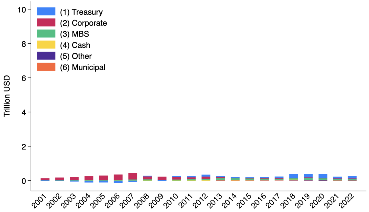
Insurance Companies



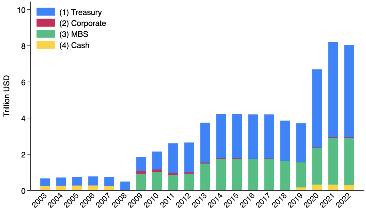
Banks



Primary Dealers



The Fed



- Investors hold multiple classes of bonds, which need to be jointly studied

Multiple classes of U.S. bonds, jointly studied

- Treasury notes and bonds: CRSP
- Corporate bonds (including agency direct obligations): FISD and TRACE
- Agency MBS (often ignored!): Refinitiv
- Exclude non-agency MBS/ABS, munis, bonds with foreign currency, floating rate, inflation protection, other optionality (e.g. convertible)
- Key criteria: data on yield to maturity, characteristics (credit rating, option-adjusted duration, coupon rate, bid-ask spread) and amount outstanding
- Analyze bond portfolios (e.g. 10Y 5% Treasuries) instead of individual CUSIPs

Roadmap

Portfolio responses to monetary policy

- We run the following quarterly time series regression for each investor group i:

$$\Delta q_t^i = \alpha + \beta_1 \Delta r_t^{1Y} + \beta_2 \Delta q_t^{FED} + \epsilon_t$$

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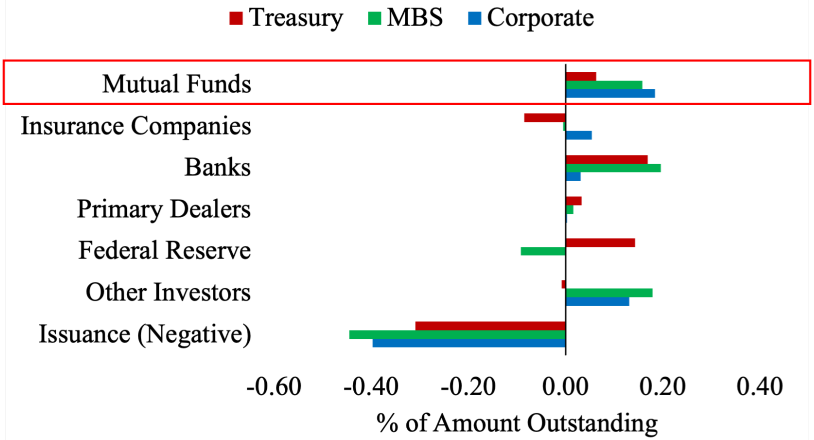
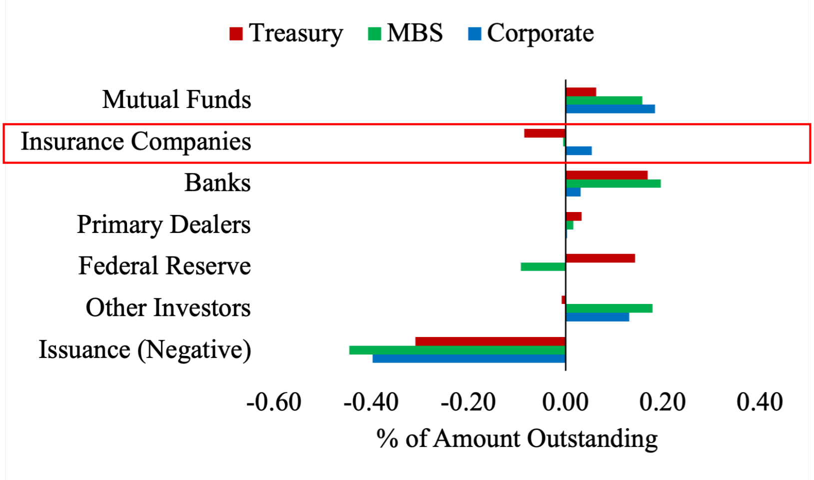
- Δq_t^i: year-over-year net purchases by investor group i scaled by total market outstanding
- Δr_t^{1Y}: year-over-year change in 1Y Treasury rate
- Δq_t^{FED}: year-over-year net purchases by the Fed scaled by total market outstanding
- total market outstanding: Treasury + MBS + Corporate

Portfolio response to 100 bps rate cut



- MFs purchase more bonds due to inflows of capital (Brooks et al, 2018; Fang, 2023)
- MFs reach for yield by tilting towards MBS and corporates (Barth et al, 2025)

Portfolio response to 100 bps rate cut



- ICs have stable cash flows that have low beta on monetary policy
- ICs sell Treasuries and buy corporates – more on credit risk later

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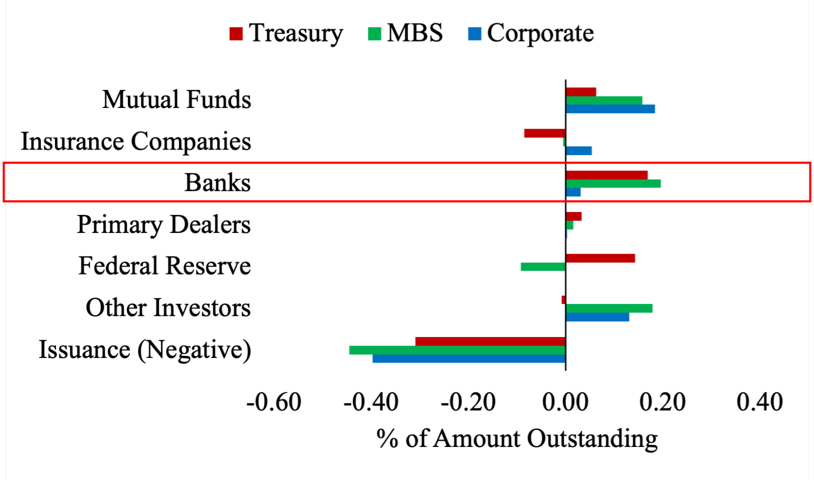
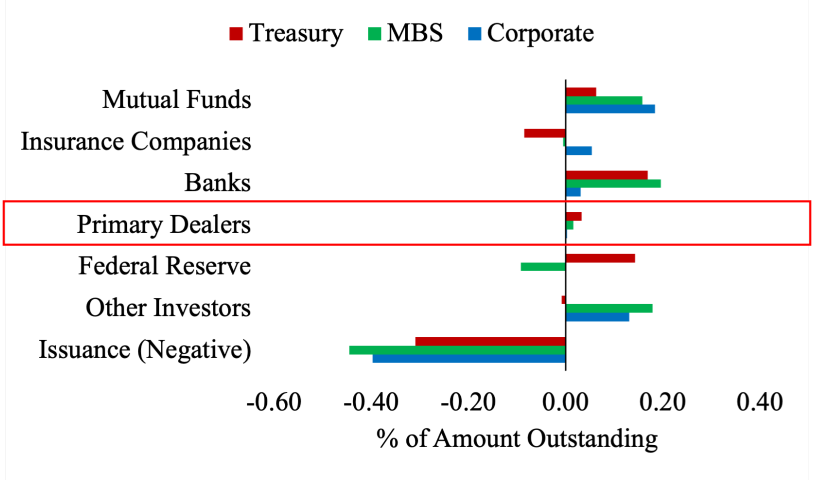


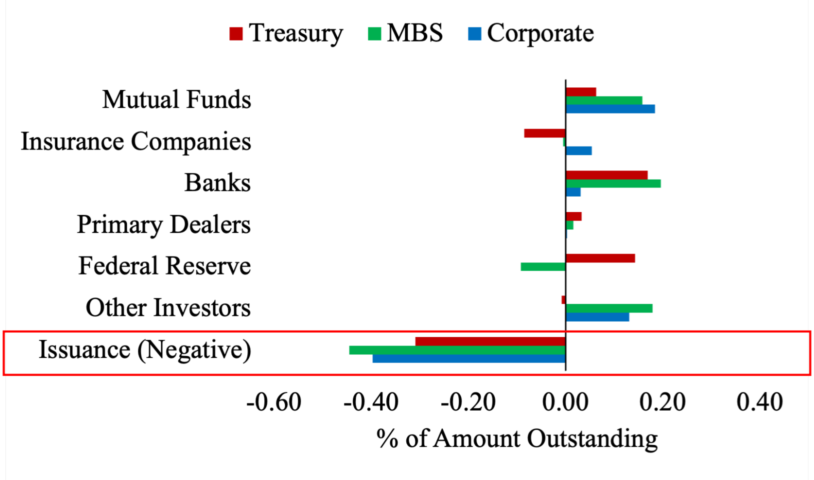
- Banks purchase more bonds due to inflows of deposits (Drechsler et al, 2017)
- MFs and banks together purchase 0.79% of total market outstanding, or 1.4% of GDP

Portfolio response to 100 bps rate cut



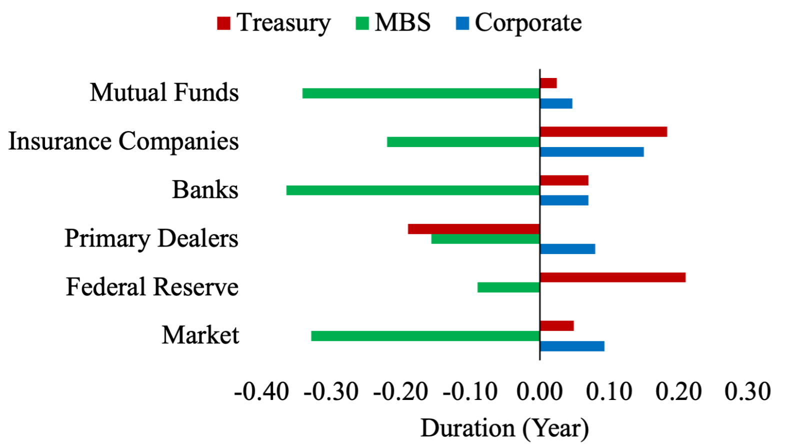
- Dealers trade in the same direction as other investors
- They provide liquidity at higher frequency, albeit still in small quantity quarterly

Portfolio response to 100 bps rate cut



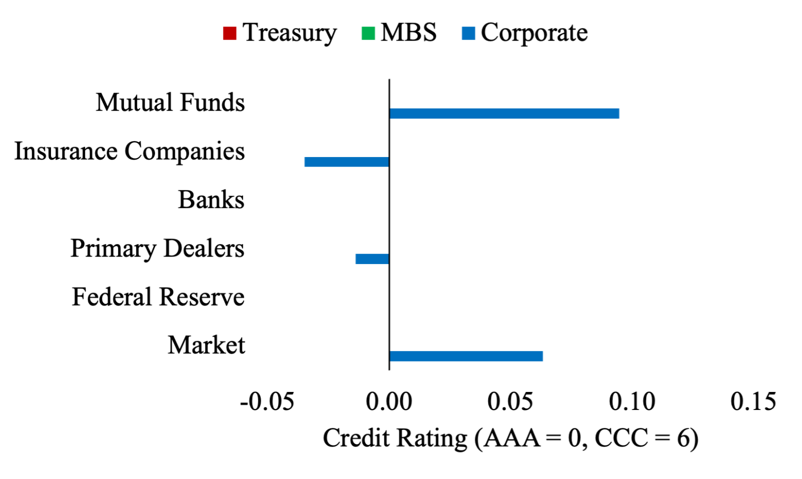
- Most of investor purchases are absorbed by new issuances of bonds
- Corporations and households issue more than the Treasury department

Portfolio response to 100 bps rate cut – duration



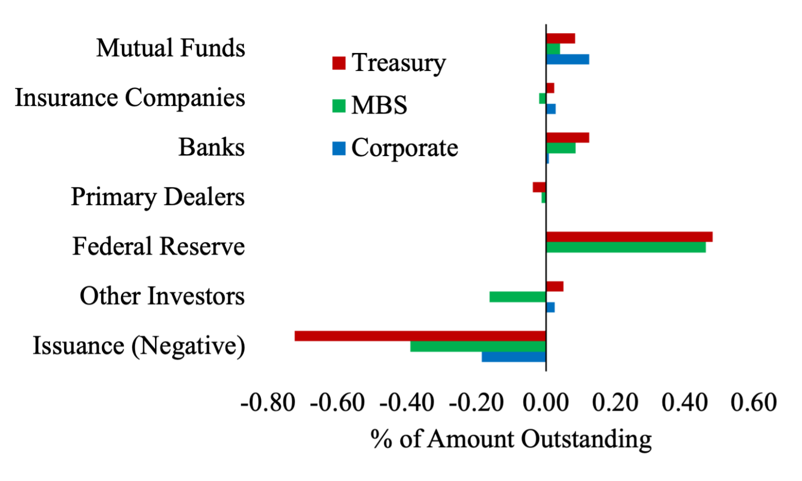
- MBS duration shortens by 0.35 years due to higher repayment propensity
- Mortgage investors (e.g. banks) lengthen duration in other bonds (Hanson, 2014)
- ICs reach for duration more, consistent with liability convexity (Domanski et al, 2017)

Portfolio response to 100 bps rate cut – credit rating



- MFs take more credit risks to attract retail flows (Choi Krunlund, 2017)
- ICs tilt towards safer corporate bonds due to tighter regulatory constraint (Li, 2025)

Portfolio response to 1% Fed purchase – amount



- Investors "helping hand" purchase another 0.50% of total market outstanding
- Most of the Fed and investor purchases are accommodated by new issuances
- Challenges conventional wisdom on portfolio rebalancing

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Roadmap

Investor demand

Original logit demand in Koijen and Yogo (2019):

$$w_{i,t}(n) = \frac{\text{utility of bond } n}{\text{sum of utility of all bonds}} = \frac{\exp\{\alpha_{i,t} y_t(n) + \boldsymbol{\beta}'_{i,t}\mathbf{x}_t(n) + \epsilon_{i,t}(n)\}}{\sum_m \exp\{\alpha_{i,t} y_t(m) + \boldsymbol{\beta}'_{i,t}\mathbf{x}_t(m) + \epsilon_{i,t}(m)\}}$$

Homogeneous cross-elasticity:

$$\frac{\partial \log w(n)}{\partial y(m)} = -\alpha w(m)$$

n does not enter the equation: when m's price/characteristics change, investors proportionally scale up or down the rest of the portfolio

$\Rightarrow$ when MBS price/duration changes, investors substitute to Treasuries and high-yield corporate bonds **alike**

Investor demand

Inspired by Berry Levinsohn Pakes (1995), we allow demand to have random coefficients:

$$w_{i,t}(n) = \int \frac{\text{util. of bond } n}{\text{sum of util. of all bonds}} dP(\text{pref.}) = \int \frac{\overbrace{\exp\{\alpha_{i,t} y_t(n) + \boldsymbol{\beta}'_{i,t}\mathbf{x}_t(n) + \epsilon_{i,t}(n)\}}^{\tilde{w}(n)}}{\sum_m \exp\{\alpha_{i,t} y_t(m) + \boldsymbol{\beta}'_{i,t}\mathbf{x}_t(m) + \epsilon_{i,t}(m)\}} dP(\boldsymbol{\beta}_{i,t})$$

Heterogeneous cross-elasticity:

$$\frac{\partial \log w(n)}{\partial y(m)} = -\frac{\alpha}{w(n)} \int \tilde{w}(n)\tilde{w}(m) dP(\boldsymbol{\beta})$$

When m's price/characteristics change, allocation to n depends on its covariance with m over the distribution of $\boldsymbol{\beta} \sim N(\mu, \Sigma)$

$\Rightarrow$ changes to MBS price/duration primarily affect demand on **similar** bonds (e.g. Treasuries)

Estimated cross-price elasticities (mutual funds), RC versus logit

Random Coefficients

	AA	A	BBB	BB	B	CCC
AA	-2.42	2.59	1.28	0.11	0.31	0.01
A	1.21	-2.78	2.93	0.87	0.08	0.07
BBB	0.93	1.35	-4.03	2.04	1.49	0.03
BB	0.14	0.18	1.25	-1.96	1.22	1.02
B	0.28	1.27	0.02	2.98	-2.06	1.00
CCC	0.03	0.34	0.94	0.08	1.12	-1.58

"Plain" Logit

	AA	A	BBB	BB	B	CCC
AA	-2.40	1.29	1.32	1.36	1.00	0.46
A	0.58	-2.72	1.41	1.34	1.02	0.51
BBB	0.70	1.24	-3.95	1.27	0.87	0.49
BB	0.62	1.24	1.31	-1.92	0.96	0.53
B	0.70	1.18	1.42	1.28	-1.99	0.60
CCC	0.58	1.27	1.46	1.22	0.93	-1.56

- RC generate "local" substitution between bonds with similar credit rating and duration

Estimated cross-price elasticities (mutual funds), RC versus logit

Random Coefficients

	1-3Y	3-5Y	5-7Y	7-10Y	10-15Y	15-30Y
1-3Y	-3.12	2.01	1.98	0.34	0.53	0.54
3-5Y	3.23	-3.54	2.44	1.72	0.11	0.31
5-7Y	1.88	2.44	-4.72	2.90	1.03	0.82
7-10Y	1.32	0.29	1.92	-2.52	1.45	0.06
10-15Y	0.02	0.43	0.44	1.53	-1.27	1.03
15-30Y	0.11	0.03	0.44	0.36	1.34	-0.84

"Plain" Logit

	1-3Y	3-5Y	5-7Y	7-10Y	10-15Y	15-30Y
1-3Y	-3.04	1.12	1.46	1.48	1.05	0.60
3-5Y	1.43	-3.51	1.53	1.57	1.02	0.59
5-7Y	1.42	1.19	-4.64	1.45	0.95	0.65
7-10Y	1.47	1.13	1.62	-2.45	0.96	0.72
10-15Y	1.41	1.04	1.58	1.48	-1.25	0.62
15-30Y	1.45	1.05	1.64	1.56	1.03	-0.79

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Identification

- Latent demand ϵ is likely correlated with yield and requires instruments
- We use flow-induced trading (FIT) by other investors (Lou, 2012; Gabaix Koijen, 2022)

$$InvestorFlow_{i,t} = a + \sum_k b_k PC_{k,t} + \tilde{InvestorFlow}_{i,t}$$

$$\tilde{BondFlow}_t(n) = \frac{\sum_{i \neq j} AmountHeld_{i,t-1}(n) \tilde{InvestorFlow}_{i,t}}{AmountOutstanding_{t-1}(n)}$$

- We include the bond's own FIT as well as its peers' FIT, where peers are defined to be bonds with similar rating and duration

Equilibrium

- In equilibrium, total demand by all investors equals supply for each bond:

$$S_t(n)P_t(n) = \sum_{i=1}^{I} A_{i,t} w_{i,t}(n)$$

where price is $P = \sum_{\tau=1}^{T} Ce^{-y\tau} + e^{-yT}$ and yields show up in price P, assets under management A, and portfolio weight w

- Market-clearing bond yields can be numerically derived as an implicit function of amount outstanding (S), characteristics $(\boldsymbol{x})$, investor AUM (A), demand coefficients $(\boldsymbol{\theta} = (\alpha, \mu, \Sigma))$, and latent demand ϵ:

$$y(S, \boldsymbol{x}, A, \boldsymbol{\theta}, \epsilon)$$

Roadmap

Decompose yield changes and yield sensitivity to monetary policy

- Change one channel c at a time, hold other channels $\{c^{-}\}$ constant
  E.g. change investor AUM A due to flows, fix bond supply S, bond characteristics $\boldsymbol{x}$, demand coefficients (α, μ, Σ), and latent demand ϵ

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- Calculate changes in market-clearing bond yields due to channel c:

$$\Delta y_t(c) = y(c_t, \{c^-_{t-1}\}) - y(c_{t-1}, \{c^-_{t-1}\})$$

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- Calculate changes in market-clearing bond yields due to channel c:

$$\Delta y_t(c) = y(c_t, \{c^-_{t-1}\}) - y(c_{t-1}, \{c^-_{t-1}\})$$

- Project yield changes to monetary policy rate changes:

$$\Delta y_t(c) = \alpha + \beta \Delta r_t + \gamma X_t + \epsilon_t$$

  where Δr_t denotes changes in 1Y Treasury rate, and X_t includes GDP growth, inflation rate, and unemployment rate changes

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- Change one channel c at a time, hold other channels $\{c^-\}$ constant
  E.g. change investor AUM A due to flows, fix bond supply S, bond characteristics $\boldsymbol{x}$, demand coefficients (α, μ, Σ), and latent demand ϵ

- Calculate changes in market-clearing bond yields due to channel c:

$$\Delta y_t(c) = y(c_t, \{c^-_{t-1}\}) - y(c_{t-1}, \{c^-_{t-1}\})$$

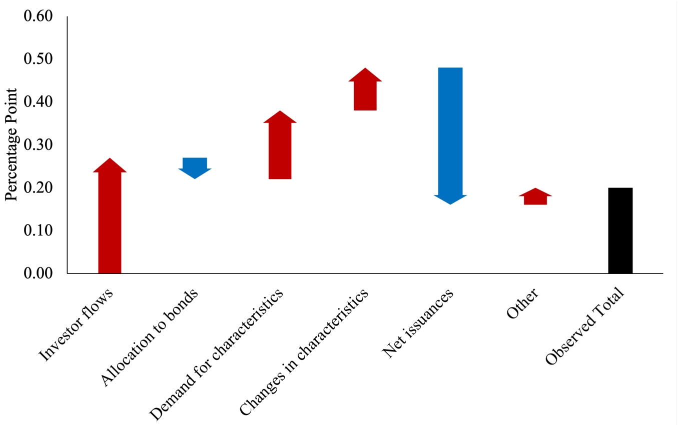
- Project yield changes to monetary policy rate changes:

$$\Delta y_t(c) = \alpha + \beta \Delta r_t + \gamma X_t + \epsilon_t$$

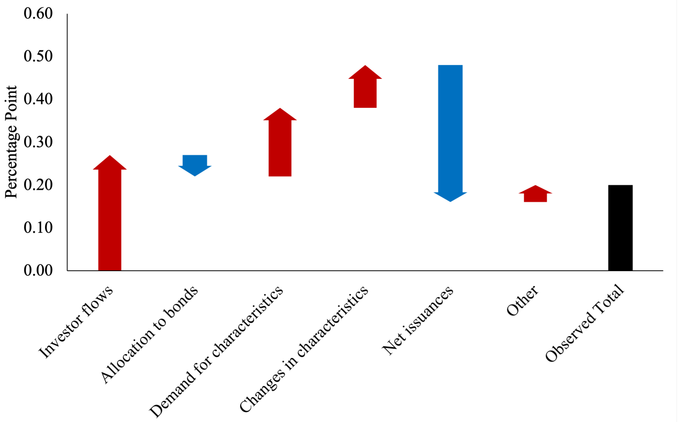
  where Δr_t denotes changes in 1Y Treasury rate, and X_t includes GDP growth, inflation rate, and unemployment rate changes

- β: the partial effect of channel c on yield sensitivity to monetary policy

10Y Treasury yield sensitivity to monetary policy, year over year

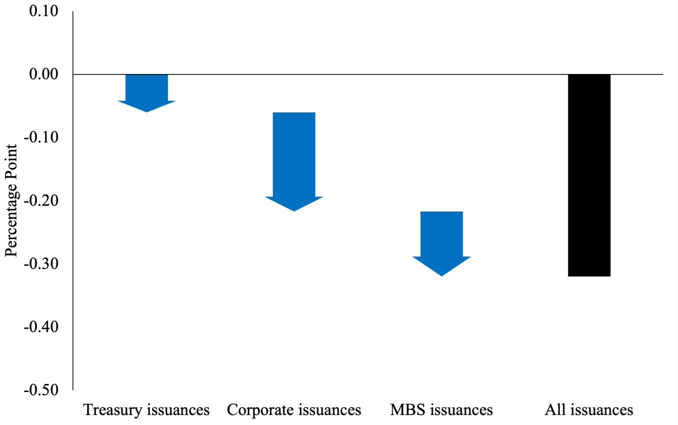


10Y Treasury yield sensitivity to monetary policy, year over year



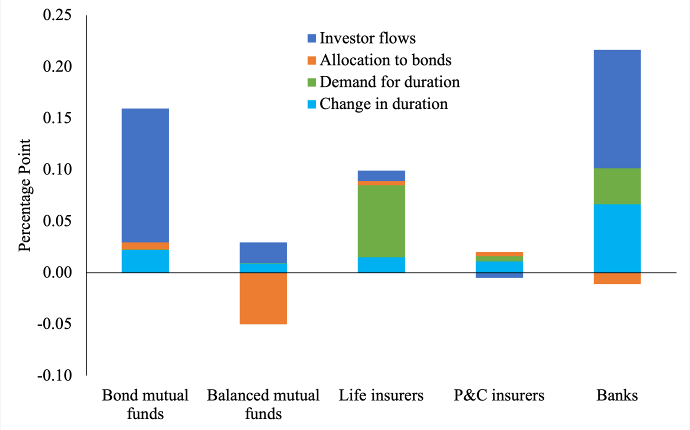
- Investor “helping hand” amplify yield sensitivity by 49 bps
- Issuances and redemptions dampen yield sensitivity by 32 bps
- These observed channels can almost entirely explain the observed yield sensitivity

10Y Treasury yield sensitivity to monetary policy, effect of issuances



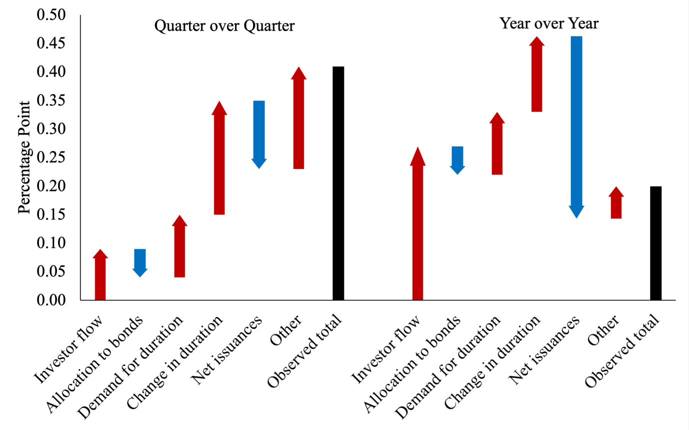
- Cross-market transmission: Treasury yield sensitivity is dampened by issuances of corporate bonds (16 bps) and MBS (10 bps)

10Y Treasury yield sensitivity to monetary policy, by investor type



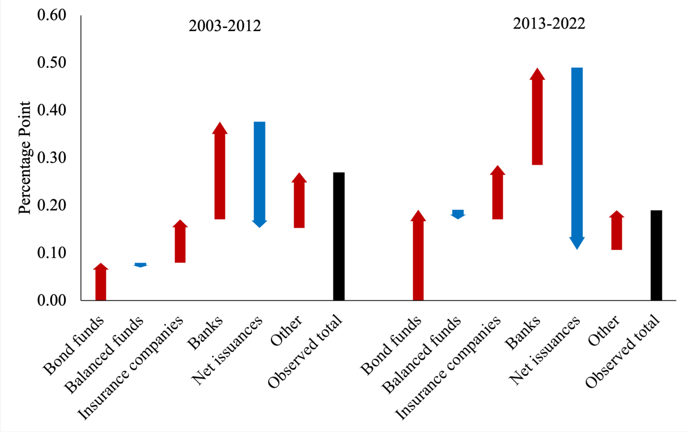
- Main amplifiers: mutual fund flows, life insurer demand for duration, banks' flows and their response to (MBS) duration change

10Y Treasury yield sensitivity, quarterly vs annual



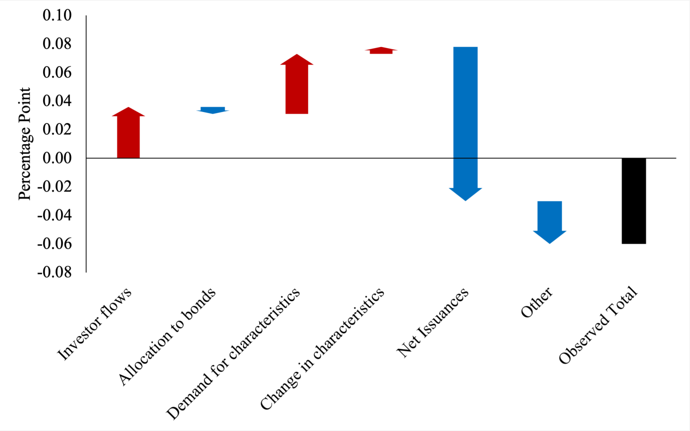
- Hanson et al (2021): yield sensitivity is smaller at lower frequency
- The dampening effect of net issuances is much larger at lower frequency

10Y Treasury yield sensitivity, over time



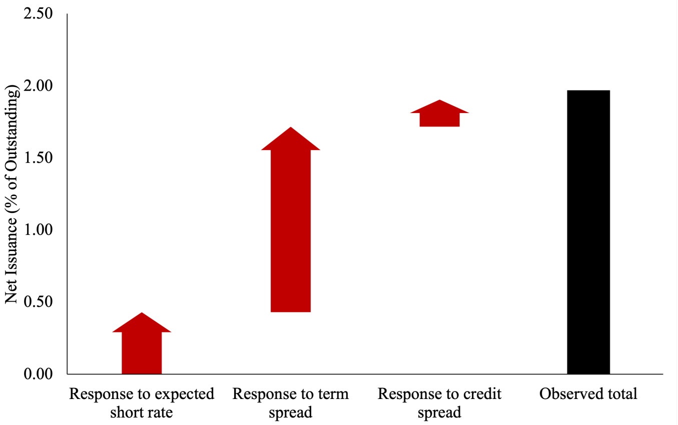
- Hanson et al (2021): low-frequency yield sensitivity has declined over time
- Issuances by corporations and households have become more elastic over time

BBB credit spread sensitivity to monetary policy



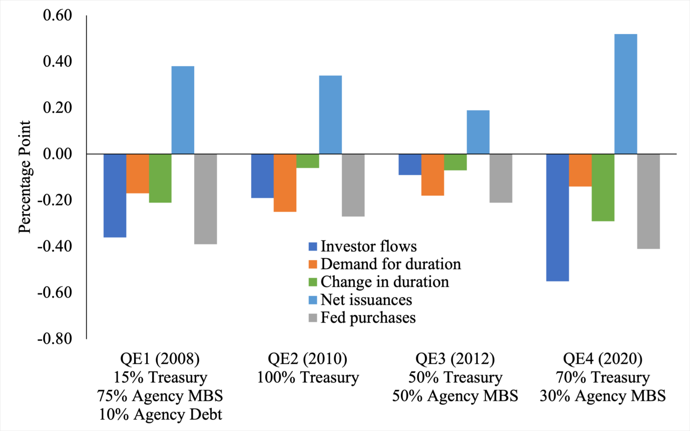
- Corporate bond issuances driven by investor demand for duration contribute to the negative correlation between credit spread and monetary policy

Decomposition of corporate bond issuances



- 0.43%: change in risk-free rate and its expected path
- 1.48%: term premium and credit spread changes due to investor "helping hand"

Decomposition of 10Y Treasury yield response to QE



- Changes in investor demand are more important than Fed purchases themselves
- The yield impacts of QE are reversed by bond issuances – as intended!

Conclusions

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Conclusions

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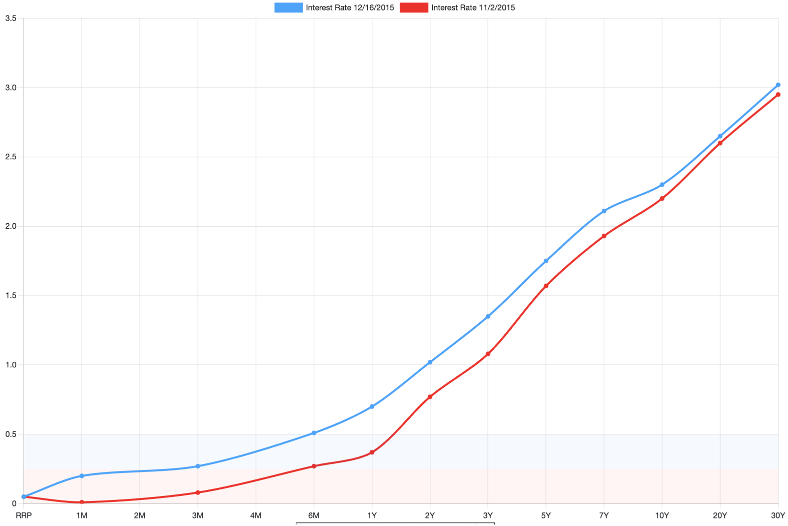
- *"...our findings suggest that the recruitment channel may not be as strong as Stein (2013) speculates since a portion of the resulting shifts in term premia are transitory..."* – Hanson, Lucca, and Wright (2021)
- This paper: elastic issuances reverse the yield impact of investor demand – the recruitment channel has become *more* effective over time!

Appendix

US Treasury Yield Curve around 25 bps Hike in 2015



- Before the hike (Nov 2, 2015): 2.16%
- Just after the hike (Dec 16, 2015): 2.30%

Portfolio holdings data

Sector	Source	Asset Granularity	Frequency	Coverage
Mutual funds and ETFs	Morningstar	CUSIP	quarterly	2003-2023
Insurance companies	NAIC	CUSIP	quarterly	2001-2023
Banks	Call Report	asset type and maturity bucket	quarterly	2001-2023
Primary dealers	New York Fed	asset type and maturity bucket	weekly	2001-2023
Federal Reserve	New York Fed	CUSIP	weekly	2003-2023
Treasury securities	CRSP	CUSIP	daily	1961-2023
Agency MBS	Refinitiv	CUSIP	monthly	2000-2023
Corporate bonds	Mergent FISD	CUSIP	monthly	1980-2023

Granular portfolio holdings

- Mutual funds and ETFs targeting U.S. assets
  - domestic funds: CRSP and Morningstar
  - offshore funds (e.g. Luxembourg): Morningstar
- Insurance companies (life and P&C): NAIC
- Banks: call reports (coarse holdings by security types and maturity buckets)
- Federal Reserve: SOMA and SMCCF

Assets

- We work with bond portfolios instead of individual CUSIPs:
  - classes: Treasury, MBS, corporate
  - rating: AA or higher, A, BBB, BB, B, CCC or lower
  - maturity: 1 or shorter, 2, 3, ..., 30 or longer
  - coupon rate: 0%, 1%, ..., 10% or higher
  - callable or not
- Bond portfolios are indexed by $n = 1, ..., N$, each with:
  - par amount outstanding $S_t(n)$
  - yield to maturity $y_t(n)$
  - characteristics $\boldsymbol{x}_t(n)$, which include rating, duration, coupon rate, bid-ask spread, and bond class
- Cash and cash equivalents ($n = 0$) have AAA rating, 0 duration, 0% coupon, 0% bid-ask spread, its yield exogenously set by Fed, its mean utility normalized to 1

Investors

Investors are indexed by $i = 1, ..., I$:

- mutual funds (bond vs balanced, active vs index)
- insurance companies (life vs P&C)
- banks
- Federal Reserve
- residual investors

"Microfoundation" for random coefficients

- An insurance company sells both short-term and long-term life insurance policies
- It buys short-term bonds to match ST liabilities, long-term bonds to match LT liabilities
- If some long-term bonds become pricier, it can be optimal to substitute to **other long-term bonds**, instead of short-term bonds
- Random coefficients capture this variation in demand for characteristics *within* the portfolio construction process and therefore achieve realistic substitution patterns

Bond Supply

- Supply is potentially responsive to bond prices

$$\Delta \log S_t(n) = \tilde{\alpha} \Delta \log P_t(n) + \tilde{\beta}' x_t(n) + \tilde{\epsilon}_t(n)$$

- Supply elasticity $\tilde{\alpha} = 0$ means issuance is not responsive to bond prices
- Supply elasticity $\tilde{\alpha} > 0$ means issuance is responsive to bond prices

Endogenize AUM

We focus on AUM of the bond portfolio (e.g. exclude stocks):

$$A_{i,t} = (A_{i,t-1} + T_{i,t})R_{i,t}$$

where T denotes net purchases of bonds (including cash):

$$T_{i,t} = \sum_{n}(Q_{i,t}(n) - Q_{i,t-1}(n))P_{t-1}(n)$$

and R denotes return on the bond portfolio, given by:

$$R_{i,t} = \sum_{n} w_{i,t}(n)\frac{P_t(n)}{P_{t-1}(n)}$$

We separate net purchases driven by flows $T^F_{i,t} = A_{i,t-1}F^{\%}_{i,t}$ vs other net purchases $T^O_{i,t} := T_{i,t} - T^F_{i,t}$, where $F^{\%}_{i,t} = F^{\$}_{i,t}/A^{total}_{i,t-1}$.

Estimation

- We want to estimate $\theta = (\alpha, \boldsymbol{\mu}, \Sigma)$ for each investor i each period t
- To simplify computation:
  - Σ is diagonal and only non-zero in rating (σ^r) and duration (σ^d)
  - include adjacent periods to use changes for identification (Nevo, 2000)
- For each guess of (α, μ, Σ), derive latent demand ϵ via contraction mapping
- Moments are then constructed by interacting estimated latent demand $\epsilon(n)$ with instruments $\boldsymbol{z}(n)$ to form:

$$g(\theta) = \frac{1}{N} \sum \boldsymbol{z}(n)' \epsilon(n)$$

and the GMM problem is:

$$\min_{\theta} g(\theta)' W g(\theta)$$

Estimating random coefficients (BLP 1995)

Define mean utility as:

$$\delta := \alpha y + \boldsymbol{\mu}'\boldsymbol{x} + \epsilon$$

and the random part of demand coefficients as

$$\boldsymbol{\eta} = \boldsymbol{\beta} - \boldsymbol{\mu}$$

We can re-write portfolio weight as:

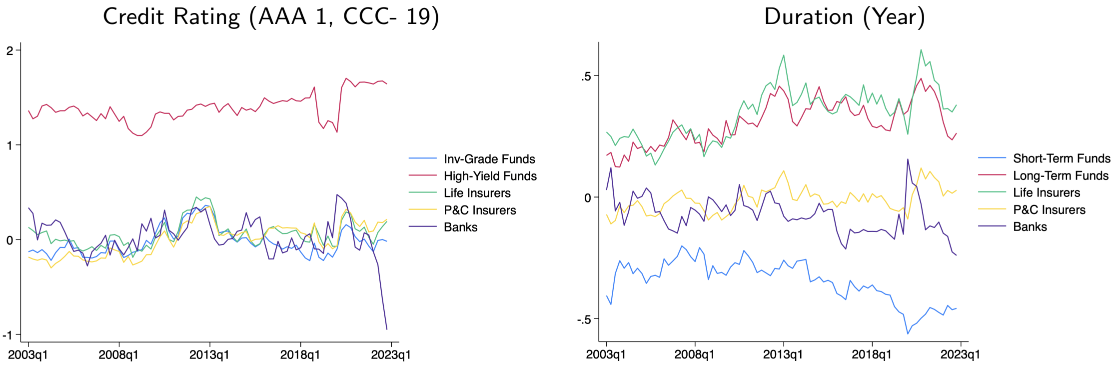
$$w_{i,t}(n) = \int \frac{\exp\{\delta_{i,t}(n) + \boldsymbol{\eta}_{i,t}'\boldsymbol{x}_t(n)\}}{\sum_m \exp\{\delta_{i,t}(m) + \boldsymbol{\eta}_{i,t}'\boldsymbol{x}_t(m)\}} dP(\boldsymbol{\eta}_{i,t})$$

Mean utility δ can be obtained via contraction mapping:

$$\delta^{h+1} = \delta^h + \log(w) - \log(w(\delta^h))$$

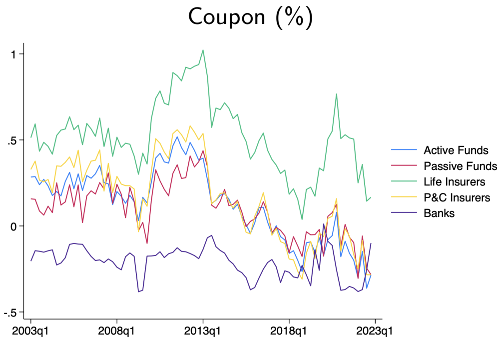
Demand Framework

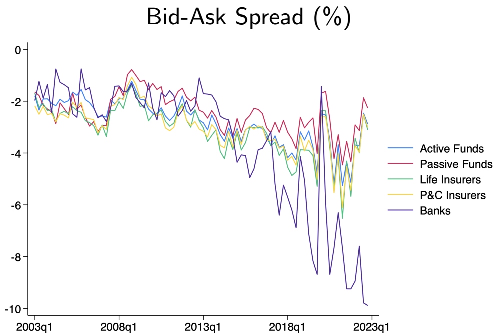
Estimated coefficients on characteristics – Mean μ



- expected regularities – e.g. high-yield funds have high demand for credit risk, life insurers have high demand for duration
- significant variation in demand coefficients over time

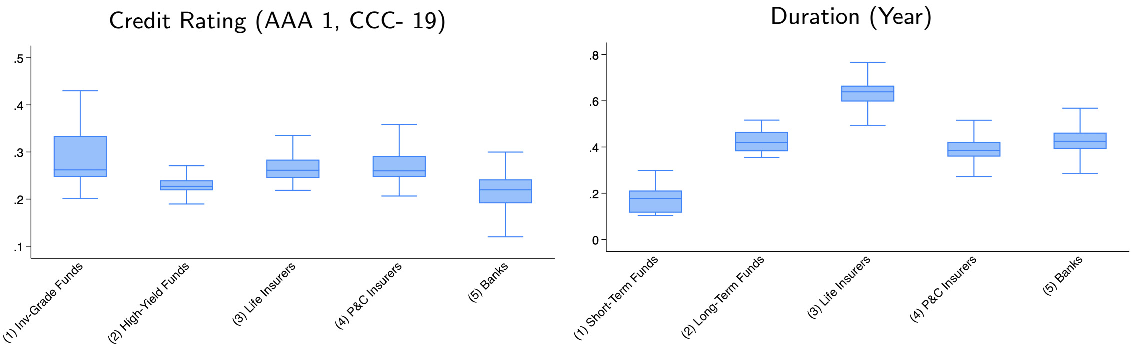
Estimated coefficients on characteristics – Mean μ (cont'd)





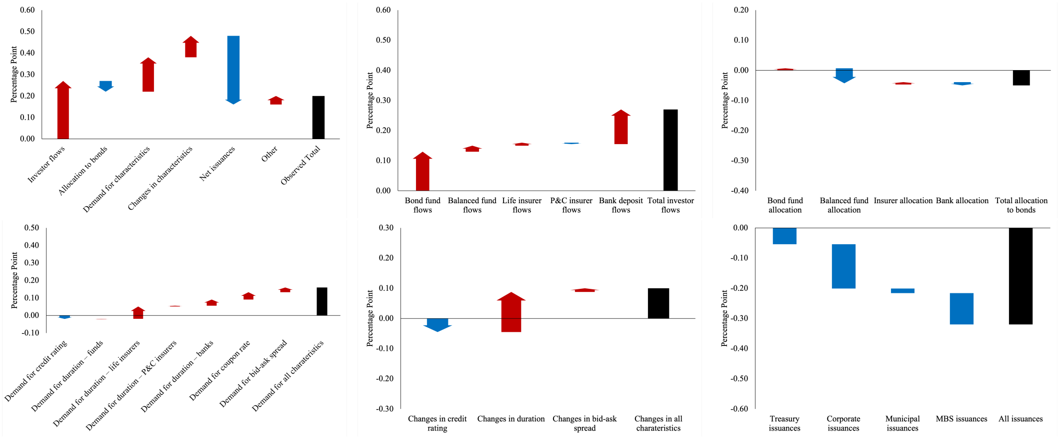
- life insurers prefer high-coupon bonds to match cash flows on the high-income-yield annuities they sell
- banks aversion to bid-ask spread in recent years (Dick-Nielsen and Rossi, 2018)

Estimated coefficients on characteristics – Variation σ

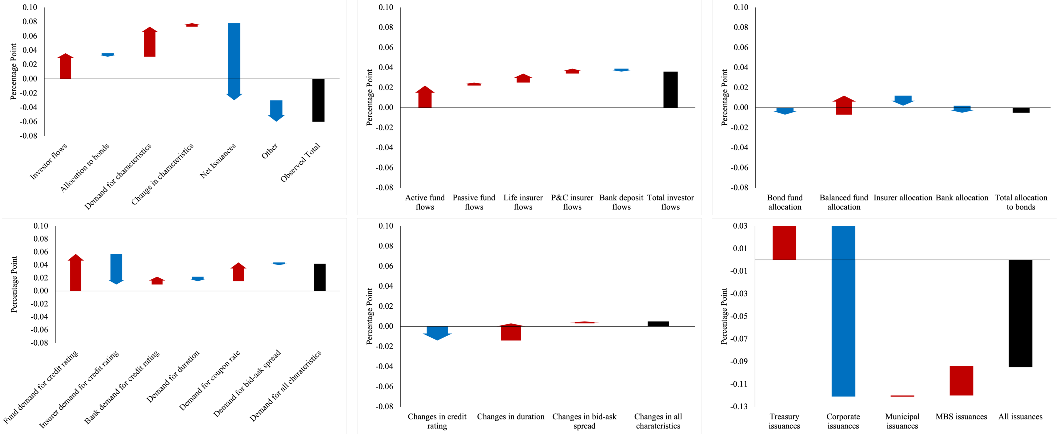


- $\sigma > 0$: substantial variation in demand for characteristics within the same portfolio
- E.g. Life insurers allocate a portion of their portfolio to short-term bonds to match 1-year term life insurance policies, while other portions are allocated to long-term bonds to match 30-year deferred annuities

Term spread sensitivity to monetary policy: details

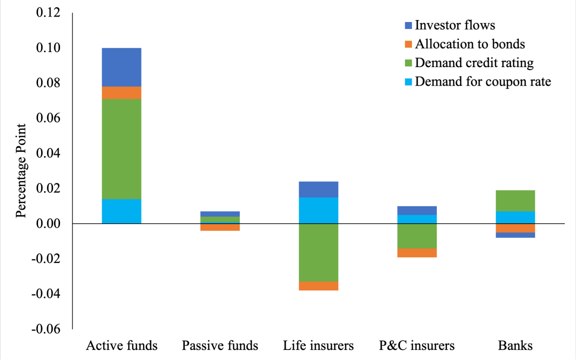


Credit spread sensitivity to monetary policy: details



- Investors flows and demand for rating and coupon increase credit spread sensitivity to monetary policy; corporate issuances significantly decrease it
- Opposing effects from demand for rating by insurers vs other investors – the importance of capturing investor heterogeneity in a structural framework

Credit spread sensitivity to monetary policy: by investor type



- Monetary easing increases flows into mutual funds and their demand for credit risk, amplifying its impact on credit spreads
- Monetary easing decreases life insurers' demand for credit risk (as duration risk increases), dampening its impact on credit spreads