Global or Regional Safe Assets: Evidence from Bond Substitution Patterns

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European Systemic Risk Board
Ieke van der Burg Prize
27 September 2024

The author is grateful to the European Central Bank for financial support of this research project under the Lamfalussy Fellowship Programme. Any views expressed are only those of the author and do not necessarily represent the views of the ECB, the Eurosystem, or the Bank for International Settlements.

Motivation: A Granular Look at International Bond Markets

- International bond markets key to understand:
  - Role of global & regional safe assets in monetary policy transmission
  - International monetary policy spillovers

- New perspective through *demand elasticities* of international bond investors:
  - *Own* elasticities → degree of portfolio rebalancing
  - *Substitution* elasticities → composition of portfolio rebalancing

This Paper: A Novel View of Portfolio Rebalancing

- Granular own- and cross-elasticities of demand by US & EA mutual funds
  - Corp & govt bonds $\sim$ 57% of global debt securities
  - 140 countries, 60 currencies, of all maturities & credit ratings

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  - CB *safe asset* purchases less effective during financial crises
  - Bond market *segmentation* through prism of fund portfolio re-balancing

Literature

1. Safe assets & segmented markets:

Caballero, Farhi and Gourinchas (2008, 2015, 2017); Gourinchas and Rey (2016, 2022); He, Krishnamurthy and Milbradt (2019); Coppola, Krishnamurthy and Xu (2023); Gorton (2017); Dang, Gorton and Holmström (2012);

Vayanos and Vila (2021); Ray (2019); Gourinchas, Ray and Vayanos (2022); Costain, Nuño and Thomas (2022); Kekre, Lenel and Mainardi (2022); Eser, Lemke, Nyholm, Radde and Vladu (2023);

2. Convenience yields & exchange rate dynamics:

Krishnamurthy and Vissing-Jorgensen (2012); Nagel (2016); Jiang, Krishnamurthy and Lustig (2018, 2023); Engel and Wu (2018); Krishnamurthy and Lustig (2019); Engel (2020); Valchev (2020); Mota (2020); Diamond and Van Tassel (2021); Van Binsbergen, Diamond and Grotteria (2022)

3. Characteristics-based asset demand & downward-sloping demand curves:

Koijen and Yogo (2019, 2020); Koijen, Richmond and Yogo (2020b); Bretscher, Schmid, Sen and Sharma (2020); Jiang, Richmond and Zhang (2021); Shen and Zhang (2021); Noh and Oh (2021); Fang, Hardy and Lewis (2022); Gabaix and Koijen (2022); Eren, Schrimpf and Xia (2023);

Shleifer (1986); Harris and Gurel (1986); Chang, Hong and Liskovich (2014); Chen, Noronha and Singal (2004); Petajisto (2011);

Froot and Ramadorai (2005, 2008); Hau and Rey (2004, 2006); Hau, Massa and Peress (2010); Camanho, Hau and Rey (2022); Bippus, Lloyd and Ostry (2023)

4. Portfolio rebalancing after QE programmes (foreign & non-bank investors):

Joyce, Liu and Tonks (2014); Bergant, Fidora and Schmitz (2018); Koijen, Koulischer, Nguyen and Yogo (2020a); Tabova and Warnock (2021); Faia, Salomao and Veghazy (2022); Holm-Hadulla and Leombroni (2023); Zhou (2023); Du et al. (2024); Faia, Lewis and Zhou (2024)

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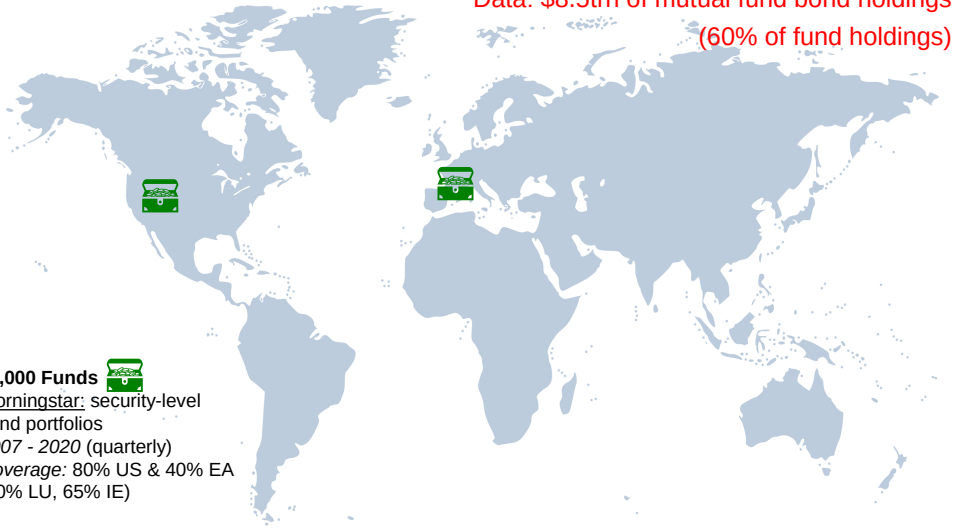
Outline

Data: $8.5trn of mutual fund bond holdings
(60% of fund holdings)



~11,000 Funds
- Morningstar: security-level bond portfolios
- *2007 - 2020* (quarterly)
- *Coverage:* 80% US & 40% EA (70% LU, 65% IE)

▸ Holdings over time,$bn ▸ Holdings over time,%

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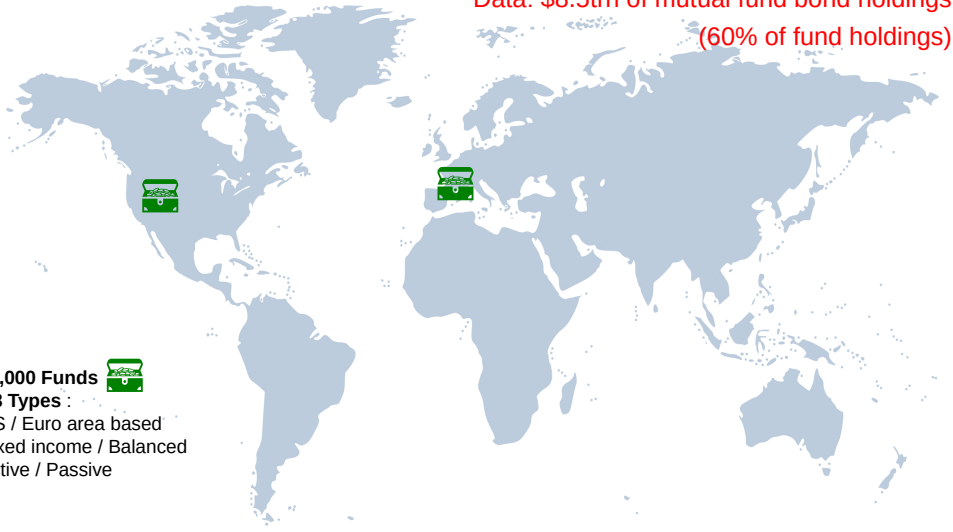

~11,000 Funds
⇒ 8 Types :
- US / Euro area based
- Fixed income / Balanced
- Active / Passive

Fund types tree Funds summary over time

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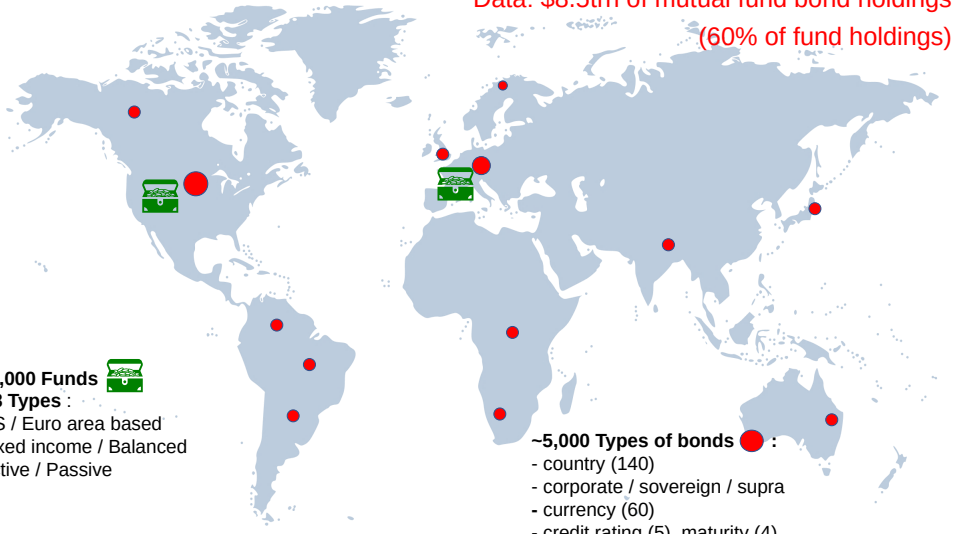

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- country (140)
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- credit rating (5), maturity (4)

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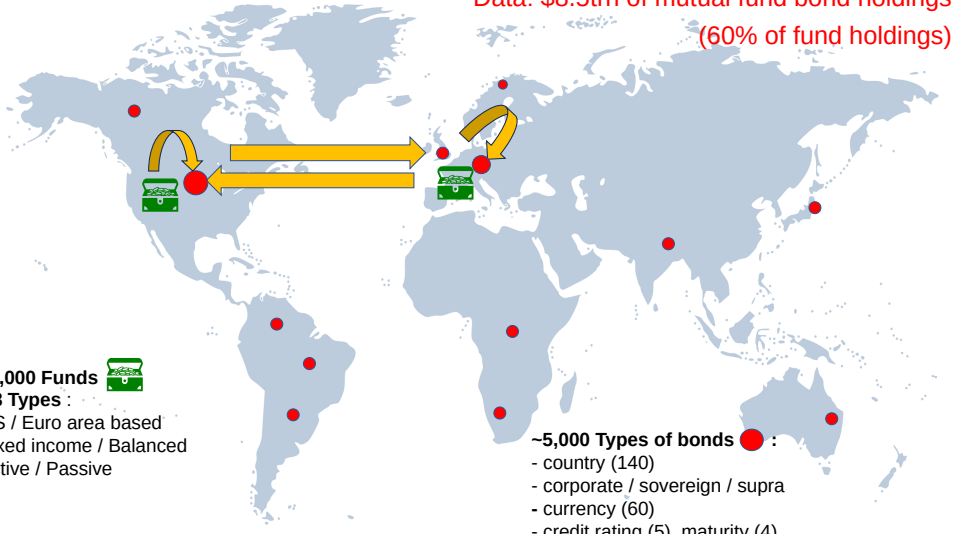

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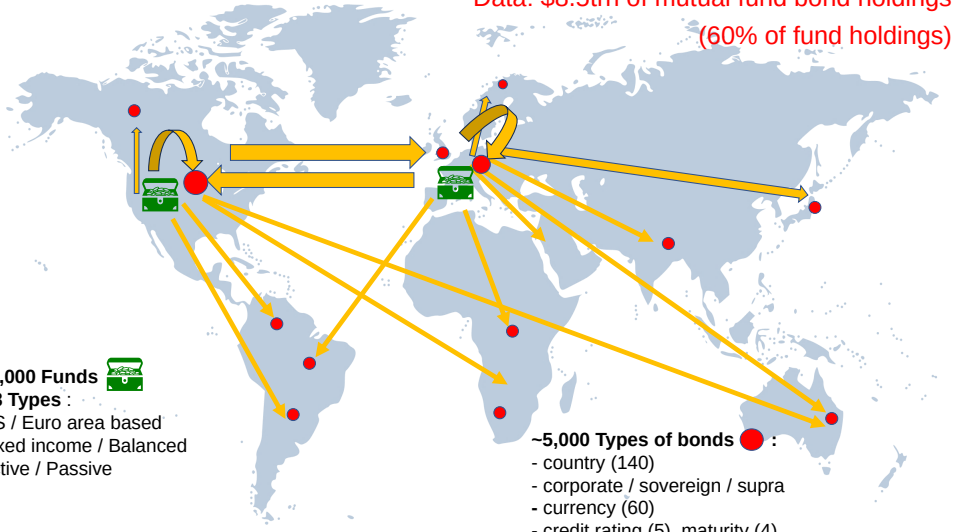

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▸ Bond buckets ▸ Bond data ▸ Bonds included

Outline

Characteristics-based bond demand

Panel Logit demand:

$$\log\left(\frac{w_{i,t}(n)}{w_{i,t}(0)}\right) = \alpha_{T(i)} per^{h}_{\chi(i),t}(n) + \mathbf{x}^1_t(n)'\beta^1_{T(i)} + \mathbf{x}^2(n)'\beta^2_{T(i)} + \mathbf{b}_i(n)'\theta_{T(i)} + \zeta_{i,t} + \varepsilon_{i,t}(n)$$

$w_{i,t}(n)$, $w_{i,t}(0)$: weight of bond n / outside asset in fund i portfolio at the end of quarter t

▸ ICAPM ▸ From ICAPM to Characteristics-based ▸ Characteristics-based demand functions

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Predicted excess bond returns $per^{h}_{\chi(i),t}(n)$:

$$\begin{aligned} rx_{\chi(i),t+h}(n) (\equiv r_{\chi(i),t+h}(n) - r^{h}_{\chi(i),t}) \\ = A^{h}_{\chi(i)}\, y_t(n) + B^{h}_{i}\, rer_{\chi(i),t}(n) + \sum_{f=1}^{3} C^{h}_{\chi(i),f}\, uspc_{f,t} + \sum_{f=1}^{3} D^{h}_{\chi(i),f}\, depc_{f,t} + F^{h}_{\chi(i),n} + E_{\chi(i),n,t+h} \end{aligned}$$

▸ Regression output ▸ Time-varying bond risk

Rich bond & fund controls

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Granular characteristics:

- $\mathbf{x}^1_t(n)$: Maturity, Amount Outstanding
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} Risk & Market Segments

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} Risk aversion

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} Risk aversion

- $\varepsilon_{i,t}(n)$: unobserved variation in investor demand across bonds, at time t

Bond demand elasticities

Aggregate fund sector elasticity: % change in weight of bond j in aggregated fund sector portfolio in response to 1ppt change in predicted excess return of bond k

$\rightarrow$ holdings-weighted average of individual elasticities:

$$\eta_t(jk) \equiv \frac{\partial \log(w_t(j)) * 100}{\partial per_t(k)} = \begin{cases} \sum_i \frac{AUM_{i,t} w_{i,t}(j)}{\sum_i (AUM_{i,t} w_{i,t}(j))} \widehat{\alpha}_{T(i)} \, (1 - w_{i,t}(j)) * 100 & \text{if } \; j = k, \\ -\sum_i \frac{AUM_{i,t} w_{i,t}(j)}{\sum_i (AUM_{i,t} w_{i,t}(j))} \widehat{\alpha}_{T(i)} \, w_{i,t}(k) * 100 & \text{otherwise.} \end{cases}$$

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- $\rightarrow$ Own demand elasticities vary across bonds and over time due to investor base
- $\rightarrow$ Substitution driven by funds who hold both bond j and k at time t: closest substitutes are those that experience greatest spillovers from safe asset return changes

▸ Definitions ▸ Weights, Summary ▸ Own, Summary ▸ Cross, Summary

Identification challenge

➢ **Need instrument:** uncorrelated with investor-specific *residual relative bond demand*

$$\mathbb{E}_t\left[\varepsilon_{i,t}(n)\, Z_t(n) \;\middle|\; \mathbf{x}_t^1(n),\, \mathbf{x}^2(n),\, \mathbf{b}_i(n),\, \zeta_{i,t}\right] = 0$$

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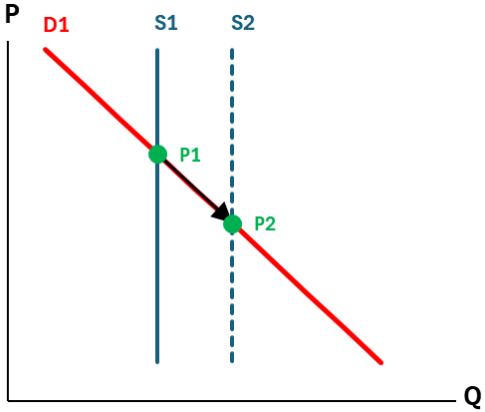

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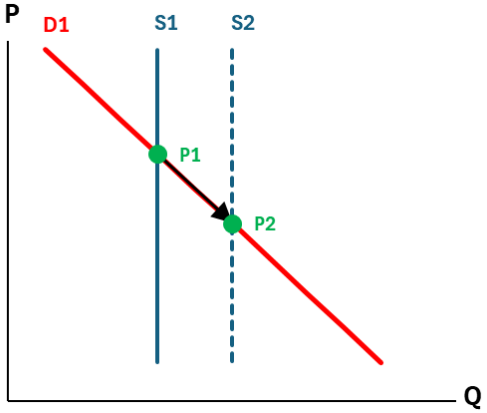

✗ Broad and long panel of bond holdings
→ bond-specific exogenous supply shocks not feasible

✗ No market clearing (fund sector holdings of bonds only)
→ Koijen and Yogo (2019, 2020) instruments not feasible

High-frequency Monetary Policy Shocks by Fed & ECB

➢ **Monetary policy shocks** that vary with bond maturity, country, currency:

$$Z_t(n) = [FEDiv_t(n),\ ECBiv_t(n)]'$$

✓ Fed & ECB surprises to the entire yield curve (Gürkaynak et al., 2022; Altavilla et al., 2019)
✓ Cleaned from central bank information effects (Jarociński and Karadi, 2018)
✓ Heterogeneous international spillovers by country & currency conditional on yield curve segment (Miranda-Agrippino and Nenova, 2022)

▸ Monetary policy instruments ▸ IV correlations ▸ First stage specification ▸ F-stats $ ▸ F-stats € ▸ First stage Fed coefs ▸ First stage ECB coefs
▸ OLS *vs* 2SLS illustration ▸ OLS *vs* 2SLS scatter ▸ OLS *vs* 2SLS table ▸ Threat risk

Stock-take: Methodological advances

1. Flexible functional form allows flexible substitution estimates
   - Compared to Nested Logit in global demand system of Koijen and Yogo (2020)

2. Precision from more granular data:
   - Fund-level holdings and characteristics ⇒ fund-specific & time-varying risk aversion + heterogeneous mandates / preferred habitats
   - Security-level bond holdings and characteristics ⇒ market segmentation along many dimensions possible (country, currency, rating, maturity, issuer type...)

3. Broader scope than previous demand estimation : 57% of global debt securities outstanding

4. New instruments for bond returns in a demand setting without market clearing

Outline

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Safe assets have low demand elasticities

Own demand elasticity: $\eta_t(jj) \equiv \frac{\partial \log(w_t(j)) * 100}{\partial per_t(j)} = \sum_i \frac{AUM_{i,t} w_{i,t}(j)}{\sum_i (AUM_{i,t} w_{i,t}(j))} \widehat{\alpha}_{T(i)} (1 - w_{i,t}(j)) * 100$

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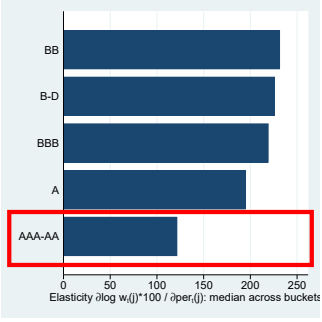
Credit rating



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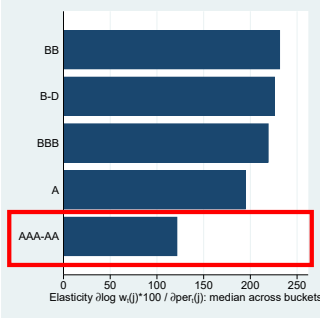
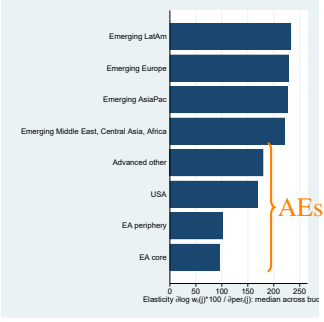


Issuer region



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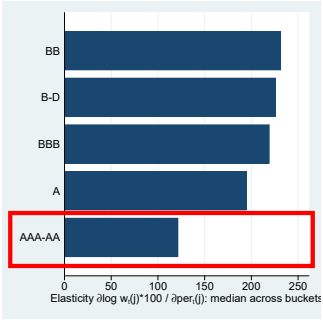

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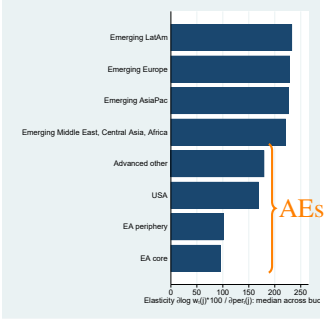
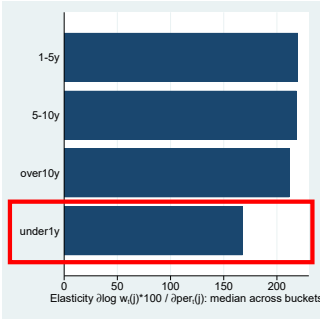


Bond maturity



Note: Medians across sovereign bond buckets. Time averages of bucket-level elasticities of the total fund sector.

▸ Corporate ▸ All bonds ▸ Bond currencies ▸ Asset types ▸ By fund residence

Spillovers from US T-bill returns ↑: Funds de-risk

Cross-elasticity: $\eta_t(jk) \equiv \frac{\partial \log(w_t(j))}{\partial per_t(k)} * 100 = \sum_i \frac{AUM_{i,t} w_{i,t}(j)}{\sum_i (AUM_{i,t} w_{i,t}(j))} \left(- \widehat{\alpha}_{T(i)} \, w_{i,t}(k) * 100 \right)$

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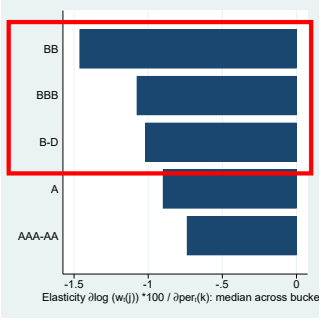
Credit rating



Spillovers from US T-bill returns ↑: Funds de-risk

Cross-elasticity: $\eta_t(jk) \equiv \frac{\partial \log(w_t(j))}{\partial per_t(k)} * 100 = \sum_i \frac{AUM_{i,t} w_{i,t}(j)}{\sum_i (AUM_{i,t} w_{i,t}(j))} \left(- \widehat{\alpha}_{T(i)} \, w_{i,t}(k) * 100 \right)$

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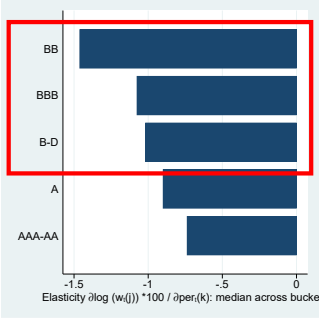
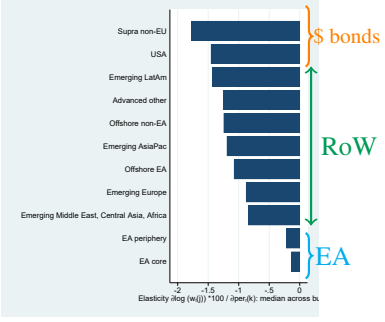


Issuer region



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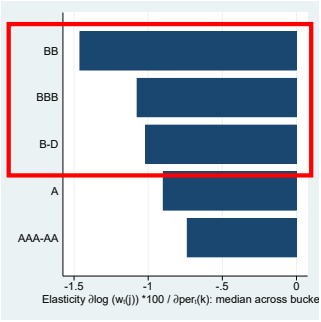

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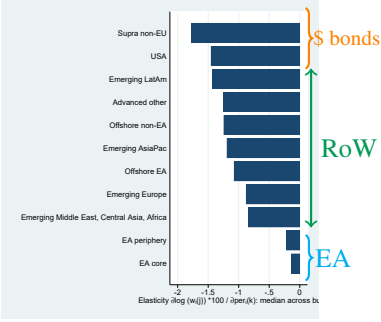
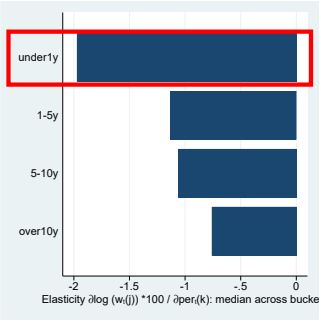


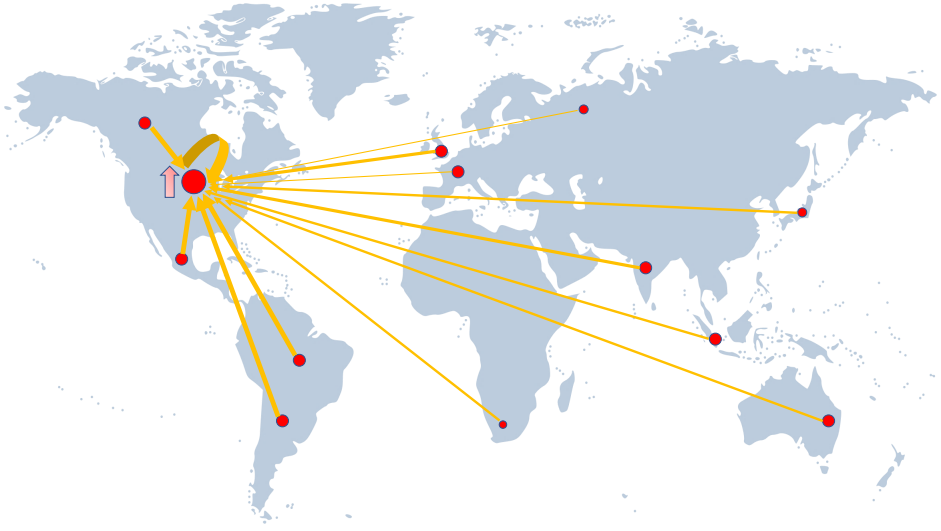
Bond maturity



Note: Medians across all bond buckets. Time averages of bucket-level elasticities of the total fund sector.

▸ Sovereign ▸ Corporate ▸ US funds ▸ EA funds ▸ US 1-5y ▸ US 5-10y ▸ US 10y+

US monetary policy triggers global rebalancing



Spillovers from DE T-bill returns ↑: Funds sell other EA safe short bonds

Cross-elasticity: $\eta_t(jk) \equiv \frac{\partial \log(w_t(j))}{\partial per_t(k)} * 100 = \sum_i \frac{AUM_{i,t} w_{i,t}(j)}{\sum_i (AUM_{i,t} w_{i,t}(j))} \left(- \widehat{\alpha}_{T(i)} \; w_{i,t}(k) * 100 \right)$

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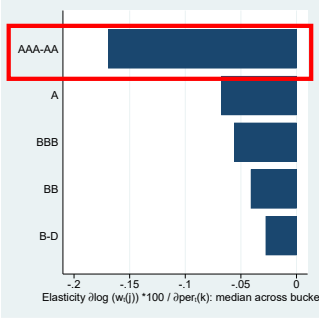

Spillovers from DE T-bill returns ↑: Funds sell other EA safe short bonds

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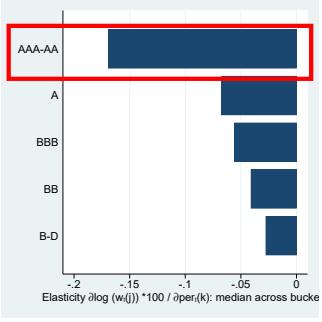
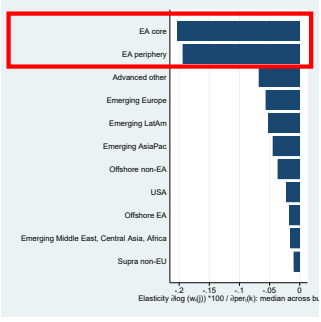


Issuer region



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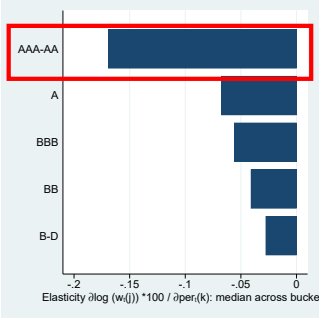

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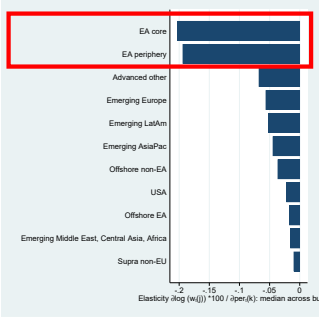

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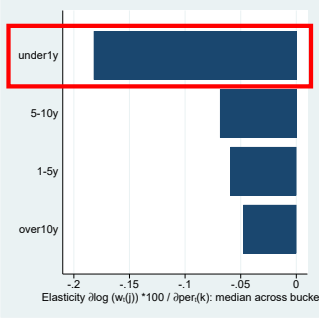


Note: Medians across all bond buckets. Time averages of bucket-level elasticities of the total fund sector.

▸ Sovereign ▸ Corporate ▸ US funds ▸ EA funds ▸ DE 1-5y ▸ DE 5-10y ▸ DE 10y+ ▸ Top substituters' portfolios

EA monetary policy triggers regional rebalancing

Rebalancing from safe assets: US *vs* EA

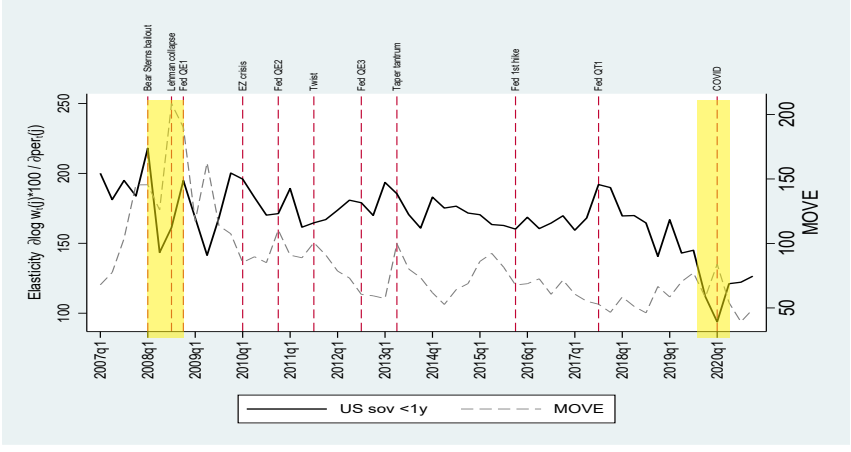
US: Global transmission with risky assets affected disproportionately

EA: Regional transmission via rebalancing in European sovereign debt market

$\Rightarrow$ Effects of monetary policy are asymmetric along segmented bond markets

Outline

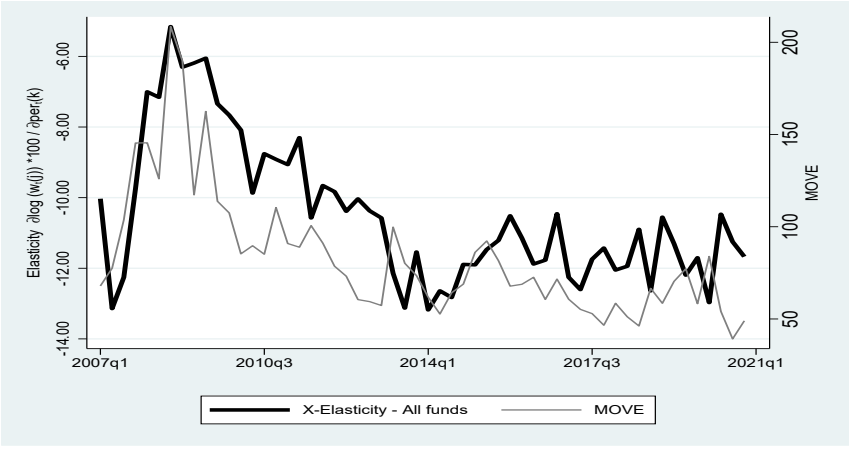
Flight to safety #1: US T-bills elasticity ↓ when market stress ↑



Black line: Funds' demand elasticity for US Treasuries with maturity under 1 year to changes *w.r.t.* 1ppt change in its predicted excess returns.

▸ Correlation table ▸ Time variation in elasticities

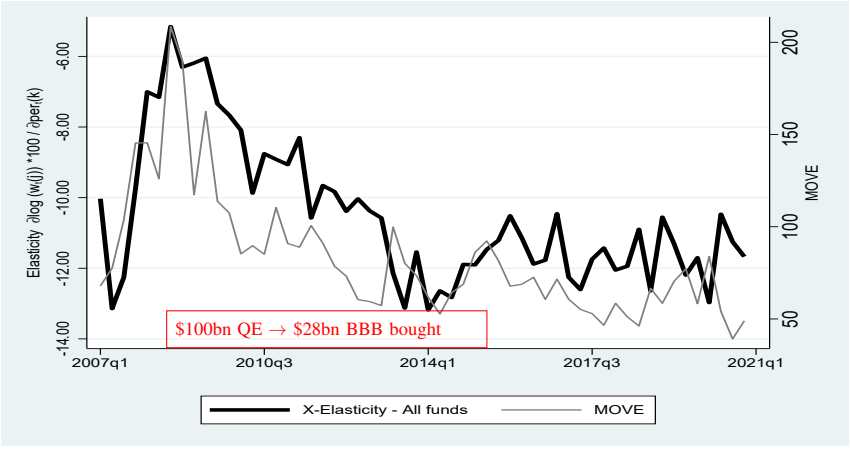
Flight to safety #2: *Relative* safety of Treasuries *vs* US BBB corp. bonds



Black line: Substitution elasticity of BBB-rated US corporate bonds with maturity of over 10 years *w.r.t.* 1ppt change in predicted excess returns on US Treasury with maturity over 10 years.

▸ Back of envelope

Flight to safety #2: *Relative* safety of Treasuries *vs* US BBB corp. bonds



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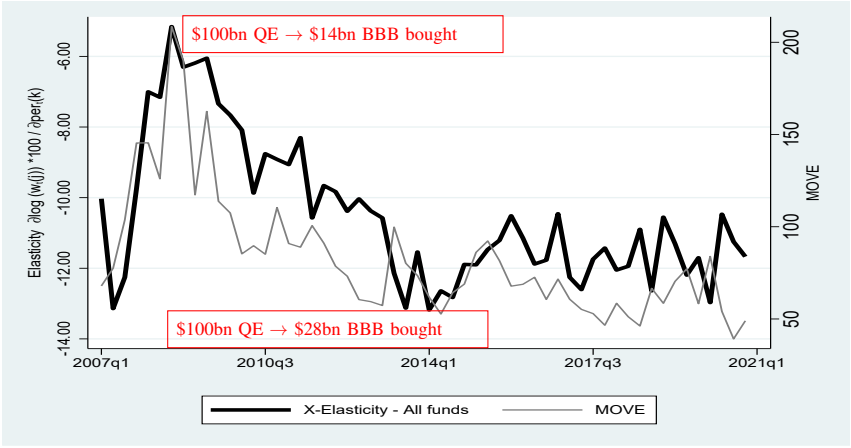

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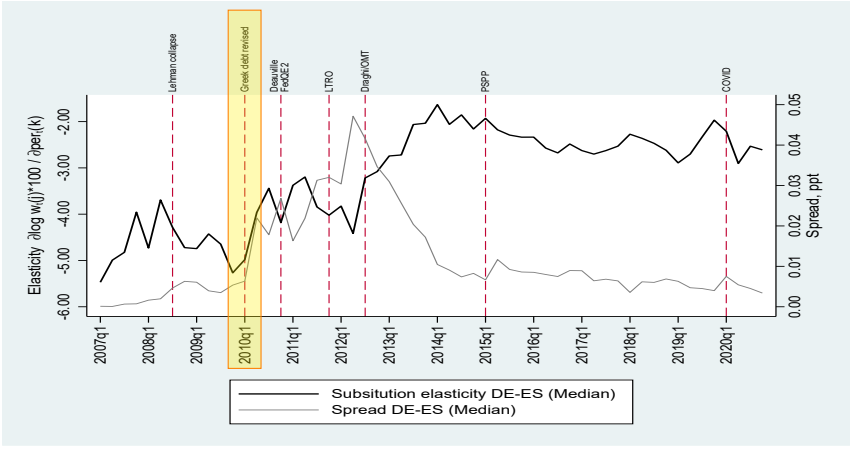
▸ Back of envelope

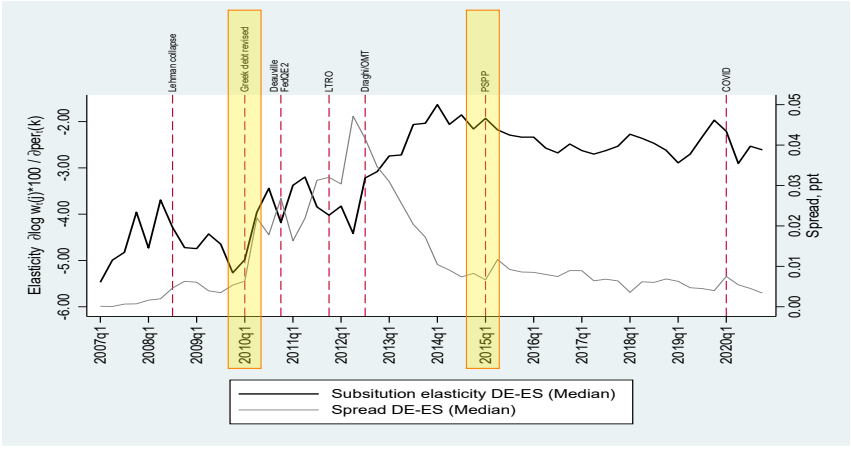
Flight to safety #3: *Relative* safety of German Bund *vs* Spain



Black line: Substitution elasticity of Spanish sovereign bonds *w.r.t.* 1ppt change in predicted excess returns on German sovereign bonds. Median of substitutions within all four maturity buckets (under 1y, 1-5y, 5-10y, over 10y).

- Italy
- France
- Belgium
- Netherlands

Flight to safety #3: *Relative* safety of German Bund *vs* Spain



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▸ Italy ▸ France ▸ Belgium ▸ Netherlands

Forms of flight to safety: US *vs* EA

US: Monetary policy transmission to risky assets is impaired during crisis

EA: European sovereign debt market integration deteriorates

$\Rightarrow$ Calibration & composition of central bank policies should be state-contingent

Outline

Lessons for theory & policy

1. Market segmentation in international bond portfolios
   - → Global *vs* regional safe assets
   - → Demand elasticities to calibrate preferred-habitat models

2. Flight to safety affects monetary policy transmission
   - → US Treasuries *vs* risky corporate bonds
   - → EA sovereign debt market

3. New way to track bond market fragmentation
   - → At time of geopolitical shifts

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1. Market segmentation in international bond portfolios
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Thank you!

References I

Altavilla, Carlo, Luca Brugnolini, Refet S. Gürkaynak, Roberto Motto, and Giuseppe Ragusa, "Measuring euro area monetary policy," *Journal of Monetary Economics*, 2019, *108*, 162 – 179. "Central Bank Communications:From Mystery to Transparency"May 23-24, 2019Annual Research Conference ofthe National Bank of UkraineOrganized in cooperation withNarodowy Bank Polski.

Bauer, Michael D, Ben S Bernanke, and Eric Milstein, "Risk appetite and the risk-taking channel of monetary policy," *Journal of Economic Perspectives*, 2023, *37* (1), 77–100.

Bergant, Katharina, Michael Fidora, and Martin Schmitz, "International capital flows at the security level – evidence from the ECB's Asset Purchase Programme," *ECMI Working Paper No 7.*, 2018.

Binsbergen, Jules H Van, William F Diamond, and Marco Grotteria, "Risk-free interest rates," *Journal of Financial Economics*, 2022, *143* (1), 1–29.

Bippus, Balduin, Simon Lloyd, and Daniel Ostry, "Granular banking flows and exchange-rate dynamics," Technical Report, Bank of England 2023.

Bretscher, Lorenzo, Lukas Schmid, Ishita Sen, and Varun Sharma, "Institutional corporate bond pricing," *Swiss Finance Institute Research Paper*, 2020, (21-07).

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas, "An Equilibrium Model of "Global Imbalances" and Low Interest Rates," *The American Economic Review*, 03 2008, *98* (1), 358–393. Copyright - Copyright American Economic Association Mar 2008; Last updated - 2016-04-30; CODEN - AENRAA; SubjectsTermNotLitGenreText - United States–US.

Caballero, Ricardo J, Emmanuel Farhi, and Pierre-Olivier Gourinchas, "Global Imbalances and Currency Wars at the ZLB.," Technical Report, National Bureau of Economic Research 2015.

__ , __ , and __ , "The safe assets shortage conundrum," *Journal of Economic Perspectives*, 2017, *31* (3), 29–46.

Camanho, Nelson, Harald Hau, and Hélene Rey, "Global portfolio rebalancing and exchange rates," *The Review of Financial Studies*, 2022, *35* (11), 5228–5274.

References II

Chang, Yen-Cheng, Harrison Hong, and Inessa Liskovich, "Regression Discontinuity and the Price Effects of Stock Market Indexing," *The Review of Financial Studies*, 07 2014, *28* (1), 212–246.

Chen, Honghui, Gregory Noronha, and Vijay Singal, "The Price Response to S&P 500 Index Additions and Deletions: Evidence of Asymmetry and a New Explanation," *The Journal of Finance*, 2004, *59* (4), 1901–1930.

Coppola, Antonio, Arvind Krishnamurthy, and Chenzi Xu, "Liquidity, debt denomination, and currency dominance," Technical Report, National Bureau of Economic Research 2023.

Costain, James S, Galo Nuño, and Carlos Thomas, "The term structure of interest rates in a heterogeneous monetary union," 2022.

Dang, Tri Vi, Gary Gorton, and Bengt Holmström, "Ignorance, debt and financial crises," *Yale University and Massachusetts Institute of technology, working paper*, 2012, *17*.

Diamond, William and Peter Van Tassel, "Risk-free rates and convenience yields around the world," *Jacobs Levy Equity Management Center for Quantitative Financial Research Paper*, 2021.

Du, Wenxin, Kristin Forbes, and Matthew N Luzzetti, "Quantitative Tightening Around the Globe: What Have We Learned?," Technical Report, National Bureau of Economic Research 2024.

Engel, Charles, "Safe U.S. Assets and U.S. Capital Flows," *Journal of International Money and Finance*, 2020, *102*, 102102. Global Safe Assets, International Reserves, and Capital Flow.

__ **and Steve Pak Yeung Wu**, "Liquidity and exchange rates: An empirical investigation," Technical Report, National Bureau of Economic Research 2018.

Eren, Egemen, Andreas Schrimpf, and Fan Dora Xia, "The Demand for Government Debt," *BIS Working Paper No. 1105*, 2023.

Eser, Fabian, Wolfgang Lemke, Ken Nyholm, Sören Radde, and Andreea Liliana Vladu, "Tracing the Impact of the ECB's Asset Purchase Program on the Yield Curve," *International Journal of Central Banking*, 2023, *19* (3), 359–422.

References III

Faia, Ester, Juliana Salomao, and Alexia Ventula Veghazy, "Granular investors and international bond prices: Scarcity-induced safety," *Available at SSRN 4287955*, 2022.

Fang, Xiang, Bryan Hardy, and Karen K Lewis, "Who holds sovereign debt and why it matters," Technical Report, National Bureau of Economic Research 2022.

Froot, Kenneth A. and Tarun Ramadorai, "Currency Returns, Intrinsic Value, and Institutional-Investor Flows," *The Journal of Finance*, 2005, *60* (3), 1535–1566.

__ and __ , "Institutional Portfolio Flows and International Investments," *The Review of Financial Studies*, 2008, *21* (2), 937–971.

Gabaix, Xavier and Ralph SJ Koijen, "In Search of the Origins of Financial Fluctuations: The Inelastic Markets Hypothesis," *Swiss Finance Institute Research Paper*, 2022, (20-91).

Gorton, Gary, "The history and economics of safe assets," *Annual Review of Economics*, 2017, *9*, 547–586.

Gourinchas, Pierre-Olivier and Hélène Rey, "Real interest rates, imbalances and the curse of regional safe asset providers at the Zero Lower Bound," in "The Future of the International Monetary and Financial Architecture" Proceedings of the ECB Sintra Forum on Central Banking 2016.

__ and Helene Rey, "Exorbitant privilege and exorbitant duty," 2022.

__ , Walker D Ray, and Dimitri Vayanos, "A preferred-habitat model of term premia, exchange rates, and monetary policy spillovers," Technical Report, National Bureau of Economic Research 2022.

Gürkaynak, Refet, Hatice Gökçe Karasoy-Can, and Sang Seok Lee, "Stock Market's Assessment of Monetary Policy Transmission: The Cash Flow Effect," *The Journal of Finance*, 2022, *77* (4).

Gürkaynak, RS, B Sack, and ET Swanson, "Do actions speak louder than words? The response of asset prices to monetary policy actions and statements," *International Journal of Central Banking*, 2005, *1* (1), 55–93.

References IV

Harris, Lawrence and Eitan Gurel, "Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures," *The Journal of Finance*, 1986, *41* (4), 815–829.

Hau, Harald and Hélène Rey, "Can Portfolio Rebalancing Explain the Dynamics of Equity Returns, Equity Flows, and Exchange Rates?," *The American Economic Review*, 2004, *94* (2), 126–133.

__ and __ , "Exchange Rates, Equity Prices, and Capital Flows," *The Review of Financial Studies*, 2006, *19* (1), 273–317.

__ , Massimo Massa, and Joel Peress, "Do demand curves for currencies slope down? Evidence from the MSCI global index change," *The Review of Financial Studies*, 2010, *23* (4), 1681–1717.

He, Zhiguo, Arvind Krishnamurthy, and Konstantin Milbradt, "A Model of Safe Asset Determination," *American Economic Review*, April 2019, *109* (4), 1230–62.

Holm-Hadulla, Fédéric and Matteo Leombroni, "Heterogeneous Intermediaries and Bond Characteristics in the Transmission of Monetary Policy," Technical Report 2023.

Jarociński, Marek and Peter Karadi, "Deconstructing monetary policy surprises: the role of information shocks," February 2018, (2133).

Jiang, Zhengyang, Arvind Krishnamurthy, and Hanno Lustig, "Foreign Safe Asset Demand for US Treasurys and the Dollar," *AEA Papers and Proceedings*, May 2018, *108*, 537–41.

__ , __ , and __ , "Dollar safety and the global financial cycle," Technical Report, The Review of Economic Studies 2023.

__ , Robert Richmond, and Tony Zhang, "A Portfolio Approach to Global Imbalances," 2021.

Joyce, Michael, Zhuoshi Liu, and Ian Tonks, "Institutional investor portfolio allocation, quantitative easing and the global financial crisis," September 2014, (510).

Kekre, Rohan, Moritz Lenel, and Federico Mainardi, "Monetary policy, segmentation, and the term structure," 2022.

References V

Koijen, Ralph S. J. and Motohiro Yogo, "A Demand System Approach to Asset Pricing," *Journal of Political Economy*, 2019, *127* (4), 1475–1515.

__ and __ , "Exchange rates and asset prices in a global demand system," Technical Report, National Bureau of Economic Research 2020.

__ , François Koulischer, Benoît Nguyen, and Motohiro Yogo, "Inspecting the Mechanism of Quantitative Easing in the Euro Area," *Banque de France Working Paper No. 601; University of Chicago, Becker Friedman Institute for Economics Working Paper No. 2019-100*, 2020.

Koijen, Ralph SJ, Robert J Richmond, and Motohiro Yogo, "Which investors matter for equity valuations and expected returns?," Technical Report, National Bureau of Economic Research 2020.

Krishnamurthy, Arvind and Annette Vissing-Jorgensen, "The Aggregate Demand for Treasury Debt," *Journal of Political Economy*, 2012, *120* (2), 233–267.

__ and Hanno N Lustig, "Mind the Gap in Sovereign Debt Markets: The US Treasury basis and the Dollar Risk Factor," in "2019 Jackson Hole Economic Symposium" 2019.

Miranda-Agrippino, Silvia and Tsvetelina Nenova, "A tale of two global monetary policies," *Journal of International Economics*, 2022, *136*, 103606. NBER International Seminar on Macroeconomics 2021.

Mota, Lira, "The corporate supply of (quasi) safe assets," *Available at SSRN 3732444*, 2020.

Nagel, Stefan, "The Liquidity Premium of Near-Money Assets*," *The Quarterly Journal of Economics*, 07 2016, *131* (4), 1927–1971.

Noh, Don and Sangmin Oh, "Measuring institutional pressure for greenness: A demand system approach," Technical Report, SSRN Working Paper 2021.

Olea, José Luis Montiel and Carolin Pflueger, "A robust test for weak instruments," *Journal of Business & Economic Statistics*, 2013, *31* (3), 358–369.

Petajisto, Antti, "The index premium and its hidden cost for index funds," *Journal of Empirical Finance*, 2011, *18* (2), 271 – 288.

References VI

Ray, Walker, "Monetary policy and the limits to arbitrage: Insights from a New Keynesian preferred habitat model," in "2019 Meeting Papers," Vol. 692 Society for Economic Dynamics 2019.

Shen, Leslie Sheng and Tony Zhang, "Risk Sharing and Amplification in the Global Financial Network," *Available at SSRN 4032741*, 2021.

Shleifer, Andrei, "Do Demand Curves for Stocks Slope Down?," *The Journal of Finance*, 1986, *41* (3), 579–590.

Tabova, Alexandra M and Francis E Warnock, "Foreign investors and us treasuries," Technical Report, National Bureau of Economic Research 2021.

Valchev, Rosen, "Bond convenience yields and exchange rate dynamics," *American Economic Journal: Macroeconomics*, 2020, *12* (2), 124–66.

Vayanos, Dimitri and Jean-Luc Vila, "A preferred-habitat model of the term structure of interest rates," *Econometrica*, 2021, *89* (1), 77–112.