Dollar Asset Holding and Hedging Around the Globe

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Research question

- US dollar has been the dominant currency in the past century.
- Studies of international finance often take stance on agents' FX activities:
  - Exchange rate determination, e.g., Koijen and Yogo (2020), Liao and Zhang (2021), Camanho et al. (2021).
  - Dollar dominance, e.g., He et al. (2016), Coppola et al. (2023).
  - US monetary policy spillover, e.g. Rey (2016), Jiang et al. (2021).
- Yet data on dollar asset holdings and hedging behaviors are scattered.
- This paper: **Which foreign investors hold what kind of USD securities and how do they manage their FX exposure?**

Approach

- Challenge 1: to estimate holdings of dollar and not just US securities.
  - Typical sources (TIC, CPIS) track holdings of securities issued by US residents.
  - **Our approach:** adjust for foreign-issued USD securities and US-issued non-USD securities.

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Total Foreign Holding of USD Securities

$=$Foreign USD Holding of U.S. Issuers $+$ Foreign USD Holding of Non-U.S. Issuers

$=$(TIC Foreign Holding of U.S. Securities

$-$TIC Foreign Holdings of Non-USD Securities)

$+$ (USD Securities Outstanding Outside the U.S.

$-$U.S. Investors' Cross-border USD Holdings).

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- Challenge 2: to analyze USD holding and hedging, by sector, and relative to investor's portfolio.
  - Typical sources do not distinguish between types of investor, nor do they track investors' overall portfolio or hedging behavior.
    - CPIS has sectoral breakdown, but highly incomplete.
  - **Our approach:** hand-collect company filings and industry statistics to track, by country and sector, overall portfolio size and USD holdings and hedging.

Data: investor's portfolio allocation

- We hand collect company filings and industry statistics to gather portfolio data from seven sectors:
  - Insurance: 34 countries.
  - Pension: 16 countries.
  - Mutual funds: 64 countries.
  - Banks: 48 countries.
  - Hedge funds: 53 countries.
  - The official sector: 237 countries.
  - The non-financial sector: 56 countries
- We focus on three key aspects:
  - Total portfolio size.
  - Holding of USD debt vs. equity.
  - Hedging of USD debt vs. equity.

Details

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- Challenge 3: to benchmark investor's portfolio allocation.
  - No existing framework on allocation when facing joint decision of domestic asset vs. USD asset vs. hedging.
  - **Our approach:** construct mean-variance investor's optimal portfolio of three types of returns and take the model prediction to data.

Key results

- Three facts on Holding:
  - Foreign investors are increasing their portfolio allocation to USD.
  - They (mostly) prefer debt over equity.
  - A significant fraction of their exposure comes from non-US issuers.

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  - Foreign investors hedge a substantial amount.
  - Increased hedging post-GFC despite deviations from covered interest-rate parity.
  - There is considerable heterogeneity in hedging practice.

Key results

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- Three facts on Hedging:
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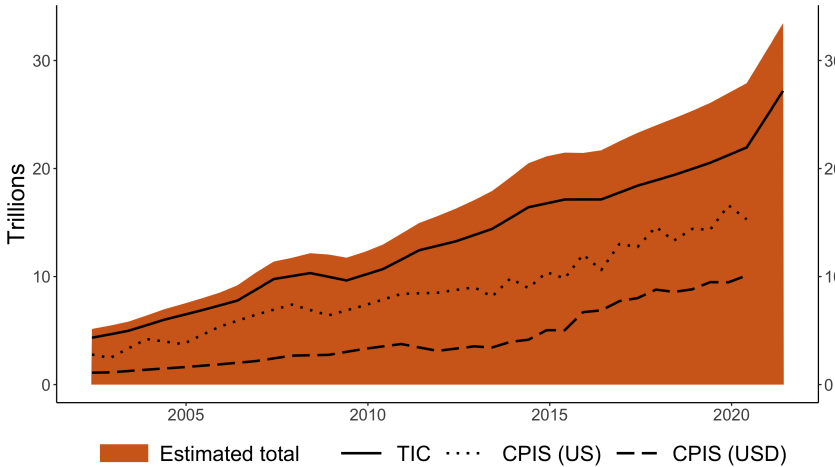
  - Increased hedging post-GFC despite deviations from covered interest-rate parity.
  - There is considerable heterogeneity in hedging practice.
- Investor behavior benchmarked:
  - Optimal behavior differs across currencies.
  - Investors' allocations show consistency with the optimum in some aspects.
  - Notable deviation in hedging suggests that investors are not FX price-takers.

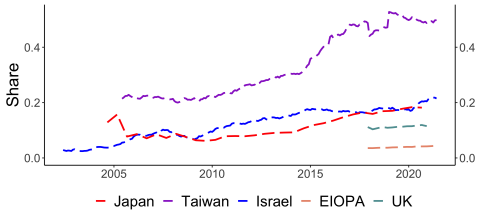
Fact 1: Foreign investors show increasing preference for USD securities

Foreign holding of USD securities

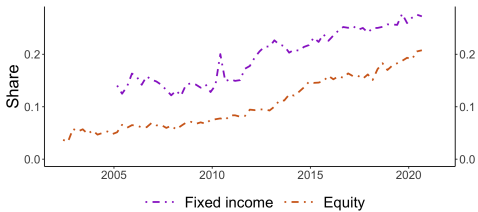


Fact 1 cont'd

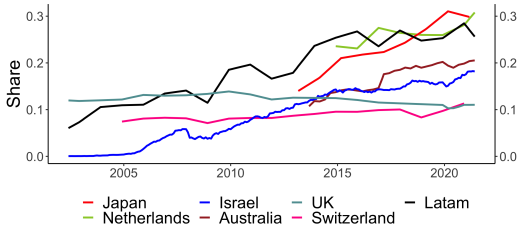
Portfolio allocation to USD across industries



(A) **Insurance**



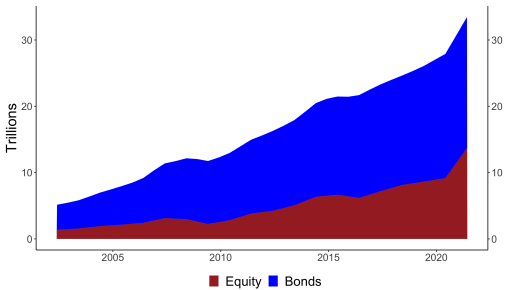
(B) **Mutual funds**



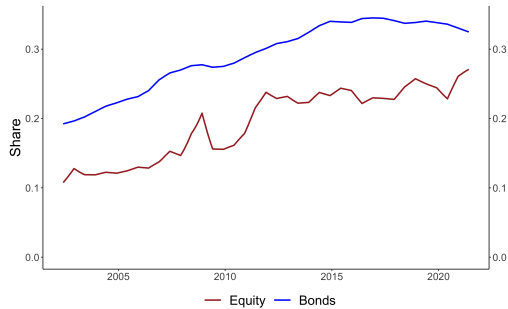
(C) **Pensions**

Fact 2: Foreign investors prefer holding USD bonds over equities

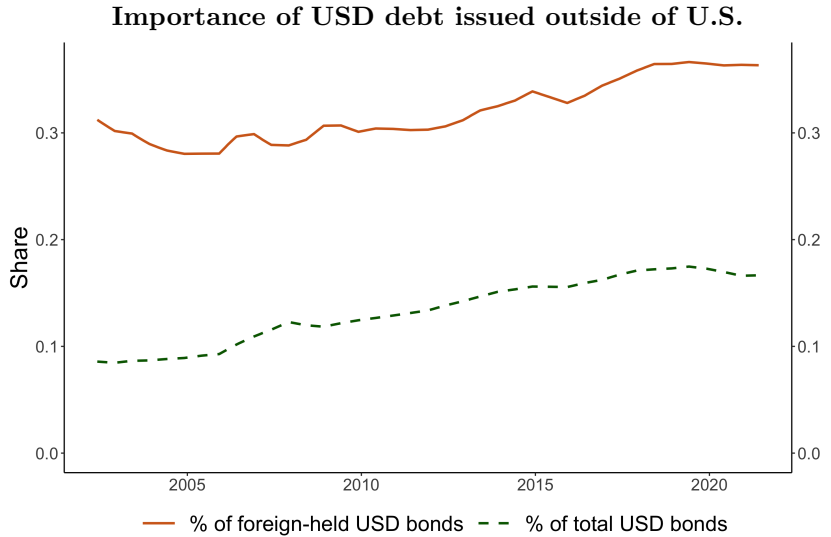
Foreign USD holding by security type



Foreign-held USD debt and equity as share of total outstanding

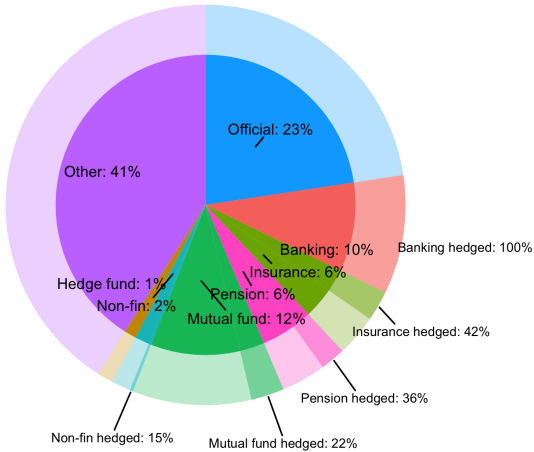


Fact 3: A large fraction of foreign investors' holdings of USD bonds is issued by non-U.S. issuers

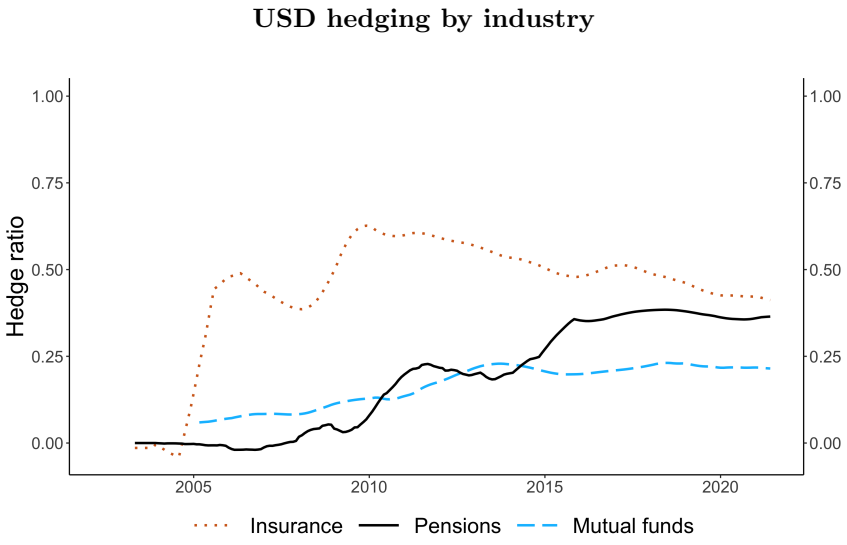


Fact 4: There is a substantial amount of hedging in actively-managed industries, especially post-GFC

Foreign holding of USD by industry and hedging status, June 2020



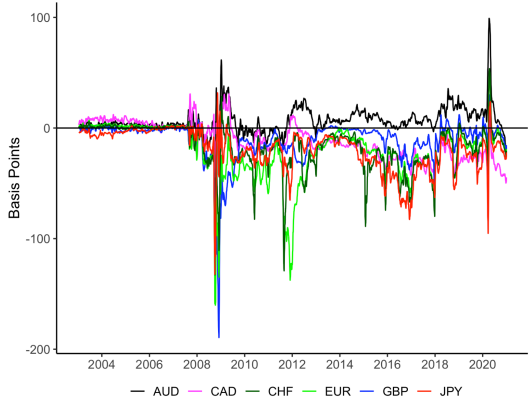
Fact 4 cont'd


USD hedging by industry
Hedge ratio
1.00
0.75
0.50
0.25
0.00
2005
2010
2015
2020
Insurance
Pensions
Mutual funds

Quick aside: cost of hedging

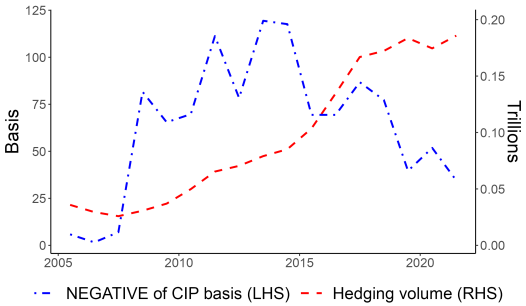
- CIP: $f_{t,\tau} = s_t + r^c_{t,\tau} - r^{\$}_{t,\tau}$.
- CIP basis: $x^{c,\$}_{t,\tau} = r^{\$}_{t,\tau} - (s_t + r^c_{t,\tau} - f_{t,\tau})$.
- Exchange rates: unit of foreign currency per USD.
  - An increase in s or f, is a depreciation of the foreign currency.
- Interest rates: log of annualized rate; c denotes foreign.

Three-month IBOR-based CIP basis

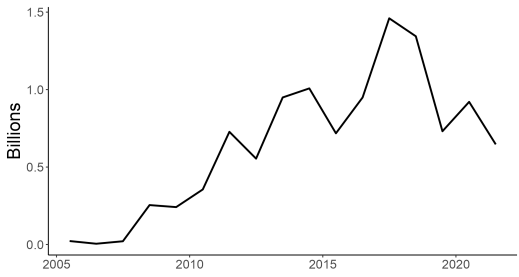


Fact 5: Investors' hedging demand not deterred by rising hedging costs

Taiwanese insurers' hedging



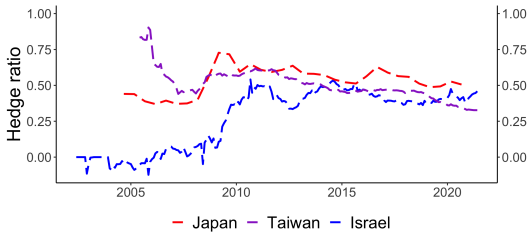
(A) **CIP basis vs. hedging volume**



(B) **Total hedging cost**

Total hedging cost across insurers and pensions in 2020: **$2.7B**.

Fact 6: Hedging behaviors show persistence and heterogeneity across sectors and countries



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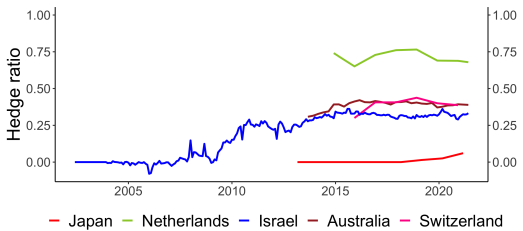

(B) **Pensions**

Model environment

- Two assets: local bonds (b) and USD bonds ($\$b$).
  - $rx^{b}_{t+1} = r^{b}_{t+1} - rf_t$.
  - $rx^{\$b}_{t+1} = r^{\$b}_{t+1} - rf^{\$}_t$.

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- Foreign investors cannot earn $rx^{\$b}_{t+1}$ without buying USD bonds; the local currency return on holding USD bonds depends on currency hedging strategy.
  - $rx^{\$b,NH}_{t+1} = r^{\$b}_{t+1} + \Delta s_{t+1} - rf_t \equiv rx^{\$b}_{t+1} + rx^{FX}_{t+1}$.
  - $rx^{\$b,H}_{t+1} = r^{\$b}_{t+1} + (f_t - s_t) - rf_t = rx^{\$b}_{t+1} + x_t$.

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- We therefore have three types of returns:
  - rx^{b}_{t+1}.
  - $rx^{\$b}_{t+1}$.
  - rx^{FX}_{t+1}; x_t is not a return but determined at time t.

Model

The investor chooses w_{US} and w_{NH} to maximize her utility:

$$\max_{w_{US},w_{NH}} \mathbb{E}rx^P_{t+1} - \frac{\gamma}{2}\mathbb{V}(rx^p_{t+1}),$$

where rx^P_{t+1} is the log excess return of the entire portfolio given by:

$$rx^P_{t+1} = (1 - w_{US})rx^b_{t+1} + w_{US}rx^{\$b}_{t+1} + w_{NH}rx^{FX}_{t+1} + (w_{US} - w_{NH})x_t.$$

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- We solve for optimal w^*_{US} and w^*_{NH}.
  - Functions of expected returns and conditional (co)variance.
- We focus on comparative statics:
  - How do w^*_{US}, w^*_{NH} change w.r.t. $rx^{\$b} - rx^b, rx^{FX}$, and x?
  - Functions of covariance: estimate assuming stationarity and using realized 1M holding returns from 2010/07 to 2022/08.

Model predictions

Model-implied optimal comparative statics

Currency	Share of USD (w_{US})			Share of Not-hedged USD (w_{NH})		
	$rx^{\$b} - rx^{b}$	rx^{FX}	x	$rx^{\$b} - rx^{b}$	rx^{FX}	x
JPY	+	+	-	+	+	-
AUD	+	+	+	+	+	-
TWD	+	-	+	-	+	-
ILS	+	-	+	-	+	-

- Intuitive predictions for $w_{\$b}^{US}, w_{FX}^{NH}, w_{x}^{NH}$.
- For others, optimal allocation depends on relative covariance and volatility.

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Testing investors' portfolio against model predictions

- Regression of changes in investors' portfolio allocation on changes in expected returns.
- Investors make portfolio allocations at time t based on expected returns and covariance structure.
  - $\mathbf{E}[rx_{t+1}] = y_{10Y,t} - rf_t$.
  - $\mathbf{E}[rx^{FX}_{t+1}] = f(s_t)$, $f'(s_t) > 0$ due to momentum.
  - Expected returns are calculated using period average, where the period is the investor's reporting frequency.
- Investors (observation frequency): Japanese insurers (SA), Australian pensions (Q), Taiwanese insurers (M), Israeli insurers (M), Israeli pensions (M).

Investor's USD allocation

Empirical determinants of *change* in USD allocation
(red denotes consistency with model prediction)

Currency	Industry	USD yield slope	CCY yield slope	USD-CCY spread in yield slope	CCY spot	CCY 1M basis	CCY 10Y basis
JPY	insurance	-**	-**	-*	+	-	+
AUD	pension	+	+	-	+**	+	+**
TWD	insurance	-*	-	-*	-***	+	+
ILS	insurance	+***	+*	+	-*	+	-**
ILS	pension	+***	+**	+	-***	+	-

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TWD	insurance	-*	-	-*	-***	+	+
ILS	insurance	+***	+*	+	-*	+	-**
ILS	pension	+***	+**	+	-***	+	-

Investor's FX allocation

Empirical determinants of *change* in *non-hedged* USD allocation
(red denotes consistency with model prediction)

Currency	Industry	USD yield slope	CCY yield slope	USD-CCY spread in yield slope	CCY spot	CCY 1M basis	CCY 10Y basis
JPY	insurance	+	+	-	-	+**	+***
AUD	pension	+	+	-	+***	+	+**
TWD	insurance	-*	-	-*	-***	+	+
ILS	insurance	+	+	-	+	+***	-**
ILS	pension	+***	+*	+	-	+***	-

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TWD	insurance	-*	-	-*	-***	+	+
ILS	insurance	+	+	-	+	+***	-**
ILS	pension	+***	+*	+	-	+***	-

Conclusions

- Foreign investors hold increasingly more USD securities and they hedge a substantial amount of their USD FX exposure.

  $\longrightarrow$ Dollar demand not necessarily driven by dollar's strength during crises.

- Investors' USD allocation is largely consistent with mean-variance trade-off but hedging shows striking deviation from what CIP deviation would predict.

  $\longrightarrow$ Investors may not be FX price takers: CIP deviations are likely driven by investors' hedging demand.

Appendix

Data detail 1

Industry	Region / Country	Company filings	Industry or national statistics providers	Start	End	Hedging info start
Insurance	Asia: Japan	11		2004	2020	2004
	Asia: Taiwan	6	Central Bank of the Republic of China	2005	2021	2005
	Europe: Euro 19 countries		EIOPA, SHS	2017	2021	–
	Europe: 11 other EU countries		EIOPA	2017	2021	–
	Europe: UK		EIOPA	2017	2020	–
	Other: Israel		Bank of Israel	2002	2021	2002

Back

Data detail 2

Industry	Region / Country	Company filings	Industry or national statistics providers	Start	End	Hedging info start
Pensions	Asia: Japan	1		2013	2021	2013
	Asia: Australia		APRA, Australian Bureau of Statistics	2004	2021	2013
	Europe: Netherlands	2		2014	2021	2014
	Europe: Switzerland		Federal Statistical Office	2004	2020	2015
	Europe: UK		Office for National Statistics	2002	2021	–
	Other: Israel		Bank of Israel	2002	2021	2002
	Other: 10 Latam countries		FIAP	2002	2021	–

Data detail 3

Industry	Region / Country	Company filings	Industry or national statistics providers	Start	End	Hedging info start
Mutual funds	64 countries		Morningstar	2002	2021	2002
Banking	48 countries		BIS Locational Banking Statistics	2002	2021	2002
Hedge funds	53 countries		13F, Factset	2002	2021	–
Non-financial	56 countries		CPIS	2002	2020	–
Official sector	237 countries		TIC	2002	2021	–

Camanho, N., Hau, H., and Rey, H. (2021). Global portfolio rebalancing and exchange rates. Working Paper 24320, National Bureau of Economic Research.

Coppola, A., Krishnamurthy, A., and Xu, C. (2023). Liquidity, debt denomination, and currency dominance. Working Paper 30984, National Bureau of Economic Research.

He, Z., Krishnamurthy, A., and Milbradt, K. (2016). What makes us government bonds safe assets? *American Economic Review*, 106(5):519–23.

Jiang, Z., Krishnamurthy, A., and Lustig, H. (2021). Dollar safety and the global financial cycle. Technical report.

Koijen, R. S. J. and Yogo, M. (2020). Exchange rates and asset prices in a global demand system. Working Paper 27342, National Bureau of Economic Research.

Liao, G. and Zhang, T. (2021). The hedging channel of exchange rate determination. Technical report, Federal Reserve Bank.

Rey, H. (2016). International channels of transmission of monetary policy and the mundellian trilemma. *IMF Economic Review*, 64(1).