U.S. Risk and Treasury Convenience

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Is The U.S. Still ‘Safe’?

- U.S. equities have consistently outperformed the rest-of-world since GFC
  - High excess equity returns consistent with compensation for risk
- Returns on a carry-trade portfolios funded in USD largely unchanged over time
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Inconsistent with no-arbitrage in canonical two-country, complete-market models:

Carry-trade returns = Cross-country risk differential

How can theory be reconciled with the data?

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Inconsistent with no-arbitrage in canonical two-country, complete-market models:

Carry-trade returns = Cross-country risk differential + Complete-markets deviation

- Investors willing to forego returns on U.S. bonds due to non-pecuniary (convenience) yields

⇒ **Key Proposition:** Cross-country risk differentials reflected in convenience yields

This Paper

#1. Two-country model with trade in bonds of various maturities with convenience yields

$\Rightarrow$ $-$ve relationship relative *permanent* risk and flow convenience on long-maturity bonds

#2. Document U.S. **permanent** risk has $\uparrow$ by $\sim$ **15p.p.** vs. G.7 since 2008

- Transitory risk has not $\Rightarrow$ U.S. 'safe' at business-cycle frequency

#3. Find single **cointegrating** relationship b/w permanent risk and long-maturity convenience

$\Rightarrow$ $\uparrow$ rel. U.S. permanent risk explains $\sim$**20-33**% of $\downarrow$ long-maturity U.S. convenience (2002-6, 2010-14)

Related Literature (Non Exhaustive)

Measuring SDF risk with equity returns [Hansen & Jagannathan, 1991; Bansal & Lehmann, 1997; Alvarez & Jermann, 2005]

$\rightarrow$ **Extend permanent-risk measure**, accounting for noise, 'good luck', expected vol. and conv.

Analyses of **convenience yields** have focused on:

- Measurement and drivers (limits to arbitrage, bond supply) [Du et al., 2018a,b; Jiang et al., 2024]
- Association with FX at *short horizons* [Engel & Wu, 2018; Krishnamurthy & Lustig, 2019]

$\rightarrow$ **'Macro'** explanation for long-maturty **long-maturity** convenience yield determination

Asymmetries in International Monetary System

- U.S. 'exorbitant privilege' and seignorage from convenience [Gourinchas et al., 2010; Jiang et al., 2024]
- But faces USD appreciation in bad times (flights-to-safety) [Maggiori, 2017; Kekre & Lenel, 2021]
- U.S. risk has $\uparrow$ since 2000s, eroding external-asset returns [Farhi & Gourio, 2018; Atkeson et al., 2022]

$\rightarrow$ $\uparrow$ relative U.S. **permanent** risk explains $\downarrow$ long-maturity UST conv. and $\leftrightarrow$ carry-trade returns

Fact 1. Rising Expected U.S. Equity Premia

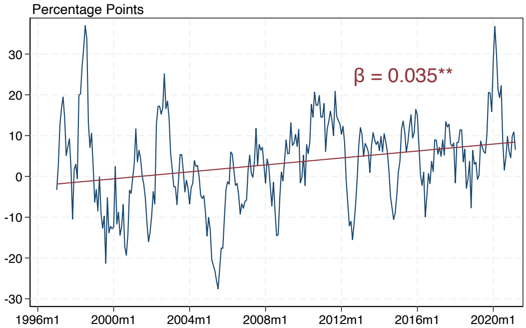
Volatility of U.S. representative investor SDF (risk) bounds Sharpe ratio on equity

[Hansen & Jaganathan 1991; Alvarez & Jermann 2005]

- In part, reflects ↑ profits from U.S. tech. adv. and/or structural changes

  [Atkeson et al., 2023; Greenwald et al., 2023; Eckhout 2025]

U.S. net G.7. *realized* equity premium



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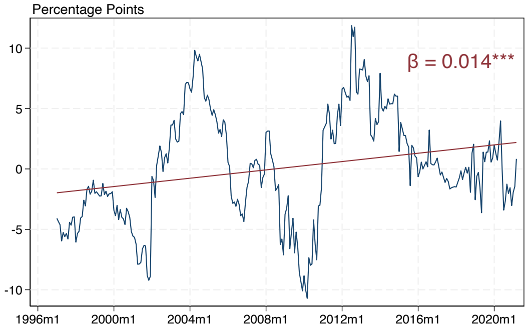
- But significant ↑ was expected:

$$\log \mathbb{E}_t \left[\frac{R^g_{t,t+1}}{R_t} \right] :\approx \frac{D_t}{P_t} + g^e_t - (r_t - \pi^e_t)$$

[Gordon 1962, Campbell & Thompson 2007, Farhi & Gourio 2018, Bordalo et al. 2020, De La'O & Myers 2021]

U.S. net G.7. average *expected* equity premium

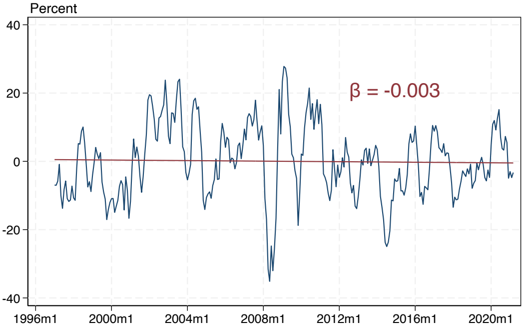


⇒ **Drives our model-implied measure of relative risk**

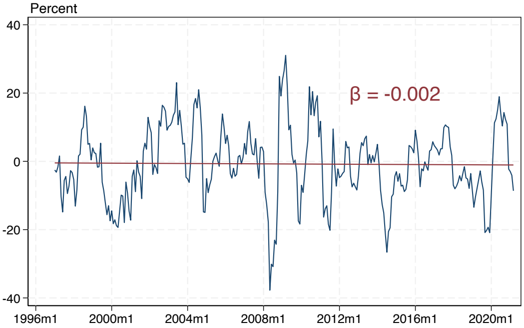
Fact 2. Carry-Trade Returns Not Trending

$$\mathbb{E}_t[rx_{t+1}^{CT,(k)}] := \underbrace{\mathbb{E}_t[rx_{t+1}^{FX}]}_{\text{Currency Returns}} + \underbrace{\mathbb{E}_t[rx_{t+1}^{(k)*}] - \mathbb{E}_t[rx_{t+1}^{(k)}]}_{\text{Difference in Local Bond Returns}}$$

Carry-Trade Returns on 6M Bonds, USD vs. G.7



Carry-Trade Returns on 10Y Bonds, USD vs. G.7



Fact 3. Decreasing Treasury Premium on Long-Maturity Bonds

- $\propto$ **Bond Convenience**: investors accept lower yield vs. other (safe) investments
    - Collateral value
    - Ease of resale

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- ' U.S. Treasury Premium': deviation from covered interest parity [Du et al., 2018]

$$CIP_t^{(k)} = \underbrace{r_t^{(k)*}}_{\text{Foreign-Bond Ret.}} - \underbrace{r_t^{(k)} + f_t^{(k)} - e_t}_{\text{UST Ret. in For. Curr.}}$$

$\Rightarrow CIP_t^{(k)} > 0$ if UST *more* convenient

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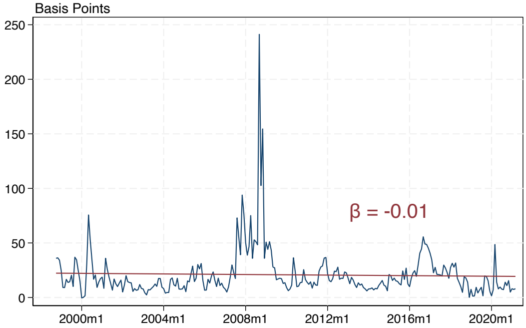
Short-Maturity (6M) U.S. Treasury Premium



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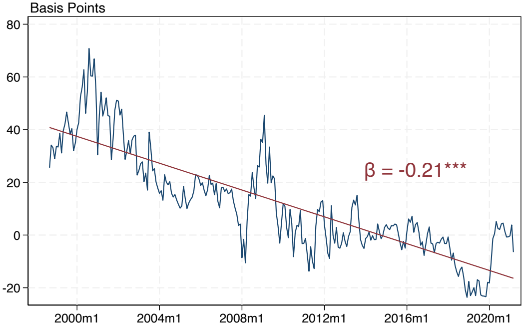
- **Our Focus**: Long-maturity convenience

Long-Maturity (10Y) U.S. Treasury Premium



Measurement
Country-by-Country

Model of Risk, Returns and Convenience

- Two countries: H (U.S.) and F (*)
- Representative investor pricing kernels: Λ_t, Λ_t^* (SDF: $M_{t,t+k} = \Lambda_{t+k}/\Lambda_t$)
- $\Lambda_t = \Lambda_t^{\mathbb{P}} \Lambda_t^{\mathbb{T}}$ such that $\Lambda_t^{\mathbb{P}}$ is a martingale ($\Lambda_t^{\mathbb{P}} = \mathbb{E}_t[\Lambda_{t+1}^{\mathbb{P}}]$) [Alvarez & Jermann, 2005]
  - $M_{t,t+1}^{\mathbb{P}} = \Lambda_{t+1}^{\mathbb{P}}/\Lambda_t^{\mathbb{P}}$: **Permanent** component reflects long-run level of e.g. consumption growth
  - $M_{t,t+1}^{\mathbb{T}} = \Lambda_{t+1}^{\mathbb{T}}/\Lambda_t^{\mathbb{T}}$: **Transitory** component reflects 'smoothable' consumption growth
- Conditional entropy (volatility) of SDF to measure country risk:

$$\mathcal{L}_t\left(M_{t+1}\right) = \mathbb{E}_t \ln M_{t+1} - \ln(\mathbb{E}_t M_{t+1}) \approx \frac{1}{2}\text{var}_t(M_{t+1})$$

- Trade in:

#1. **Bonds**: pecuniary returns + non-pecuniary convenience

#2. **Equities**: pecuniary returns

#3. **Foreign Exchange**

Euler Equations

Bonds and FX: term structure of H and F zero-coupon bonds, with maturity $k = 1, 2, ..., \infty$:

Home Investor (U.S.):

$$e^{-\theta_t^{H,H(k)}} = \mathbb{E}_t \left[M_{t,t+k} R_t^{(k)} \right]$$
$$e^{-\theta_t^{H,F(k)}} = \mathbb{E}_t \left[M_{t,t+k} \frac{\mathcal{E}_{t+k}}{\mathcal{E}_t} R_t^{(k)*} \right]$$

Foreign Investor ($\uparrow \mathcal{E}_t$ a Foreign appreciation):

$$e^{-\theta_t^{F,F(k)}} = \mathbb{E}_t \left[M^*_{t,t+k} R_t^{(k)*} \right]$$
$$e^{-\theta_t^{F,H(k)}} = \mathbb{E}_t \left[M^*_{t,t+k} \frac{\mathcal{E}_t}{\mathcal{E}_{t+k}} R_t^{(k)} \right]$$

A1. Term structure of convenience yields $\theta_t^{i,j(k)}$ (investor i, bond j) observable at time t

A2. In the limit of complete spanning $\Delta e_{t+1} = m^*_{t+1} - m_{t+1} + \theta_t^{F,H(1)} - \theta_t^{H,H(1)}$ Details

Equities: agents also invest in at least one domestic risky asset

$$1 = \mathbb{E}_t \left[M_{t,t+1} R^g_{t,t+1} \right] \quad \text{and} \quad 1 = \mathbb{E}_t \left[M^*_{t,t+1} R^{g*}_{t,t+1} \right]$$

A3. Convenience of risky assets normalized to zero

Short-Maturity Equilibrium

Eulers and FX process imply tight link b/w relative *total* risk, one-period pecuniary currency returns ($rx^{FX}_{t+1} = r^*_t - r_t + \Delta e_{t+1}$) and non-pecuniary convenience yields

Proposition 1 (Short-Maturity Equilibrium)

$$\mathbb{E}_t[rx^{FX}_{t+1}] = \underbrace{\mathcal{L}_t(M_{t,t+1}) - \mathcal{L}_t(M^*_{t,t+1})}_{\text{Rel. Total Risk}} + \underbrace{\theta^{F,H(1)}_t - \theta^{F,F(1)}_t}_{\text{Rel. Convenience}}$$

$\uparrow$ *relative U.S. total risk can generate adjustment through two channels:*

* ***FX Risk Premia***: *USD depreciates $\rightarrow$ Foreign investors earn higher Foreign bond returns:* $rx^{FX}_{t+1} \uparrow$
* ***Convenience Yields***: *Foreign investors earn lower UST convenience:* $(\theta^{F,H(1)}_t - \theta^{F,F(1)}_t) \downarrow$

Long-Maturity Equilibrium

Proposition 2 (Long-Maturity Equilibrium)

$$\mathbb{E}_t[rx_{t+1}^{CT(\infty)}] = \underbrace{\mathcal{L}_t(M_{t,t+1}^{\mathbb{P}}) - \mathcal{L}_t(M_{t,t+1}^{\mathbb{P}*})}_{\text{Rel. Permanent Risk}} + \underbrace{\mathbb{E}_t[\theta_{t,t+1}^{F,H(\infty)}] - \mathbb{E}_t[\theta_{t,t+1}^{F,F(\infty)}]}_{\text{Rel. Long-Maturity \textbf{Holding-Period} Convenience}}$$

Absent convenience (with complete markets) long-horizon UIP holds $(\mathbb{E}_t[rx_{t+1}^{CT(\infty)}] \approx 0)$
$\Rightarrow$ *permanent risk equalized across countries* $\mathcal{L}(M_{t,t+1}^{\mathbb{P}}) = \mathcal{L}(M_{t,t+1}^{\mathbb{P}*})$ *[Lustig et al., 2019]*

With convenience Δ rel. permanent risk can generate adjustment through non-pecuniary yields:

$$\left(\mathcal{L}(M_{t,t+1}^{\mathbb{P}}) - \mathcal{L}(M_{t,t+1}^{\mathbb{P}*})\right)\uparrow \longleftrightarrow \left(\mathbb{E}_t[\theta_{t,t+1}^{F,H(\infty)}] - \mathbb{E}_t[\theta_{t,t+1}^{F,F(\infty)}]\right)\downarrow$$

$\Rightarrow$ Rel. permanent risk + convenience yield term must be $\mathcal{I}(0) \implies$ *cointegration*

Total, Permanent and Transitory Risk

Total Risk: Lower bound conditional SDF volatility (where $R^g_{t,t+1}$ is 'riskiest' return in economy):

$$\mathcal{L}_t(M_{t,t+1}) \geq \underbrace{\log \mathbb{E}_t\left[\frac{R^g_{t,t+1}}{R_t}\right]}_{\text{Growth Optimal Porftolio}} - \underbrace{\mathcal{L}_t\left[\frac{R^g_{t,t+1}}{R_t}\right]}_{\approx VIX^2/2 \text{ (Martin, 2017)}} - \underbrace{\theta_t^{H,H(1)}}_{\text{Convenience}}$$

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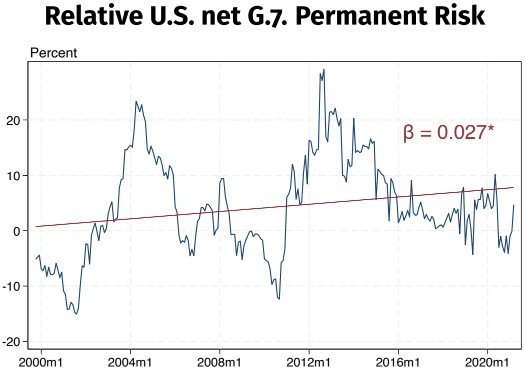
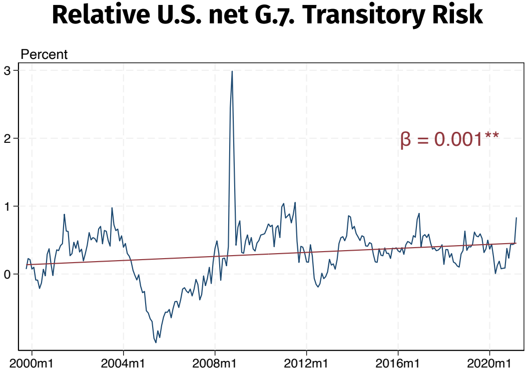
Permanent Risk: Lower bound for permanent SDF volatility

$$\mathcal{L}_t\left(M^{\mathbb{P}}_{t,t+1}\right) \geq \underbrace{\log \mathbb{E}_t \left[\frac{R^g_{t,t+1}}{R_t} \right]}_{\text{Growth Optimal Porftolio}} - \underbrace{\mathcal{L}_t \left[\frac{R^g_{t,t+1}}{R_t} \right]}_{\approx VIX^2/2 \text{ (Martin, 2017)}} - \underbrace{\mathbb{E}_t\left[rx^{(\infty)}_{t+1} \right]}_{\propto \text{Trans. Risk}} - \underbrace{\mathbb{E}_t\left[\theta^{H,H(\infty)}_{t+1} \right]}_{\text{Holding-Period Convenience}}$$

Measuring Permanent and Transitory Risk





Dynamics of Long-Maturity Convenience and Permanent Risk

Derive ECM:

▸ ECM: Short-Run Adj. ▸ UR, Coint tests

$$\Delta CIP_t^{(10Y)} = \beta_0 + \beta_1 \Delta \mathcal{D}PermRisk_t + \beta_2 \Delta rx_{t+1}^{CT(10Y)} \cdots$$
$$+\gamma \left[CIP_{t-1}^{(10Y)} - \alpha_1 \mathcal{D}PermRisk_{t-1} - \alpha_2 rx_t^{CT(10Y)} \right] + \varepsilon_t$$

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Panel A: Long-Run Adjustment	(1)	(2)	(3)	(4)
$\mathcal{D}PermRisk_t$	-0.496**	-1.037**		
	(0.145)	(0.345)		
$\mathcal{D}TransRisk_t$				-0.014
				(0.400)
$rx_t^{CT(10Y)}$	0.123	0.181	0.136	0.140
	(0.112)	(0.224)	(0.106)	(0.130)
Deterministic Trend	Yes	No	Yes	Yes

Contribution of Permanent Risk to Long-Maturity Convenience

Use estimated ECM to perform counterfactual:

> *"Given realized* $rx_{t+1}^{CT(10Y)}$*, how would* $CIP_t^{(10Y)}$ *have evolved if* $\mathcal{D}PermRisk_t$ *had evolved differently?"*

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Focus on post-crisis periods:

#1. **Dot-Com Bubble**: from 2000 to 2007

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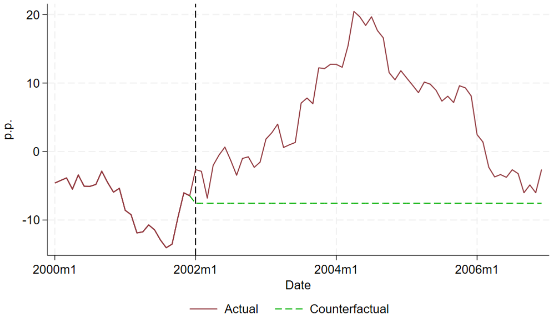
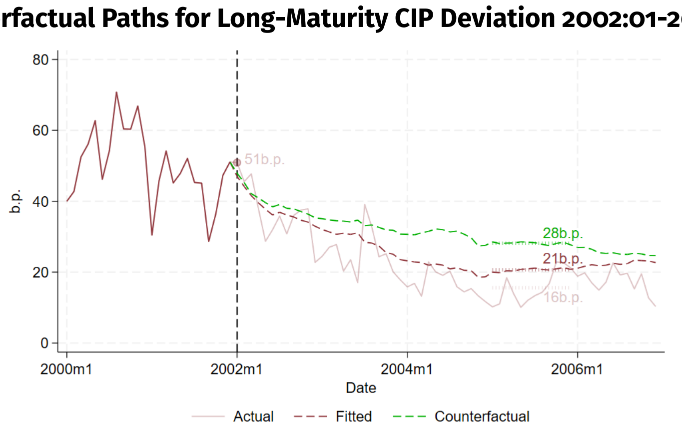
Counterfactual Path for Rel. Perm. Risk



Contribution of Permanent Risk to Long-Maturity Convenience

Post Dot-Com Bubble



⇒ **Full model explains ~ 90% $\downarrow$ 10Y CIP dev., of which ~ 25% due to $\uparrow$ rel. permanent risk**

Contribution of Permanent Risk to Long-Maturity Convenience

Use estimated ECM to perform counterfactual:

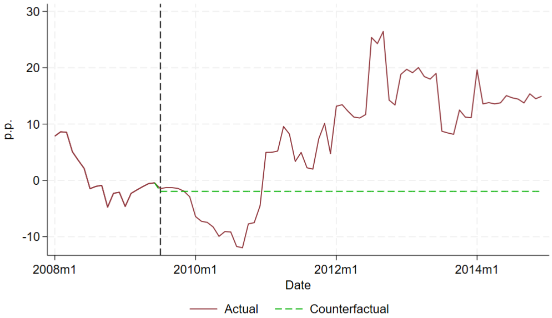
- *Given realized path for* $rx^{CT(10Y)}_{t+1}$*, how would* $CIP^{(10Y)}_{t}$ *have evolved if* $\mathcal{D}PermRisk_t$ *had followed different path?*

Focus on post-crisis periods:

#1. **Dot-Com Bubble**: from 2000 to 2007

#2. **Global Financial Crisis**: from 2008 to 2014

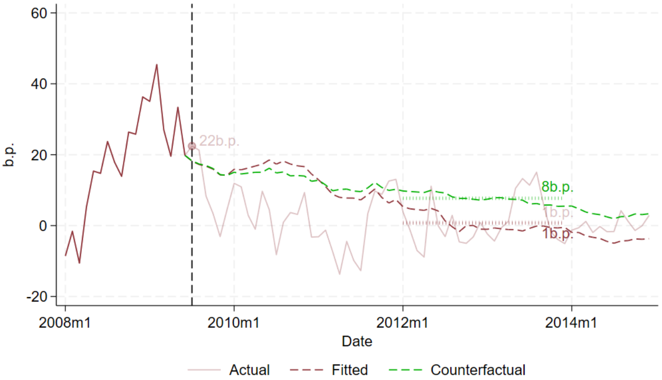
Counterfactual Path for Rel. Perm. Risk



Contribution of Permanent Risk to Long-Maturity Convenience

Post Global Financial Crisis

Counterfactual Paths for Long-Maturity CIP Deviation 2002:01-2006:12



$\Rightarrow$ **Full model explains ~ 100% $\downarrow$ 10Y CIP dev., of which ~ 33% due to $\uparrow$ rel. permanent risk**

Short-Run

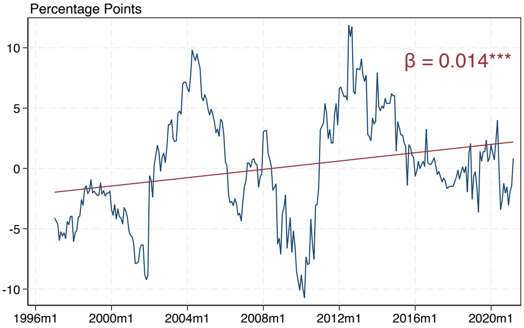
Conclusion

- ⋆ Framework to jointly assess dimensions of U.S. 'specialness' in FX, bond and equity markets
- ⋆ **Document rise in relative U.S. permanent risk vs G.7, reflected in rising equity risk premia**
- ⋆ $\downarrow$ **long-maturity UST convenience and** $\uparrow$ **rel. U.S. permanent risk are two sides of same coin**
  - ⋆ In Draft: investigate potential mechanism of dollar scarcity / fiscal sustainability

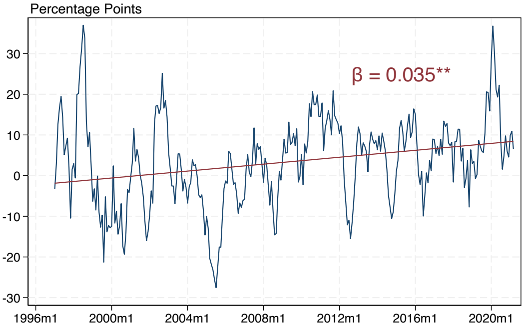
Appendix

Rising Equity Premia

Rel. U.S. vs. G.7 *Ex Ante* Eq. Premia



Rel. U.S. vs. G.7 *Ex Post* Eq. Premia



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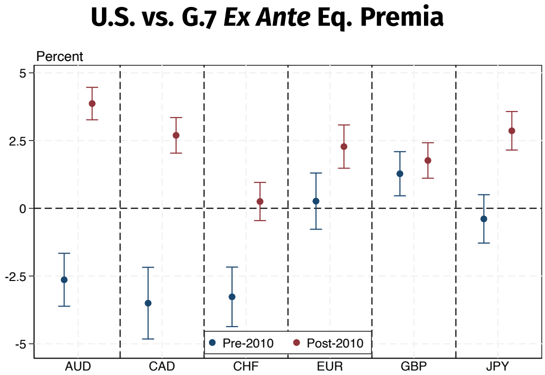
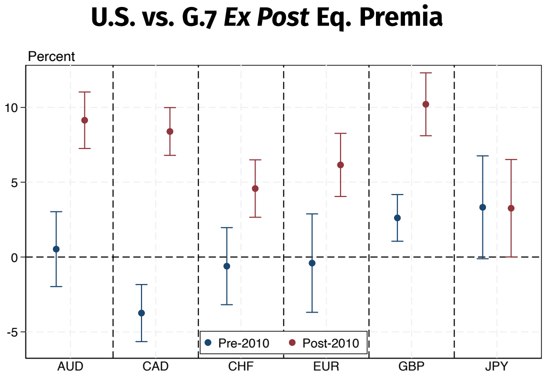
Country-by-Country Equity Premia





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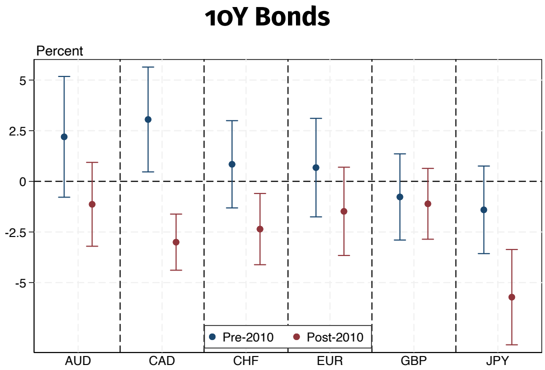
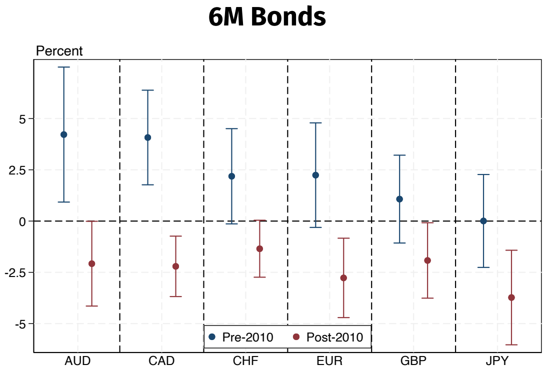
Country-by-Country Carry Trade Returns





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Measuring CIP Deviations

Du, Im & Schreger (2018)

- Bloomberg BFV govt. bond yield curves, interest-rate swaps and cross-currency basis swaps
- **Short Maturities (<1Y)**: market-implied forward premium from forward and spot FX:

$$CIP_t^{(k)} := \frac{1}{k}\left[f_t^{(k)} - e_t\right]$$

- **Longer Maturities (≥1Y)**: poor liquidity of outright forwards, so quote CIP deviation through collection of interest-rate and cross-currency basis swaps:

$$CIP_t^{(k)} = r_{irs,t}^{(k)*} - bs_t^{(k)} - r_{irs,t}^{(k)}$$

  - $r_{irs,t}^{(k)*}$: k-year swap exchanging fixed Foreign currency cash flows into floating interbank bmk. (i.e., LIBOR swap)
  - $bs_t^{(k)}$: k-year cross-currency basis swap exchanging floating Foreign currency rate for U.S. LIBOR
  - $r_{irs,t}^{(k)}$: k-year U.S. LIBOR swap exchanging fixed USD cash flows into U.S. LIBOR

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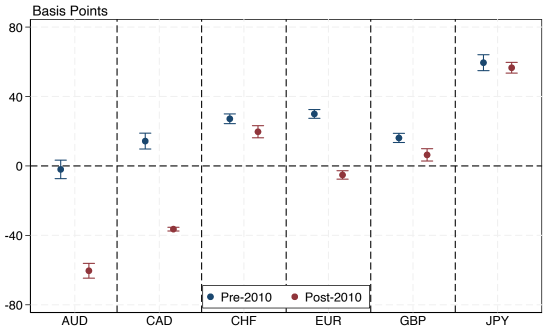
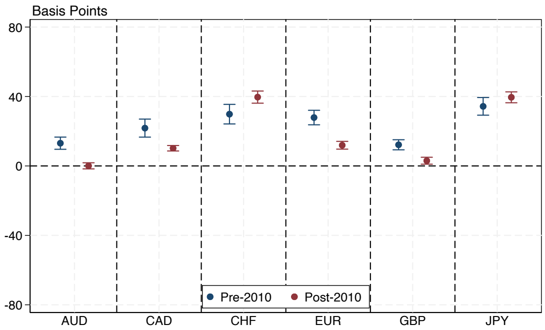
Country-by-Country CIP Deviations

10Y CIP Deviation



6M CIP Deviation



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Mapping CIP to Cross-Country Convenience Yields

Measure relative U.S. Treasury convenience $\theta_t^{F,H(k)} - \theta_t^{F,F(k)}$ from CIP deviations

$$\mathbb{E}_t[M^*_{t,t+k} \frac{\mathcal{E}_t}{\mathcal{E}_{t+k}} \underbrace{\left(\frac{F_t^{(k)}}{\mathcal{E}_t} R_t^{(k)*} \right)}_{\text{Synthetic Treasury}}] = e^{-\theta_t^{F,F(k)} - \beta_k^* (\theta_t^{F,H(k)} - \theta_t^{F,F(k)})}$$

- $\beta_k^* = 1$: Foreign investor values a synthetic Treasury same as a U.S.-issued Treasury
  - $\Rightarrow$ U.S. Treasuries only convenient due to their currency
- $\beta_k^* < 1$: Intrinsic convenience from U.S. Treasury, beyond its currency denomination

$$\theta_t^{F,H(k)} - \theta_t^{F,F(k)} := \frac{1}{1 - \hat{\beta}_k^*} CIP_t^{(k)}$$

[Jiang, Krishnamurthy & Lustig 2021]

Maturity	6-month	1-year	10-year
$\hat{\beta}_k^*$	0.77	0.88	0.84

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FX Markets

Consider equilibrium FX processes with **incomplete-market wedge** η_{t+1}:

$$\frac{\mathcal{E}_{t+1}}{\mathcal{E}_t} = \frac{M^*_{t,t+1}}{M_{t,t+1}} e^{\eta_{t+1}}$$

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* Exmpl. Mkt. Structure: trade in additional risky assets (with lower convenience yield than bonds) spanning both convenience yields and SDF risk

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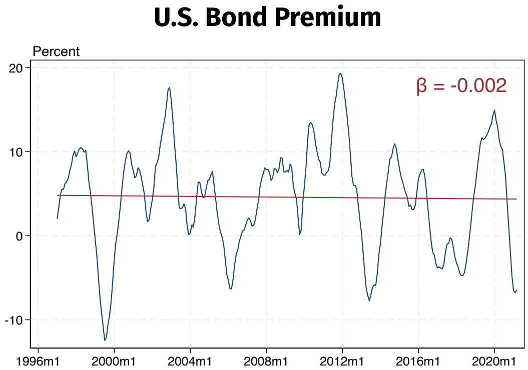
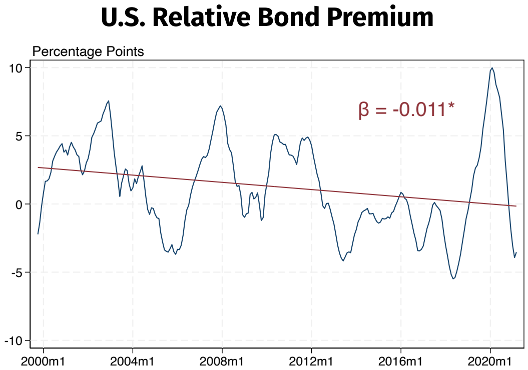
U.S. Bond Premia $rx_{t+1}^{(\infty)}$





Note. Absolute and relative (avg. vs. other G.7) U.S. transitory risk, 2000:M2 to 2020:M12.

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Dynamics of Long-Maturity Convenience and Permanent Risk

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$$\Delta CIP_t^{(10Y)} = \beta_0 + \beta_1 \Delta \mathcal{D}PermRisk_t + \beta_2 \Delta rx_{t+1}^{CT(10Y)} + \gamma \left[CIP_{t-1}^{(10Y)} - \alpha_1 \mathcal{D}PermRisk_{t-1} - \alpha_2 rx_t^{CT(10Y)} \right] + \varepsilon_t$$

Panel B: Short-Run Adjustment	(1)	(2)	(3)	(4)
$\Delta \mathcal{D}PermRisk_t$	-0.410**	-0.435**		
	(0.204)	(0.211)		
$\Delta PermRisk_t$			0.075	
			(0.321)	
$\Delta PermRisk_t^*$			-0.375*	
			(0.206)	
$\Delta \mathcal{D}TransRisk_t$				-0.045
				(0.572)
$\Delta rx_{t+1}^{CT(10Y)}$	0.107*	0.104*	0.096	0.106*
	(0.059)	(0.061)	(0.060)	(0.060)
Diseq. Adjustment $\hat{\gamma}$	-0.191***	-0.065***	-0.190***	-0.178***
	(0.038)	(0.022)	(0.037)	(0.037)
Engel-Granger Test Statistic	-4.335***	-2.707***	-4.331***	-4.149***
Deterministic Trend	Yes	No	Yes	Yes

Panel Unit-Root Tests

Table: Panel Unit Root Test Results for Long-Maturity Variables

	$CIP_t^{(10Y)}$	$\mathcal{D}PermRisk_t$	$rx_{i,t+1}^{CT(10Y)}$
Pesaran's CADF	-1.24	-1.44^{*}	-13.69^{***}

Note. Pesaran (2007) CADF tests. H_0: all panels include unit root. H_1: at least one panel does not include a unit root.

Table: Panel Unit Root Test Results for Short-Maturity Variables

	$CIP_t^{(6M)}$	$\mathcal{D}TotRisk_t$	rx_{t+1}^{FX}
Pesaran's CADF	-6.87^{***}	-5.68^{***}	-12.83^{***}

Note. Pesaran (2007) CADF tests. H_0: all panels include unit root. H_1: at least one panel does not include a unit root.

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Long-Run Cointegration

Proposition 2 + Corollary imply equilibrium relationship of the form:

$$CIP_t^{(10Y)} = \alpha_0 + \alpha_1 \mathcal{D}PermRisk_t + \alpha_2 rx_{t+1}^{CT(10Y)} + \varepsilon_t$$

Cointegration tests confirm prediction of corollary:

Table: Inference on Cointegration

Null Hypothesis	$trace$	5% Crit. Val.	λ_{max}	5% Crit. Val.
$r = 0$	47.73	29.68	34.24	20.97
$r \leq 1$	**13.49**	**15.41**	**7.71**	**14.07**
$r \leq 2$	5.78	3.76	5.78	3.76

Johansen (1991) trace-test $trace$ and max.-eigenvalue-test λ_{max} statistics for # cointegrating vectors r. Sample: 2000m1-2021m3. H_1: $r+1$ cointegrating vectors.

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Panel Cointegration Tests

Table: Panel Cointegration Tests for Long-Run Variables

Test	$CIP_t^{(10Y)}$ and $\mathcal{D}PermRisk_t$
Mod. Phillips-Perron	-3.58^{***}
Phillips-Perron	-3.19^{***}
ADF	-4.21^{***}
Westerlund Gt	-5.84^{***}
Westerlund Ga	-7.32^{***}
Westerlund Pt	-4.51^{***}
Westerlund Pa	-6.19^{***}

Note. Panel cointegration tests. H_0: no cointegration. H_1: all panels cointegrated.

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Short-Maturity Association

Proposition 1 implies following equilibrium association:

$$CIP_t^{(6M)} = \delta_0 + \delta_1 \mathcal{D}TotRisk_t + \delta_2 rx_{t+1}^{FX} + \varepsilon_t$$

	(1)	(2)	(3)
Δrx_{t+1}^{FX}	0.392^{*}	0.371^{*}	0.392^{*}
	(0.232)	(0.215)	(0.228)
$\Delta \mathcal{D}TotRisk_t$		1.285	
		(1.757)	
$\Delta TotRisk_t$			0.980
			(1.247)
$\Delta TotRisk_t^{*}$			−0.166
			(0.591)

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