

# U.S. Risk and Treasury Convenience

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The views expressed here do not necessarily reflect the position of the Bank of England.

# 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
  - ★ Suggests USD insulated from risk—i.e. no increase in risk

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$$\text{Carry-trade returns} = \text{Cross-country risk differential}$$

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  
⇒ -ve relationship relative *permanent* risk and flow convenience on long-maturity bonds
- #2. Document U.S. **permanent** risk has ↑ by ~ **15p.p.** vs. G.7 since 2008
  - Transitory risk has not ⇒ U.S. 'safe' at business-cycle frequency
- #3. Find single **cointegrating** relationship b/w permanent risk and long-maturity convenience  
⇒ ↑ rel. U.S. permanent risk explains ~**20-33%** of ↓ 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]

→ **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]

→ **'Macro' explanation for 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 ↑ since 2000s, eroding external-asset returns [Farhi & Gourio, 2018; Atkeson et al., 2022]

→ ↑ **relative U.S. permanent risk** explains ↓ long-maturity UST conv. and ↔ carry-trade returns

# Stylized Facts

# Fact 1. Rising Expected U.S. Equity Premia

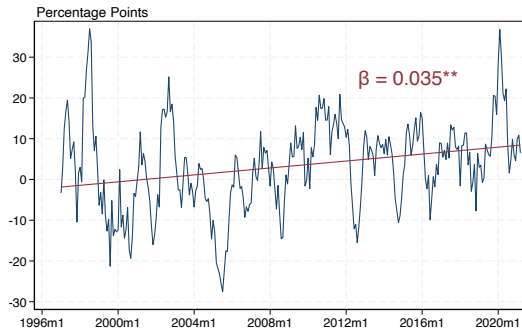
Volatility of U.S. representative investor SDF (risk) bounds Sharpe ratio on equity

[Hansen & Jagannathan 1991; Alvarez & Jermann 2005]

- In part, reflects  $\uparrow$  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  $\uparrow$  was expected:

$$\log \mathbb{E}_t \left[ \frac{R_{t,t+1}^g}{R_t} \right] : \approx \frac{D_t}{P_t} + g_t^e - (r_t - \pi_t^e)$$

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

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

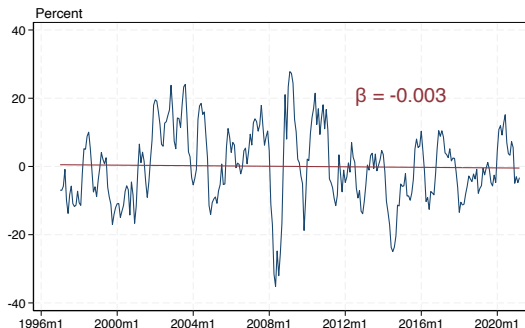
## U.S. net G.7. average *expected* equity premium



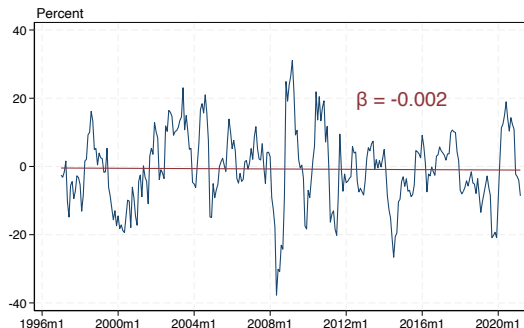
## Fact 2. Carry-Trade Returns Not Trending

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

### 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

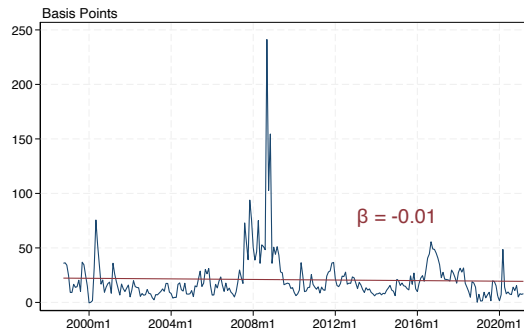
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## Short-Maturity (6M) U.S. Treasury Premium



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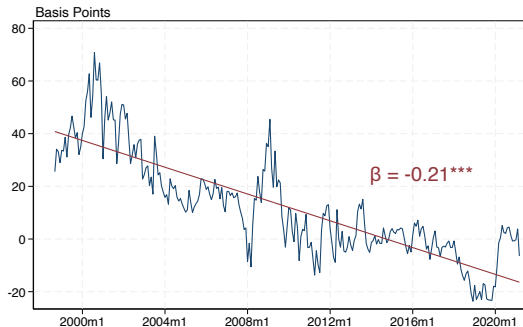
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- ▶ **Our Focus:** Long-maturity convenience

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



▶ Measurement

▶ Country-by-Country

# Model

# Model of Risk, Returns and Convenience

- Two countries:  $H$  (U.S.) and  $F$  (\*)
- Representative investor pricing kernels:  $\Lambda_t, \Lambda_t^*$  (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:

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



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- Trade in:
  - #1. **Bonds:** pecuniary returns + non-pecuniary convenience
  - #2. **Equities:** pecuniary returns
  - #3. **Foreign Exchange**

# Bond Markets

Agents invest in term structure of  $H$  and  $F$  zero-coupon bonds, with maturity  $k = 1, 2, \dots, \infty$ :

**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:**

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## Assumption 1 (Convenience-Yield Term Structure)

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

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## Assumption 2 (Complete Spanning)

*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

# Equity Markets

Agents also invest in at least one domestic risky asset:

$$1 = \mathbb{E}_t \left[ M_{t,t+1} R_{t,t+1}^g \right]$$

$$1 = \mathbb{E}_t \left[ M_{t,t+1}^* R_{t,t+1}^{g*} \right]$$

## Assumption 3 (Equities and Convenience)

*Investors trade in domestic risky asset (return  $R_{t,t+1}^g$ ) whose convenience is normalized to zero.*

# Short-Maturity Equilibrium

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

## Proposition 1 (Short-Maturity Equilibrium)

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

↑ *relative U.S. total risk can generate adjustment through two channels:*

\* **FX Risk Premia:** USD depreciates → Foreign investors earn higher Foreign bond returns:

$$rx_{t+1}^{FX} \uparrow$$

\* **Convenience Yields:** Foreign investors earn lower UST convenience:  $(\theta_t^{F,H(1)} - \theta_t^{F,F(1)}) \downarrow$

# Long-Maturity Equilibrium

## Proposition 2 (Long-Maturity Equilibrium)

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

*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  $\Delta$  rel. permanent risk can generate adjustment through non-pecuniary yields:*

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

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

# Measurement



# Total, Permanent and Transitory Risk

**Total Risk:** Lower bound conditional SDF volatility (where  $R_{t,t+1}^g$  is ‘riskiest’ return in economy):

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

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**Permanent Risk:** Lower bound for permanent SDF volatility

$$\mathcal{L}_t(M_{t,t+1}^{\mathbb{P}}) \geq \underbrace{\log \mathbb{E}_t \left[ \frac{R_{t,t+1}^g}{R_t} \right]}_{\text{Growth Optimal Portfolio}} - \underbrace{\mathcal{L}_t \left[ \frac{R_{t,t+1}^g}{R_t} \right]}_{\approx VIX^2/2 \text{ (Martin, 2017)}} - \underbrace{\mathbb{E}_t \left[ rx_{t+1}^{(\infty)} \right]}_{\propto \text{Trans. Risk}} - \underbrace{\mathbb{E}_t \left[ \theta_{t+1}^{H,H(\infty)} \right]}_{\text{Holding-Period Convenience}}$$

# Measuring Permanent and Transitory Risk

## Relative U.S. net G.7. Permanent Risk



## Relative U.S. net G.7. Transitory Risk



# Measuring Convenience

- Conv. yield differentials ( $\kappa$ -maturity)  $\theta_t^{F,H(\kappa)} - \theta_t^{F,F(\kappa)} \propto CIP_t^{(\kappa)}$  with coef.  $\frac{1}{1-\beta_\kappa^*}$

► Euler

- Assume some flow of convenience per period:

$$\theta_t^{F,H(\kappa)} - \theta_t^{F,F(\kappa)} = \omega^{(\kappa)} \left( \theta_t^{F,H(\kappa)} - \theta_t^{F,F(\kappa)} \right) + \mathbb{E}_t \left[ \theta_{t+1}^{F,H(\kappa-1)} - \theta_{t+1}^{F,F(\kappa-1)} \right]$$

⇒ holding-period convenience  $\propto$  level of CIP deviation with coef.  $\frac{\omega^{(\kappa)}}{1-\beta_\kappa^*}$

- Cannot use off-the shelf methods to estimate  $\omega, \beta$  due to non-stationarity and dependence on risk premia!

[Jiang, Krishnamurthy and Lustig 2018]

# Empirics

# Dynamics of Long-Maturity Convenience and Permanent Risk

Derive ECM:

► ECM: Short-Run Adj.

► UR, Coint tests

$$\begin{aligned}\Delta CIP_t^{(10Y)} &= \beta_0 + \beta_1 \Delta DPermRisk_t + \beta_2 \Delta rx_{t+1}^{CT(10Y)} \dots \\ &+ \gamma \left[ CIP_{t-1}^{(10Y)} - \alpha_1 DPermRisk_{t-1} - \alpha_2 rx_t^{CT(10Y)} \right] + \varepsilon_t\end{aligned}$$

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$$+ \gamma \left[ CIP_{t-1}^{(10Y)} - \alpha_1 DPermRisk_{t-1} - \alpha_2 rx_t^{CT(10Y)} \right] + \varepsilon_t$$

Panel A: Long-Run Adjustment	(1)	(2)	(3)	(4)
$DPermRisk_t$	-0.496** (0.145)	-1.037** (0.345)		
$DTransRisk_t$				-0.014 (0.400)
$rx_t^{CT(10Y)}$	0.123 (0.112)	0.181 (0.224)	0.136 (0.106)	0.140 (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

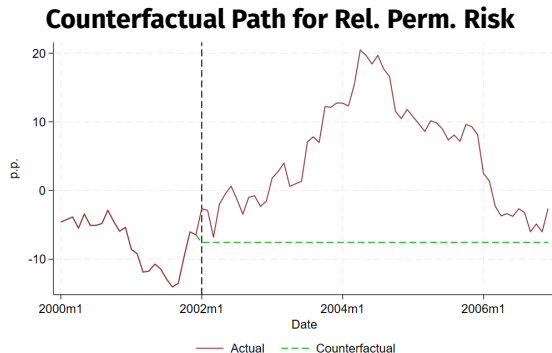
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# Contribution of Permanent Risk to Long-Maturity Convenience

Post Dot-Com Bubble

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



⇒ Full model explains  $\sim 90\%$  ↓ 10Y CIP dev., of which  $\sim 25\%$  due to ↑ rel. permanent risk

# Contribution of Permanent Risk to Long-Maturity Convenience

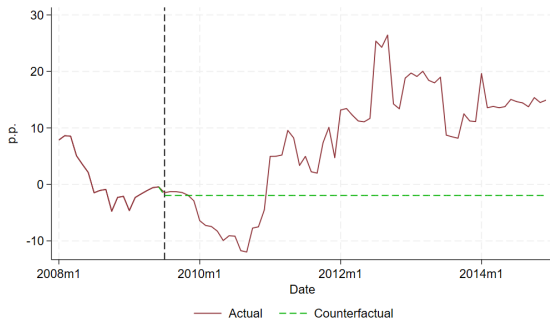
Use estimated ECM to perform counterfactual:

- Given realized path for  $rx_{t+1}^{CT(10Y)}$ , how would  $CIP_t^{(10Y)}$  have evolved if  $DPermRisk_t$  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



⇒ Full model explains  $\sim 100\%$  ↓ 10Y CIP dev., of which  $\sim 33\%$  due to ↑ 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**
- ★ **↓ long-maturity UST convenience and ↑ rel. U.S. permanent risk are two sides of same coin**
  - ★ In Draft: investigate potential mechanism of dollar scarcity / fiscal sustainability

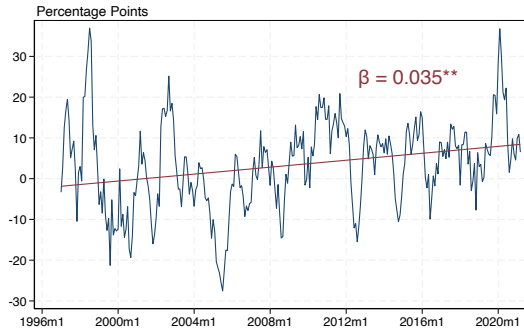
# Appendix

# Rising Equity Premia

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



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

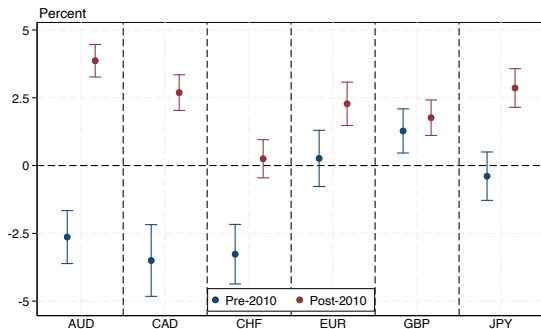


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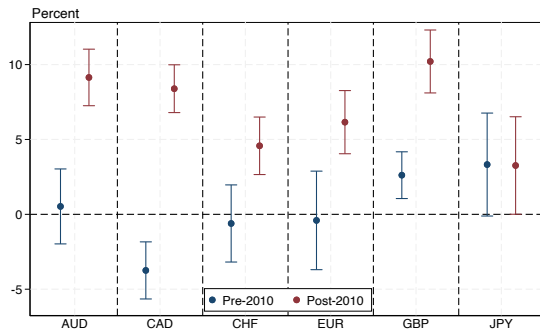


# Country-by-Country Equity Premia

## U.S. vs. G.7 Ex Ante Eq. Premia



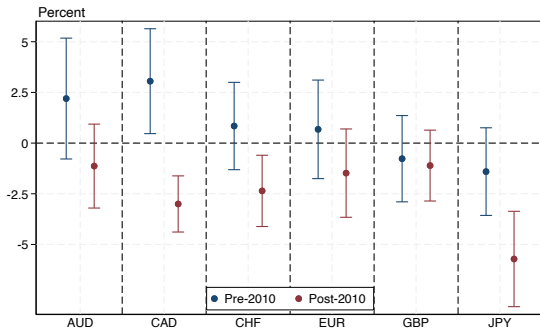
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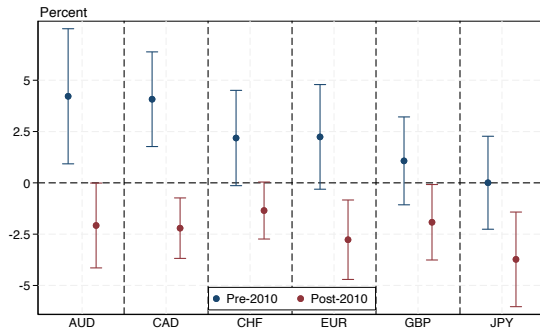
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# Country-by-Country Carry Trade Returns

## 10Y Bonds



## 6M Bonds



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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:

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

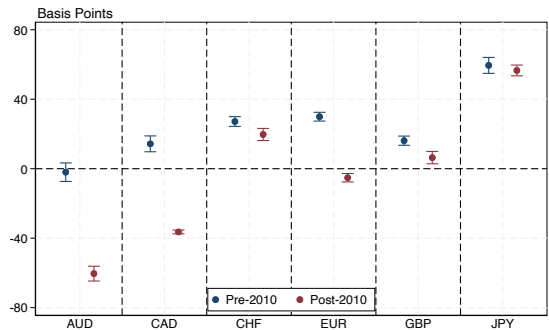
- **Longer Maturities ( $\geq 1Y$ ):** poor liquidity of outright forwards, so quote CIP deviation through collection of interest-rate and cross-currency basis swaps:

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

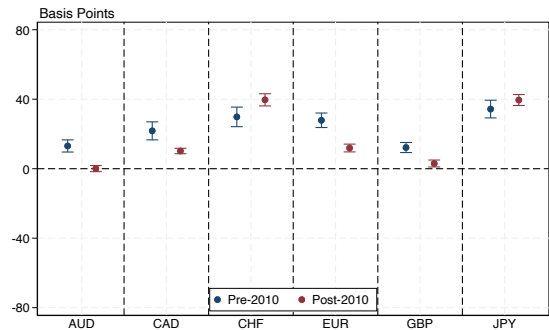
- $r_{irs,t}^{(k)*}$ :  $k$ -year swap exchanging fixed Foreign currency cash flows into floating interbank bmk. (i.e., LIBOR swap)
- $bs_t^{(k)}$ :  $k$ -year cross-currency basis swap exchanging floating Foreign currency rate for U.S. LIBOR
- $r_{irs,t}^{(k)}$ :  $k$ -year U.S. LIBOR swap exchanging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

# 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

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

- $\beta_k^* = 1$ : 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

$$\theta_t^{F,H(k)} - \theta_t^{F,F(k)} := \frac{1}{1 - \hat{\beta}_k^*} CIP_t^{(k)} \quad [\text{Jiang, Krishnamurthy \& Lustig 2021}]$$

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

# FX Markets

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

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

## Assumption 3 (Complete Spanning)

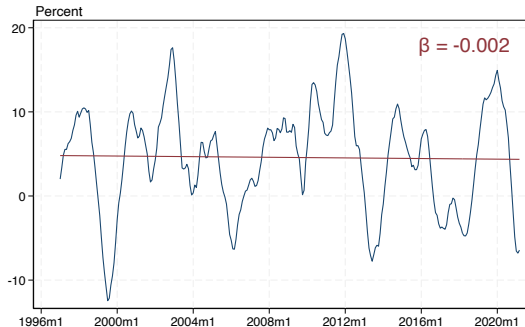
*Consider  $\lim \mathcal{L}_t(e^{\eta_{t+1}}) \rightarrow 0$ , then:  $\mathbb{E}_t[\eta_{t+1}] = \theta_t^{F,H(1)} - \theta_t^{H,H(1)} = \theta_t^{F,F(1)} - \theta_t^{H,F(1)}$*

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

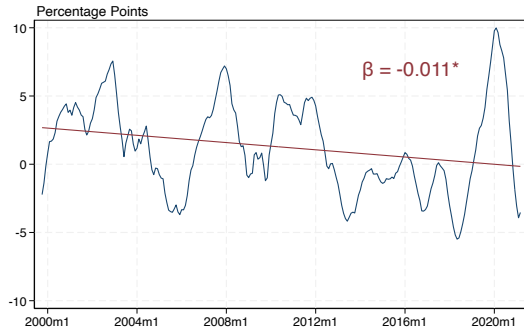
Delivers unique FX process:  $\Delta e_{t+1} = m_{t,t+1}^* - m_{t,t+1} + \theta_t^{F,H(1)} - \theta_t^{H,H(1)}$

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

## U.S. Bond Premium



## U.S. Relative Bond Premium



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

Panel B: Short-Run Adjustment	(1)	(2)	(3)	(4)
$\Delta DPermRisk_t$	-0.410** (0.204)	-0.435** (0.211)		
$\Delta PermRisk_t$			0.075 (0.321)	
$\Delta PermRisk_t^*$			-0.375* (0.206)	
$\Delta DTransRisk_t$				-0.045 (0.572)
$\Delta rx_{t+1}^{CT(10Y)}$	0.107* (0.059)	0.104* (0.061)	0.096 (0.060)	0.106* (0.060)
Diseq. Adjustment $\hat{\gamma}$	-0.191*** (0.038)	-0.065*** (0.022)	-0.190*** (0.037)	-0.178*** (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.

# Long-Run Cointegration

Proposition 2 + Corollary imply equilibrium relationship of the form:

$$CIP_t^{(10Y)} = \alpha_0 + \alpha_1 DPermRisk_t + \alpha_2 r_{t+1}^{CT(10Y)} + \varepsilon_t$$

Cointegration tests confirm prediction of corollary:

Table: Inference on Cointegration

Null Hypothesis	<i>trace</i>	5% Crit. Val.	$\lambda_{max}$	5% Crit. Val.
$r = 0$	47.73	29.68	34.24	20.97
$r \leq 1$	<b>13.49</b>	<b>15.41</b>	<b>7.71</b>	<b>14.07</b>
$r \leq 2$	5.78	3.76	5.78	3.76

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

# 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.

# Short-Maturity Association

Proposition 1 implies following equilibrium association:

$$CIP_t^{(6M)} = \delta_0 + \delta_1 \mathcal{DTotRisk}_t + \delta_2 r_{t+1}^{FX} + \varepsilon_t$$

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