A Dataset for Covered Interest Rate Parity Deviations Between Government Bond Yields

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NBER IFM Data Sources Project

Introduction

- Dataset measuring deviations from covered interest rate parity (CIP) between government bond yields
- Available at https://sites.google.com/view/jschreger/CIP
- A CIP deviation between government bond yields means that the yield on country *i*'s government bond in its own currency is ***not*** equal to the yield on a U.S. Treasury with all cash-flows hedged into currency *i*

Based on two papers

1. Du, Wenxin and Jesse Schreger (2016). "Local Currency Sovereign Risk." *Journal of Finance, 71,* 1027-1070
2. Du, Wenxin, Joanne Im, and Jesse Schreger (2018). "The U.S. Treasury Premium." *Journal of International Economics,* 112, 167-181

Both papers study the deviations from CIP but emphasize a different interpretation for emerging and developed markets

Why would CIP fail between government bonds?

1. Sovereign Default Risk
   - Du and Schreger (2016, 2017)
2. Difference in Liquidity and Convenience Yields
   - Du, Im, and Schreger (2018), Jiang, Krishnamurthy, and Lustig (2018)
3. Financial Market Frictions
   - CIP deviations for risk free rates: Du, Tepper, and Verdelhan (2017)
   - Segmented markets (capital controls)

Covered Interest Rate Parity for Government Bond Yields

Measuring CIP deviations between government bond yields:

$$\Phi_{i,n,t} \equiv y^{Govt}_{i,n,t} - \rho_{i,n,t} - y^{Govt}_{USD,n,t}$$

- $y^{Govt}_{i,n,t}$ is the government bond yield of country i in it's own currency at maturity n at time t
- $y^{Govt}_{USD,n,t}$ is the government bond yield of the United States in USD at maturity n at time t
- $\rho_{i,n,t}$ is the forward premium $\left(\frac{1}{n}\left(f_{i,n,t} - s_{i,t}\right)\right)$
- $\Phi_{i,n,t}$ is the CIP deviation between government bond yields of country i and the United States at tenor n at time t

Main Dataset

$$\Phi_{i,n,t} = y^{Govt}_{i,n,t} - \rho_{i,n,t} - y^{Govt}_{USD,n,t}$$

Symbol	Variables	Definition
$y^{Govt}_{i,n,t} - y^{Govt}_{USD,n,t}$	diff_y	Foreign - US Govt bond yield spread (%)
$\rho_{i,n,t}$	rho	Forward premium (%)
$\Phi_{i,n,t}$	cip_govt	CIP deviation between Govt bond yields (bps)

At currency i, tenor n, and date t

- $y^{Govt}_{i,n,t} - y^{Govt}_{USD,n,t}$: based on government yield curves in Bloomberg
- $\rho_{i,n,t}$: based on swap/forward data from Bloomberg and spot rates from Datastream and Bloomberg
- **Commercial data restrictions mean we cannot post raw data, only constructed data**

Sample Coverage

- Countries:
  - Developed markets (G10): Australia (AUD), Canada (CAD), Switzerland (CHF), Denmark (DKK), Germany (EUR), United Kingdom (GBP), Japan (JPY), Norway (NOK), New Zealand (NZD), Sweden (SEK)
  - Emerging markets (EM): Brazil (BRL), Colombia (COP), Hungary (HUF), Indonesia (IDR), Israel (ILS), Korea (KRW), Mexico (MXN), Malaysia (MYR), Peru (PEN), Philippines (PHP), Poland (PLN), Russia (RUB), Thailand (THB), Turkey (TRY), South Africa (ZAR)
- Time: Daily data, back to ~2000 for G10 and ~2005 for EMs (unbalanced panel)
- Tenors: 3-month (3M), 1-year (1Y), 3Y, 5Y, 7Y, 10Y

Construction of Forward Premium

- Forward premium:

$$\rho_{i,n,t} = \frac{1}{n}\left(f_{i,n,t} - s_{it}\right)$$

where $f_{i,n,t}$ is the log forward rate and $S_{i,t}$ is the log spot exchange rate

- Can measure this directly using forwards at short tenors
- At longer tenors, forward markets illiquid and so forward premium is constructed using swaps. Idea is exactly the same.

Construction of 1Y+ Forward Premium (Details)

- For countries with deliverable currencies

$$\rho_{i,n,t} = irs_{i,n,t} + bs_{i,n,t} - irs_{USD,n,t}$$

- For many EMs

$$\rho_{i,n,t} = nds_{i,n,t} - irs_{USD,n,t},$$

- $irs_{i,n,t}$: interest rate swap, exchanges fixed currency i cash flows into the floating interbank rate (e.g. Libor)
- $bs_{i,n,t}$: cross-currency basis swap, exchanges i floating interbank rate into USD Libor
- $nds_{i,n,t}$: non-deliverable cross-currency swap, exchanges fixed currency i cash flows into USD Libor, cash settled in USD

▸ Cash-Flow Diagram

Dataset Supplement

- Raw data are from Bloomberg and Datastream
- We have posted an Excel file with tickers and variable names for all instruments used in the construction of CIP deviations
  - Government bond yields
  - IRS rates
  - Cross-currency basis swaps
  - Tenor basis swaps
  - Dates when quoting conventions change
- Note: the dataset is not identical to that used in either published paper. This dataset only uses commercially available data and some Bloomberg tickers have been updated. Current data represents best available data to our knowledge.

What can we learn by measuring CIP deviations?

$$\Phi_{i,t} \equiv y^{Govt}_{i,t} - \rho_{i,t} - y^{Govt}_{USD,t}$$

$$y^{Govt}_{i,t} \approx \underbrace{y^{rf}_{i,t}}_{\text{Risk-Free Rate in } i} - \underbrace{\lambda_{i,t}}_{\text{Convenience Yield}} + \underbrace{l_{i,t}}_{\text{Credit Spread}}$$

$$y^{Govt}_{USD,t} \approx y^{rf}_{USD,t} - \lambda_{USD,t} + l_{USD,t}$$

$$y^{rf}_{i,t} \approx y^{rf}_{USD,t} + \rho_{i,t} + \underbrace{\tau_{i,t}}_{\text{Risk-Free CIP Deviation}}$$

What can we learn by measuring CIP deviations?

$$\Phi_{i,t} \equiv y_{i,t}^{Govt} - \rho_{i,t} - y_{USD,t}^{Govt}$$

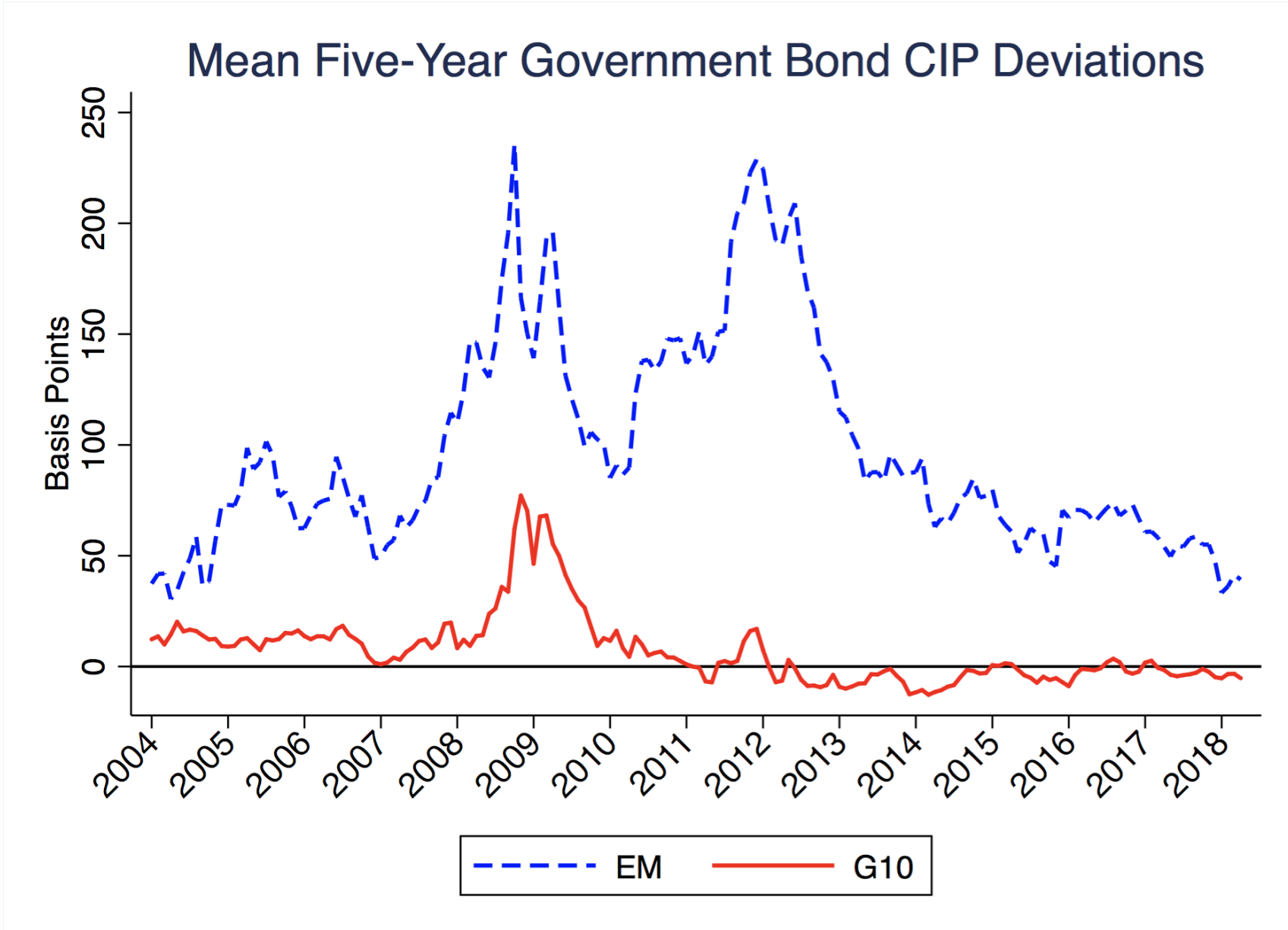
$$y_{i,t}^{Govt} \approx y_{i,t}^{rf} - \lambda_{i,t} + l_{i,t}$$

$$y_{USD,t}^{Govt} \approx y_{USD,t}^{rf} - \lambda_{USD,t} + l_{USD,t}$$

$$y_{i,t}^{rf} \approx y_{USD,t}^{rf} + \rho_{i,t} + \tau_{it}$$

$$\Phi_{i,t} \approx \underbrace{\hat{\lambda}_{i,t}}_{\text{Relative Convenience Yield}} - \underbrace{\hat{l}_{i,t}}_{\text{Relative Credit Spread}} + \underbrace{\tau_{i,t}}_{\text{Risk-Free CIP Deviation}}$$

CIP Between Government Bonds at 5Y



Local Currency Credit Spread

- Assumptions to measure for default risk in EMs (Du Schreger 2016): $\lambda_{i,t,} \approx 0$, $\lambda_{USD,t} \approx 0$, $\tau_{i,t} \approx 0, l_{USD,t} \approx 0$

$$\Phi_{i,t} \equiv y_{i,t}^{Govt} - \rho_{i,t} - y_{USD,t}^{Govt}$$

$$y_{i,t}^{Govt} \approx y_{i,t}^{rf} - \lambda_{i,t} + l_{i,t}$$

$$y_{USD,t}^{Govt} \approx y_{USD,t}^{rf} - \lambda_{USD,t} + l_{USD,t}$$

$$y_{i,t}^{rf} \approx y_{USD,t}^{rf} + \rho_{i,t} + \tau_{it}$$

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$$\Phi_{i,t} \equiv y_{i,t}^{Govt} - \rho_{i,t} - y_{USD,t}^{Govt}$$

$$y_{i,t}^{Govt} \approx y_{i,t}^{rf} + l_{i,t}$$

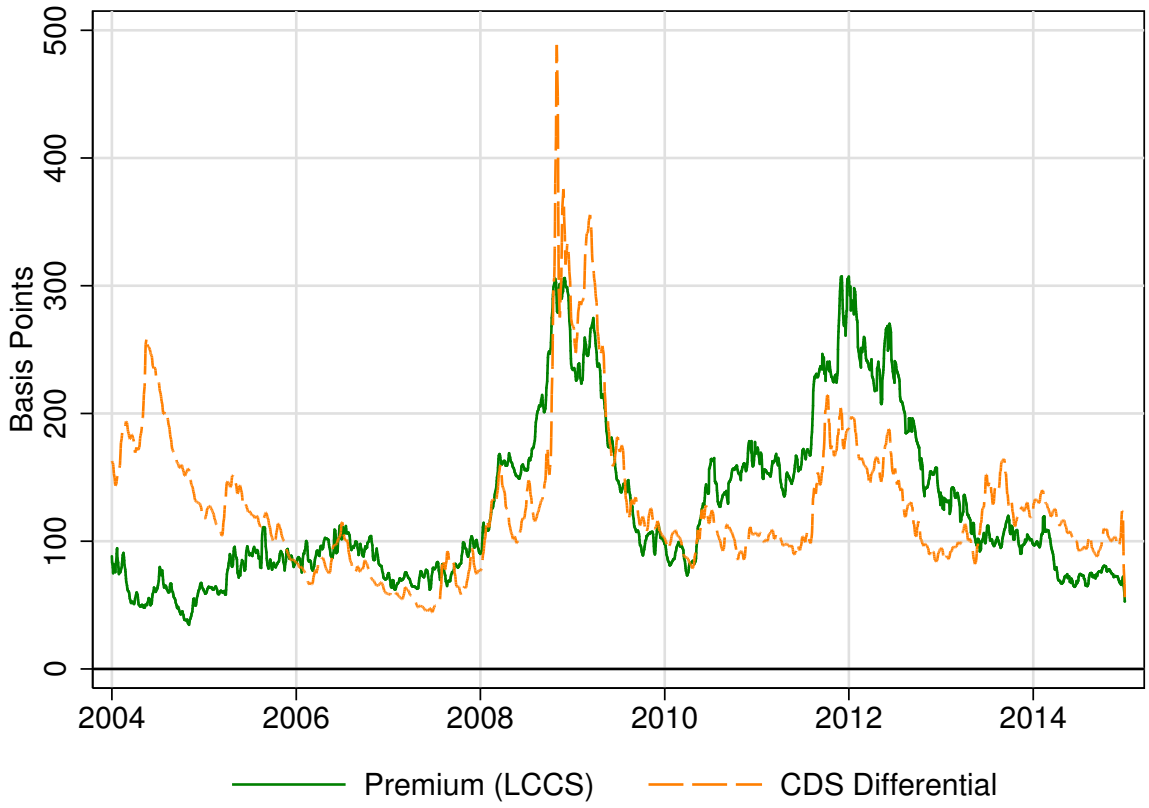
$$y_{i,t}^{rf} \approx y_{USD,t}^{Govt} + \rho_{i,t}$$

$$\boxed{\Phi_{i,t} \approx \underbrace{l_{i,t}}_{\text{LC Credit Spread}}}$$

Deviation from CIP measures the default risk in an EM sovereign bond because $y_{USD,t} + \rho_{i,t}$ measures the risk-free rate in currency i

CIP Deviations in Emerging Markets and Default Risk

Figure: EM CIP Failure and CDS Spreads, 5Y



Green line: Mean CIP deviation between EM govt bonds and US Treasuries
Orange line: Mean difference in CDS spread between EMs and US government

U.S. Treasury Premium

- Assumptions to measure relative convenience yield in G10 (Du, Im, Schreger 2018), $l_{i,t} \approx 0$, $l_{USD,t} = 0$, $\tau_{it} \approx 0$ (relaxed in paper)

$$\Phi_{i,t} \equiv y_{i,t}^{Govt} - \rho_{i,t} - y_{USD,t}^{Govt}$$

$$y_{i,t}^{Govt} \approx y_{i,t}^{rf} - \lambda_{i,t} + l_{i,t}$$

$$y_{USD,t}^{Govt} \approx y_{USD,t}^{rf} - \lambda_{USD,t} + l_{USD,t}$$

$$y_{i,t}^{rf} \approx y_{USD,t}^{rf} + \rho_{i,t} + \tau_{it}$$

$$\Phi_{i,t} \approx \underbrace{\hat{\lambda}_{i,t}}_{\text{Relative Convenience Yield}} - \underbrace{\hat{l}_{i,t}}_{\text{Relative Credit Spread}} + \underbrace{\tau_{i,t}}_{\text{Risk-Free CIP Deviation}}$$

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$$\Phi_{i,t} \equiv y_{i,t}^{Govt} - \rho_{i,t} - y_{USD,t}^{Govt}$$

$$y_{i,t}^{Govt} \approx y_{i,t}^{rf} - \lambda_{i,t}$$

$$y_{USD,t}^{Govt} \approx y_{USD,t}^{rf} - \lambda_{USD,t}$$

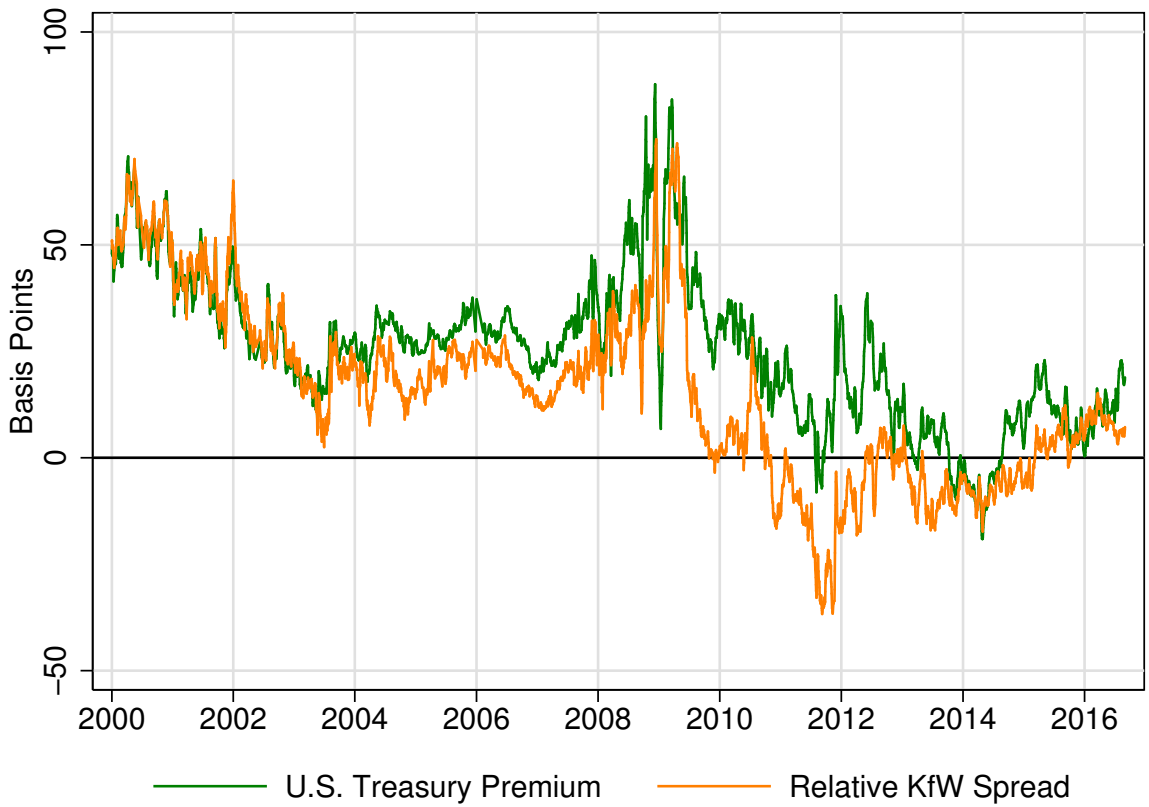
$$y_{i,t}^{rf} \approx y_{USD,t}^{rf} + \rho_{i,t}$$

$$\Phi_{i,t} \approx \underbrace{\hat{\lambda}_{i,t}}_{\text{Relative Convenience Yield}}$$

Deviation from CIP measures the difference in convenience yields between country $i's$ government bond and a U.S. Treasury

CIP Deviations as a Convenience Yield

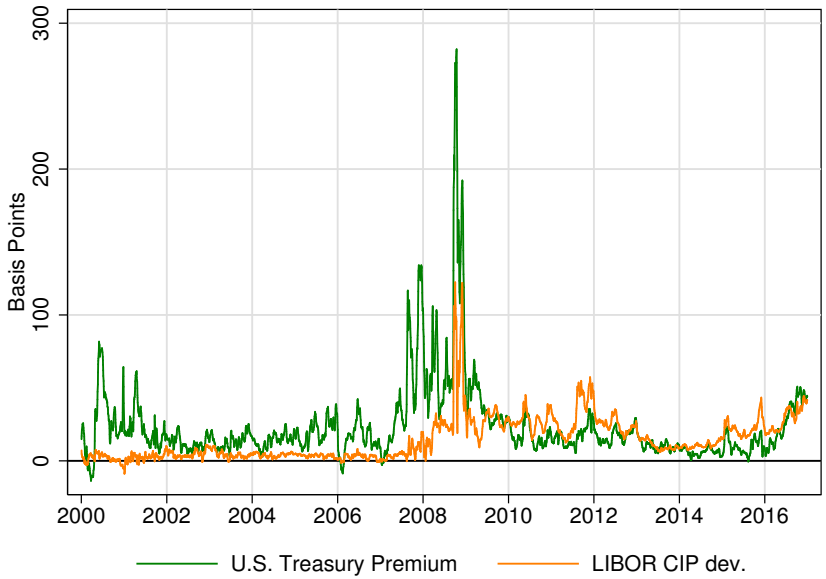
Figure: EUR-USD CIP Failure and Relative KfW Spread, 5Y



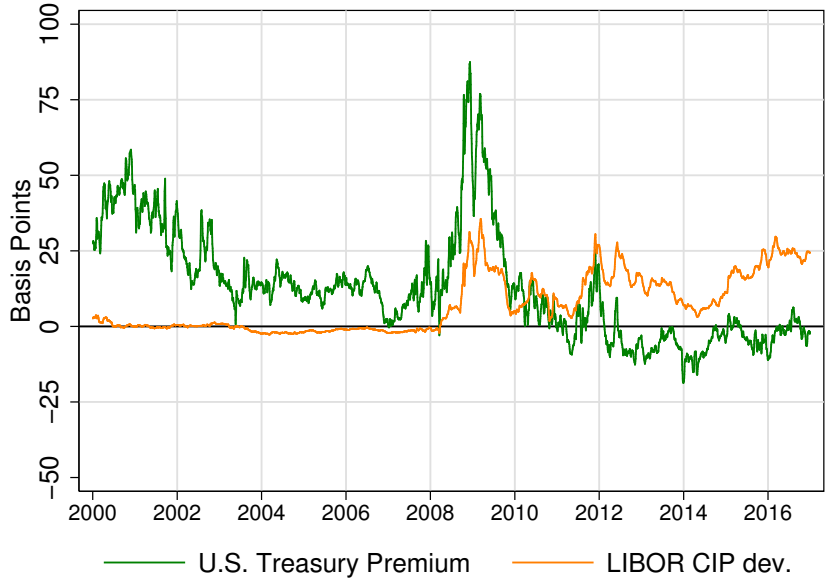
$$\text{Relative KfW spread} = \left(y^{Govt}_{EUR,5Y,t} - y^{KfW}_{EUR,5Y,t}\right) - \left(y^{Govt}_{USD,5Y,t} - y^{KfW}_{USD,5Y,t}\right)$$

Government Bond and Libor CIP Deviations

Figure: G10 Currencies, Average



(a) 3-Month



(b) 5-Year

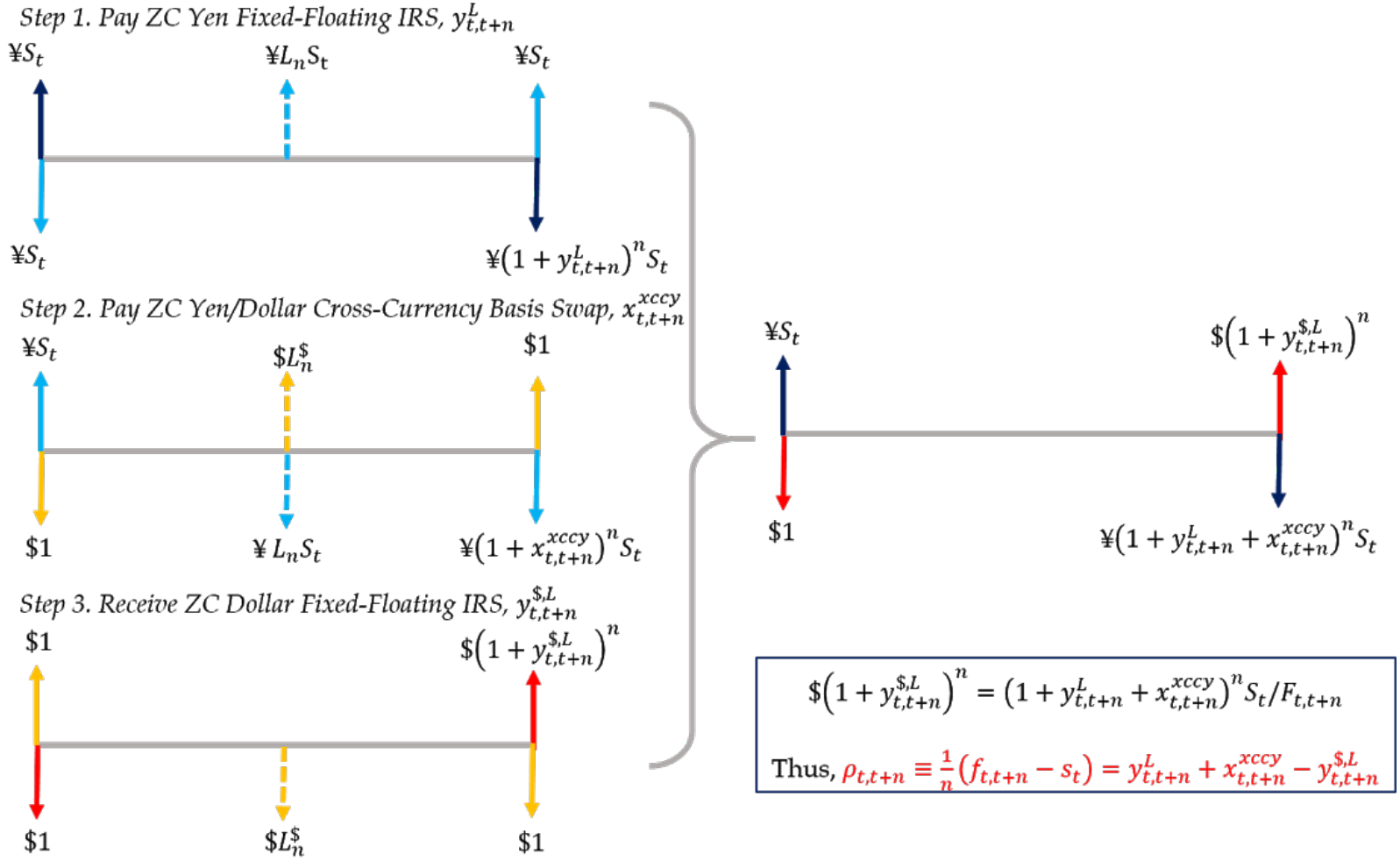
Caveats

1. Illiquidity in forwards/swaps can lead to measurement problems for EMs
   - Three-month premium can be quite noisy for several EMs (e.g. THB, MYR)
   - Forwards/swaps become more illiquid during time of distress, which introduces downward bias to the U.S. Treasury Premium during the crisis
2. Market segmentation (i.e. capital controls) complicates interpretation of measure
   - Large negative spreads in for IDR, RUB during crisis

Conclusion

- CIP deviations in government bonds useful to study a number of important questions
  - Nature of default risk on local currency debt
  - Safe assets and the exorbitant privilege
  - Exchange rate determination
  - Market integration and the effects of capital controls

Construction of Forward Premium



Source: Du, Tepper, Verdelhan (2017)

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