The paper quantifies the difference in the convenience yield of U.S. Treasuries and government bonds of other developed countries by measuring the deviation from covered interest parity between government bond yields.

The U.S. Treasury Premium

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Introduction

The research paper quantifies the difference in convenience yield of U.S. Treasuries and government bonds of other developed countries. This is done by measuring the deviation from CIP (Covered Interest Parity) between government bond yields. For each foreign country, a positive premium implies:

$$Convenience\ Yield(U.S.\ Treasuries) > Convenience\ Yield(Foreign\ country\text{^}'s\ govt.\ bond)$$

The U.S. Treasury Premium has been measured vis-à-vis govt. bonds in Australia, Canada, Denmark, Germany (benchmarked for Europe), Japan, New Zealand, Norway, Sweden, Switzerland and the United Kingdom (commonly referred as G10 currency countries).

Basic Terminologies

Convenience Yield:

A convenience yield is the benefit or premium associated with holding an underlying product or physical good, rather than the associated derivative security or contract. If investors value the liquidity and safety of government bonds, they may be willing to accept a lower yield to hold them over alternative investments that offer the same cash flows. The extent to which they value these non-pecuniary benefits is often referred to as the "convenience yield".

Covered Interest Parity (CIP):

Covered interest rate parity refers to a theoretical condition in which the relationship between interest rates and the spot and forward currency values of two countries are in equilibrium. Covered interest rate parity is a no-arbitrage condition that could be used in the foreign exchange markets to determine the forward foreign exchange rate. The condition also states that investors could hedge foreign exchange risk or unforeseen fluctuations in exchange rates (with forward contracts).

Interest Rate Swaps (Fixed-Floating):

Interest rate swaps usually involve the exchange of a fixed interest rate for a floating rate, or vice versa. This helps reduce or increase exposure to fluctuations in interest rates or to obtain a marginally lower interest rate than would have been possible without the swap.

Basis Swap (Floating-Floating):

A basis rate swap (or basis swap) is a type of swap agreement in which two parties agree to swap variable interest rates based on different money market reference rates. The goal of a basis rate swap is for a company to limit the interest rate risk it faces as a result of having different lending and borrowing rates.

Overnight Indexed Swaps (Fixed-Floating):

An overnight index swap uses an overnight rate index such as the federal funds rate as the underlying rate for the floating leg, while the fixed leg would be set at a rate agreed on by both parties.

Data Sources

The paper has used major data providers such as Bloomberg, IHS Markit, and Thomson Reuters. However, in our implementation we have used only Bloomberg's data (snapshot of tickers below).

Table A1: Bloomberg Tickers: IRS, Basis Swaps, Government Yields, Policy Rates, OIS Swap Rates

	Series					
Currency	IRS	Basis Swaps	Government Yields	Policy Rates	OIS Swap Rates	VIX
USD	USSW## Curncy		C082##Y Index	FEDL01 Index	USSO## Curncy	VIX Index
EUR	EUSW##V3, EUSA## Curncy	EUBS## Curncy	C910##Y Index	EUORMARG Index	EUSWE## Curncy	
GBP	BPSW##V3, BPSW## Curncy	BPBS## Curncy	C110##Y Index	UKBRBASE Index	BPSWS## Curncy	
CHF	SFSW##V3, SFSW## Curncy	SFBS## Curncy	C256##Y Index	SZLTTR Index	SFSWT## Curncy	
JPY	JYSW## Curncy, JYBC## Curncy	JYBS## Curncy	C105##Y Index	MUTKCALM Index	JYSO## Curncy	
AUD	ADSWAP## Curncy	ADBS## Curncy	C127##Y Index	RBACOR Index	ADSO## Curncy	
CAD	CDSW## Curncy	CDBS## Curncy	C101##Y Index	CABROVER Index	CDSO## Curncy	
NZD	NDSWAP## Curncy	NDBS## Curncy	C250##Y Index	NZOCR Index	NDSO10## Curncy	
NOK	NKSW## Curncy, NKBFV## Curncy	NKBS## Curncy	C266##Y Index	NOBRDEP Index		
SEK	SKSW## Curncy	SKBS## Curncy	C259##Y Index	SWBRDEP Index		
DKK	DKSW## Curncy	DKBS## Curncy	C267##Y Index	DEBRDISC Index		

Notes: This table lists the Bloomberg tickers used to construct the U.S. Treasury Premium for each country. The ## denotes the maturity of the contract. EUR denotes Germany.

Data Preprocessing

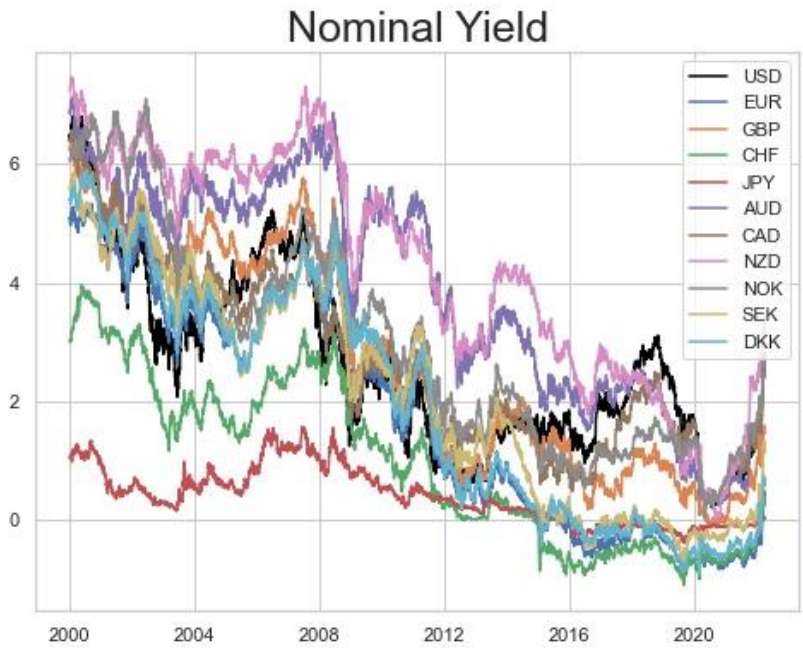
- Columns Renaming – for better interpretability
- Backward & Forward Filling the data
    - First forward fill the data assuming the yesterday's rate will same as today's rate in case of unavailable of data.
    - Then backfill the data assuming that today's rate will be same as yesterday's rate in case of unavailability of data.
- Converting the Basis Swap value into percentage terms from basis terms by dividing it by 100

Assumptions

- Govt. bonds are default-free.
    - Except for Japan, all sample countries have AA or above sovereign credit ratings and are perceived as near default-free.
- International financial markets are frictionless.

Preliminary Data Visualization

- Plotting the Nominal Yields
    - Currency-specific nominal yields of our 10 countries sample at the five-year horizon
    - The variation across country is wide.



Methodology

Formal Definition:

U.S. Treasury Premium ($\varphi_{i,n,t}$):

At time t, the n-year U.S. Treasury Premium ($\varphi\ (i, n, t)$) vis-à-vis country i as the deviation from covered interest rate parity between government bond yields in the U.S. and country i:

$$\varphi_{i,n,t} = y_{i,n,t}^{Govt} - \rho_{i,n,t} - y_{USD,n,t}^{Govt}$$

U.S. Treasury Premium is defined for each country in our sample. It is the deviation from the CIP between government bond yields in US and sample country.

Market-implied forward premium ($\rho_{i,n,t}$):

Market-implied forward premium is also defined at country-level. For maturity less than a year, it is the mean of log difference in Forward rate and Spot rate. However, for longer maturities equal to or greater than one year, the liquidity of outright forward contracts is quite poor. The market convention is instead to quote the forward premium through a collection of interest rate swaps and cross-currency basis swaps based on the given formula.

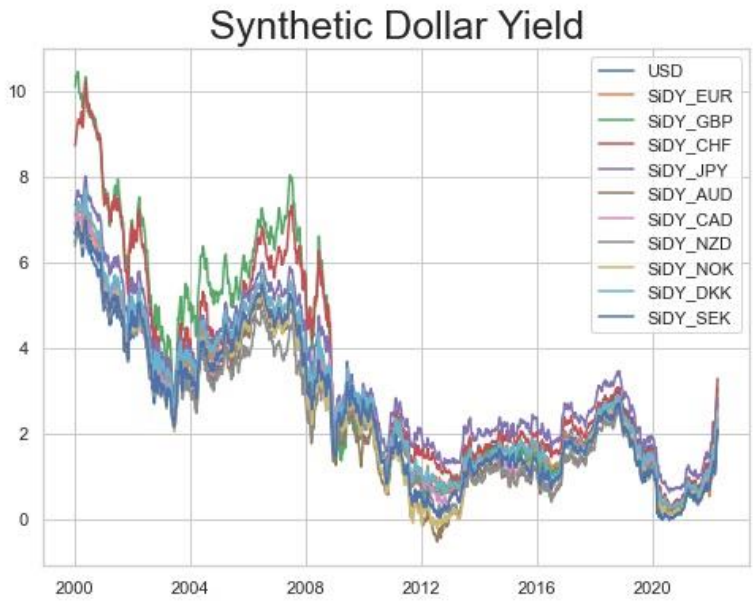
- ***Maturity<1year:*** average over time of log difference in the outright forward F (i, t, t+1) and spot exchange rate S (i, t).
- ***Maturity>=1year:*** quoted as a collection of interest rate swaps and cross-currency basis swaps as described:

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

Swap-implied Dollar Yield ($SiDY_{i,n,t}$):

It is clear that these swap-implied dollar yields track the yield on U.S. Treasuries very closely, with significantly less dispersion than currency-specific yields:

$$SiDY_{i,n,t} = y_{i,n,t}^{Govt} - \rho_{i,n,t}$$



Variation of U.S. Treasury Premium

$$\boldsymbol{\varphi'_{i,n,t} = \varphi_{i,n,t} - \tau_{i,n,t}}$$

There are a number of places where the assumptions made in the previous section could fail.

- First, each sovereign bond could have some default risk, and V(i,n,t) could be capturing sovereign credit risk differentials.
- Second, there could be frictions in the swap market, such that the observed forward premium q(i,n,t) is different than the hypothetical premium q(i, n, t) that ensures CIP for risk-free rates.
- Third, government bonds could be mispriced due to market segmentation, financial repression, or other frictions.

Premium, Adj. LIBOR CIP dev. ($\boldsymbol{\varphi_{i,n,t}^{CIP}}$):

In the benchmark calculation, we use the Libor interest rate swap as our risk-free rate proxy:

$$\varphi_{i,n,t}^{\boldsymbol{CIP}} = \varphi_{i,n,t} - \tau_{i,n,t}$$

Where, CIP deviations for LIBOR rates is measured as:

$$\tau_{i,n,t} = (irs_{i,n,t} - irs_{USD,n,t}) - \rho_{i,n,t}$$

Premium, Adj. LIBOR CIP dev & CDS. ($\boldsymbol{\varphi_{i,n,t}^{LIBOR,\,CDS}}$):

It measures the credit risk differential between sovereigns, $\Gamma\ (i, n, t)$, as the difference in CDS spreads:

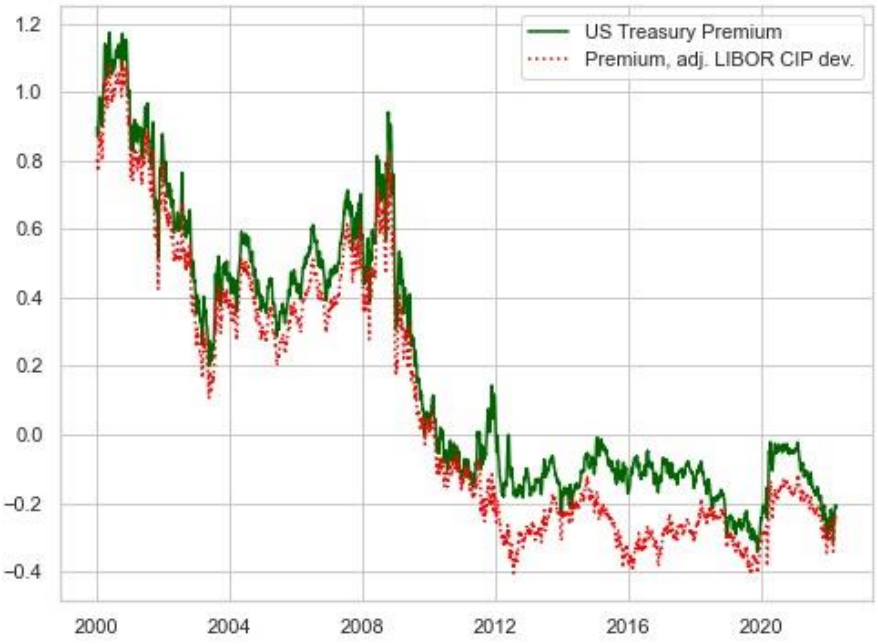
$$\varphi_{i,n,t}^{\boldsymbol{CIP,\ CDS}} = \varphi_{i,n,t} - \tau_{i,n,t} + \hat{I}_{i,n,t}$$

Where, CIP deviations for LIBOR rates is measured as:

$$\tau_{i,n,t} = (irs_{i,n,t} - irs_{USD,n,t}) - \rho_{i,n,t}$$

$$\hat{I}_{i,n,t} \equiv I_{USD,n,t} - I_{i,n,t}$$

Note: This variation is not covered in the analysis as we did not have CDS data for the G10 countries.



Here is the cross-country mean of the five-year U.S. Treasury Premium and the one versions of the adjusted premium as discussed in previous slide.

1. The difference between these measures is smallest from 2000 to 2006. During that time, CIP held for interbank rates between U.S. and foreign countries were approximately zero. Therefore, the U.S. Treasury Premium and the adjusted versions, were nearly equal.
2. During the GFC (2007–2009), all three measures widened with the benchmark premium widening most significantly.
3. In the post-GFC sample (2010–2016), we document a steady decline in the U.S. Treasury Premium. Also, the term spread widens due to increased difference in IRS of each country and USD.

U.S. Treasury Premiums

Summary Statistics

- U.S. Treasury premiums vis-à-vis other sample countries all exhibit a decline post-crisis.
- Except for Australia and Norway, U.S. Treasury premiums vis-à-vis other sample countries has shown continuous decline even after 2016 as well.

		Full Sample	2000-2006	2007-2009	2010-2016	2017-2021
AUD	mean	-0.274442	0.049871	-0.158500	-0.584616	-0.357615
	sem	0.004039	0.003653	0.008494	0.003600	0.004037
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
CAD	mean	0.020292	0.266418	0.293134	-0.177683	-0.197813
	sem	0.003708	0.003745	0.010263	0.003523	0.001684
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
CHF	mean	0.768251	1.488871	1.421674	0.289132	0.079138
	sem	0.011386	0.021122	0.027252	0.004367	0.003320
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
DKK	mean	0.237812	0.597210	0.555338	0.016215	-0.124142
	sem	0.004492	0.002980	0.004659	0.003503	0.002548
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
EUR	mean	0.166233	0.472989	0.378175	0.024235	-0.171602
	sem	0.003757	0.002417	0.004403	0.002300	0.003732
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
GBP	mean	0.784535	2.049544	1.415205	-0.013945	-0.187465
	sem	0.015110	0.016033	0.042539	0.002532	0.003497
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
JPY	mean	0.674165	0.874277	0.887737	0.608120	0.375583
	sem	0.003499	0.004466	0.007538	0.003923	0.003345
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
NOK	mean	-0.125777	0.157313	0.082524	-0.405539	-0.247437
	sem	0.003973	0.002683	0.008390	0.005522	0.003267
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
NZD	mean	-0.266208	-0.081532	-0.161686	-0.391345	-0.403833
	sem	0.003790	0.005935	0.014709	0.004920	0.003905
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000
SEK	mean	-0.078783	0.193951	0.245672	-0.287907	-0.346671
	sem	0.003830	0.002137	0.005016	0.003527	0.003691
	count	5805.000000	1819.000000	784.000000	1826.000000	1376.000000

Average U.S. Treasury Premium

- U.S. Treasury premiums have declined over the years for all maturities.
- Can we solely blame the 2008 crisis for the decline?
    - Answer: We find that even though medium- to-long-term U.S. Treasuries have lost their specialness relative to other near-default free government bonds since the GFC, short-dated U.S. Treasury bills still command a sizable premium

Maturity=1-year:

	Full Sample	2000-2006	2007-2009	2010-2016	2017-2021
mean	0.370223	0.778625	0.766849	0.056969	0.019302
sem	0.007368	0.009031	0.023243	0.003682	0.003531
count	5805.000000	1819.000000	784.000000	1826.000000	1305.000000

Maturity=5-year:

	Full Sample	2000-2006	2007-2009	2010-2016	2017-2021
mean	0.220540	0.652773	0.523733	-0.070603	-0.133089
sem	0.005973	0.007004	0.014250	0.003799	0.003105
count	5805.000000	1819.000000	784.000000	1826.000000	1305.000000

Maturity=10-year:

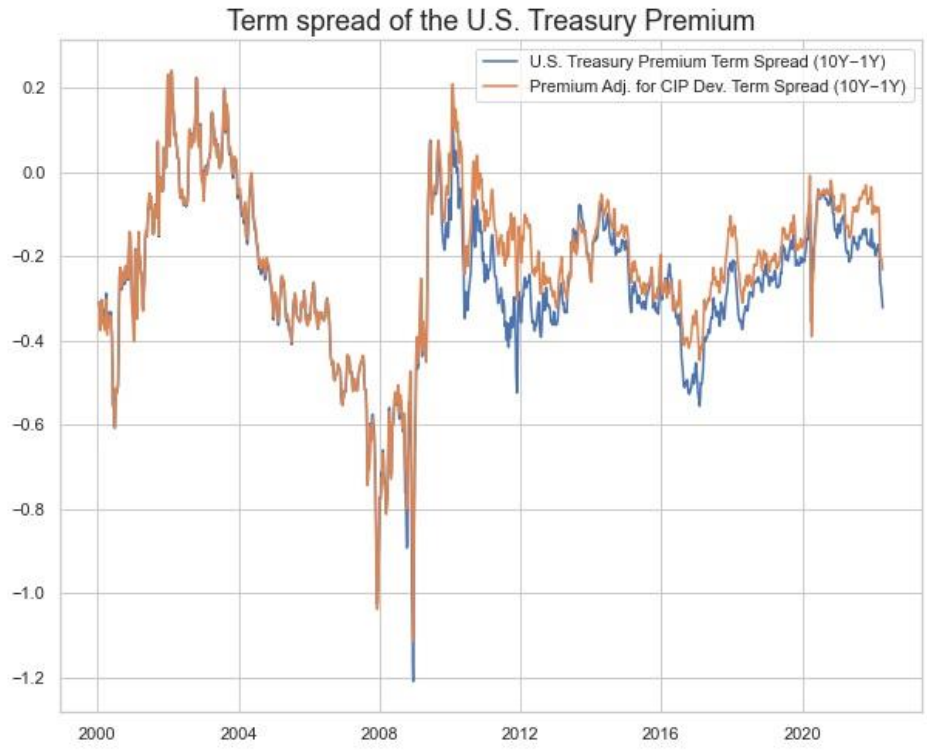
	Full Sample	2000-2006	2007-2009	2010-2016	2017-2021
mean	0.116389	0.573127	0.266613	-0.173554	-0.191068
sem	0.005624	0.006790	0.011465	0.003720	0.003345
count	5805.000000	1819.000000	784.000000	1826.000000	1305.000000

U.S. Treasury Premium

- Before the GFC (2004-2008), the term structure of the U.S. Treasury Premium is upward sloping and the average premia are positive across all maturities.
- During the GFC, we see an inversion in the term structure of the premia and an increase in the U.S. Treasury Premium across maturities, with the increase concentrated at shorter maturities.

U.S. Treasury Premium Term Spread (10-1Y)

- The term spread of the U.S. Treasury Premium, which we define as the ten-year premium minus the one-year premium, for the U.S. Treasury premium and the adjusted version.
- The term spread becomes negative for all three premium measures post-GFC.
- This also directs us to postulate that even though medium- to-long-term U.S. Treasuries have lost their specialness relative to other near-default-free government bonds.



Decomposition of the U.S. Treasury Premium

- This decomposition shows that the decline in the U.S. Treasury Premium is largely driven by the decline in the U.S. swap spread from 53 basis points pre-crisis to 13 basis points after the crisis.
- Meanwhile, the average non-U.S. swap spread only increased slightly from 6 basis points to 33 basis points.

		Swap spread					Cross-currency basis				
		Full Sample	2000-2006	2007-2009	2010-2016	2016-2021	Full Sample	2000-2006	2007-2009	2010-2016	2016-2021
AUD	mean	0.408667	0.388182	0.710748	0.468760	0.176029	0.173499	0.094678	0.092711	0.245104	0.224284
	sem	0.003154	0.002609	0.011033	0.004756	0.002759	0.001256	0.000667	0.004228	0.001263	0.001698
CAD	mean	0.256292	0.160125	0.241468	0.268659	0.370185	0.031048	0.106106	0.108249	0.038991	-0.123466
	sem	0.002115	0.002183	0.010503	0.002768	0.001537	0.001424	0.000867	0.003421	0.001537	0.001363
CHF	mean	-0.185669	-0.716877	-0.533387	0.227263	0.186044	-0.275548	-0.240445	-0.240445	-0.387186	-0.200319
	sem	0.008455	0.017075	0.022275	0.002687	0.002388	0.001581	0.0	0.0	0.003064	0.003126
DKK	mean	0.416436	0.230850	0.382304	0.538261	0.514252	-0.346494	-0.295	-0.295	-0.423945	-0.34272
	sem	0.002367	0.002467	0.006529	0.002866	0.002201	0.001318	0.0	0.0	0.003383	0.001143
EUR	mean	0.337775	0.204803	0.410274	0.378257	0.404300	-0.196152	-0.145095	-0.145095	-0.272527	-0.197339
	sem	0.002217	0.002935	0.006692	0.003438	0.003039	0.001437	0.0	0.0	0.003387	0.002763
GBP	mean	-0.488570	-1.574804	-0.819165	0.185686	0.260290	0.010463	0.055196	0.055196	-0.042078	-0.003362
	sem	0.012557	0.012586	0.039343	0.002543	0.001763	0.00085	0.0	0.0	0.001561	0.001824
JPY	mean	0.132632	0.083701	0.180811	0.149882	0.148341	-0.498916	-0.425	-0.425	-0.628752	-0.477128
	sem	0.000801	0.001407	0.001794	0.000868	0.001434	0.00192	0.0	0.0	0.003897	0.003769
NOK	mean	0.531827	0.418531	0.707642	0.684768	0.385430	-0.098564	-0.042797	-0.147672	-0.149535	-0.080773
	sem	0.003652	0.003033	0.007900	0.008616	0.002482	0.001124	0.000528	0.00438	0.002062	0.001158
NZD	mean	0.395818	0.582748	0.724791	0.212046	0.198451	0.178386	0.032437	0.078766	0.309071	0.25438
	sem	0.004185	0.004237	0.017235	0.004518	0.003382	0.001823	0.000733	0.003103	0.00186	0.002011
SEK	mean	0.429232	0.357267	0.469028	0.450085	0.464030	-0.042591	-0.01831	-0.072142	-0.032056	-0.074099
	sem	0.002284	0.003628	0.009194	0.004068	0.002189	0.00085	0.000261	0.002811	0.001966	0.001353
Non-USD	mean	0.231107	0.060661	0.283389	0.335741	0.287487	-0.106487	-0.087823	-0.099043	-0.134291	-0.102054
	sem	0.004136	0.005147	0.012802	0.003627	0.002250	0.001358	0.000306	0.001794	0.002398	0.002021
USD	mean	0.307735	0.532740	0.642760	0.129480	0.055007					
	sem	0.003711	0.004463	0.008319	0.002771	0.001576					

Variations of U.S. Treasury Premium:

In this section we will be using OIS (overnight indexed swap rate) as alternative to risk-free rate. In the analysis till now, we used Libor IRS rate as risk-free rate proxy and also measured swap market frictions as deviation from CIP.

Premium, Adj. for OIS CIP dev. ($\varphi_{i,n,t}^{OIS}$):

In the OIS variation, we show that the decline in medium – to long-term US Treasury premium still exists when we choose the OIS rate as risk free rate proxy. The OIS rate is indexed to the overnight rate, which contains very little credit risk, and is unaffected by frictions in the Libor rate.

$$\varphi_{i,n,t}^{OIS} = \varphi_{i,n,t} - \tau_{i,n,t}^{OIS}$$

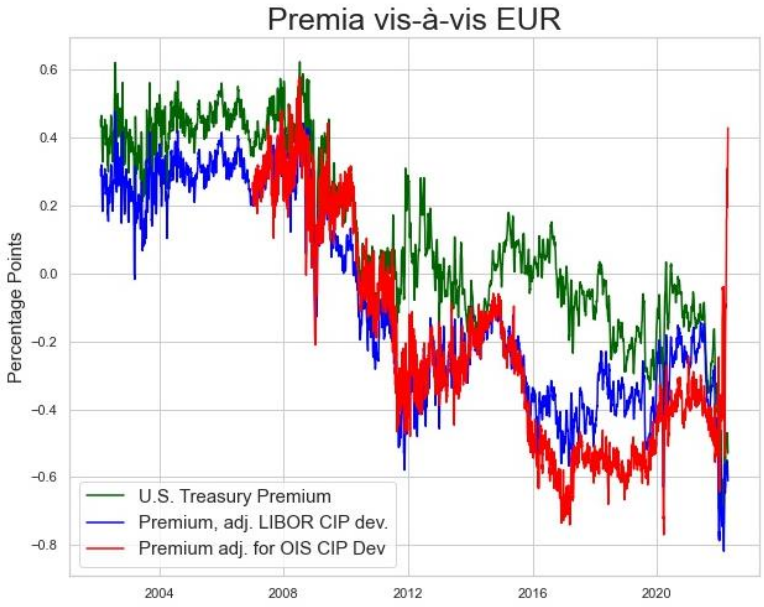
Where, CIP deviations for OIS rates is measured as:

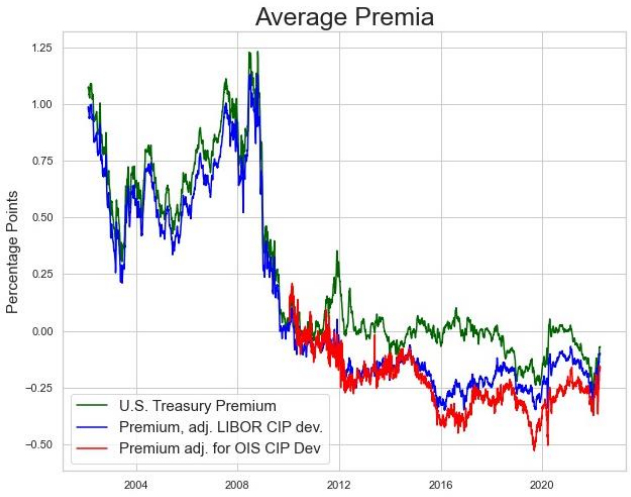
$$\tau_{i,n,t}^{OIS} = (ois_{i,n,t} - ois_{USD,n,t}) - \rho_{i,n,t}$$

The 5-year U.S. Treasury premium vis-à-vis the German bund (green),

The premium adjusted for Libor CIP deviations (blue),

The premium adjusted for OIS CIP deviations (red)





The average, 5-year U.S. Treasury Premium (in green),

The average premium adjusted for Libor CIP deviations (in blue),

The premium average adjusted for OIS CIP deviations (in red).

Averages are for seven countries with long OIS data history: Australia, Canada, Switzerland, Germany, United Kingdom, Japan, and New Zealand.

Conclusions

- Conclusively, we can say that post-crisis, all of the measures follow a similar trend, demonstrating that our result on the decline of the U.S. Treasury Premium is not driven by our choice of the risk-free rate
- As we discussed earlier, can we say that the 'specialness' of US has decreased in comparison to other developed countries or the shift has moved to developing countries?

Future Consideration:

- We can extend the analysis to compare convenience yield of government bonds of Emerging Markets (e.g., China, India, Brazil, etc.).
- Explore alternate data sources like user sentiments and Delphi surveys (Experts survey) to validate if the US Treasury premium is for real.
- Compare US Treasury premium in other asset classes like Equity and Real estate.

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