Violations of Covered Interest Rate Parity in Developing Economies

By

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ABSTRACT

I find that covered interest rate parity (CIP), the fundamental international finance no arbitrage condition, has been persistently violated in a handful of developing economies from 2013 to November of 2020. This paper serves to 1) confirm trends in deviations from CIP in developed economies persist, 2) be the first to introduce evidence of deviations from CIP in a broad basket of developing economies, South Korea, India, Turkey, Thailand, Indonesia, Malaysia, Poland, Russia, Hungary, South Africa, Colombia, and Mexico and talk briefly about the implications for borrowers and lenders, and 3) to examine the effects of deviations on forward premiums. I find that developing economies exhibit uncorrelated deviations pointing to idiosyncratic drivers to the violations observed.

I. Introduction

Covered Interest Parity is one of the most fundamental condition in international finance, it is the no arbitrage condition that stipulates earning domestic interest rates and earning foreign interest rates by exchanging spot to a foreign currency then exchanging back to domestic currency at expiration of the interest earning vehicle using a FX forward will net exactly same payoff. Assuming simple interest returns without compounding, it is formally defined as:

$$\left(1 + r_{\$,TTM}\right) = \frac{S_t}{F_{t,TTM}}\left(1 + r_{foreign,TTM}\right),$$

Where $r_{\$,TTM}$ and $r_{foreign,TTM}$ denotes the domestic (in my analysis U.S.) and foreign interest rates of the same term to maturity TTM, S_t is the spot exchange rate at time t denoted in foreign currency per U.S dollar, and $F_{t,\,TTM}$ is the forward rate at time t expiring in TTM also denoted in foreign currency per U.S dollar. In this paper I will refer to the left-hand side as the US rate and the left-hand side as the synthetic rate. Note in some literature $\frac{F_{t,TTM}}{S_t}$ is the notation used, this is dependent on whether the foreign or domestic currency is your base currency. In my case where the domestic currency (USD) is my base currency $\frac{S_t}{F_{t,TTM}}$ is the notation I will use.

In frictionless markets, CIP will hold as arbitrage opportunities should be quickly traded away by savvy investors, however the reality is violations in CIP has been well documented. There is a good amount of interest in CIP because it links two of the world's largest asset markets, the FX market and the fixed income market. And we have seen a resurgence of research examining violations in CIP and trying to find the drivers and implications these violations. What a violation in CIP means is that we see a deviation from the CIP identity. Consider:

$$x = \left(1 + r_{\$}\right) - \frac{S_t}{F_{t,TTM}}\left(1 + r_{foreign}\right),$$

which Du et al. (2018) coined cross-currency basis, x, should equal zero when CIP holds. However, previous literatures have introduced evidence that $x \neq 0$ in even some of the largest currencies in the world.

It is interest to think about what happens when $x \neq 0$. We have two cases:

$$x < 0 \rightarrow \left(1 + r_{\$}\right) < \frac{S_t}{F_{t,TTM}}\left(1 + r_{foreign}\right) \quad (1)$$

$$x > 0 \rightarrow \ (1 + r_{\$}) > \frac{S_t}{F_{t,TTM}}\left(1 + r_{foreign}\right) \quad (2)$$

In case (1) when x < 0, our U.S rate is less than what I called the synthetic rate. We can think of it in two ways, for a borrower it would be best to borrow using the US rate because that would be cheaper, and for a lender, it would be best to lend in the synthetic rate obtained in the foreign market because it would net a greater return. And borrowers and lenders should take the opposite strategy in case (2). As long as deviations exist there will be an optimal strategy, and thus could present investment opportunities for borrowers and lenders.

My paper will be structured as follows: I will discuss previous literature then data and empirical models followed by a discussion of my results and implications for U.S investors and developing economy entities (investors, corporations, and governments) ending with a conclusion.

II. Literature

There are no shortages of papers that examined deviations in CIP in developed economies currencies. Du, Tepper and Verdelhan (2018) were one of the first to identify the breakdown in CIP especially after the Great Financial Crisis (GFC) in 2008. They looked a sample of the most liquid currencies which are developed country currencies and found on average countries experience negative cross-currency bases. Furthermore, a key contribution by Du et al. (2018) was they concluded that deviations could not be explained away by credit risk or transaction cost, citing tightening banking regulations as a key driver to the breakdown in CIP with Avjiev et al. (2017) and Borio et al. (2018) further arguing the large persistent deviations in CIP are the results of Basel III requirements implemented through the Dodd-Frank Act.

Rime, Schrimpf and Syrstad (2017) also analyzed CIP violations and criticized previous literature on the using unrealistic funding costs. Rime et al. (2017) used more conservative rates such as T-bills and commercial papers. They also established evidence for deviations however concluded that the deviations are small enough that most investors cannot achieve arbitrage profits taking into account all transaction costs. As with Du et al. (2018), Rime et al. (2017) also found that most countries experience negative cross-currency bases.

Cerutti, Obstfeld, and Zhou (2019) extended Du et al.'s (2018) analysis through 2018 confirming persistent deviations in G10 currencies even through 2018. Their key finding was after GFC we see a deterioration in the predictive power of interest differentials on forward premium as stated by CIP (when CIP holds interest differentials have a perfect correlation with forward premiums), and a significance in dollar strength on forward premiums which built upon Avdjiev et al.'s (2017) finding that a stronger dollar is associated with wider CIP deviations. Cerutti et al. (2019) hypothesized the significance in dollar strength as reflecting increased hedging demand for dollar swaps in times of rising uncertainty.

The previous papers all analyzed CIP violations in developed country currencies, with a focus on G10 currencies. Hartley (2020), however, was first to examined CIP deviations in Mexico and Brazil using external emerging market sovereign debt. By using USD denominated and BRL, and MXN denominated sovereign bonds to analyze the deviation from CIP in Brazil and Mexico respectively, he has eliminated the credit risk differential. In his article he found persistent negative cross-currency basis in BRL and MXN from early 2014 to late 2017, the deviation thus must be explainable by factors other that credit risk.

Hong et al. (2019) examined the implications of deviations from CIP in Asia, focusing on developed countries and a small number of emerging market economies, namely, India, Philippines, Thailand, and Korea from 2014 – 2017. What they found was these emerging markets experienced smaller deviations than developed economies in terms of magnitude.

III. Data and Empirical Models

i. Data

CIP can be examined in a variety of lens; depending on the maturity and yield type, deviations in CIP will have drastically different magnitudes. I have chosen 3-month locally denominated sovereign unsecured fixed rate debts as my instrument and the corresponding interest rate as my r_i $i \in \{\$, \text{foreign}\}$ because of my focus on developing countries. Under strict CIP assumptions, two bonds should have equivalent credit and timing risks. Timing can be controlled for by using bonds of the same maturity and payment scheme however credit risk is tricky. Because on the left-hand side we have U.S treasury bills, which is widely known to be the safest fixed income security in the world, the best way to have an equivalent risk-free synthetic rate would be to purchase a credit default swap (CDS). However, CDS on developing country sovereign debt is not widely traded, thus the best way to control for credit risk would be to chose as short a maturity as possible, and credit risk correlates positively with time. The shortest possible maturity would be an overnight deposit; however, Rime et al. (2017) criticized the use of overnight rates deeming it an unrealistic reflection of funding costs. I have thus chosen a short common maturity that most countries issue and is often cited as the left-side of the yield curve, 3 months.

Initially, my analysis would focus on all developing economy floating currencies[1], however the interest rate data for Brazil, Philippines, and Chile had issues that rendered them unusable, so my final analysis will focus on the following 12 developing country currencies: South Korean Won (KRW), Indian Rupee (INR), Russian Ruble (RUB), South African Rand (ZAR), Turkish Lira (TRY), Thai Baht (THB), Indonesian Rupiah (IDR), Malaysian Ringgit (MYR), Polish zloty (PLN), Hungarian Forint (HUF), Colombian Peso(COP), and Mexican Peso (MXN). And will touch on the following 9 developed country currencies: Euro (EUR), New Zealand Dollar (NZD), Australian Dollar (AUD), Japanese Yen (JPY), Great British Pound (GBP), Swiss Franc (CHF), Swedish Krona (SEK), Norwegian Krone (NOK), and Canadian Dollar (CAD).

I will use data from the start of 2013 (January 3rd being the first business day) to November 12th, 2020 accounting only for U.S trading days which exclude the weekend and holidays. All data for analysis, 3-month unsecured sovereign yields, 3-month forward rates, and spot exchange rates were obtained from Bloomberg (see Appendix A). Furthermore, all analysis was carried out through python (see Appendix C).

In my analysis I had to make some manipulations to both yields and forward rates. Yields were quoted in effective annual rates (EAR) as a percentage thus I had to make changes to yields so that I would have an effective 3-month rate. Namely, if $r_{i,EAR}$ is data directly obtained from Bloomberg, and $r_{i,3M}$ is the rate I need in my analysis then I had to calculate $r_{i,3M} = \sqrt[4]{\left(1 + \frac{r_{i,EAR}}{100}\right)} - 1$. Furthermore, the data on forward rate was in forward points quoted in basis points, so to obtain a proper forward rate I had to take f_p from Bloomberg and get $F_t = S_t + \frac{f_p}{10000}$, where F_t is my forward rate and S_t is my spot exchange rate.

ii. Empirical Models

a. Persistent Deviations in CIP

To confirm persistent deviations in CIP still exist in G10 currencies and check for evidence of deviation in developing countries, I will deploy a T-test to test H_0: $x_i = 0$ vs H_a: $x_i \neq 0$, where x_i is the true mean deviation from CIP in basis points of country i. My test statistic will be $T = \frac{\bar{x}_i - x_i}{\sqrt{s_i^2/n}} \sim T_{n-1}$, where $\bar{x}_i$ is an estimator for x_i and $\bar{x}_i = \frac{1}{n}\sum_{t=1}^{n} x_{it}$ where n = number of trading days in the period of analysis. I choose α = 5% and will reject the null hypothesis if $P(|T| > T_{1-\alpha/2,n-1}) < 0.05$.

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[1] *Developing as defined by the United Nations and floating currency as defined by the IMF

To use a T-test I will have to first ensure the assumptions of normality will not be violated. Given high frequency financial data often violate the Gaussian assumption an alternative will be to use a non-parametric test, namely, the Wilcoxon Signed-Rank Test. The Wilcoxon Signed-Rank Test is normally used in paired samples but can also be used in a one sample test, and it is more powerful than the sign test. Although not as powerful as the T-test, it does not require a distribution for the underlying data.

b. Effect of deviation on forward premium

As part of examining the implications of the breakdown in CIP I wish to examine the effects if any that deviations in CIP has on forward premiums. A useful econometrics tool is impulse response analysis, which helps analyze the response of a variable (forward premium) given a shock to another variable (deviation). A vector autoregressive (VAR) model will be developed to allow for building an impulse response function. I will specify my model as $y_{it} = \alpha_1 y_{it-1} + \cdots + \alpha_l y_{it-l} + \beta_1 x_{it-1} + \cdots + \beta_k x_{it-k} + \varepsilon_{it}$, for $t = 1, \ldots, n$ where $y_{it} = \frac{s_{it}}{f_{it}}$, $x_{it} =$ cross-currency basis of country i at time t and l,k represent the number of lags.

The assumption of a VAR model is that variables are not perfectly autocorrelated and that the variables are stationary. To test for stationarity, I will use an augmented dicky fuller (ADF) test on variables y_i, x_i. The null hypothesis is the times series possesses a unit root and thus is non-stationary. I would reject the null hypothesis in favor of the alternative hypothesis that the time series is stationary if the $p\text{-value} < 0.05$. If I fail the ADF test I will take first difference of the time series.

III. Results

Deviations in developed countries persist, although it seems to have converged since late 2016 since Du et al.'s (2018) analysis. We also see an extreme volatility in around February – March of 2020 when financial markets around the world were under stress and the US circuit breaker halted stock trading for the first time since 1997. However, since early 2020 we are for the first time seeing converge in cross-currency basis in these developed countries.

What is interesting is from figure 1 we see that cross-currency bases in many of the developed countries seem to follow a general trend, moving up and down together. If we look at their correlations in table 1 we find that there is a strong positive correlation for many developed countries. This may suggest that there is some common underlying driver for these developed countries. Du et al. (2018),

Figure 1. Developed Country Cross-Currency Basis

Table 1. Cross-Currency Basis Correlation in Developed Countries

	EUR	JPY	GBP	AUD	CAD	CHF	NZD	SEK	NOK
EUR	1.000000	0.801472	0.622910	0.364757	0.500125	0.779392	-0.029092	0.587603	0.387795
JPY	0.801472	1.000000	0.695936	0.381741	0.615273	0.766188	-0.056437	0.717336	0.335776
GBP	0.622910	0.695936	1.000000	0.644078	0.848221	0.544832	0.294744	0.493250	0.652739
AUD	0.364757	0.381741	0.644078	1.000000	0.661843	0.289922	0.428974	0.310030	0.530787
CAD	0.500125	0.615273	0.848221	0.661843	1.000000	0.427842	0.187558	0.396855	0.616897
CHF	0.779392	0.766188	0.544832	0.289922	0.427842	1.000000	-0.007314	0.717845	0.327924
NZD	-0.029092	-0.056437	0.294744	0.428974	0.187558	-0.007314	1.000000	0.005273	0.454135
SEK	0.587603	0.717336	0.493250	0.310030	0.396855	0.717845	0.005273	1.000000	0.169400
NOK	0.387795	0.335776	0.652739	0.530787	0.616897	0.327924	0.454135	0.169400	1.000000

Avjiev et al. (2017) and Borio et al. (2018), have all suggested tightening financial regulations as a key driver. As a result of tightening financial regulations, financial institutions may not be able to capitalize on the arbitrage opportunities seen in the market; however, I believe the flaw in that argument is we see varying levels of cross-currency basis across countries as we see in table 2. If the restricted access to capital is the key driver of the breakdown in CIP we would expect to see similar magnitudes of cross-currency basis as larger deviations, which are more profitable arbitrage opportunities, are traded away. Furthermore, the explanation does not explain why we see a tightening in cross-currency basis after mid-2020. I only pose these questions as something to think about in future research, in hopes as these new findings have surfaced, I or someone will push forward the research on drivers of CIP. I will not talk more explicitly on drivers of CIP as that is beyond the scope of this paper.

Table 2. Mean Cross-Currency Basis in Developed Countries

	EUR	JPY	GBP	AUD	CAD	CHF	NZD	SEK	NOK
Mean Cross-Currency Basis (sd)	-3.74 (3.21)	-9.85 (5.09)	-1.86 (3.87)	-0.1 (3.27)	-3.65 (3.6)	-9.37 (4.65)	4.26 (4.07)	-2.11 (6.34)	0.3 (3.9)

When we turn our attention to developing countries, we find we lose the trend in cross-currency bases. From table 3, we see that the cross-currency bases are uncorrelated with a few exceptions. In general, having a significantly weaken correlation when compared to correlations in developed countries, with the highest correlation of 0.55 between Russian Rubles and Thai Bahts. What this suggests is more idiosyncratic drivers for the breakdown in CIP in developing economies. Again the

Figure 2. Developing America Country Cross-Currency Basis

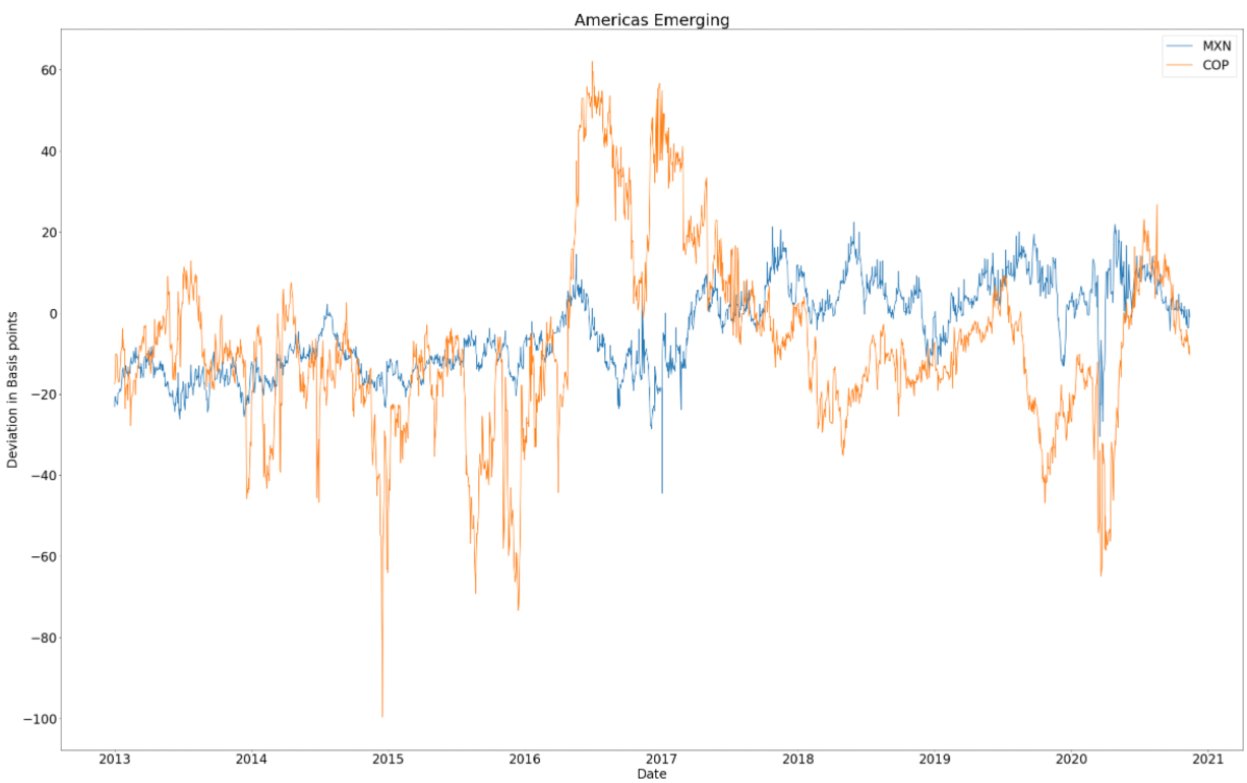


Figure 2. Developing Europe and Africa Country Cross-Currency Basis

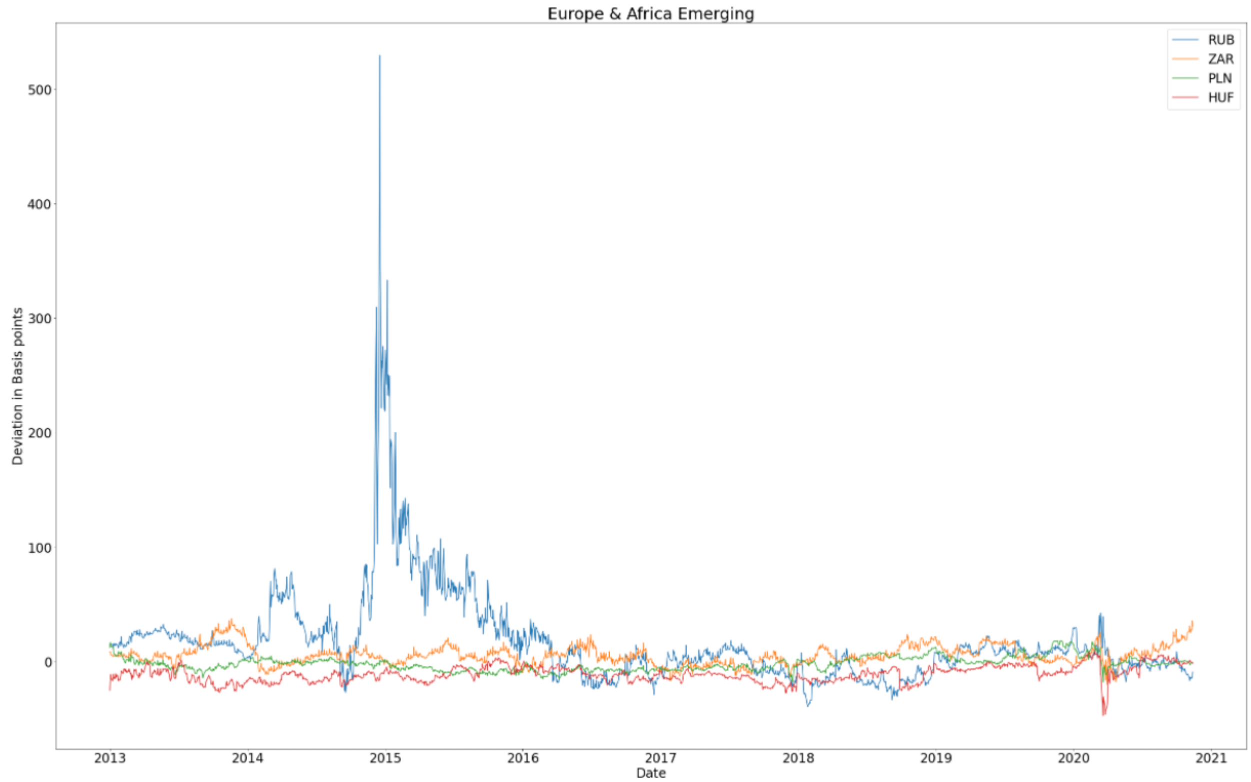


Figure 4. Developing Asia Country Cross-Currency Basis

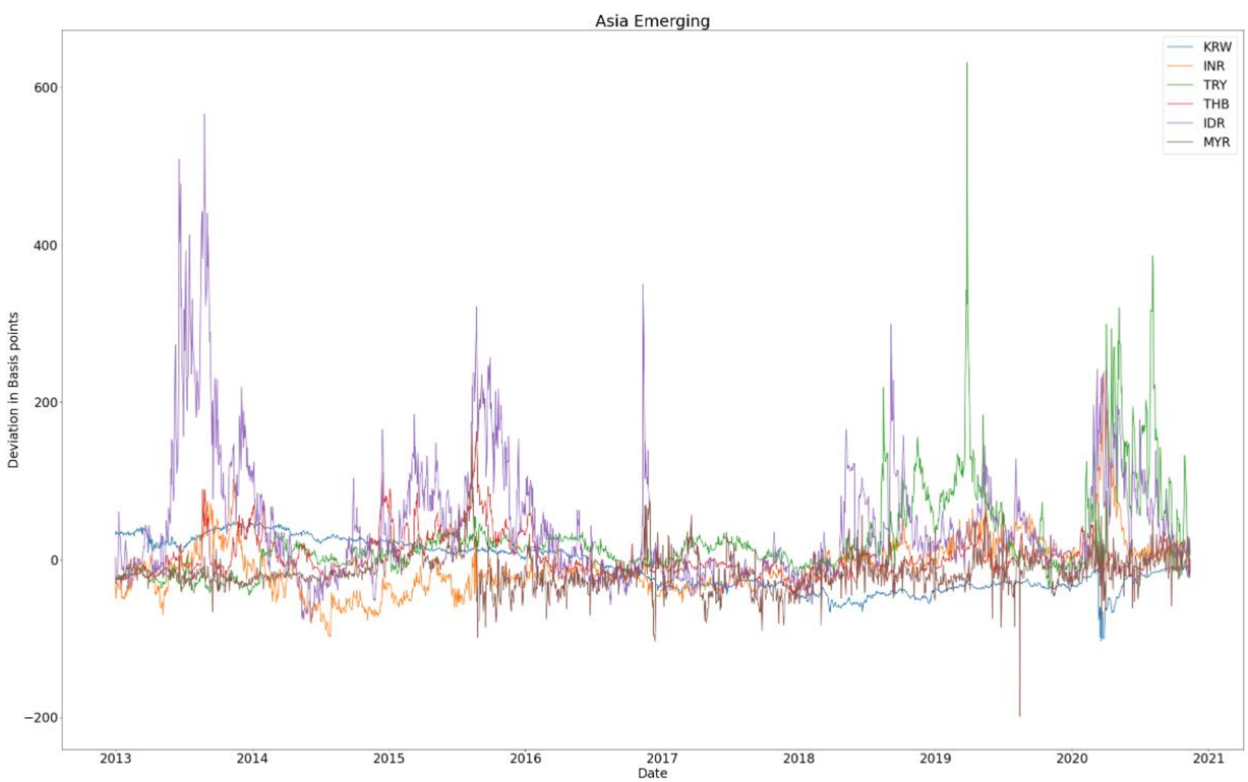


Table 3. Cross-Currency Basis Correlation in Developing Countries

	MYR	COP	IDR	HUF	THB	PLN	TRY	ZAR	RUB	MXN	INR	KRW
MYR	1.000000	-0.091540	0.143296	0.170589	0.264059	0.051524	0.145716	0.048694	0.239190	-0.000835	0.060349	-0.010718
COP	-0.091540	1.000000	-0.261288	0.053525	-0.431001	-0.232110	-0.005241	-0.013909	-0.379385	0.042140	-0.155984	-0.135460
IDR	0.143296	-0.261288	1.000000	0.034868	0.430760	-0.145479	0.062843	0.248265	0.132785	-0.184307	0.412840	0.197011
HUF	0.170589	0.053525	0.034868	1.000000	0.184125	0.194097	0.292984	0.111437	0.010506	0.269245	0.059290	-0.053688
THB	0.264059	-0.431001	0.430760	0.184125	1.000000	-0.091892	0.030405	0.104920	0.551989	-0.252891	0.013056	0.332811
PLN	0.051524	-0.232110	-0.145479	0.194097	-0.091892	1.000000	0.101391	0.111917	-0.104458	0.349956	0.188288	-0.231483
TRY	0.145716	-0.005241	0.062843	0.292984	0.030405	0.101391	1.000000	0.081095	-0.120316	0.426729	0.343760	-0.365174
ZAR	0.048694	-0.013909	0.248265	0.111437	0.104920	0.111917	0.081095	1.000000	-0.088387	-0.000340	0.270012	0.181670
RUB	0.239190	-0.379385	0.132785	0.010506	0.551989	-0.104458	-0.120316	-0.088387	1.000000	-0.380124	-0.237927	0.448400
MXN	-0.000835	0.042140	-0.184307	0.269245	-0.252891	0.349956	0.426729	-0.000340	-0.380124	1.000000	0.336239	-0.671675
INR	0.060349	-0.155984	0.412840	0.059290	0.013056	0.188288	0.343760	0.270012	-0.237927	0.336239	1.000000	-0.371684
KRW	-0.010718	-0.135460	0.197011	-0.053688	0.332811	-0.231483	-0.365174	0.181670	0.448400	-0.671675	-0.371684	1.000000

topic of drivers in beyond the scope of this paper but is a topic I hope to revisit with an in-depth analysis on each developing country giving them the attention it deserves.

From table 4, the results from formal statistical tests, I can reject the null hypothesis that persistent deviations from CIP does not exist in every developing country except Thailand. The normality assumption was violated for almost every country (see appendix B) so I concluded my results based on the Wilcoxon Signed-Rank test. Again, note as with the case of developed countries, mean cross-currency bases in developing countries vary even wildly. With the greatest being 42.81 basis points in Indonesia and -15.72 in Malaysia.

Table 4. Results from T-Test and Wilcoxon Signed-Rank Test

	KRW***	INR***	MXN***	RUB***	ZAR***	TRY***	PLN***	THB	HUF***	IDR***	COP***	MYR***
$\bar{x}$	-8.39	-9.46	-4.27	16.81	5.43	23.71	-1.93	3.3	-10.93	42.81	-8.03	-15.72
T	-12.34	-12.15	-18.51	17.9	29.21	19.92	-14.46	6.02	-71.7	24.5	-16.58	-30.17
T-Test p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Signed-Rank Test p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00

The results should be taken with a grain of salt. The interest rates I used were from 3-month locally denominated sovereign unsecured fixed rate debts, thus credit risk may play a significant role in explaining cross-currency basis. Most previous literature have not controlled for credit risk, but in my case the credit risk differential between the U.S and a developing country is greater than those between the U.S and a developed country. Consider a model that includes credit risk differentials:

$$x' = (1 + r_{\$}) - \frac{S_t}{F_{t,TTM}}\left(1 + (r_{foreign} - r_p)\right)$$

where r_p = risk premium. I need to take subtract a risk premium from the nominal foreign rate such that the two yields $r_\$$ and $r_{foreign} - r_p$ are equivalent in risk. What this means is the difference between my model and the new model that considers credit risk differential:

$$x - x' = \left((1 + r_\$) - \frac{S_t}{F_{t,TTM}}(1 + r_{foreign})\right) - \left((1 + r_\$) - \frac{S_t}{F_{t,TTM}}\left(1 + (r_{foreign} - r_p)\right)\right)$$

$$x - x' = -\frac{S_t}{F_{t,TTM}} r_p$$

$$x' = x + \frac{S_t}{F_{t,TTM}} r_p$$

makes my model underestimates the cross-currency basis by $\frac{S_t}{F_{t,TTM}} r_p$, since $\frac{S_t}{F_{t,TTM}} > 0$ and $r_p > 0$ the cross-currency basis has downward bias and should be more positive. Now revisiting my results, KRW, INR, MXN, PLN, HUF, COP, and MYR had negative cross-currency bases but should in fact have more positive cross-currency basis, so a decrease in the magnitude of their deviations. This could explain away the deviation; however, for the rest of the countries that have positive cross-currency bases RUB, ZAR, TRY, IDR, and even the previously insignificant THB, they should have an even larger magnitude of deviation.

Something interesting to note is from figures 3 and figure 4 we tend to see more extreme positive cross-currency bases, that again is a whole topic of its own, to just quickly look at the mechanics:

$$(1 + r_\$) > \frac{S_t}{F_{t,TTM}}\left(1 + r_{foreign} - r_p\right) \rightarrow (1 + r_\$) \gg \frac{S_t}{F_{t,TTM}}\left(1 + r_{foreign} - r_p\right)$$

Could mean $r_\$\uparrow$, $S_t\downarrow$, $F_{t,TTM}\uparrow$, $r_{foreign}\downarrow$, or $r_p\uparrow$, perhaps even a combination of them.

Finally, I will examine the effects of deviation in CIP on forward premium. I first develop at VAR(5) model on the first difference of my variables. The model of choice is thus:

$$\Delta y_{it} = \alpha_1 \Delta y_{it-1} + \alpha_2 \Delta y_{it-2} + \alpha_3 \Delta y_{it-3} + \alpha_4 \Delta y_{it-4} + \alpha_5 \Delta y_{it-5} + \beta_1 \Delta x_{it-1} + \beta_2 \Delta x_{it-2} + \beta_3 \Delta x_{it-3} + \beta_4 \Delta x_{it-4} + \beta_5 \Delta x_{it-5} + \varepsilon_{it}$$

I chose 5 lags because economically 5 trading days correspond with exactly one business week, and statistically, partial autocorrelation seems to taper off after around 5 lags (See appendix D). Furthermore, I had to take first difference as the bulk of my variables failed to reject the null hypothesis that the time series is not stationary in the ADF test.

I am less interested in the model itself than the tools, namely impulse response analysis, that come with the model that allows me to analyze the effect deviations in CIP has on the forward premium through time. None the less the results of the VAR models can be found in Appendix E.

I will focus the discussion on statistically significant results. Please note in my figures I use a slightly different notation from my specified model (i.e. $\Delta \mathrm{y}_{\mathrm{MYRt}} = \mathrm{fMYR}$ and $\Delta \mathrm{x}_{\mathrm{MYRt-1}} = \mathrm{MYR}$).

Figure 5. Impulse Response Function for MYR

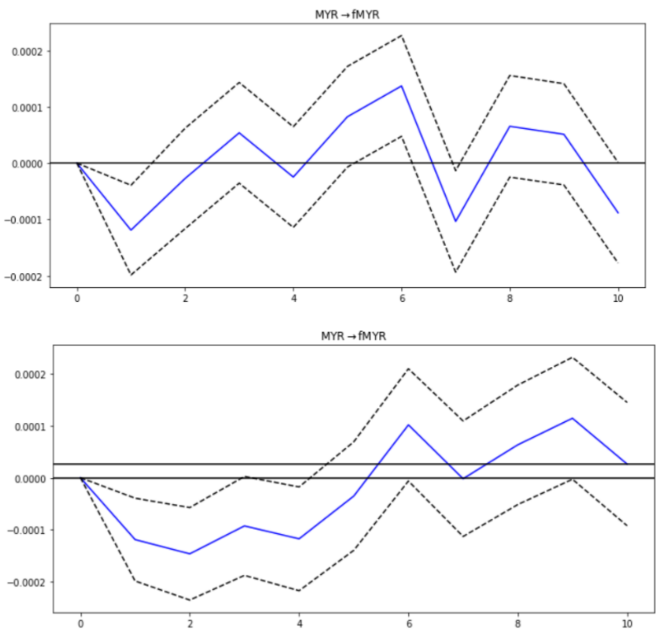


Figure 6. Impulse Response Function for HUF

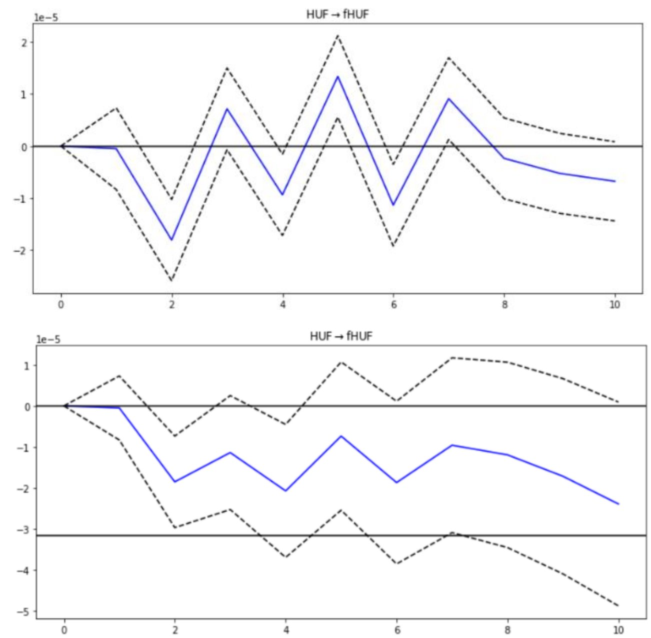
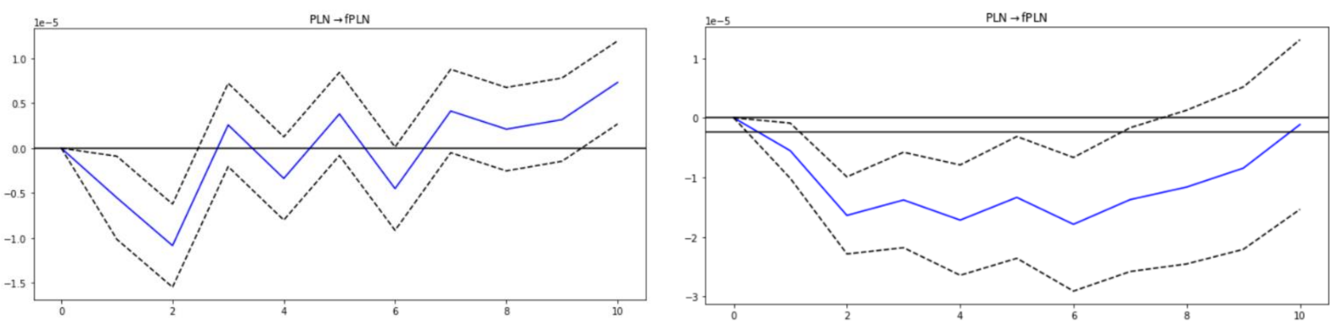


Figure 7. Impulse Response Function for PLN



Note the figures with one black bar is the impulse response whereas the figure with two black bars is the cumulative response. Even from just a couple of developing countries, we notice a trend in the impulse responses. We see the forward premium react to a shock to cross-currency basis. Let’s look at one currency for some intuition, let’s take MYR as an example:

$$\text{MYR}\uparrow = (1 + r_{\$}) - \frac{S_{MYR/USD}}{F_{MYR/USD}}(1 + r_{MYR}) \rightarrow r_{\$} \uparrow \text{ or } r_{MYR}\downarrow$$

If $r_{\$} \uparrow$ that has two effects, interest rates and money supply go hand in hand, increase in interest rate is met with decrease in money supply, which means more expensive dollar, secondly, the US interest rate will be more attractive to foreign investors so expect foreign investors to pour in thus buying USD, more money demand, more expensive dollar. If $r_{MYR}\downarrow$, we still have the second effect where investors in Malaysian rates will want to divest and go into the more attractive U.S rate, adding to USD demand. This gives rise to:

$$\text{USD expected to appreciate } \rightarrow F_{MYR/USD}\uparrow \rightarrow \text{fMYR}\downarrow = \frac{S_{MYR/USD}}{F_{MYR/USD}}.$$

This result can be generalized countries that see a negative response from forward premiums to a shock in the deviation. However, from the cumulative response we can see the effects does not last long, persisting for about 4-5 days before completely dissipating into the system with the exception of ZAR and INR.

Figure 7. Impulse Response Function for ZAR

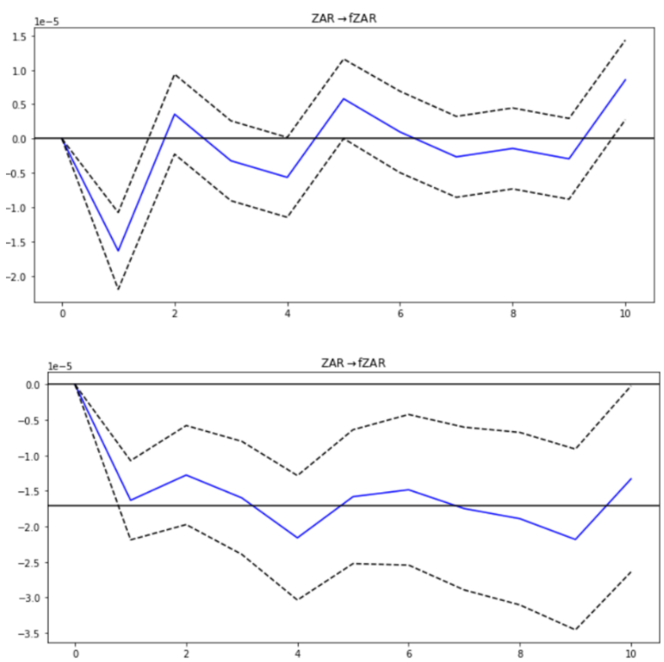
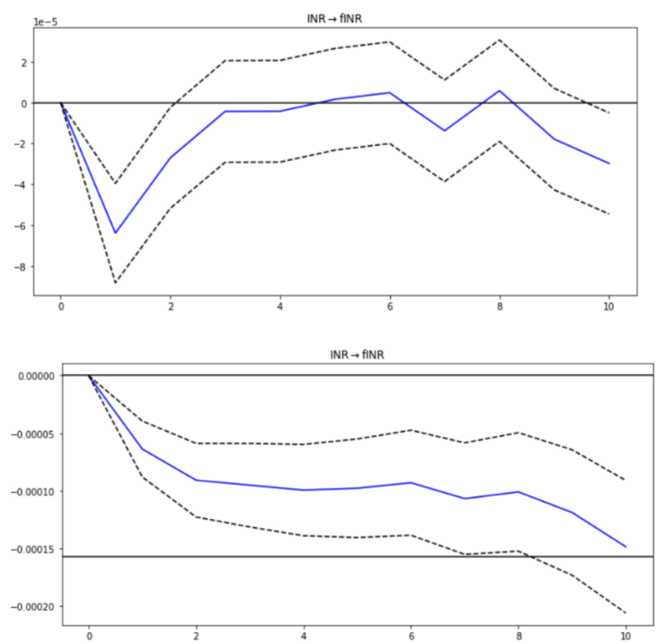


Figure 8. Impulse Response Function for INR



IV. Conclusion

I have introduced evidence for persistent deviations in CIP in 11 developing countries, these countries being South Korea, India, Turkey, Indonesia, Malaysia, Poland, Russia, Hungary, South Africa, Colombia, and Mexico through rigorous statistical test. I was unable to establish statistical significance for the breakdown of CIP in Thailand, however, it should still be noted that there may be economic significance. The absence of a control for credit risk has limited my research and my results for some developing countries that experience negative cross-currency bases and should be looked at in future research.

My findings have two key implications outside of scholarly research. For investors, whenever there is a negative cross-currency basis they should be looking to invest in the foreign market for US investors and their home country for foreign investors, and vice versa for positive cross-currency basis. For emerging economy governments and corporations, when there is a negative cross-currency basis they should be issuing debt in the US, and vice versa for positive cross-currency basis. These results are especially for large corporations that have access to a foreign market who can capitalize on borrowing at a significantly lower rate.

Furthermore, I was able to find that cross-currency bases in fact have a transient impact on forward premiums from impulse response analysis.

I hope my introduction to deviations in developing countries will give rise to further research examining the idiosyncratic drivers behind persistent deviations in CIP in these countries. And another direction of research that stemmed from my findings is the explanation of convergence in CIP deviations since mid-2020.

IV. References

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V. Appendix

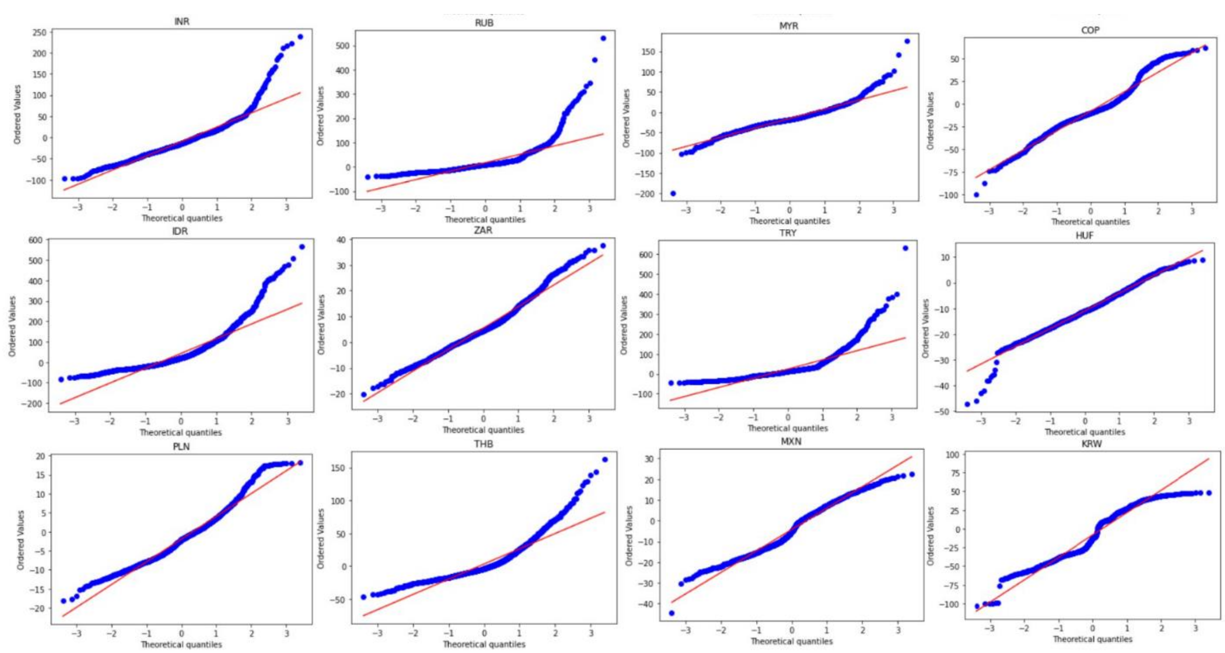
Appendix A: Security tickers for Bloomberg

	EUR	JPY	GBP	AUD	CAD	CHF	NZD	SEK	NOK	KRW	INR
3 Month Yields	C9603M	C1053M	C1103M	C1273M	C1013M	C2563M	C2503M	C2593M	C2663M	C2323M	C1233M
Spot Rate	EUR	JPY	GBP	AUD	CAD	CHF	NZD	SEK	NOK	KRW	INR
3 Month Forward Points	EUR3M	JPY3M	GBP3M	AUD3M	CAD3M	CHF3M	NZD3M	SEK3M	NOK3M	KWN3M	IRN3M

	MXN	RUB	ZAR	TRY	PLN	THB	HUF	IDR	COP	MYR	USD
3 Month Yields	C4763M	C4963M	C2623M	C9653M	C1193M	C1223M	C1143M	C1323M	C4773M	C1283M	C0823M
Spot Rate	MXN	RUB	ZAR	TRY	PLN	THB	HUF	IDR	COP	MYR	-
3 Month Forward Points	MXN3M	RUB3M	ZAR3M	TRY3M	PLN3M	THB3M	HUF3M	IHN3M	CLN3M	MRO3M	-

*C…3M denotes Bloomberg Valuation BVAL of locally denominated 3 month government issued unsecured fixed rate bonds

Appendix B: QQ-Plot



Appendix C: Link to Python Code for Analysis

COVID-19/CIP Violation New.ipynb at master · Flyingnano/COVID-19 (github.com)

Appendix D: Autocorrelation Plots

Please refer to COVID-19/CIP Violation New.ipynb at master · Flyingnano/COVID-19 (github.com)

Appendix E: VAR models

Please refer to COVID-19/CIP Violation New.ipynb at master · Flyingnano/COVID-19 (github.com)

Appendix F: Impulse Response Functions

Please refer to COVID-19/CIP Violation New.ipynb at master · Flyingnano/COVID-19 (github.com)