Emerging Markets Investment Insight

Local bond benchmarks: Yield tilts and funding diversification

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Low yields in developed fixed income markets combined with rising global issuance has made investments in local currency emerging markets (EM) bonds popular. In prior publications, we wrote about using factor decomposition to synthetically recreate exposure to the EM cash bonds through duration, currency, and credit derivative instruments. Extending this research, we investigate whether these factors can be used to enhance benchmark performance.

The aim of this publication is to explore extensions to existing benchmarks, specifically the US dollar hedged and unhedged Bloomberg Barclays EM Local Currency Government 10% Country Capped TR Index.

We find evidence that tilting hedged benchmarks based on yield has attractive properties while a diversified funding approach may be more appropriate for unhedged benchmarks. As part of the discussion, we examine:

- The key factor relationships contributing to the performance of the benchmarks
- A rules-based approach to increase portfolio yield
- The performance impact of introducing turnover constraints via an optimizer
- The use of currency correlations to reduce the risk from US dollar funding
Introduction

Investors looking to access emerging markets (EM) local bond returns are exposed to three distinct risks – duration, currency and credit (See Synthetic Access to the EM Local Bond Market, 2013). In prior publications, we used this decomposition to illustrate how investors can get synthetic (unfunded) exposure to EM local bond markets. Here, we revisit the factor-based approach and examine applications to enhancing yield, and a potential means of reducing currency risk.

Over the past decade, the relatively high yields of EM local currency bonds have been especially attractive in the context of the low interest rate environment within developed markets. However, accessing this additional yield is accompanied by exposure to currency volatility – which is significantly higher than that of local bond returns.

For the purposes of tradability, our reference benchmark is the US dollar Bloomberg Barclays EM Local Currency Government 10% Country Capped TR Index — EML1TRUU Index for unhedged returns and EML1TRUH Index for hedged returns. We refer to these as the unhedged benchmark and hedged benchmark respectively. The impact of currency exposure on the characteristics of the bond portfolio can be seen through two charts; the first highlights the difference in yield (Figure 1) while the second illustrates the impact of currency returns on benchmark volatility (Figure 2).

Figure 1: Unhedged and hedged yields

* Yield to worst for EML1TRUU and net yield plus 1-M LIBOR for EML1TRUH
Source: Bloomberg

The yield of the unhedged benchmark is simply the local bond yield. To access this, foreign investors need to take-on both duration risk and currency risk. The hedged benchmark seeks to isolate exposure to local duration by removing currency risk via one-month currency forwards. For a currency-hedged bond portfolio, we define a ‘modified (bond) yield’ as the local bond yield plus the difference between the investor’s base currency funding rate (in this case the US dollar) and the local funding rate implied by the currency forward. Over the sample period (2008 – 2019), incorporating currency risk in the bond portfolio enhanced yield by 410 bps p.a. but degraded risk adjusted returns (Figures 3 and 4). The correlation between the hedged and unhedged portfolios is 0.72 based on full-sample monthly returns.

Figure 2: Portfolio volatility (24- months rolling)

Source: Bloomberg
Figure 3: Significant difference in returns profiles

![Graph showing significant difference in returns profiles between Unhedged and Hedged benchmarks.]

**Figure 4: Investigating performance statistics**

<table>
<thead>
<tr>
<th></th>
<th>Unhedged benchmark</th>
<th>Hedged benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Period:</strong> July 2008 - March 2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average yield*</td>
<td>6.0%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Ann. total return</td>
<td>2.4%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Ann. local return</td>
<td>7.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Ann. currency return</td>
<td>-4.6%</td>
<td>-3.6%</td>
</tr>
<tr>
<td>Ann. volatility</td>
<td>11.7%</td>
<td>3.5%</td>
</tr>
<tr>
<td><strong>Sharpe ratio</strong></td>
<td><strong>0.15</strong></td>
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<td>Max drawdown</td>
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<tr>
<td>Drawdown to volatility</td>
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<td>1.7</td>
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</table>

* Yield to worst for EML1TRUU and net yield plus 1-M LIBOR for EML1TRUH

Source: Bloomberg

**Currency exposure ≠ currency carry**

From the results in Figure 4, we see currency exposures contributes a net -1.2% p.a. to the portfolio. Is this surprising given the popularity of the EM currency carry strategy? A portfolio consisting of a long position in 15 equally weighted global EM currencies versus the US dollar can be considered a rudimentary form of an EM currency carry trade.¹ This portfolio had a return of -0.6% p.a. over the same period. As it turns out, the currency exposure embedded within the unhedged benchmark differs in three important respects from a typical currency carry strategy:

1. **Portfolio weights:** Carry strategies tend to have equally weighted exposure to different currencies. The currency exposures via the bond benchmark are sized in accordance with the benchmark weights.

2. **Funding leg:** The funding leg of a carry strategy has multiple currencies instead of the US dollar being the sole constituent.

3. **Selection criteria:** A carry strategy takes long/short positions in currencies displaying the highest/lowest implied yields. The currency exposure within the benchmark comprises of passive long exposure to EM currencies versus the US dollar regardless of the implied yields of each currency.

For example, in the case of the local currency bond benchmark, South Korea comprises 10% of the bond benchmark despite the implied interest rate associated with the Korean won being persistently low.

While we have written extensively about the long run benefits of the EM currency carry premium, for the reasons outlined above and given currency volatility is much larger than fixed income volatility (see Figure 2), we focus on the properties of the currency hedged benchmark. In later publications, we use risk premia signals to inform our currency exposures.

¹ See Deconstructing currency carry, January 2019, Bloomberg LP.
Data

Our data set spans the period from June 2008 to March 2019 and includes the following: the returns and statistics universe of the aggregate benchmarks, constituent country indices, spot currency rates, and implied 1-month interest rates from the respective currency forward to proxy a funding rate (unless otherwise noted – see Appendix 1).

In summary, historical benchmark weights reveal significant concentration; with nine countries comprising, on average, approximately 70% of the benchmark. The country weights display stability over time (Figure 5).

Figure 5: Country market value weights

![Figure 5: Country market value weights](source: Bloomberg)

The box and whisker plot (Figure 6) highlights the dispersion of bond yield to worst (YTW) both within and between countries. We order countries in descending order of market value (measured as an average over the full sample). The box contains the interquartile range, the line within demarcates the median and the extended lines display the range of values. The three key takeaways are (1) the large variation in average YTW between countries (2) the relatively small dispersion within countries (over time) and (3) a lack of a monotonic relationship between market value and YTW.

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2 Values beyond 1.5x the interquartile range are winsorized.
Figure 6: Relatively large differences in YTW between countries

Our measure of the funding rate is derived from the 1-month currency forward\(^3\). Alternatively, funding rates can be derived from deposits, swaps, or the interbank market. As expected, funding rates display some dispersion within each country over the macroeconomic cycle. Egypt, Nigeria and Argentina – which are the small components of the benchmark – display especially high variation (Figure 7).

Figure 7: Funding rates derived from currency forwards

Unpacking factor relationships

The yield of local currency unhedged bonds \((Y_{UH})\) is given by:

\[
Y_{UH} = Y_{BOND}
\]

Where \(Y_{BOND}\) is simply the YTW of the bond. The modified yield of the local currency hedged bonds \((MY_h)\) incorporates the yield of the currency forward – which is the cost of carry as calculated by the US interest rate \(R_{US}\) and the implied foreign interest rate \(IR_{FX}\). In this particular case, the currency forward is long the US dollar versus the foreign currency. Thus \(MY_h\) is given by:

\[
\text{We use a 3-days average to smooth any distortions from the currency markets.}
\]
\[ MY_H = Y_{BOND} + (R_{US} - IR_{FX}) \]

Which can be re-written as:
\[ MY_H = (Y_{BOND} - IR_{FX}) + R_{US} \]

This implies that in a yield maximization exercise, the objective function should be YTWT for an unhedged investor and net yield for a hedged investor (since the US funding rate is a constant across all countries).

**Key relationships**

There are some important relationships that determine the potential benefits of enhancing yield. In the case of the hedged benchmark, these are:

1. Net yield and the local currency return
2. Net yield and the FX return
3. Net yield and the US dollar denominated bond return

All values are calculated based on the full-sample country averages using monthly data. The analysis excludes the three countries (Argentina, Egypt and Nigeria) that have a persistently low benchmark weight but parameter values that are outliers. While we do not believe excluding these three countries affects the broad research conclusions, we show full results in Appendix 2 through 4.

Before examining the link between net yield and hedged total returns it is necessary to unpack the relationship between hedged and unhedged index returns. The Bloomberg Barclays benchmark methodology decomposes the hedged total return into the following:

\[ HedgedTotalRet = LocalRet + UnhedgedCurrencyRet + H(ForwardRet) \]

The second and third terms represent the currency return components. Of these, the first represents the unhedged currency exposure and the second is the return from the currency forward entered into at the beginning of the month.

It can be shown that the hedged currency returns are equivalent to the cost of carry plus the residual exposure to the currency markets from being unable to implement a perfect hedge. In the language of the benchmark documentation, this is given by:

\[ HedgedCurrencyRet = CarryRet + ResidualRet \]

This simplifies the hedged total return to:

\[ HedgedTotalRet = LocalRet + CarryRet + ResidualRet \]

If on average the residual return is approximately zero (or at the very least appreciably

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*Bloomberg Barclays Index Methodology March 2017.*
smaller than the local return and carry return), the hedged total return is further simplified to

\[ \text{HedgedTotalRet} \approx \text{LocalRet} + \text{CarryRet} \]

This would suggest the returns would be a function of the bond YTW and the interest rate differentials. Looking at this in the form of charts, we examine country-based regressions that map local returns, currency returns and US dollar returns versus the net yield.

The relationship between net yield and local returns displays no discernable pattern and has an R-square of 0 (Figure 8). However, net yield versus the (currency implied) carry return does display a moderately positive relationship (Figure 9). Combining the local market bond returns with the carry returns from the currency hedge leads to a moderately positive relationship between hedged total returns and net yield (Figure 10).

**Increasing portfolio yield**

A smart beta benchmark — in this case enhancing portfolio yield — typically tilts constituent weights starting from market value weights. There are two elements that determine the final weights; firstly the scoring system for the yields and secondly the importance given to the scores. In this section, we outline a method of scoring and tilting followed by summary results for the hedged benchmark.

**Country scores and tilting**

A two-step process is used to assign a score to each country based on the yield of the associated country subindex. For the hedged benchmark, it is the net yield. The first step is to calculate a raw country score which is based on the difference between the country yield \( CY_{i,t} \) and the composite benchmark yield \( BY_{i,t} \). This is given by \( \Delta_{i,t} \):

\[ \Delta_{i,t} = CY_{i,t} - BY_{i,t} \]

To make the analysis robust in the face of potential outliers, we use a decile-based
approach that truncates extreme values (those in deciles 1 and 10). This is similar to winsorizing the data. To ensure all signals lie on a continuum bounded by -1 and 1, the set of decile-based country scores are scaled by their maximum absolute value to obtain the final signal ($\Delta_i^t$). The tilted weights $TW_i,t$ for each country $i$ is given by:

$$TW_i,t = \left(1 + \Delta_i^t\right)^\lambda \times BW_i,t$$

Where $BW_i,t$ the (market value) benchmark weight and $\lambda$ (tilt factor) controls the degree to which weights are tilted from the benchmark. To ensure diversification, reduction in turnover and no short selling, we ensure that the resulting $TW_i,t$ is no greater than 2x the corresponding $BW_i,t$ (recursively solved) and is greater than 0.

**Assessing performance**

Local market yields incorporate the cost of funding and is essentially a level effect. Net yield on the other hand — defined as YTW minus local funding rate — approximates the slope. Figure 11 displays the interquartile range (excluding Egypt, Nigeria, and Argentina) of net yields. It is interesting to note that the dispersion in the level of rates (country yields as shown in Figure 6) is far higher than the corresponding differences in slopes (net yields).

**Figure 11: Dispersion of net yield**

![Dispersion of net yield](image)

Source: Bloomberg

Based on the scoring and tilting methodology described above, we construct portfolios tilted on net yield (Figures 12 and 13). Increasing the tilt (and by implication the portfolio’s modified yield) leads to a monotonic increase in both annualized and risk-adjusted returns. Depending on the size of the tilt factor, this approach increased annualized returns between 40-110 bps, while maintaining both the drawdown and option adjusted duration of the market value weighted benchmark. The modified yield (see page 6 for the definition) of the portfolio is enhanced by 30-80 bps.

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5 Among other things this is to avoid negative weights.

6 See the definition on page 6.
However, the increase in returns is accompanied by a higher turnover. The excess monthly turnover relative to the benchmark ranges from 9.7% to 24.3%. Given bid/offer spreads for EM bonds and the increased operational intensity in managing the portfolio, this will likely be a concern for investors.

How can we control for turnover while maintaining the underlying improvement in portfolio characteristics? One route is to use an optimization-based approach.

**Controlling turnover**

The monthly portfolio turnover incurred by the tilting is driven by a combination of (1) changes in the difference in net yields and (2) the monthly weights being calculated on a standalone basis with no reference to prior weights (‘memoryless’). While this can be attenuated in a somewhat ad hoc manner such as using averaging over several periods to smooth changes in net yields, we can address this more directly by using an optimization routine. At the cost of some additional conceptual complexity, multiple constraints can be simultaneously imposed — namely weight allocation, turnover and tracking error. For the purposes of this study, the objective of the optimization function is to maximize portfolio net yield relative to the benchmark, while imposing weight and turnover constraints.
We ran four versions of the strategy:

1. **Version 1**: Country weight deviations constrained to +/- 50% of the benchmark weight and turnover restricted to 5% per month
2. **Version 2**: Country weight deviations constrained to +/- 50% of the benchmark weight and turnover restricted to 7.5% per month
3. **Version 3**: Country weight deviations constrained to +/- 100% of the benchmark weight and turnover restricted to 5% per month
4. **Version 4**: Country weight deviations constrained to +/- 100% of the benchmark weight and turnover restricted to 7.5% per month

If no solution is found, the turnover is allowed to increase by an additional 1%. Country weights sum to 1 for each period. The results are displayed in Figure 14 and Figure 15.

**Figure 14: Index performance: Optimized net yield**

![Graph showing index performance over time for different versions of the strategy.]

Source: Bloomberg

Similar to the section above, annualized returns for the tilted portfolios range from 60 – 110 bps in excess of the market value benchmark. However, the difference is the corresponding increase in volatility, which leaves risk adjusted returns approximately unchanged. In keeping with the characteristics of a typical carry strategy, the maximum drawdowns are higher than the hedged benchmark. For the least restrictive portfolios, the average OAD is lower than the benchmark — suggesting a negative relationship between net yield and duration.
Figure 15: Performance statistics: Optimized net yield

<table>
<thead>
<tr>
<th></th>
<th>Hedged benchmark</th>
<th>.5x/1.5x</th>
<th>0x/2x</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full sample (Jul 2008 - Mar 2019)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annualized total return</td>
<td>3.6%</td>
<td>4.2%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Annualized volatility</td>
<td>3.5%</td>
<td>3.7%</td>
<td>3.7%</td>
</tr>
<tr>
<td><strong>Sharpe ratio</strong></td>
<td>0.85</td>
<td>0.96</td>
<td>1.00</td>
</tr>
<tr>
<td>Modified yield</td>
<td>1.9%</td>
<td>2.3%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Average duration (OAD)</td>
<td>5.01</td>
<td>4.99</td>
<td>5.01</td>
</tr>
<tr>
<td>Max drawdown</td>
<td>-6.0%</td>
<td>-6.7%</td>
<td>-6.7%</td>
</tr>
<tr>
<td>Average monthly turnover</td>
<td>2.5%</td>
<td>5.0%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Annualized tracking error</td>
<td>0.0%</td>
<td>0.6%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

Source: Bloomberg

Diversifying funding

In earlier sections we highlighted the large impact of currency movements on the unhedged benchmark. Given the funding currency is the US dollar, changes in the value of the US dollar translate into gains/losses for benchmark investors. Since 2008, the correlation of monthly benchmark returns with the Bloomberg Dollar Spot Index\(^7\) is -0.87 (Figure 16). As the US dollar is considered a safe haven asset, the side effect of a US dollar funded investment is the manifestation of the ‘risk-on/off’ phenomenon commonly associated with uncertainty in the financial markets. The correlation between the unhedged benchmark and the VIX index; over the full sample, it is approximately -0.6 (Figure 17).

Figure 16: Negative correlation to the US dollar...

Figure 17: ... and the VIX index

Source: Bloomberg

Is there a simple solution to mitigate this effect and in the process enhance performance? In prior publications\(^8\) we discussed using correlations between the major G10 currencies (US dollar, euro, yen and sterling) to diversify away from the ‘dollar effect’. The proposal

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\(^7\) The Bloomberg Terminal ticker is BBDXY Curncy <GO>.

\(^8\) For example see Revisiting the EM Replicator, August 2017, Bloomberg LP.
was to use a portfolio of (long US dollar) currency forwards to reduce exposure to the US dollar for the EM investor. In the case of the Unhedged benchmark, potential benefits can be analyzed by examining the full sample and conditional behavior of the currency forwards.

**Examining correlations**

The excess returns profile of the (long) euro, yen and sterling forwards (Figure 18) suggests a low to moderate correlation. This is confirmed by the correlation matrix in Figure 19 which examines the monthly returns of the Unhedged benchmarks denominated in euro, sterling, yen and the US dollar. Over the period 2008 – 2019, correlations ranged between 0.3 – 0.7 and suggest that diversification might be beneficial.

![Figure 18: Long US dollar currency returns](image)

![Figure 19: Correlations of unhedged index returns](image)

As behavior over the full sample does not necessarily hold over subsamples – most notably periods of market distress – we turn next to conditional correlations. Using the VIX index as a gauge of market sentiment, we define periods of market distress (‘risk-off’ periods) as months when the level of VIX increased. The conditional correlation is measured as the correlation between rising VIX levels and the corresponding returns of the US dollar, euro, yen and sterling denominated unhedged local bond benchmarks (Figure 20). While all correlations are negative and range between -0.7 and -0.2, there is a clear distinction between the US dollar and yen which are considered to be part of the so-called ‘flight to quality’ assets and the euro and sterling.

The average monthly returns (Figure 20) reflect a similar pattern between the funding currencies. The US dollar and yen denominated benchmarks incur average losses of between -1.6 to -1.1%. In contrast, funding with sterling leads to an average loss of -0.1% while euro funding actually leads to a gain of 0.3%. An equally weighted average of the four currencies – referred to as Diversified in Figure 20 – maintains the same conditional correlation as the US dollar funded benchmark, but incurs an average monthly loss of only -0.6%.
Figure 20: Behavior during periods of rising market uncertainty (2008-2019)

<table>
<thead>
<tr>
<th>Base currency</th>
<th>Correlation</th>
<th>Av. monthly return</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR</td>
<td>-0.23</td>
<td>0.3%</td>
</tr>
<tr>
<td>GBP</td>
<td>-0.32</td>
<td>-0.1%</td>
</tr>
<tr>
<td>JPY</td>
<td>-0.66</td>
<td>-1.6%</td>
</tr>
<tr>
<td>USD</td>
<td>-0.59</td>
<td>-1.1%</td>
</tr>
<tr>
<td>Diversified</td>
<td>-0.60</td>
<td>-0.6%</td>
</tr>
</tbody>
</table>

Source: Bloomberg

Portfolio performance

The diversified funding portfolio is implemented via a basket of three equally (notional) weighted currency forwards. The currency portfolio consists of long positions in one-month currency forwards that are positioned long the US dollar versus the euro, sterling and yen. Each forward is sized to be 25% of the total notional of the bond benchmark. This results in a de facto funding basket comprising 25% exposure to the US dollar, euro, sterling and yen.

The composite portfolio comprises of the funded bond benchmark and the unfunded currency portfolio; effectively converting the US dollar funding exposure of the EMLitTRUU index to a G4 funded exposure. We refer to this portfolio as the Diversified Funding EM portfolio (Diversified funding) and show results in Figures 21 and 22.

Figure 21: The impact of funding

Figure 22: Comparing performance

<table>
<thead>
<tr>
<th></th>
<th>Unhedged benchmark</th>
<th>Diversified funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full sample (Jul 2008 - Mar 2019)</td>
<td></td>
<td></td>
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<tr>
<td>Annualized total return</td>
<td>2.4%</td>
<td>4.6%</td>
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<td>Annualized volatility</td>
<td>11.7%</td>
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<tr>
<td>Sharpe ratio</td>
<td>0.15</td>
<td>0.43</td>
</tr>
<tr>
<td>Max Drawdown</td>
<td>-24.7%</td>
<td>-16.2%</td>
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</table>

Source: Bloomberg

There is a significant improvement in both the magnitude and quality of returns (Figure 22) along with a reduction in downside risk (drawdown-to-volatility ratio declines from 2.1 to 1.8). While the Diversified funding portfolio has better risk adjusted returns, the correlation to the US dollar benchmark remains high (0.91). This suggests that were it to be used, it would not significantly impact the long-run characteristics of the wider EM portfolio within which this allocation would likely reside.
Conclusion

Building on previous research that decomposes the returns of emerging markets into factors (duration, currency, and credit), we assessed the performance impact of enhancing portfolio yield and diversifying currency exposure. The analysis suggests tilting on net yield leads to an increase in annualized and risk-adjusted returns for currency hedged benchmarks, while diversification of the funding currency leads to higher and less volatile returns for unhedged benchmarks.
References


5. Ghia K., Khambatta Z. (2017), "Revisiting the EM Replicator", Bloomberg LP
## Appendix

### Appendix 1: EM Local Currency Government 10% Country Capped Index (ID 22850) Country Constituents

<table>
<thead>
<tr>
<th>Region</th>
<th>Country</th>
<th>Index ID</th>
<th>Currency Ticker</th>
<th>Funding Rate Ticker</th>
<th>Notes</th>
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Source: Bloomberg
Appendix 2: Net yield vs. monthly local return

Source: Bloomberg

Appendix 3: Net yield vs. monthly carry available

Source: Bloomberg

Appendix 4: Net yield vs. monthly total return (US dollar)

Source: Bloomberg
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