

Global Rates Strategy

Global rates: converging or drifting apart?

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- On the other hand, output gap and core inflation differences are statistically and economically important drivers of rate differences. We find the difference in core inflation to be a particularly important driver of the Bund-Treasury spread
- After accounting for these factors, we find the current bunds-treasury rate differential is still too wide. Thus, we expect it to compress unless core inflation differentials widen further between the US and Euro area
- More generally, after accounting for the drivers of policy rates, cross-country rate differentials tend to close in a matter of months.

Global Rates

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Global rates: converging or drifting apart?

After moving in a tight range since the financial crisis, a large gap has emerged between Treasury and Bund yields since May 2013 (Figure 2). Investors have noted that perhaps this is appropriate given the very different growth performance in the Euro area versus the US. If so, will this rate differential persist for several years or will rates converge?

In this article, we examine the drivers of rate differentials among some of the core markets government markets and conclude that:

- (i) Contrary to conventional wisdom, near-term GDP growth differentials (both realized and forecast) have a negligible effect on rate differentials in the three country pairs we studied
- (ii) On the other hand, output gap and core inflation differences are statistically and economically important drivers of rate differences. We find the difference in core inflation to be a particularly important determinant of the Bund-Treasury spread
- (iii) After accounting for these factors, we find the current bunds-treasury rate differential is still too wide. Thus, we expect it to compress unless core inflation differentials widen further between the US and Euro area
- (iv) More generally, after accounting for the drivers of policy rates, cross-country rate differentials tend to close in a matter of months.

Yield spreads are mean reverting

In contrast to rate levels, where there has been a declining trend since the early 1980s, yield spreads are quite notably mean reverting. The statistics in Figure 1 confirm the intuition from visual inspection; the three yield spreads we examine mean revert with a half-life of between 0.9 and 1.5 years. Clearly, yield spreads are promising candidates for mean reversion trading. The question is, can we do better than merely trading the raw yield spread as a mean reverting quantity?

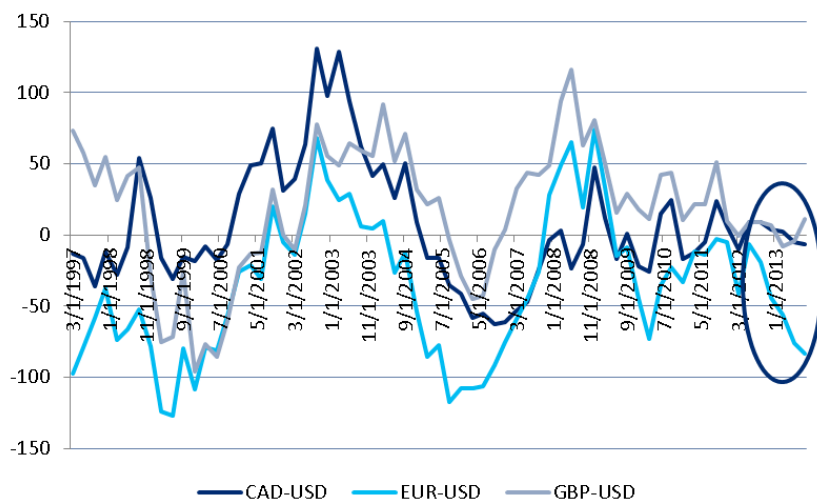
Figure 1. Yield spreads are mean reverting

	Mean Reversion Half-Life (Yr)	Standard Deviation
CAD-USD	0.9	42
EUR-USD	1.5	49
GBP-USD	0.9	45

Source: Citi Research

Notes: Half-life of 10-year cash yield spreads is the time it takes for the spread to move halfway to the long-term mean. It is computed by regressing spread changes on lagged spread levels.

Figure 2. Bund and Treasury yields diverge



Source: Citi Research, Bloomberg

Note: 10-year cash spreads in all cases with Bunds for EUR-USD spread. Quarterly data ended September 30th 2013

Figure 3. Growth differentials do not drive the Bund-Treasury spread...

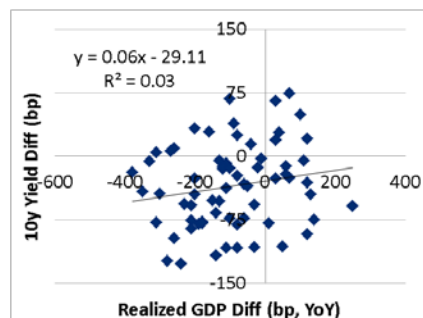
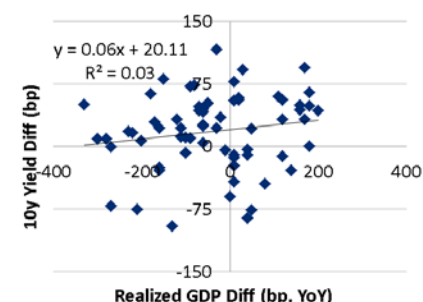


Figure 4. ... or the Gilt-Treasury spread



Source: Citi Research, Bloomberg
Notes: Scatter plot of spread in quarterly change in GDP vs spread in 10y yields for Eurozone, UK vs US. Quarterly data, March 1997 through June 2013.

The growth differences between countries/regions is the first metric investors bring up when discussing yield differences; the plausible argument being that the countries with faster growth should have higher rates. This is based on the argument that nominal GDP growth drives 10-year yields. Unfortunately, the data are not kind to the theory. There is a barely discernible positive relationship between realized GDP growth differences and 10-year differences (and Figure 4). One year ahead growth forecasts do an equally poor job.

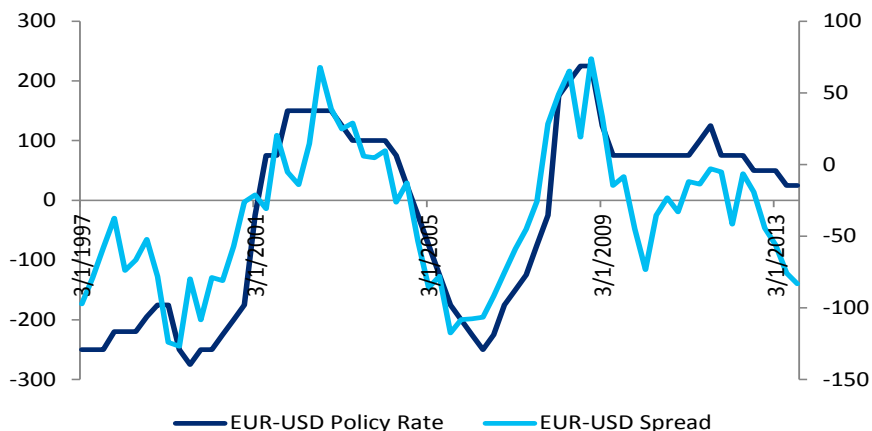
Figure 5 provides some clues to this seemingly strange finding; policy rate differences and 10-year rate differentials move together closely. While the growth outlook is certainly an important consideration for the monetary policy stance, inflation and the level of economic slack are clearly the more important drivers. For example, the famous Taylor rule specifies the appropriate policy rate entirely in terms of inflation and output gap. The appendix formalizes an analogous argument for longer term rates.

Inflation and output gap are the key drivers

The tight link between policy rate and 10-year yield differentials suggests that inflation and output gap are promising candidates and indeed this is confirmed by Figure 6 and Figure 7. Inflation differences are the most important driver of the Bund-Tsy spread with the output gap a significant but less important driver. Note that the widest spreads between Bunds and Treasuries occurred in late 2002 and mid-2008, coinciding with peak core inflation differentials. Similarly, the last time that Bunds traded ~100 bp rich to Treasuries was in late 2005/early 2006 when core inflation in the US was running well above target.

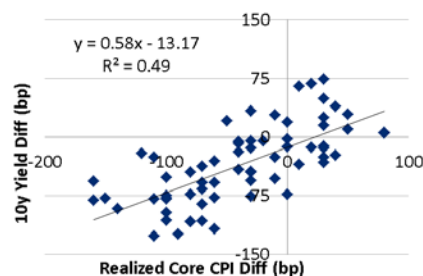
Combining the two variables via multiple regression analysis should permit a better fit to yield spreads. Figure 8 summarizes the results of this analysis for the years 1997 to 2013. As discussed earlier, inflation largely drives the Bund-Treasury spread; a 1 pp change in the core inflation differential predicts a 50 bp change in the yield spread. The sensitivity of relative rates to inflation is quite consistent with the ECBs rather single minded focus on inflation.

Figure 5. Tight link between policy rate and 10-year rate differentials



Source: Citi Research, Bloomberg
Note: Quarterly Data, Through Sep 30, 2013

Figure 6. Core inflation moves the Bund-Treasury spread ...



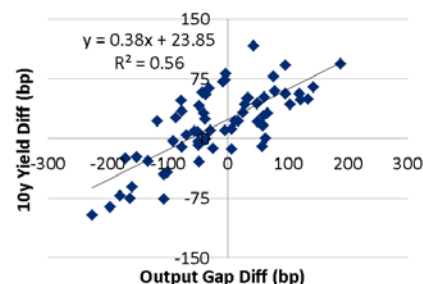
Source: Citi Research, Bloomberg

Notes: Quarterly change in HICP less energy and unprocessed food (EU) -Core CPI (US) vs Bund-Tsy 10y yield spread. Quarterly data, Mar '97 – Jun '13.

The situation is quite different for the Gilt-Treasury yield spread, which is explained largely by output gap differences. While both the BOE and the Fed focus on inflation as a key objective, the output gap looms large in the policy rate settings as evidenced by the recent forward guidance in both countries.¹ Specifically, the guidance prescribes necessary conditions for increasing rates in terms of unemployment thresholds – a proxy for the output gap.

Finally, both inflation and output gap matter in the Canadian government yields versus Treasury yields, though the results are not as strong as for Bunds and Gilts. Canada is a smaller and more open economy and we suspect that movements in the FX rate could trigger meaningful movements in future inflation rates and, by implication, the appropriate level of 10-year yields.

Figure 7. ...and output gap the Gilt-Treasury spread



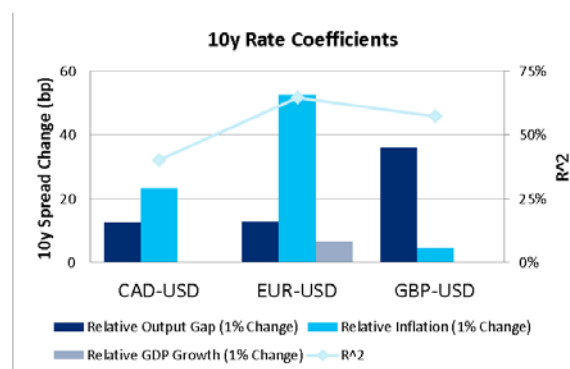
Source: Citi Research, OECD

Output Gap is the difference between actual and potential GDP. Quarterly data, Mar '97 – Jun '13.

Multivariate regression improves mean reversion

While the results of the regression analysis are encouraging, how much more information does it add to our earlier observation that the yield spread series tend to converge over time? In other words, if the residual from the regression is large, does it signal that the yield spreads will move in a way to close the residual? While we have not completed the study of a trading strategy, it is encouraging that the residuals from the regression mean revert faster than the raw yield spreads (Figure 9) suggesting that information from output gap and inflation does seem to improve yield spread forecasting.

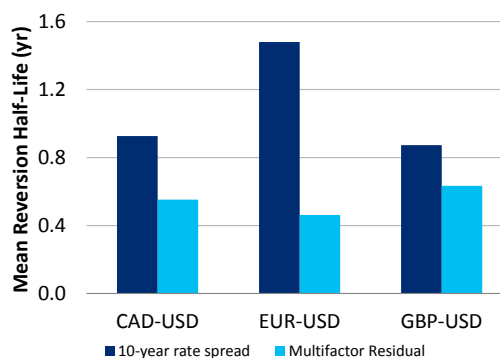
Figure 8. Output gap and inflation key variables for yield spreads



Source: Citi Research

Notes: Coefficients from regression of 10-year yield spread on yoy core CPI, output gap, and GDP growth (in the case of EUR) differences. A 1% change in the factor corresponds to a change in the model 10y spread equal to the factor coefficient.

Figure 9. Multivariate regression residuals mean revert quicker than yield spreads



Source: Citi Research

Notes: Half-life is the time it takes for the spread to move halfway to the long-term mean.

¹ As of January 2012, the FOMC's monetary policy statement was augmented to include statements of the FOMC's longer-run goals, including that the longer-run inflation goal most consistent with the FOMC's price stability mandate is 2 percent, and that the central tendency of FOMC participants' estimates of the longer-run normal rate of unemployment ranges from 5.2 to 6 percent. In December 2012, the FOMC replaced its 'calendar' guidance regarding the timing of raising the fed funds rate with quantitative measures of economic conditions. Specifically, the Committee said it anticipates that exceptionally low levels for the federal funds rate will be appropriate "at least as long as the unemployment rate remains above 6-1/2 percent, inflation between one and two years ahead is projected to be no more than a half percentage point above the Committee's 2 percent longer-run goal, and longer-term inflation expectations continue to be well anchored." The Fed's monetary policy statements can be found at: <http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm>.

But how about the flight to quality premium?

One potential criticism of our analysis would be that it does not account for some significant changes that have occurred in the market since the financial crisis; for instance, all core government bond yields have been lowered due to increasing risk aversion. This should not prejudice our analysis since we are examining yield differences. However, it is possible that different markets have been affected by different amounts. In particular, the supply of Euro denominated high quality bonds has shrunk dramatically as investors have lowered exposure to periphery economies. This should have affected Bunds more than other core markets.

Figure 10. Bunds and Canadian govt. bonds richen post financial crisis

	10-year swap spread (bp)		Cash Richening
	Median (2003-2013)	Current (Oct 2013)	
US	46	15	-31
EUR	28	31	3
GBP	36	-1	-37
CAD	34	49	15

Source: Citi Research, Bloomberg

Notes: Cash richening = Median of the past 16 years – Current spread

Swap spread dynamics suggest a way to quantify the effect of flight to quality on different markets. In general, the fixed leg of 10-year swap rates closely track 10-year government rates since the floating leg counterpart – 3-month LIBOR versus repo rates² – trades in a tight range. If there is increasing investor preference for Bunds, for example, 10-year Bunds should richen to 10-year swap rates. Or equivalently, swap spreads should widen relative to historical experience.

A comparison of current 10-year swap spreads in the different currencies suggests that Bunds have richened more because of a flight to quality spread relative to other markets (Figure 10); specifically, Bunds have richened around 34 bp to Treasuries.

Outlook for core inflation should drive the Bunds-Treasury spread

Applying the analysis to current market conditions suggests that Gilts and Canadian government bonds are priced fair to Treasuries (Figure 11). However, the Bund-Treasury spread is much too wide relative to the currently observed inflation and output gap difference. Even accounting for the 34 bp richening in bunds versus Treasuries due to the flight to quality premium, Bunds still appear rich to Treasuries by around 24 bp. It is possible that investors expect inflation differentials to widen as core inflation falls in the Euro area as part of the necessary adjustment process. Were this not to happen, it would be hard to see these yield differentials sustained.

Figure 11. Bunds rich to Treasuries given current inflation and economic slack

	Core inflation gap (%)	Output gap (%)	GDP Growth (%)	10-yr Yield Spread (bp)	
				Market	Fair Value
EUR-USD	-0.5	1.4	-2.2	-81	-24
GBP-USD	2.2	-0.4		8	13
CAD-USD	-0.9	1.6		-8	15

Source: Citi Research, Bloomberg, OECD

Notes: Fair value is computed via the regression described in the text. Regressors are yoy core CPI, output gap, and GDP growth difference. Analysis date October 15, 2013.

² Receiving the fixed leg of a 10-year swap is equivalent in risk terms to a repo financed long position in 10-year government paper. Both are unfunded positions with duration risk.

Appendix: An Empirical Model of International Rate Spreads

In this section, we derive a model of international relative rates in terms of the observed values of current macroeconomic variables. Our objective is to lay bare the range of assumptions, implicit or explicit, benign or heroic, that go into our estimates of cross-country rate differential drivers presented above.

Our empirical point of departure is the Taylor rule relationship between the central bank's policy instrument (r) and economic fundamentals. These fundamentals include: (i) the 'inflation gap' ($\pi_t - \pi^*$), which is the difference between actual inflation and the central bank's target rate, (ii) the output gap ($GDP_t - GDP^*$), which is the difference between the economy's actual and potential levels of output, and (iii) the 'neutral' rate (r^*), which is the rate prevailing when the inflation and output gaps are closed. The central bank's reaction to deviations from its target inflation rate and potential GDP is characterized by the parameters δ and β , respectively.³

$$r_t = r^* + \delta(\pi_t - \pi^*) + \beta(GDP_t - GDP^*)$$

Longer-term rates reflect the expected path of the shorter term rates (i.e., the future policy rates) as well as a term premium (TP), which is the extra compensation required by investors to hold a long-term asset instead of rolling over shorter-term exposures. For simplicity, we will model the cumulative path of short term rates as the sum of r between today and some period in the future T and the term-premium as the residual between the long-rate and that expected path of short rates.⁴ The gross T -period return of the longer-dated security is thus:

$$\begin{aligned} R_t &= \sum_{i=0}^T r_t + TP_t \\ &= R^* + \delta \sum_{i=0}^T (\pi_i - \pi^*) + \beta \sum_{i=0}^T (GDP_i - GDP^*) + TP_t \end{aligned}$$

This expression tells us that the long rate is a function of the expected future paths of the inflation and output gaps as well as the term premium. Providing estimates of the inflation and output paths is complicated, since it requires a model of the reaction of both inflation and GDP to r and to each other. Recall that in reality, short rates and macroeconomic fundamentals determine one another simultaneously, which makes it difficult to lay out a very precise path for any given variable. That path will be buffeted not only by that variable's idiosyncratic behavior but also its reaction to the behavior of all other variables.

We will take a shortcut by modeling the response of each variable to the policy rate only implicitly, taking as given that r will be set by policymakers to close both inflation and output gaps over time. Specifically, assume that the inflation gap closes at a rate α_π per period while the output gap closes at a rate of α_{GDP} per period, which implies that the gaps evolve according to:

³ It is also worth noting that r_t should be interpreted as an 'effective' rate rather than the actual path of the central bank's policy rate, given that many of the policy rates under consideration have been bound at or close to zero over recent years.

⁴ This assumption implies that the gross return of 10 1-year exposures at 2 percent equals 20 percent, which ignores the compounding of interest earned each year. The more realistic modeling of compound interest (i.e., modeling the long rate as the geometric, not arithmetic, mean of expected future short rates) would complicate our exposition without much gain in intuition. As Russian President Vladimir Putin might say, "It's like shearing a piglet - too much squealing, too little wool." (June 25, 2013)

$$(\pi_{t+1} - \pi^*) = \alpha_\pi(\pi_t - \pi^*)$$

$$(GDP_{t+1} - GDP^*) = \alpha_{GDP}(GDP_t - GDP^*)$$

Plugging these into the equation for long rates and iterating forward over a large number of periods (i.e., for some large value of T) yields:

$$R_t \cong r^* + \frac{\delta}{(1 - \alpha_\pi)}(\pi_t - \pi^*) + \frac{\beta}{(1 - \alpha_{GDP})}(GDP_t - GDP^*) + TP_t$$

In this latest expression, we no longer have to worry about modeling the future path of inflation or output since long rates are a function of only *today's* inflation and output gaps combined with the speed at which policy is expected to close those gaps in the future. Taking the difference of R across countries, while holding the parameters ($\delta, \beta, \alpha_\pi, \alpha_{GDP}$) fixed across countries, gives us something quite close to our regression specification for international relative rates:

$$\begin{aligned} R_{t, EUR} - R_{t, US} &= (r_{EUR}^* - r_{US}^*) + (TP_{t, EUR} - TP_{t, US}) \\ &+ \frac{\delta}{(1 - \alpha_\pi)} [(\pi_{t, EUR} - \pi_{EUR}^*) - (\pi_{t, US} - \pi_{US}^*)] \\ &+ \frac{\beta}{(1 - \alpha_{GDP})} [(GDP_{t, EUR} - GDP_{EUR}^*) - (GDP_{t, US} - GDP_{US}^*)] \end{aligned}$$

The first expression on the right-hand side is the relative neutral rate, which is likely to be fairly stable over the time horizons that we consider. Given its stability, that expression will not factor into our estimates by much at all; it will either be absorbed in the constant term of our regression or else drop out altogether when looking at changes in the rate spread over time.

It is more difficult to make similar statements for the relative term premium, the second expression on the right-hand side. Research has shown that term premia tend to evolve over time and, further, that they are likely responsive to changes in economic fundamentals. However, in the absence of very reliable empirical estimates of these term premia for each country and how they change with economic developments, we will largely abstract from their influence on rate spreads. One might thus interpret our empirical exercise as providing 'risk neutral' estimates of the drivers of international rate spreads. It is also worth noting that the relative term premium across countries will be insensitive to drivers that are common to both countries. For example, if there is a global financial shock that raises term premia in all countries equally, the difference in term premia across countries will not be affected.

Our empirical exercise focusses mostly on the final two expressions on the right-hand side, which show the relationship between the relative inflation gap and the relative output gap across countries on rate spreads. As noted before, these estimates will reflect features of both the underlying central bank Taylor rule as well as the dynamic response of inflation and GDP to short term interest rates.⁵

⁵ Since one might not expect those parameters to be equal across countries, the terms $\frac{\delta}{(1 - \alpha_\pi)}$ and $\frac{\beta}{(1 - \alpha_{GDP})}$ might themselves be best interpreted as cross country averages.

Appendix A-1

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