# How much should we trust z-spreads in bond RV analysis?

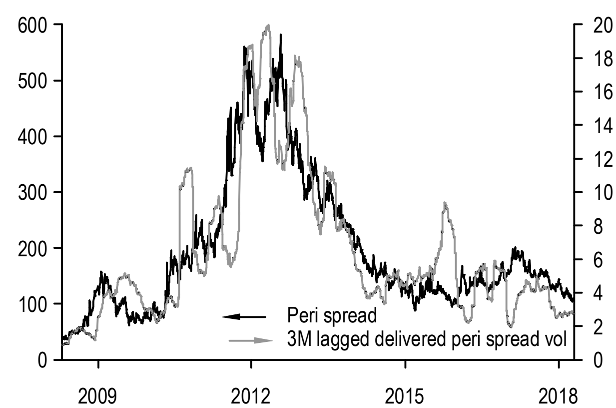
- **If the low volatility environment persists, investors in fixed-income markets will be pushed towards RV to generate alpha**
- **Looking at bond RV, in this technical note we use theoretical curves to highlight that z-spreads, although better than maturity-matched swap spreads, do not perfectly take into account different coupon rates across bonds**
- **The z-spread mispricing of the coupon effect is a function of the relative slope of the government curve compared to the swap curve**
- **In the case of French 10-30Y bonds, we estimate that, ceteris paribus, a 1% higher coupon makes a bond around 0.4bp optically richer on the z-spread curve, and show that the RV analysis leads to different conclusions once the coupon adjustment is taken into account**

With risk-free rate volatility stuck at very low levels and sharp tightening in intra-EMU spreads hinting at subdued intra-EMU volatility going forward (**Exhibit 1**), investors in fixed-income markets are pushed towards RV to generate alpha.

In the past we have analysed the micro impact of cash flows (auctions, syndicated deals, coupon payments and redemptions[1]). We have also discussed in various weeklies bond RV frameworks for the periphery[2] and in core[3].

**Exhibit 1: Intra-EMU volatility is likely to remain subdued going forward**

10Y weighted peripheral spread to Germany and 3M ex-post delivered volatility of 10Y weighted peripheral spread to Germany lagged by 3 months;




In this technical note, we analyse how using z-spread[4] for RV purpose still leaves some residual components when comparing bonds with different coupons, and we propose some rules of thumb to adjust in real-life situations, looking at Italy, France and Germany curve proxies.

**Why z-spreads are better than maturity-matched swap spreads but still not good enough?**

[1] See *Follow the cash flow: Trading strategies around supply, redemptions and coupon payments in Euro government bond markets* and *Follow the cash flow (Part 2): Trading strategy around Euro government bond syndicates*.
[2] See Special focus I: Update on high-low coupon performance on the Italian curve in *Euro Cash*, 18 August 2017
[3] See Special focus II: Framework to screen bond specific RV in core countries in *Euro Cash*, 13 October 2017.
[4] In our context, the z-spread is the margin that needs to be applied to zero curves extracted from swap curve to match the PV of the bond cash flow to the dirty price of the bond.

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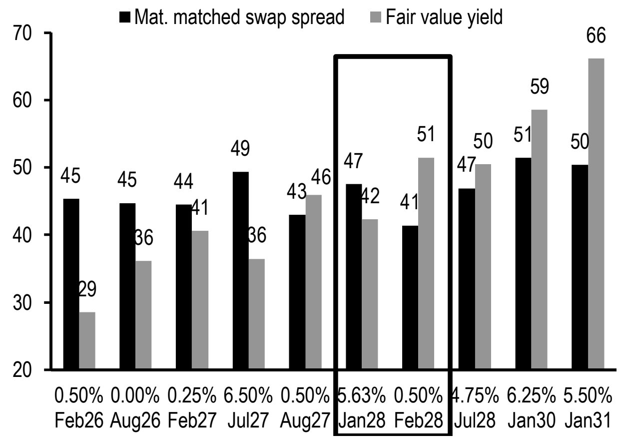
The Holy Grail of bond RV is to have very precise government par curves, with a fitting process that is not too sensitive to market movements and to the inclusion/exclusion of new bonds. In practice, these issues have not been solved in a fully satisfactory way and force RV analysis to look at other options besides cheap/dear calculated on a fitted par curve.[5]

A cross-sectional bond RV analysis on the yield curve is not very accurate, especially when curves are very steep, and the first obvious step is to look at the maturity-matched swap spread curve. This tends to work reasonably well apart from instances when high-coupon off-the-run bonds neighbour more recent low-coupon bonds. With steep curves the maturity-matched swap spread and the fair value yield calculated from a fitted par curve can be very different for high- and low-coupon bonds (**Exhibit 2**). For instance there is a more than 10bp difference between these measures for Bund 5.625% Jan28 and the Bund 0.5% Feb28!

**Exhibit 2: RV analysis based on fitted curve yields and swap spreads is not ideal in case of adjacent high-low coupon bonds**

Matched-maturity swap spread and fair value yield based on J.P. Morgan fitted par curve for German bonds in the 6Y-13Y sector; as of 17 April




The z-spread calculation tries to address the problem of different coupons by using as anchor the entire shape of the swap curve rather than the maturity-matched point. For this to work perfectly, i.e. fully compensating for different coupons, the swap spread curve needs to have exactly the same slope as that of a fitted government bond curve. Unfortunately, empirically only the German curve is close to satisfying that requirement: most of the other Euro area government curves are steeper than the swap curve. As we will see more in details below, the more inclined the swap spread curve is the more watered down the high-low coupon adjustment is.

Are we being too picky? Our simulations argue that we are not. We build theoretical government and swap curves that share some key characteristics with real life example, and we shock them to gauge the relative impact of different drivers. Our reference variable is the "*z-spread mispricing*", i.e. we look at the difference between z-spread between a 6% and a 1% 30Y bond priced fair on the government bond curve (see Appendix for more details on the methodology). For the z-spread to be a true measure of RV (i.e. robust to high-low coupon effects), the z-spread difference between the two bonds should be 0bp: any deviation from 0bp is entirely optical and misleading.

**Exhibit 3** shows a summary of our simulations. We highlight:

1. The z-spread mispricing is largest for an Italy proxy, followed by France and Germany. With a 5% coupon difference in 30Y bonds, the mispricing ranges from more than 10bp for Italy to ~1bp in the case of Germany.

2. The level of the government spread to the swap curve matters only up to a point. A parallel 100bp rise or fall in the government zero curve increases the mispricing by roughly 10%, i.e. almost negligible. Parallel rises and falls in the swap zero curve do not have any impact by construction.[6]

3. Changes to the relative shape of the government and swap curve are more important. For instance, a relative 100bp steepening/flattening of the government bond curve increases/reduces the z-spread mispricing by 6-9bp, with the exact size depending on the starting shape of the swap spread curve. As discussed above in the case the shape of the theoretical government bond curve has exactly the same shape as the swap curve, the z-spread is an accurate measure of fair value.

[5] Cheap/dear measures for European bonds are available in our daily cash packages.
[6] Any parallel shift in the swap zero curve is immediately reflected in a different level of the z-spread but with no impact on relative valuations between bonds.

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**Exhibit 3: Z-spread based RV analysis is also distorted by the level and shape of government and swap curves**

Z-spread mispricing under various simulations described in the text; bp

| | Italy | France | Germany |
|---|---|---|---|
| **Proxy*** | 12.4 | 3.0 | 1.0 |
| **Level** | | | |
| Govt +100bp | 1.1 | 0.3 | 0.1 |
| Govt -100bp | -1.2 | -0.3 | -0.1 |
| Swap +100bp | 0.0 | 0.0 | 0.0 |
| Swap -100bp | 0.0 | 0.0 | 0.0 |
| **Curve** | | | |
| Govt +100bp | 9.2 | 7.6 | 7.1 |
| Govt -100bp | -8.0 | -6.3** | -5.8** |
| Swap +100bp | -7.5 | -6.7** | -8.5** |
| Swap -100bp | 7.2 | 6.5 | 4.2 |

Note: "*z-spread mispricing*", i.e. we look at the difference between z-spread between a 6% and a 1% 30Y bond priced fair on the government bond curve (see Appendix for more details on the methodology).

* z-spread mispricing: if positive the z-spread on the low coupon bond is optically higher than the one on the high-coupon one, but the cheapness of the former is misleading as both bonds are priced fair by construction

** In these cases the mispricing flips sign, i.e. low-coupon bond appears richer than the high-coupon bond

In our view, any serious static and dynamic bond RV analysis based on z-spreads should therefore incorporate an adjustment for the distortions discussed above.

### How to adjust for z-spread distortions?

**Exhibits 4-5** show our attempt to mimic the corrections required looking at the long end of the French curve. We price existing French bonds in the 2028-48 using the government and swap curves used in the simulation above. All bonds are priced fair by construction whereas the optical RV ranges from +1bp to -1bp (Exhibit 4). The rule of thumb for French bonds is that every 1% difference in the coupon rate requires a 0.4bp adjustment to the cheap/dear estimate based on z-spread (on average, low-coupon bonds are less cheap than they look and high-coupon bonds are less expensive than they look, Exhibit 5).

**Exhibit 4: Plenty of RV? No, it's all optical**

Z-spread of existing 2028-48 French bonds calculated over our simulated government bond and swap curves (see Appendix for detail); bonds are trading fair by construction; bp

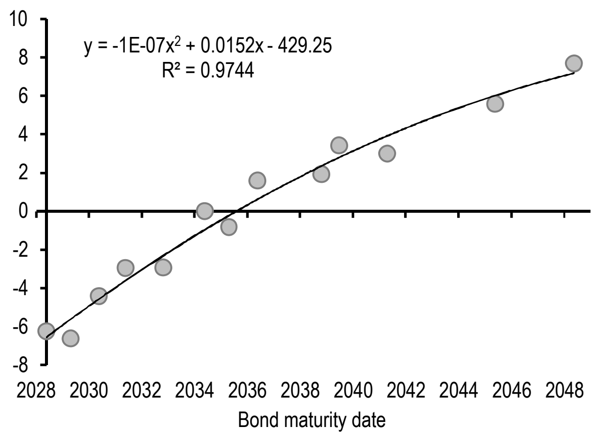


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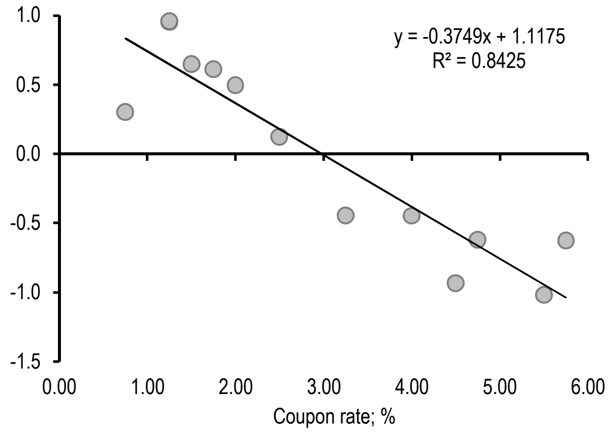
**Exhibit 5: Every 1% difference in the coupon rate requires a 0.4bp adjustment to the cheap/dear estimate based on z-spread on the French curve**

**Y-axis**: Residual of z-spread existing 2028-48 French bonds calculated over our simulated government bond and swap curve (see Appendix for detail) regressed against maturity (quadratic fit); **X-axis**: bond coupon rate; bp




When we apply the coupon adjustments to the market z-spreads, the RV analysis changes quite a bit. For instance, based on the market z-spread measure, the OAT Oct32 could be described as slightly dear vs. the May31 and the May34 as the z-spread is close to the one of the short-dated May31 and more than 1bp dearer than the longer dated May34. However, the coupon-adjusted z-spread shows the OAT Oct32 cheaper than both![7]

**Exhibit 6: Adjusting z-spreads for the coupon effect gives a different assessment of fair value**

Market and coupon-adjusted using methodology discussed above z-spreads and maturity-matched swap spreads; 10-30Y French bonds; as of 19 April; bp

| Maturity | Coupon | Z-spread (market) | Z-spread (with coupon adjustment) | Coupon adjustment | Maturity-matched swap spread |
|---|---|---|---|---|---|
| 25-May-28 | 0.75 | -21.2 | -22.1 | -0.8 | -21.3 |
| 25-Apr-29 | 5.50 | -20.0 | -19.0 | 0.9 | -28.1 |
| 25-May-30 | 2.50 | -19.6 | -19.8 | -0.2 | -23.1 |
| 25-May-31 | 1.50 | -18.9 | -19.5 | -0.6 | -20.3 |
| 25-Oct-32 | 5.75 | -18.5 | -17.5 | 1.0 | -28.4 |
| 25-May-34 | 1.25 | -17.1 | -17.7 | -0.6 | -17.4 |
| 25-Apr-35 | 4.75 | -16.9 | -16.3 | 0.7 | -25.3 |
| 25-May-36 | 1.25 | -14.2 | -14.8 | -0.6 | -14.4 |
| 25-Oct-38 | 4.00 | -10.4 | -10.0 | 0.4 | -17.1 |
| 25-Jun-39 | 1.75 | -7.9 | -8.4 | -0.5 | -9.5 |
| 25-Apr-41 | 4.50 | -4.4 | -3.8 | 0.6 | -11.5 |
| 25-May-45 | 3.25 | 6.8 | 6.9 | 0.1 | 2.6 |
| 25-May-48 | 2.00 | 13.7 | 13.3 | -0.4 | 11.8 |

As shown in Exhibit 3, the z-spread mispricing and its beta to the coupon rate are not fixed but depend on the shape of the swap spread curve to a large extent with the level less important: for instance the beta is lower for German bonds and much higher for Italian bonds.[8]

We conclude by highlight that given the slow-moving nature of the drivers of the distortion, a dynamic analysis (i.e. looking at how measures of cheap/dear evolve over time) will be less impacted than a static one. However, it remains crucial to determine whether, for instance, a bond has been moving from cheap to fair or from fair to expensive, so we believe that the corrections for high-low coupon effects even using z-spreads are necessary.

[7] We also show as a reference the maturity-matched swap levels.

[8] When looking at RV on Italian (or other peripheral) bonds, the most important variable to consider is the pricing of the probability of debt restructuring with exit PV that is fixed and independent of the original cash flow. We plan to tackle the issue with a simulation framework similar to this in a future note.

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## Appendix: Synthetic curve methodology

To isolate the distortions created by high-low coupon effects in bond RV analysis based on z-spreads and explore their sensitivity to easy-to-understand and observable drivers, we create proxies for the Italian, French and German government zero curves and the Euro swap zero curve. The curves are generated using the following formula:

$\text{Yield}_{t} = \text{yield}_{t-1} + \text{increase factor} / t$

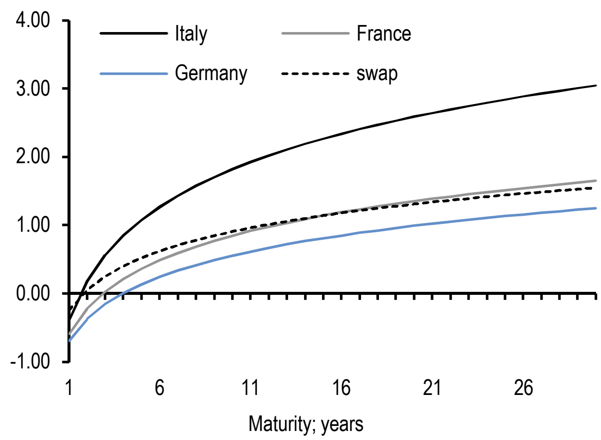
With t = 1, 2, 3,… 30 (annual)

Only two parameters are needed: *1)* the starting level (or yield 0) and *2)* the increase factor that determines the steepness of the curve. In this very simple set-up, the most important characteristics of yield curves are maintained and the curves are easy to manipulate.

The parameters are chosen to provide levels of 1Y and 30Y zero rates fairly close to market levels in each curve (**Exhibit 7**). By changing the starting level and increasing factor parameters, we can simulate changes to the level of one curve, changes to its shape of the curve or a combination of the two.[9]

**Exhibit 7: We create proxies for government and the Euro swap zero curves**

Proxy zero curves for the Italian, French and German government zero curves and the Euro swap zero curve created based on the methodology explained in text; %




We use the discount factors from these curves to price 30Y bonds with par, 6% and 1% coupons that by constructions are trading fair, i.e. the dirty price is equal to the sum of the discounted cash flow. We then calculate z-spreads; the optical difference between the high- and low-coupon bonds provides the "*z-spread mispricing*" under the different scenarios.

*All chart sources are J.P. Morgan, unless otherwise noted.*


**Rates Strategy**

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[9] We believe that an analysis of changes in the convexity/concavity of the curve would be one step too far and does not add much to the discussion.

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