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Understanding the Z-Spread
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A key measure of relative value of a corporate bond is its swap spread. This is the basis point spread over the interest-rate swap curve, and is a measure of the credit risk of the bond. In its simplest form, the swap spread can be measured as the difference between the yield-to-maturity of the bond and the interest rate given by a straight-line interpolation of the swap curve. In practice traders use the asset-swap spread and the Z-spread as the main measures of relative value. The government bond spread is also considered. We consider the two main spread measures in this paper.

Asset-swap spread

An asset swap is a package that combines an interest-rate swap with a cash bond, the effect of the combined package being to transform the interest-rate basis of the bond. Typically, a fixed-rate bond will be combined with an interest-rate swap in which the bond holder pays fixed coupon and received floating coupon. The floating-coupon will be a spread over Libor (see Choudhry *et al* 2001). This spread is the asset-swap spread and is a function of the credit risk of the bond over and above interbank credit risk.¹ Asset swaps may be transacted at par or at the bond's market price, usually par. This means that the asset swap value is made up of the difference between the bond's market price and par, as well as the difference between the bond coupon and the swap fixed rate.

The zero-coupon curve is used in the asset swap valuation. This curve is derived from the swap curve, so it is the implied zero-coupon curve. The asset swap spread is the spread that equates the difference between the present value of the bond's cashflows, calculated using the swap zero rates, and the market price of the bond. This spread is a function of the bond's market price and yield, its cashflows and the implied zero-coupon interest rates.²

Exhibit 1 shows the Bloomberg screen ASW for a GBP-denominated bond, GKN Holdings 7% 2012, as at 10 August 2005. We see that the asset-swap spread is 121.5 basis points. This is the spread over Libor that will be received if the bond is purchased in an asset-swap package. In essence the asset swap spread measures a difference between the market-price of the bond and the value of the bond when cashflows have been valued using zero-coupon rates. The asset-swap spread can therefore be regarded as the coupon of an annuity in the swap market that equals this difference.

¹ This is because in the interbank market, two banks transacting an interest-rate swap will be paying/receiving the fixed rate and receiving/paying Libor-flat. See also the author's "Learning Curve" on asset swaps available on www.yieldcurve.com

² Bloomberg refers to this spread as the Gross Spread.

Currency		Bond			Underlying Curves		
From GBP	To GBP	Buy/Sell	\$ Par Amt	1000 M	Price Date	BP	BP
		Workout	5/14/12 @	100.0000	8/10/05	22	<SWDF#> 22
Spot F/X		Swap			Crv Settle		
	1.000	Fixed	Coupon	Day Count	Freq	8/15/05	BGN BGN
Trade Settlement		Floating	4.76384%	ACT/ACT	1	Z-Spread	
8/15/05		Swap Par Amt (FLT)	4.64635%	ACT/365	2	118.8 bp	
			1000 M				
Gross Spread Valuation							
Implied Value 112.6477				Money	69.7M	=	Spread(bp)
							121.5
Swapped Spread Details							
Calculate <input type="button" value="B"/>				Money			Spread(bp)
1: Bond Price	105.6800/	5.94627%					
Swap Price	100	Cash Out	5.6800	-56.8M	=	-99.1 bp	
2: Swap Rate	4.76384%	Bond Cpn	7.0000	126.5M	=	220.6	
Redemption Premium / Discount		0.0000%		0.0	=	0.0	
Funding Spread		0.0 bp		0.0M	=	0.0	
3: Swapped Spread							121.5 bp
1 <Go> for X-currency spread summary, 2 <Go> to save, 3 <Go> to update swap crv							
<small>Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 920410 Hong Kong 852 2977 6000 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2005 Bloomberg L.P. 2 10-Aug-05 16:46:57</small>							

Exhibit 1

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Z-Spread

The conventional approach for analysing an asset swap uses the bond's yield-to-maturity (YTM) in calculating the spread. The assumptions implicit in the YTM calculation (see Choudhry 2005) make this spread problematic for relative analysis, so market practitioners use what is termed the Z-spread instead. The Z-spread uses the zero-coupon yield curve to calculate spread, so is a more realistic, and effective, spread to use. The zero-coupon curve used in the calculation is derived from the interest-rate swap curve.

Put simply, the Z-spread is the basis point spread that would need to be added to the implied spot yield curve such that the discounted cash flows of the a bond are equal to its present value (its current market price). Each bond cashflow is discounted by the relevant spot rate for its maturity term. How does this differ from the conventional asset-swap spread? Essentially, in its use of zero-coupon rates when assigning a value to a bond. Each cashflow is discounted using its own particular zero-coupon rate. The price of a bond's price at any time can be taken to be the market's value of the bond's cashflows. Using the Z-spread we can quantify what the swap market thinks of this value, that is, by how much the conventional spread differs from the Z-spread. Both spreads can be viewed as the coupon of a swap market annuity of equivalent credit risk of the bond being valued.

In practice the Z-spread, especially for shorter-dated bonds and for better credit-quality bonds, does not differ greatly from the conventional asset-swap spread. The Z-spread is usually the higher spread of the two, following the logic of spot rates, but not always. If it differs greatly, then the bond can be considered to be mis-priced.

Exhibit 2 is the Bloomberg screen YAS for the same bond shown in Exhibit 1, as at the same date. It shows a number of spreads for the bond. The main spread of 151.00 bps is the spread over the government yield curve. This is an interpolated spread, as can be seen lower down the screen, with the appropriate benchmark bond identified. We see that the asset-swap spread is 121.6 bps, while the Z-spread is 118.8 bps. When undertaking relative value analysis, for instance if making comparisons against cash funding rates or the same company name credit default swap (CDS), it is this lower spread that should be used.³

The same screen can be used to check spread history. This is shown at Exhibit 3, the Z-spread graph for the GKN bond for the six months prior to our calculation date.

1) YA		YIELDS		2) YASD		RISK & HEDGE RATIOS		GKNLN 7 05/14/12	
PRICE	105.680000	No Rounding				workout		HEDGE BOND	
YIELD	5.860	Wst				5/14/12	OAS	OAS	
SPRD	151.00	bp	gld-decimals	3/3		Mod Dur	5.39	5.40	5.47
						Risk	5.795	5.801	5.784
						Convexity	0.35	0.35	0.36
versus		UKT 5 03/07/12		BENCHMARK		Workout HEDGE Amount:1,001 M		DAS HEDGE Amount:1,003 M	
PRICE	103.680000	Save	Delete						
YIELD	4.350 %	sd:	8/11/05						
Yields are: Semi-Annual									
3) OAS		SPREADS		4) ASW		5) FPA		FINANCING	
OAS:	151.1	CRV#	110	VOL		Repo%	4.540	(360/365)	365
OAS:	118.7	CRV#	155	TED:		Int Income	191.78	Carry P&L	
ASW (A/A)	121.6	ZSPR	118.8	11) History		Fin Cost	-133.67	58.11	
CRV#	155	U.K. POUND SWAP				Amortiz	-21.70 <->	36.41	
ISPRD	115.9	DSPRD	116.6			Forward Prc	105.674189		
Yield Curve: 122 U.K. GOVT BNCHMARK						Prc Drop	0.005811		
+ 151	v 6.8yr (4.353 %)	INTERPOLATED				Drop (bp)	0.06		
+ 160	v 3yr (4.26)	UKT 5 03/07/08				Accrued Interest /100	1.783562		
+ 157	v 4yr (4.29)	UKT 4 03/07/09				Number Of Days Accrued	93		
+ 154	v 5yr (4.32)	UKT 4 3/4 06/07/10							
Australia 61 2 9777 8600		Brazil 5511 3048 4500		Europe 44 20 7330 7500		Germany 49 69 920410			
Hong Kong 852 2977 6000		Japan 81 3 3201 8900		Singapore 65 6212 1000		U.S. 1 212 318 2000		Copyright 2005 Bloomberg L.P.	
								0 10-Aug-05 16:47:39	

Exhibit 2

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³ On the date in question the 10-year CDS for this reference entity was quoted as 96.8 bps, which is a rare example of a positive basis, in this case of 22 bps.

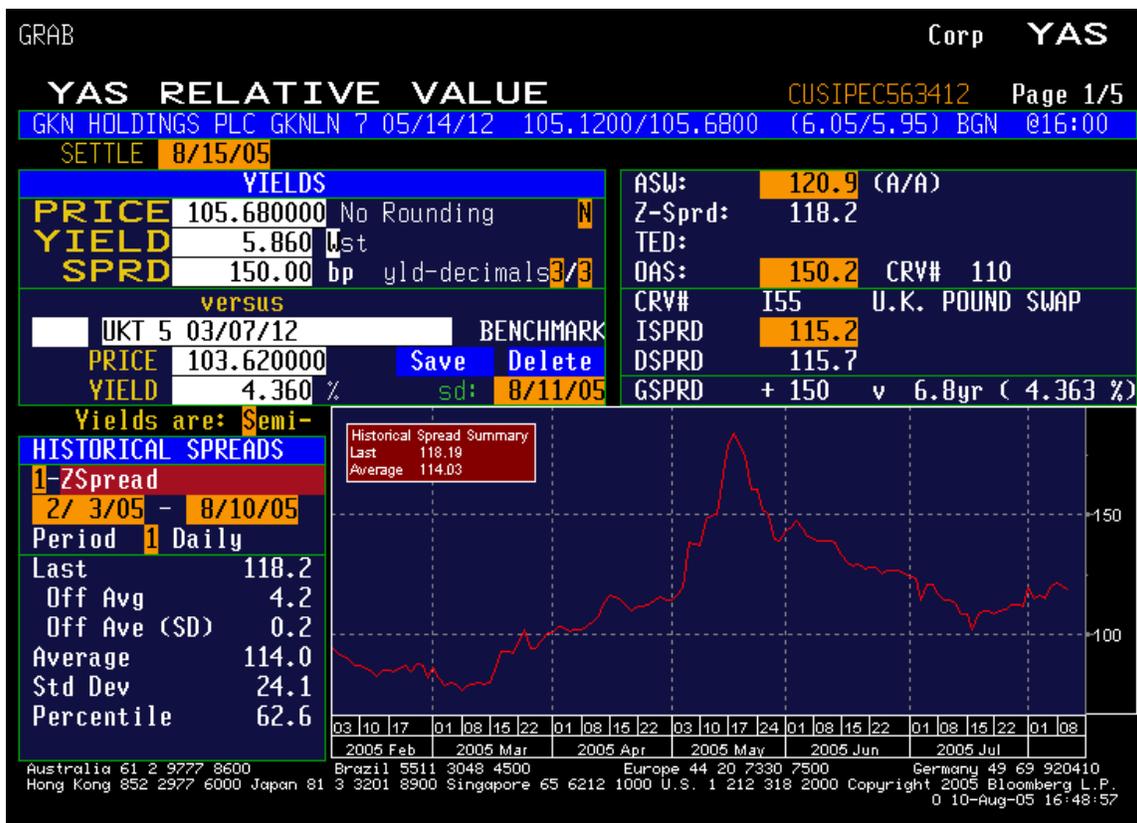


Exhibit 3

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References

Choudhry, M., Joannas, D., Pereira, R., Pienaar, R., *Capital Markets Instruments: Analysis and Valuation*, FT Prentice Hall 2001

Choudhry, M., *Corporate Bond Markets: Instruments and Applications*, John Wiley & Sons (Asia) 2005, chapter 2

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