PRICE SENSITIVITY (BASIS POINT VALUE)

Fast Facts

What is it?
Euro Swapnote® is an on-exchange futures contract referenced to the European interbank curve.

Who is it for?
Euro Swapnote® futures are for anyone who wishes to gain or hedge exposure to the European interest rate swaps curve via a centrally cleared contract.

What does it provide?
Euro Swapnote® provides an open and efficient means of gaining euro swap market exposure in a contract that already meets new regulatory requirements.

When determining the number of Euro Swapnote® futures to execute in a trading or hedging strategy, it is important to establish the price, to changes in interest rates, of each of the components of the strategy.

Price sensitivity is often established by computing an instrument's Basis Point Value (BPV, also known as PV01). BPV characterises a price change in the instrument as a result of a basis point change in interest rates.

Having calculated the BPV of each of the instruments in a strategy, the ratio of BPVs will determine the appropriate number of contracts to trade or size of exposure to each instrument. This ratio is termed the Hedge Ratio.

Method 1 — Using modified duration

The underlying asset of a Euro Swapnote® future is a notional bond with known cashflow amounts and known cashflow dates. Consequently, as with any bond futures contract, analytical values such as implied yield, Macaulay duration and modified duration can be calculated. Further the BPV for Euro Swapnote® futures can be approximated using the standard BPV formula for bond futures.

BPV = Modified Duration x Dirty Price x 0.0001

Yield

For a June 2012 10 Year € Swapnote® future, valued on 12 June, the underlying bond has cashflows per €100 nominal as follows:

MATURITY (YEARS)	ADJUSTED CASHFLOW CASHFLOW DATE	CASHFLOW
1	20 Jun 13	6.00000000
2	20 Jun 14	6.00000000
3	22 Jun 15	6.03333336
4	20 Jun 16	5.96666664
5	20 Jun 17	6.00000000
6	20 Jun 18	6.00000000
7	20 Jun 19	6.00000000
8	22 Jun 20	6.03333336
9	21 Jun 21	5.98333332
10	20 Jun 22	105.98333332

10 Year € Swapnote® price is 138.39

The bond equivalent implied forward yield is the single rate at which all of the notional bond's cashflows can be discounted such that the sum of these discounted cashflows at the delivery date equates to the futures price.

$$\text{Future price} = \sum \frac{\text{Cashflow}_i}{(1 + \text{yield})^{\text{Days}_i \div 360}}$$

Using a standard iteration technique, the yield value that satisfies this equation can be determined.

In the above example 10 Year € Swapnote® futures with a price of 138.39 has an implied forward yield of **1.776%**

Modifed Duration

Modified duration measures the proportional change in the price of a bond for a unit change in yield. For a bond with a single annual coupon, modified duration is calculated as follows:

$$\text{Modified Duration} = \frac{\text{Macaulay Duration}}{1 + \text{yield}}$$

Macaulay Duration is defined as the average time to cashflow and calculated as follows:

$$\text{Modified Duration} = \frac{\sum (\text{present value of cashflow} \times \text{time to cashflow})}{\sum \text{present value of cashflow}}$$

Market convention to present value the cashflows is to use the implied yield to discount the cashflows.

MATURITY (YEARS)	ADJUSTED CASHFLOW DATE	CASHFLOW	DISCOUNTED CASH FLOW	TIME TO CASHFLOW (YEARS)
1	20 Jun 13	6.00000000	5.8953	1.00000000
2	20 Jun 14	6.00000000	5.7924	2.00000000
3	22 Jun 15	6.03333336	5.7230	3.00555556
4	20 Jun 16	5.96666664	5.5609	4.00000000
5	20 Jun 17	6.00000000	5.4944	5.00000000
6	20 Jun 18	6.00000000	5.3985	6.00000000
7	20 Jun 19	6.00000000	5.3043	7.00000000
8	22 Jun 20	6.03333336	5.2407	8.00555556
9	21 Jun 21	5.98333332	5.1066	9.00277778
10	20 Jun 22	105.98333332	88.8751	10.00000000

Macaulay Duration = 8.1696 years
Modified Duration = 8.1696 / (1 + 1.776%) = 8.0270
Now, the BPV for 10 Year € Swapnote® futures can be calculated.
BPV = Modified Duration x Dirty Price x 0.0001

The dirty price is defined as the total price paid for a bond after including accrued interest at the date of purchase. For Swapnote® futures, the underlying asset is simply a notional bond and no interest is accrued prior to the delivery date – the entire first coupon is valued in full at final settlement – therefore the dirty price is the same as the clean price, which is the same as the futures price.

BPV = 8.0270 x 138.39 x 0.0001 = 0.11109 per €100 nominal.

Euro Swapnote® futures have a nominal value of €100,000, so the BPV expressed in value terms is **€111.09 per lot**.

Method 2 — Modelling a 1 basis point shift in yields

The Euro Swapnote® futures price is the forward value of the underlying cashflows on the next IMM date, discounted using par swap rates. When determining a suitable hedge ratio for use in swap book hedging, Euro Swapnote® BPV can be calculated by adjusting the forwarding and discounting curves by 1 basis point to establish new par swap rates and discounting the Euro Swapnote® cash flows accordingly. The Euro Swapnote® BPV will be the resultant change in futures price.

Example: Determining the 2 Year IMM par swap rate and determining the shift using market rates +1bp

(Quoted vs. 6 month Euribor®)

Valuation Date: 12 June

IMM Date: 20 June

	FIXED SIDE		FLOATING SIDE		
PAYMENT DATE	DAYCOUNT	EONIA DISCOUNT (DISCOUNTING CURVE)	6M EURIBOR (FORWARDING CURVE)	DAYCOUNT	EONIA DISCOUNT (DISCOUNTING CURVE)
20 Dec 12			0.937%	0.50000000	0.99862
20 Jun 13	1.00000000	0.99742	0.821%	0.50000000	0.99742
20 Dec 13			0.836%	0.50000000	0.99600
20 Jun 14	1.00000000	0.99400	0.938%	0.50000000	0.99400
SUM	1.99142		0.017598		
FIXED RATE	= 0.017598 / 1.99142 = **0.884%** (to 3 d.p.)				

	FIXED SIDE		FLOATING SIDE		
PAYMENT DATE	DAYCOUNT	EONIA DISCOUNT (DISCOUNTING CURVE)	6M EURIBOR (FORWARDING CURVE)	DAYCOUNT	EONIA DISCOUNT (DISCOUNTING CURVE)
20 Dec 12			0.947%	0.50000000	0.99857
20 Jun 13	1.00000000	0.99732	0.831%	0.50000000	0.99732
20 Dec 13			0.846%	0.50000000	0.99585
20 Jun 14	1.00000000	0.99379	0.948%	0.50000000	0.99379
SUM	1.99111		0.017795		
FIXED RATE	= 0. 017795 / 1.99111 = **0.894%** (to 3 d.p.)				

Similarly, adjusting the forwarding and discounting curves by 1 basis point for all the par swap rates we get the following:

MATURITY	IMM PAR SWAP RATE	IMM PAR SWAP RATE +1BP
1	0.607%	0.617%
2	0.884%	0.894%
3	0.985%	0.995%
4	1.133%	1.143%
5	1.293%	1.303%
6	1.436%	1.446%
7	1.557%	1.567%
8	1.663%	1.672%
9	1.752%	1.761%
10	1.833%	1.843%
IMM FORWARD VALUE OF 10 YEAR € SWAPNOTE® CASHFLOWS	138.38869	138.27726

Using this method:

The BPV of June 2012 10 Year € Swapnote® on 12 June 2012

= 138.38869 – 138.27726 = 0.11143

or (0.11143 x €10 / 0.01) = **€111.43 per lot**

Note: It is important to note that both of these methods for determining Basis Point Value effectively assume a parallel shift in yields of 1 basis point to establish a Hedge Ratio. Hedge performance will in practice be determined by the exact nature of any yield curve shift. If the investment manager is concerned about other shifts in yields, Method 2 above can be modified to model alternative scenarios. Frequent review of the BPV of each of the legs of the strategy and dynamic adjustment of the positions will help to secure the efficacy of the hedge.

Further Information

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