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TUTORIAL

FINANCIAL MODELLING OF INTEREST RATE HEDGING

Interest rate risk is where the risk that interest rates move and adversely affect the project economics. There are a range of approaches to interest rate risk management to protect your cost of funds on borrowings. This tutorial explains how to model the mechanics of interest rate hedging in a clear and transparent way which will satisfy most users of project finance analysis most of the time.

Interest rates historically have been volatile. Long-term borrowings (five years plus) on a floating rate loan such as in project finance transactions may expose an SPV or the sponsors to unwanted risk if interest rates rise to levels that seriously affect their borrowing or repayment capability. Because of this many wish to hedge such interest rate risk and look for greater certainty in cash flow, seeking to protect the project against a higher cost of borrowing. More often than not it is the lenders themselves that require this protection. Interest rate hedging, compared to lending funds, is a very lucrative banking product, so it's not surprising that even though projects are generally not that sensitive to interest rate movements, IR hedging is common.

Floating : Fixed interest rate hedge

The floating-fixed interest rate swap provides a means of converting floating to a fixed interest rate.

For the two parties involved, it is a contractual agreement whereby they exchange a series of absolute payments based on different interest rate indices, but on a common notional principal. There is no exchange of principal, only an exchange of interest payments (usually settled in net $X amount).

Example: Company A has a $100 thousand 6-year bank loan with an agreed credit margin of 2% over base rate (assume the current spot rate is 3.20%). The borrower wishes to fix 50% of their interest rate exposure for the 6-year term as they believe that rates will rise over this period. The quoted fixed rate is 3.70%. They draw down the $100 thousand bank loan and simultaneously enter into an interest rate swap with a notional principal of $50 thousand (50% of the loan amount).

Key features of interest rate swap:

- It is independent from the underlying loan.
- It is not a commitment to borrow although it might be a requirement to enter into interest rate hedge under loan documentation.
- It can be tailored to suit the debt repayment profile.
- May be reversed at a future date with potential breakage cost.
- You will be exposed to interest rate risk if there is a mismatch between the start dates or end dates of the underlying debt and any interest rate protection.
- You will be exposed to interest rate risk if there is a difference between the value of the debt that is to be protected and the notional principal of your interest rate contract.

Modelling the interest rate

Interest rate basic

We use the basic formula to calculate interest rate on borrowing:

> Interest rate (%) = Base rate + Margin (plus PRI if appropriate)
>
> Where the Base rate is tied to calendar year or financial year;
> Margin is tied to operating year. Tying Margin to calendar year is a very common mistake in project finance modelling.

The Base rate here is the benchmark or reference rate used for commercial loans. Common base rates could be Bank Bill Swap Bid Rate (BBSY) or London Inter-bank Offered Rate (LIBOR). For example, a five-year loan may be priced at six-month LIBOR + 2.00%.

The portion of the interest rate on a floating rate loan that is over and above the base rate is called the margin. Margin is provided by lenders - think of margin very generally as a proxy for lender's perception of credit risk.

In a project finance loan, a Political Risk Insurance (PRI) instrument may also be added to cover payment of all or part of the project's debt service against specific political or sovereign risks. If it is applicable, PRI shall be added to the margin in interest rates calculation.

Let's work through an example with assumptions as shown in screenshot below.

7		**Interest Rates**									
8		**Margin & PRI**									
9					Constr	Op Yr 1	Op Yr 2	Op Yr 3	Op Yr 4	Op Yr 5	
10		Credit margin		% p.a.	2.00%	1.75%	1.85%	1.95%	2.00%	2.00%	
11		PRI		% p.a.	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	
12											
13		**Base rate**									
14		Spot (Floating)			2009	2010	2011	2012	2013	2014	
15		Spot		% p.a.	3.20%	3.40%	3.60%	3.75%	3.95%	4.10%	
16		Flex	0.00%	% p.a.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
17		Spot		% p.a.	3.20%	3.40%	3.60%	3.75%	3.95%	4.10%	
18											
19		Forward (Fixed)		% p.a.	3.70%	3.70%	3.70%	3.70%	3.70%	3.70%	
20											
21		Hedging Profile									
22		Select:	Base Case								
23	1	Base Case	◀▶	%	50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	
24	0	No Hedging	◁▷	%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
25	0	100% Hedging	◁▷	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
26		Applied			50.00%	50.00%	50.00%	50.00%	50.00%	50.00%	
27											
28		Effective rate		% p.a.	3.45%	3.55%	3.65%	3.73%	3.83%	3.90%	
29											

Screenshot 1: Example of assumption layout for interest rates

Interest rate hedge

Recall in this example that the borrower enters into an interest rate swap to fix 50% of their interest rate exposure for the 6-year term as they believe that rates will rise over this period. The quoted fixed rate is 3.70%. The formula to calculate the effective Base rate is:

> Base rate = Spot (flexed) * (1 - % Hedged) + Fixed * % Hedged

Note that in reality, the floating-fixed interest rate swap is usually settled in net $X amount, but effective % hedged is best used for modelling.

The Spot rate (Row 15) is the floating rate which is for example 3.20% in calendar year 2009 and is assumed to rise to 4.10% in 2014.

Lenders might want to flex the spot rate to run some sensitivity / scenario analysis (Row 16). Hence, the spot rate used in the model (Row 17) would be the Spot rate input (Row 15) plus the flex (Row 16).

Row 19 is the fixed rate from the interest rate swap, which is assumed 3.70% for 6 years in this example (Row 19).

Row 23 to 25 shows the hedge profiles or the effective % hedged. There are 3 profiles in this example which will be described in the next sub-section.

Refer to Screenshot 2 on the effective base rate calculation.

13		**Base rate**						
14		Spot (Floating)			2009	2010	2011	2012
15		Spot		% p.a.	3.20%	3.40%	3.60%	3.75%
16		Flex	0.00%	% p.a.	0.00%	0.00%	0.00%	0.00%
17		Spot		% p.a.	3.20%	3.40%	3.60%	3.75%
18								
19		Forward (Fixed)		% p.a.	3.70%	3.70%	3.70%	3.70%
20								
21		Hedging Profile						
22		Select:	Base Case					
23	1	Base Case	◀▶	%	50.00%	50.00%	50.00%	50.00%
24	0	No Hedging	◁▷	%	0.00%	0.00%	0.00%	0.00%
25	0	100% Hedging	◁▷	%	100.00%	100.00%	100.00%	100.00%
26		Applied			50.00%	50.00%	50.00%	50.00%
27								
28		Effective rate		% p.a.	3.45%	3.55%	3.65%	3.73%
29						=F17*(1-F26)+F19*F26		

Screenshot 2: Incorporate hedging mechanic to the base rate

Hedge profiles

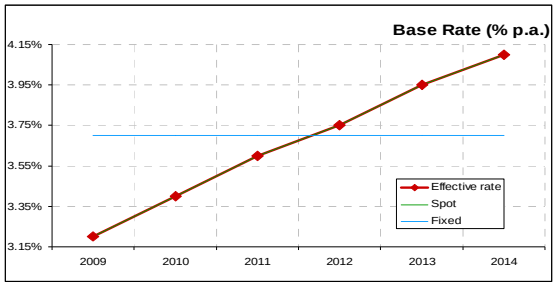
13		**Base rate**						
14		Spot (Floating)			2009	2010	2011	2012
15		Spot		% p.a.	3.20%	3.40%	3.60%	3.75%
16		Flex	0.15%	% p.a.	0.15%	0.15%	0.15%	0.15%
17		Spot		% p.a.	3.35%	3.55%	3.75%	3.90%
18								
19		Forward (Fixed)		% p.a.	3.70%	3.70%	3.70%	3.70%
20								
21		Hedging Profile						
22		Select:	Base Case					
23	1	Base Case	◀▶	%	50.00%	50.00%	50.00%	50.00%
24	0	No Hedging	◁▷	%	0.00%	0.00%	0.00%	0.00%
25	0	100% Hedging	◁▷	%	100.00%	100.00%	100.00%	100.00%
26		Applied			50.00%	50.00%	50.00%	50.00%
27								
28		Effective rate		% p.a.	3.53%	3.63%	3.73%	3.80%

Screenshot 3: Base case hedging profile with flex in Spot rate

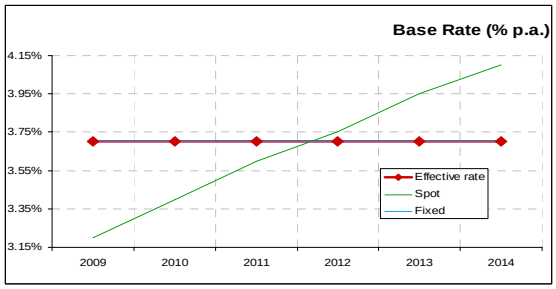
To illustrate on how the base rate moves in associate with the hedge profiles, we include three (3) hedge profiles in this example: Base case (H=50%), No hedged (H=0%) and Full hedged (H=100%).

Let say, the Lenders would like to flex the spot rate by 15 bp. If Base Case is selected (50% hedged), the effective rate is in the middle of the Spot and the Fixed rates (refer to Screenshot 3)

With H=0%, the effective base rate would be exactly equal to the flexed Spot rate (Screenshot 4). And with H=100%, the effective rate would 100% follow the fixed rate which means flexing the spot rate would have no effect (Screenshot 5).



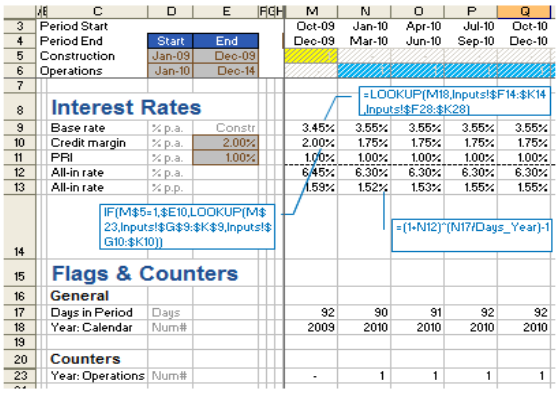
Screenshot 4: No hedged (H = 0%)



Screenshot 5: Full hedged (H=100%)

Calculate total interest rate

Refer to Screenshot 6 on how to link to calculation page in the financial model. Note that the Base rate is tied to calendar year and the Margin (credit & PRI) is tied to operating year.



Screenshot 6: Interest rates calculation

About Navigator Project Finance

Founded in 2004, Navigator Project Finance Pty Ltd (Navigator) is the project finance modelling expert. Headquartered in Sydney, Australia, Navigator is raising the global benchmark in financial modelling services to the project finance sector. Navigator designs and constructs financial models for complex project financings, offers training courses throughout the Middle East, Asia and Europe, and conducts independent model reviews of project finance transaction models. Navigator delivers fast, flexible and rigorously-tested project finance services that provide unparalleled transparency and ease of use.

Customers include market leaders such as Deutsche Bank, ANZ Investment Bank, Bovis Lend Lease, Oxiana, Mirvac Property, Westpac and the Commonwealth Bank of Australia, together with leaders from the finance, mining, property, utilities, banking, chemical and infrastructure sectors.

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