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Case Study: Average Price Options Strip

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Problem: An oil-consuming client needs to buy oil in the future and needs to protect against a future rise in the price of oil, whilst still being able to benefit from a future drop.

Solution: The client asks a bank to enter an *Average Price Option Strip*, in which the bank pays periodically to the client any rise of the price of oil F over an *Exercise Price* (aka *Strike*) K . For each period, the price of oil F is the average of daily observations of the Front Future Contract's price during the period's duration (a month in general). The pay-off for each period is therefore:

“If $F > K$ then the bank pays $F - K$, otherwise the bank pays zero.”

The client receiving such a pay-off is said to be *long* a strip of *Call Options*. The *Premium* due by the client for the strip can be either paid upfront or paid over the duration of the Options Strip under the form of a fixed coupon C per period, so that, at each period, the net cash flow is:

“If $F > K$ then the bank pays $F - K$. The client always pays C .”

Variations on the problem and on the solution: The client may be an oil producer instead of an oil consumer and therefore in need to protect against a drop in the price of oil, whilst still being able to benefit from a rise. The client may then *buy Put Options* and the pay-off at each period is:

“If $F < K$ then the bank pays $K - F$, otherwise the bank pays zero.”

The client may be a non-oil-based energy producer, whose net revenue is positively correlated with the price of oil. In that latter case, the client may opt for *selling Call* options to monetise future profits now. In this case, the pay-off at each period is:

“If $F > K$ then the client pays $F - K$, otherwise the client pays zero.”

The *Premium* for the calls sold by the client can be used to subsidise preferential terms on a loan taken by the client, or else to boost the coupon served by a fixed rate investment taken by the client.

The client may also be an investor holding the view that the price of oil will rise over a level H in the future and will not drop below a level L . The client may therefore elect to subsidise her purchase of *Call Options* with the sale of *Put Options*. The resulting position is called a *Risk Reversal*, in which the pay-off at each period is:

“If $F > H$, then the bank pays $F - H$
If $F < L$, then the client pays $L - F$
Otherwise, no cash flow takes place.”

The client holding the reverse view can sell (aka '*short*') the Risk Reversal rather than buying it. The levels H and L may be chosen so that the *Premiums* of the *Call Options* purchased and the *Premiums* of the *Put options* sold cancel out, to form a self-financing structure.

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Example Term Sheet And Valuation:

Deal: A monthly sequence of Options (Calls or Puts) on the arithmetic average of daily observations of the front Futures contract in the *underlying* commodity (i.e., oil in our example).

Daily Observations are made on each business day of the period month. Each period is cash-settled in the *numeraire* currency (i.e., the USD in our example) on the business day immediately following the last business day of the period month.

Currency Pair	WTIUSD (US Dollar per Barrel of Cushing WTI Crude)
Effective Date	Fri 1 Jul 2011
Termination Date	Sun 1 Jul 2012
Strike	At-The-Money Options
Value of the Strip	USD 103.64
Value of a USD 1.00 Annuity	USD 11.97578070365786
Swap's Breakeven Coupon	USD 101.53027259792063
Valuation Date	Mon 6 Jun 2011

Schedule Table

Maturity Date	Settlement Date	Expected Average	Payoff Type	Strike	Volatility of Average ¹	Option PV
Fri 29 Jul 2011	Mon 1 Aug 2011	99.7785	CALL	99.7785	23.99%	USD 3.64
Wed 31 Aug 2011	Thu 1 Sep 2011	100.246957	CALL	100.246957	26.89%	USD 5.21
Fri 30 Sep 2011	Mon 3 Oct 2011	100.712381	CALL	100.712381	27.62%	USD 6.24
Mon 31 Oct 2011	Tue 1 Nov 2011	101.0825	CALL	101.0825	28.23%	USD 7.21
Wed 30 Nov 2011	Thu 1 Dec 2011	101.382	CALL	101.382	28.52%	USD 8.01
Thu 29 Dec 2011	Tue 3 Jan 2012	101.61	CALL	101.61	28.77%	USD 8.73
Tue 31 Jan 2012	Wed 1 Feb 2012	101.8165	CALL	101.8165	29.04%	USD 9.5
Wed 29 Feb 2012	Thu 1 Mar 2012	101.997	CALL	101.997	29.06%	USD 10.08
Fri 30 Mar 2012	Mon 2 Apr 2012	102.199091	CALL	102.199091	28.87%	USD 10.57
Mon 30 Apr 2012	Tue 1 May 2012	102.374286	CALL	102.374286	28.64%	USD 11.04
Thu 31 May 2012	Fri 1 Jun 2012	102.545455	CALL	102.545455	28.39%	USD 11.46
Fri 29 Jun 2012	Mon 2 Jul 2012	102.63	CALL	102.63	28.49%	USD 11.95

Valuation Notes: the *Value of a USD 1.00 Annuity* can be used to determine the coupon payable at each period to spread the premium over the life of the deal. The periodic coupon is just the *Value of the Strip* divided by the *Value of a USD 1.00 Annuity*.

In the *specific case of oil*, averaging observations made over a month span two successive Future contracts, since the last trading day for oil futures contract is around the 16th of each month. Successive contract prices are well correlated for far out contracts, but not for upcoming ones (in one or two months). This has pricing / position management implications that must be considered by oil options market makers and traders.

¹ The *log-normal* volatility of the average is *implied* from the Asian option's price.