



**BNP PARIBAS**  
CORPORATE & INVESTMENT BANKING

# Targeted hedging

Demand for target forwards has taken off in the past two years as liability managers look for more precise ways to manage their foreign exchange (FX) exposures. George Nunn and PK Sinha explore what these 'targeted' FX hedging tools can do and how to risk-manage them

The last few years have seen an explosion in the use of the 'target' family of foreign exchange (FX) products. Target forwards were first introduced in mid-2005 in response to the specific hedging requirements of Asian clients. The need for liability managers to meet their budgeted FX rates without losing the entire hedge at a barrier FX rate (as with traditional knock-out forwards) was the driver for the development of target forwards.

As pioneering and highly customisable hedging products, targets have become a core part of corporates' risk management toolbox in the past two years.

BNP Paribas transacted more than \$6 billion notional of target forwards in Asia alone in 2006. In 2007, several variations of targets were developed in response to specific hedging requirements and we estimate the transaction volume was more than \$15 billion in just EURUSD (€/\$) and USDJPY (\$/¥) in the year.

What has driven this phenomenal growth? Target forwards can achieve hedge rates (strikes) that are significantly better than the outright forward rate, provided that the risk manager has some flexibility in the notional and tenor.

This article provides liability managers with an overview of targets and examines how they are priced and risk-managed by dealers, as well as comparing their performance to more traditional hedge products such as knock-in and knock-out forwards.

## The basics of a target – an example

The liability manager of a European importer of software has forecast that she needs to sell €20 million (and buy \$) every quarter for the next year. She could hedge this exposure using a strip of €/\$ forwards. With spot at 1.5850, she may be content to sell € at the outright forward rates of 1.5780, 1.5700, 1.5625, and 1.5665 for three, six, nine and twelve months, respectively.

However, if she has some regulatory and internal flexibility, and wishes to incorporate the view that €/\$ spot will stay range bound, then she may hedge her exposure with a target forward at a much better rate.

At the inception of a target, a maximum benefit or target profit and a strike are specified. The intrinsic value is the difference (positive only) between the strike and where the spot fixes. When

## A. Description

Target forward to sell € every quarter	
Strike (selling €)	1.6300
Fixing/settlement	Quarterly
Notional	€10 million or €20 million
Target profit	0.1700 \$ per €
Premium	Zero

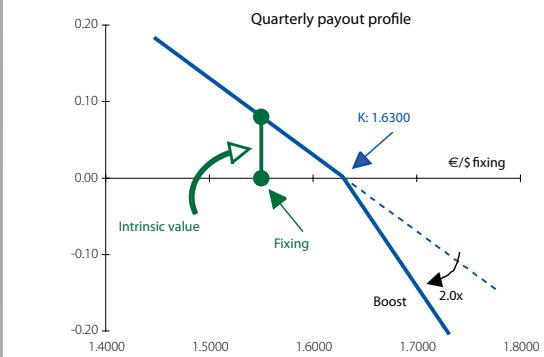
## B. Spot fixes at implied forwards

€ sell strike	1.6300			Target profit	0.1700
Fixing	Spot fixing	€ sold	Intrinsic value	AIV	Cash flow (\$)
Q1	1.5780	10 million	0.0520	0.0520	520,000
Q2	1.5700	10 million	0.0600	0.1120	600,000
Q3*	1.5625	10 million	0.0675	0.1795	675,000
Q4	1.5665			Terminated	
* Target profit is reached on third fixing. No further obligations for either party				Total cash flow (\$)	1,795,000

the accumulated intrinsic value (AIV) reaches the target profit, the structure terminates and there are no further transactions or cash flows between the client and the dealer.

In the example presented in tables A and B, a target forward may allow the liability manager to sell €/\$ at 1.6300 – the strike. We can examine the cash flows, assuming that spot fixes every quarter at the implied outright forwards.

## 1 Target payout



### C. Simulations with different €/\$ spot

Simulation with €/\$ lower					Simulation with €/\$ higher						
€ sell strike	1.6300			Target profit	0.1700	€ sell strike	1.6300			Target profit	0.1700
Fixing	Spot fixing	€ sold	Intrinsic value	AIV	Cash flow (\$)	Fixing	Spot fixing	€ sold	Intrinsic value	AIV	Cash flow (\$)
Q1	1.4949	10 million	0.1351	0.1351	1,350,900	Q1	1.6562	20 million	-0.0262	0.0000	-524,716
Q2*	1.4542	10 million	0.1758	0.3109	1,757,824	Q2	1.6775	20 million	-0.0475	0.0000	-949,345
Q3	1.4206	Terminated				Q3	1.6939	20 million	-0.0639	0.0000	-1,277,293
Q4	1.3947					Q4	1.7039	20 million	-0.0739	0.0000	-1,477,099
* Target profit is reached on second fixing. No further obligations for either party				Total cash flow (\$)	3,108,724	* Target profit is never reached				Total cash flow (\$)	-4,228,454

Every quarter that €/\$ fixes below/above the selling strike, the liability manager sells €10 million/€20 million at the strike. This continues every quarter until the target profit of 17 cents (\$0.1700 per €) is achieved. In the specific variation illustrated in table A, a target inclusive forward, the client receives the benefit of the full profit of 17.95 cents in the third quarter.

By giving up potential gains above the strike, and taking the risk that she will not be 100% notional hedged if spot declines, the client may achieve a substantially better hedge rate. The prudent use of targets should be limited to an amount that is less than the full notional.

#### Why targets? When knocking out is not an option

The example above already gives a sense of what targets can do. The payout or the hedge rate achieved depends on the extent of 'in-the-money' fixings (see figure 1).

The performance of first-generation exotic options is governed by the level of spot. Embedding knock-out and knock-in options (and their variants) allows the dealer to create structured forwards that can potentially achieve a hedge rate that is better than the outright forward as long as spot stays above or below a predetermined barrier.

We can compare the zero premium target to zero premium knock-out (strike 1.6350 KO 1.4300) and knock-in (strike 1.5950 KI 1.6350) forwards. A knock-out forward can beat the outright forward (selling € at 1.6350), but runs the risk that the structure knocks out at 1.4300 (continuous observation), leaving the exposure unhedged. Knock-out forwards do not address the basic client requirement of hedging FX exposure since the hedge disappears when it is needed most. A knock-in forward provides potential for improvement in the hedge rate, but if the barrier at 1.6350 is triggered, then the client is locked in at 1.5950.

This explains why target forwards have appealed to many liability managers. They could potentially achieve better hedge rates initially and partially re-hedge once the target profit was achieved.

#### Demystifying targets

The innovation of targets is that their performance is linked to previous cash flows or the AIV. Unlike a barrier option that looks solely at the level of spot, a target forward looks at the 'profit'. At the end of each period, the target strike is compared to the market rate and any improvement over the market rate counts towards the target profit.

Once the target profit is exhausted, there is no further obligation on either party and the product terminates. The target profit may

be achieved in the first few observations, or not at all. Although the maximum tenor of the product is known at the time of the trade, the actual tenor and effective hedge rates depend on the path of the underlying and how quickly the target profit is achieved.

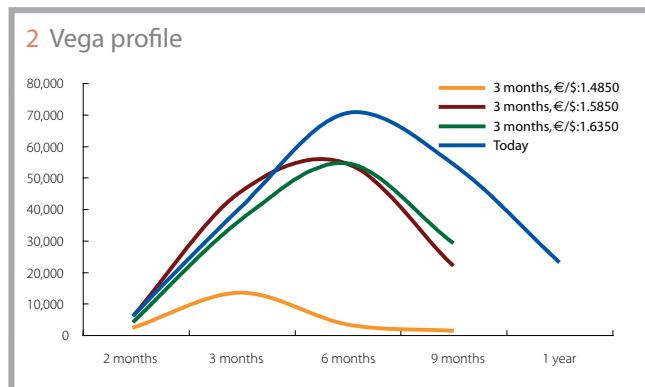
We can examine how the target behaves using different hypothetical paths for €/\$ spot rate. The target forward could terminate very quickly if €/\$ was dramatically lower at the end of the first quarter, or continue until maturity (one year) if €/\$ traded higher and remained at elevated levels. If €/\$ spot tracked the implied forward rates, then the target forward example would accumulate the target profit of 17 cents on the third quarterly fix (see table C).

#### From the dealer's perspective

How does a dealer who needs to risk manage targets look at his exposure? The dealer needs to sell €/\$, his delta, which is some fraction of the notional. He is long volatility and long gamma, as the client is selling options embedded in the target. The client is compensated for these options through the above-market forward rate.

The dealer's vega profile is based on the expected maturity of the target. At inception, the vega will be distributed by maturity based on the expected expiry of the target forward (currently concentrated between six and nine months). The dealer can neutralise his first-order vega risk by selling a combination of options with maturities between three months and one year (see figure 2).

Besides the first-order Greeks, the dealer also has to contend with a discontinuous payout: if spot approaches the strike on the fixing, the dealer's risk is similar to that of a European digital option. If spot fixes below the strike, the dealer has to pay the client; if spot fixes above, the dealer receives from the client.



D. Comparing liability management products					
	Target (1x2)	KO forward (1x2)	KI forward (1x2)	Outright forward (full notional)	
Spot	<b>Best strike</b>	1.6300	1.6350	1.5950	Forward
	1.7450	-12.1%	-11.6%	-14.9%	-17.8%
	1.6650	-5.3%	-5.0%	-7.4%	-9.3%
	1.5850	0.0%	0.0%	0.0%	0.0%
	1.5050	3.0%	1.8%	6.6%	10.3%
	1.4250	4.4%	KO	13.0%	21.8%
Client may hedge some portion of the notional at the strike and may be able to re-hedge at a new strike better than the outright forward		Knocked-out. Client has no hedge and initiating a new hedge will be much worse than the original outright forward		Knocked-in. Client is locked in where the best strike that is significantly worse than target or knock-out forward	

As illustrated in figure 2 the vega profile depends on the level of spot. With a lower €/\$ spot rate, the target forward is more likely to reach the target profit rapidly, and the expected maturity will shrink. The vega profiles are similar to a risk reversal position. The dealer's vega exposure depends on the level of spot. He must take into account the cost of the risk reversal, along with the vega and gamma hedges, to price the strike of the target forward.

### The influence of market parameters on targets

Although a target forward cannot be deconstructed using first-generation exotic options, our example can be approximated as:

*Client buys a strip of K = 1.6300 € put with reverse KO at 1.4600 in 10 million notional/quarter*

*Client sells a strip of K = 1.6300 € calls in 20 million notional/quarter*

The strike of the target is more attractive if implied volatility is higher. The dealer's static hedge is to sell volatility and he is able to offer better terms to the client. If the risk-reversal favours € calls, the strike will be higher than 1.6300 and will maintain net zero premium. The slope of the forward curve also impacts the strike through the in-the-moneyness of the options sold. Upwardly sloping curves allow better selling rates and vice versa.

Extending the tenor also improves the strike. The probability of the target forward achieving the target profit is no different, but the value of the € calls is greater since they are of a longer tenor.

The target profit also influences the value of the target forward but in a more complex manner. A higher target profit implies a greater potential payout to the client and less chance of the target terminating early. In practice, the target profit amount should incorporate the client's need to meet her budgeted FX rate, and how early she prefers the target to terminate based on her view of spot and tenor of the hedge programme.

### Comparing liability management products

A liability manager's optimal hedge strategy will include a combination of forwards and options. We have analysed the behaviour and risk characteristics of targets and how they can incorporate a market view to outperform outright forwards and traditional option strategies. Table D compares the mark-to-market of the target forward, the knock-out forward and the knock-in forward at different spot levels.

### Conclusion – What do we target from here?

The original target forward has spawned a plethora of variations

in response to specific client needs. The target accelerator, for instance, uses a quadratic payout that may terminate the structure earlier. Two-way targets allow de-accumulation of the target profit (when fixings are out-of-the-money), thereby extending the expected life of the target and potentially achieving better strike rates. And target pivots allow an investor to buy and/or sell at better than the outright forward. Pivots have found applications with investors who have traditionally used range-accrual-type products for yield enhancement.

BNP Paribas's focus is to offer an open dialogue with our liability managers and investor clients and address their needs with tailor-made products. In today's volatile environment, successful hedging products will be evolutionary rather than revolutionary. While there are several hedging products that work well in such environments, given the scope for customisation that targets afford, liability managers are unlikely to knock the target out anytime soon.

**Disclaimer:** This material is directed at persons to whom it may otherwise lawfully be communicated. Any investment or investment activity to which this document relates is available only to and will be engaged in only with such persons. This material is intended to provide only a general outline of the subjects covered. It should neither be regarded as comprehensive nor sufficient for making decisions, nor should it be used in place of professional advice. The BNP Paribas Group does not accept responsibility for any loss arising from any action taken by anyone using this material.

© BNP Paribas (2008). All rights reserved. BNP Paribas London Branch, 10 Harewood Avenue, London NW1 6AA tel: +44 (0)20 7595 2000 fax: +44 (0)20 7595 2555 www.bnpparibas.com. BNP Paribas is incorporated in France with limited liability. Registered office 16 Boulevard des Italiens, 75009 Paris. BNP Paribas is regulated by the Financial Services Authority for the conduct of its designated investment business in the UK and is a member of the London Stock Exchange. BNP Paribas London Branch is registered in England and Wales under no. FC13447. Registered office at the above address.



#### Americas

##### George Nunn

Head of Interest Rate and Foreign Exchange Structuring, Americas  
E. george.nunn@americas.bnpparibas.com T. +1 212 841 3169

##### Garry Popofsky

Head of FX Sales, Americas  
E. garry.popofsky@americas.bnpparibas.com T. +1 212 841 2418

##### PK Sinha

Director, FX Structuring, Americas  
E. pk.sinha@americas.bnpparibas.com T. +1 212 471 8323

#### Europe

##### Kara Lemont

Head of Interest Rate and Foreign Exchange Structuring, EMEA  
E. kara.lemont@uk.bnpparibas.com T. +44 (0)20 7595 8517

##### Francois Boisson

Head of Institutional FX Sales, Europe  
E. francois.boisson@uk.bnpparibas.com T. +44 (0)20 7595 4775

#### Asia-Pacific

##### Stuart Brigden

Head of FX Structuring, Asia-Pacific  
E. stuart.brigden@asia.bnpparibas.com T. +65 6210 3312

##### Eliza Ning

Head of Institutional Sales, FX and Rates, Hong Kong  
E. eliza.ning@asia.bnpparibas.com T. +852 2108 5057