

# Case Study: Double No Touch and Other FX Option Strategies for Low Volatility Markets

This case study covers various foreign exchange (FX) option strategies that take advantage of low volatility market conditions. Specifically, it explores the risks, benefits and mechanics of traditional strategies, such as straddles and strangles, but also focuses on and examines more advanced FX option strategies, such as double no touch (DNT) options, European range bet (ERB) options and DNT options in emerging markets.

**Udi Sela, Vice President, Numerix**

Option strategy prices are typically determined by the level of volatility in the market. In recent months, many foreign exchange (FX) currency pairs have been trading in narrow ranges. Whether it was just a seasonal phenomenon or a structural shift in market volatility, no one can be certain; but it has created challenges for many FX investors who find it difficult to make money in range-bound, narrow markets.

Given an environment of historically low market volatility, and in order to capture the benefits of this low volatility environment, this case study explores how traders and institutional investors can employ popular trading strategies, using traditional vanilla strategies. It also describes the potential risks, as well as suggesting more advanced strategies, such as double no touch (DNT) and European range bet (ERB) options to overcome the shortfalls of vanilla strategies.

## A Snapshot of Volatility: What Has Changed?

*Figure 1: US Dollar (USD)/Japanese Yen (JPY) Spot Rate History*



When we look at volatility levels approximately one year ago, we can observe that three-month implied volatility traded around 11%, with spot three-month historical volatility trading around 9.5%.

As of mid-August 2012 we saw a significant change, with three-month implied volatility trading around 7.5%, and the spot three-month historical volatility trading around 6.4%. It is important to note that these represent the lowest volatility levels in the past five years.

### Case Study Examples: FX Options for Low Volatility Markets

In the case study examples that follow, we will uncover the best strategies for taking advantage of these types of low volatility environments, examining the benefits, risks and mechanics of each option type. As far as our underlying currency choice, we have selected to use a US dollar (USD)/Japanese yen (JPY) case study, given that JPY is perceived as a 'safe haven' currency, and because the Bank of Japan (BoJ) is supporting the USD below 76.50 and thereby creating a floor for the dollar.

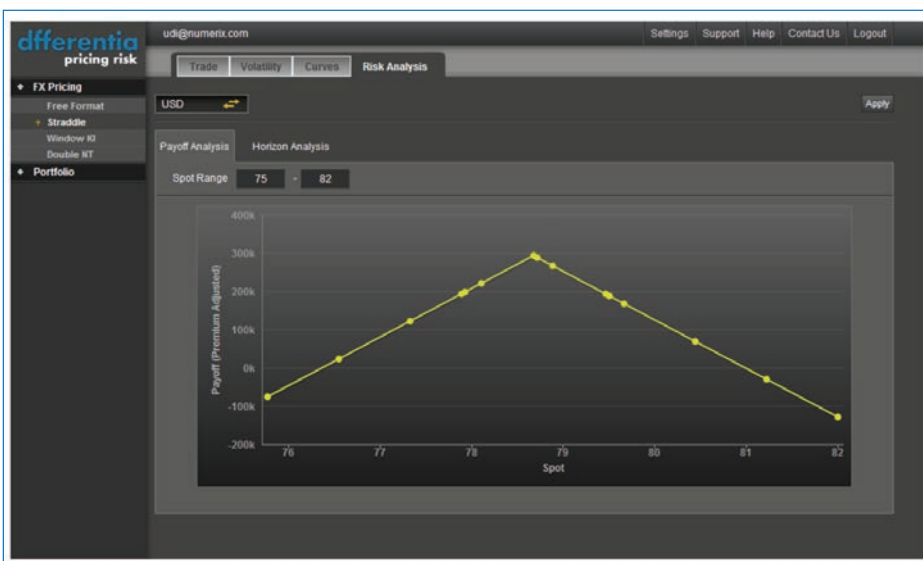
### Exhibit I: Selling Volatility Using Traditional Strategies (USD/JPY)

First, we will take a closer look at the more traditional vanilla strategies, beginning with selling a straddle. In this scenario, we sell a straddle, consisting of two options: USD call plus USD put USD/JPY; with both struck at the money (zero delta straddles); US\$10m per leg and expiry in three months. The premium received would be US\$293,000.

#### Risk analysis for selling a straddle (USD/JPY)

The potential risks involved in this strategy include: limited profit (premium), with potentially unlimited loss; mark-to-market losses; and short gamma, which means expensive hedging for those choosing to hedge (typically sell-side players) (see Figure 2).

Figure 2: Risk of Selling a Straddle (USD/JPY)



Source: Numerix

We can also observe the following risks: increased loss as the spot rate moves significantly in either direction; short gamma mostly across the strike prices; and short Vega. We would also need to take a look at the time horizon, and determine the risk features of the strategy over time.

Figure 3: Sell Volatility: Selling USD/JPY Strangle

Time to Expiry	1M	2M								
Spot	75	76	77	78	79	80	81	82		
Premium	-527,638.	-424,349.	-347,614.	-303,151.	-293,783.	-318,419.	-372,354.	-448,664.		
Delta Spot	8,044,419.	6,500,793.	4,377,382.	1,808,558.	-937,555.	-3,543,522.	-5,748,374.	-7,418,544.		
Delta Fwd	8,051,489.	6,506,507.	4,381,230.	1,810,148.	-938,379.	-3,546,637.	-5,753,426.	-7,425,064.		
Vega	-17,298.	-25,867.	-33,873.	-39,044.	-39,802.	-36,052.	-29,142.	-21,110.		
Gamma	-936,457.	-1,400,340.	-1,833,804.	-2,113,697.	-2,154,755.	-1,951,717.	-1,577,639.	-1,142,859.		
Volga	-4,090.	-3,221.	-1,658.	-324.	-52.	-961.	-2,424.	-3,583.		
Vanna	-627,654.	-684,753.	-568,674.	-282,244.	87,903.	415,575.	604,114.	629,524.		
Theta	792.	1,118.	1,415.	1,591.	1,585.	1,398.	1,088.	741.		
Rho	21,668.	17,505.	11,943.	5,337.	-1,627.	-8,152.	-13,589.	-17,618.		

Source: Numerix

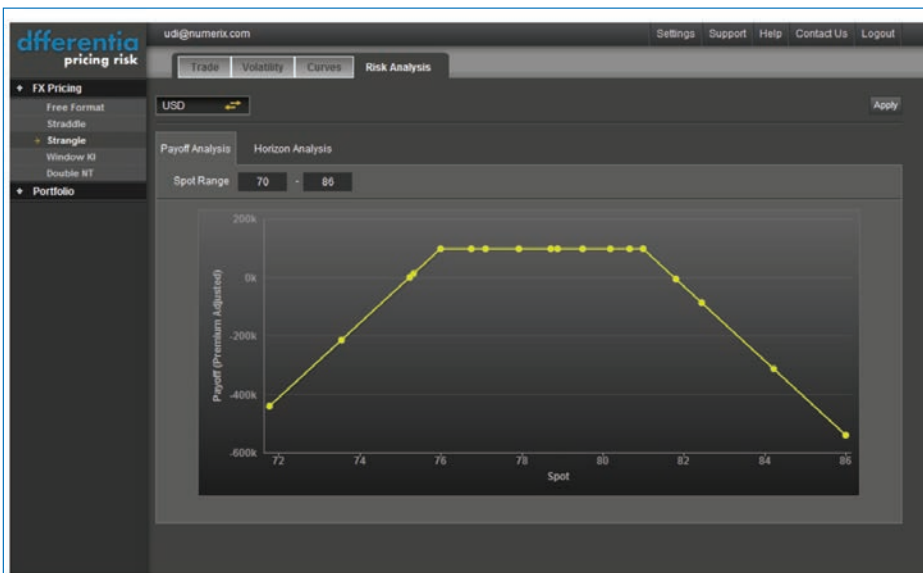
### Exhibit II: Sell Volatility - Selling USD/JPY Strangle

Here we will take a closer look at a second vanilla strategy: selling a strangle. In this scenario, we sell a strangle, consisting of a USD put struck at 76 and a USD call struck at 81; with US\$10m per leg and expiry in three months. The premium received would be US\$95,500.

#### Risk analysis for selling a strangle (USD/JPY)

The potential risks involved in this strategy include: limited profit (premium) with potentially unlimited loss; mark-to-market losses; short gamma, which again means expensive hedging (when performing dynamic hedging), and short vega. We can observe lower risk as opposed to the earlier straddle, since strike prices are further out of the money. As a result, the premium received for this strategy would not surprisingly be lower than the straddle.

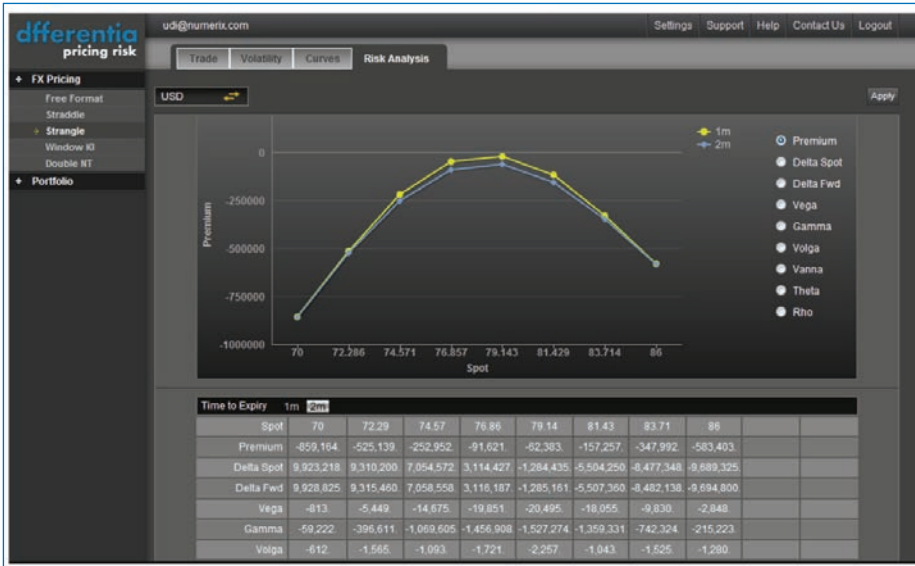
Figure 4: Risk of Selling a Strangle (USD/JPY)



Source: Numerix

We can also observe risks such as increased loss, as the spot rate moves significantly in either direction; short gamma mostly across the strike prices; and short vega. We would also need to take a look at the time horizon again.

Figure 5: Time Horizon of Selling a Strangle (USD/JPY)



Source: Numerix

### Exhibit III: A Comparative Analysis: Straddle/Strangle (USD/JPY)

Table 1: A Comparative Analysis: Straddle/Strangle (USD/JPY)

A Comparative Analysis: Straddle / Strangle (USD/JPY)	
Straddle	Strangle
Premium received \$293,000	Premium received \$95,500
Strategy 'in-the-money' as the market moves away from 78.68 (the Strike Price)	Strategy 'in-the-money' if the market trades below 76, or above 81 (the respective Strike Prices)
Short Vega (\$40,000)	Short Vega (\$29,000)
Short Gamma (\$2,000,000)	Short Gamma (\$1,400,000)

Source: Numerix

## Advanced FX Option Trading Strategies for Low Volatility Markets

### Exhibit IV: Sell Volatility (USD/JPY) - Buy a DNT Option

Here we will take a closer look at some of the more advanced FX option strategies that can be advantageous in low volatility markets, including first the DNT option. We will explore the mechanics of DNT strategies and explain how they can help investors seeking higher returns, while limiting potential losses.

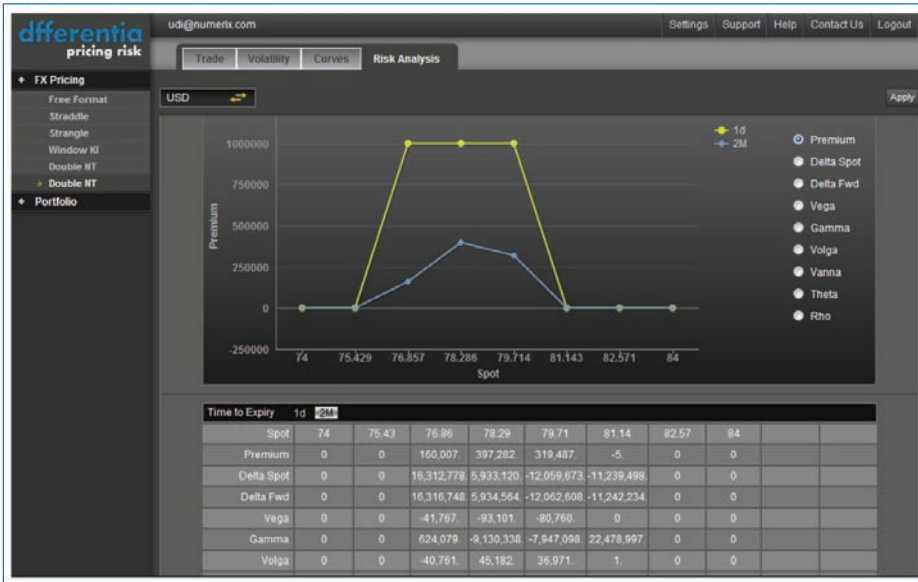
In this case study example, we receive US\$1m if the market doesn't trade on any day up until expiry, at 76.50 or below - or at 81 and above. This sample option has a three-month expiry, with premium to be paid of US\$230,000 (upon inception date).

#### Risk analysis for buying a DNT option (USD/JPY)

The potential risks and benefits to this strategy include limited loss (premium); potential profit of US\$1m (four times over premium paid); but also potential mark-to-market losses. In addition, the premium must be paid in advance (upon inception date).

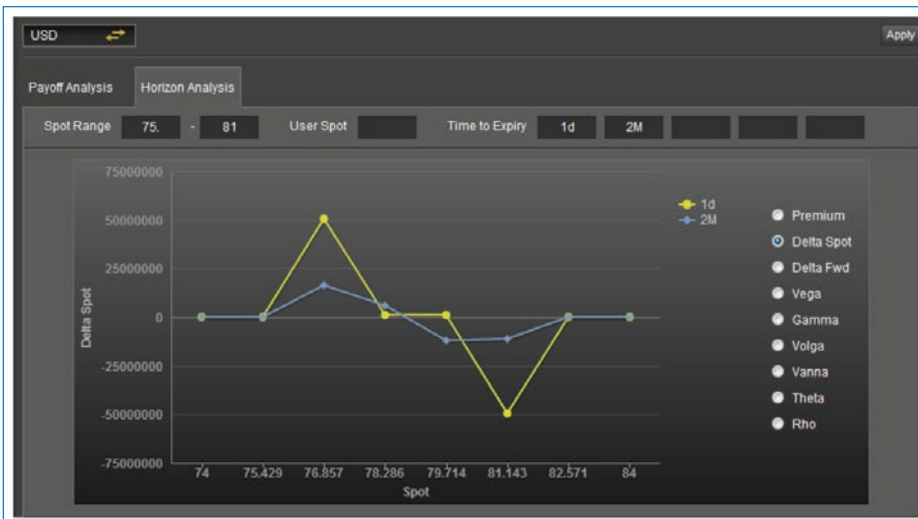
If toward expiry, the spot rate trades near the triggers, then the delta and gamma become very high. Here, we can also observe that vega diminishes over time.

Figure 6: Risk of Buying a DNT Option (USD/JPY)



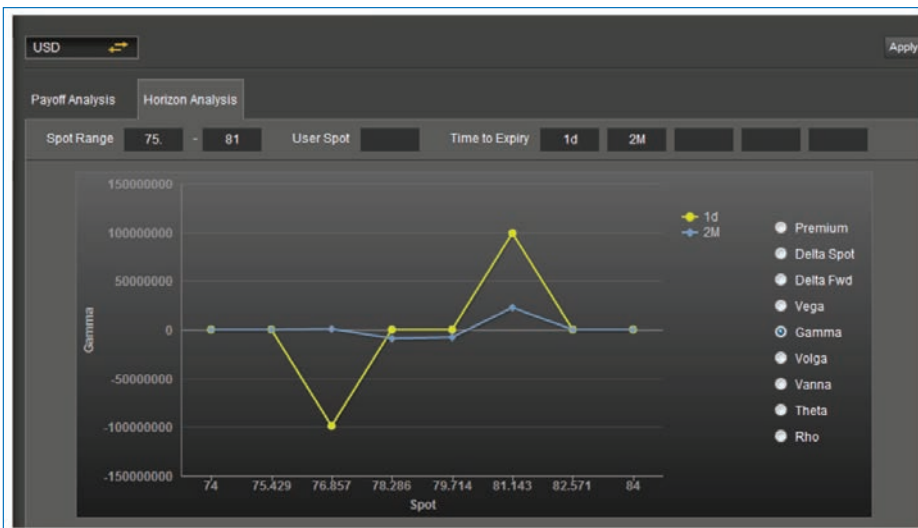
Source: Numerix

Figure 7: Snapshot: USD/JPY DNT Delta Differences



Source: Numerix

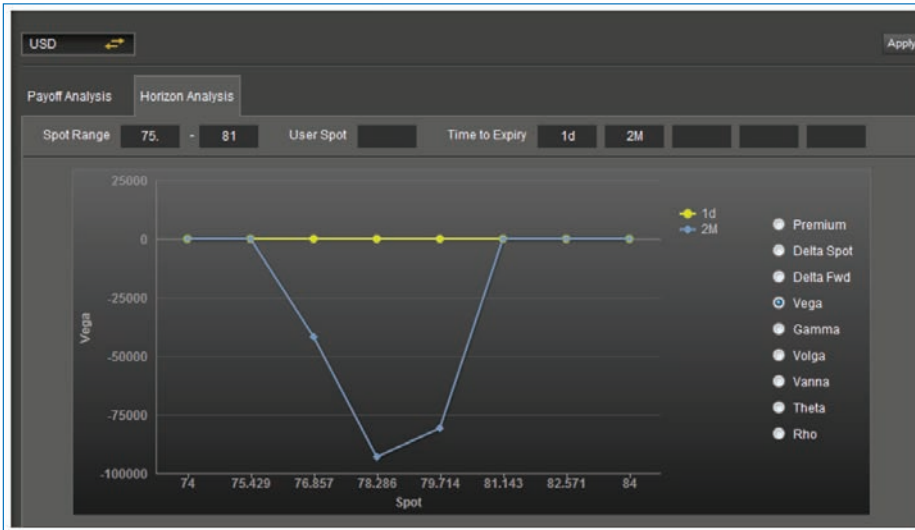
Figure 8: Snapshot: USD/JPY DNT Gamma Differences



Source: Numerix



Figure 9: Snapshot: USD/JPY DNT Vega Differences



Source: Numerix

### Exhibit V: Sell Volatility - USD/JPY ERB Option

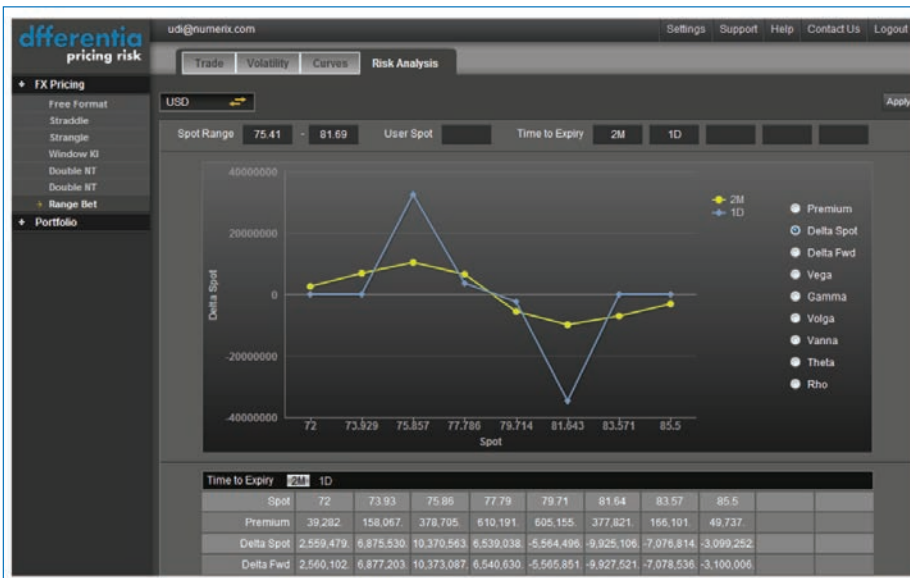
In this scenario, we buy an ERB option. We would receive US\$1m only if at expiry the market doesn't trade at 76.50 or below, or trade at 81 and above. The option would have a three-month expiry with premium to be paid of US\$558,000.

With this option, we would experience limited loss (premium) and a potential profit of US\$1m (almost twice over premium paid). Potential mark-to-market losses would be possible. The premium would need to be paid in advance (upon inception date) for this option. It is important to note that there is a lower probability of the range being breached than with the DNT option, hence the lower potential profit than the DNT.

#### Risk analysis for USD/JPY ERB option

We can observe that the ERB's risk profile is very similar to the DNT's risk profile. However, if towards expiry the spot rate trades near the triggers, delta and gamma increase to extreme levels (well above DNT), due to the additional leverage effect.

Figure 10: Risk of USD/JPY European Range Bet Option



Source: Numerix

### Exhibit VI: DNT Options in Emerging Markets: USD/ZAR

In this last case study example, we have chosen South African rand (ZAR) as the underlying currency because it is highly volatile and exhibits high negative correlation with the euro (around -0.7).

If we buy a USD/ZAR DNT, we would receive US\$1m if the market doesn't trade on any day until expiry at 7.95 or below, or 8.95 and above. The option would have a three-month expiry with premium to be paid in the amount of US\$230,000.

When buying a DNT option in an emerging market (in this case USD/ZAR), we can observe limited loss (premium); a better leverage ratio or set a wider range between the two triggers; and we can gain a potential profit of US\$1m (four times over premium paid). We would experience potential mark-to-market losses; and the premium would need to be paid in advance (upon inception date).

### Risk analysis for USD/ZAR DNT option

As the option has a high time value, we should highlight what is happening to the theta in the chart below. In addition, as the volatility of the currency pair is much higher, the risk of hitting the barriers is higher as well. We would experience a better risk reward/ratio, but clearly there is a lower probability of a payoff at expiry.

Figure 11: Risk of USD/ZAR DNT Option

Time to Expiry	2M	1D			
Spot	7.9972	8.2014	8.4055	8.6097	8.8139
Premium	127,420.	333,105.	406,469.	312,607.	148,767.
Delta Spot	10,970,452.	6,031,430.	371,772.	-6,371,672.	-6,430,544.
Delta Fwd	10,840,008.	5,959,714.	367,352.	-6,295,909.	-6,354,081.
Vega	-13,277.	-46,184.	-54,776.	-40,077.	-17,534.
Gamma	-3,543,178.	-1,785,902.	-1,496,566.	-173,763.	1,393,343.
Volga	-446.	2,508.	3,255.	10,836.	2,721.
Vanna	-1,614,790.	-829,518.	-245,834.	1,081,418.	838,495.
Theta	1,161.	13,428.	13,486.	10,947.	6,773.
Rho	228.	40,050.	-38.	-174.	-136.

Source: Numerix

The unprecedented levels of volatility experienced over the past two years, coupled with the high level of uncertainty, have been drivers for adopting a prudent approach to managing FX exposures. When deciding and implementing a hedging programme one must take into account the historical and projected underlying prices fluctuations, examine and select the most suitable hedging strategies, as well as running the selected programme through various potential market scenarios and determine its efficiency. Decision support systems to assist with managing the hedging process are readily available.

Figure 12: Summary: A Comparative Glance at MTM Three Weeks Later

USD/JPY Spot		Horizon Date:		USD/ZAR Spot	
78.72		78.07		78.45	
8.4743		8.2324		8.2707	
	28-Aug-12	14-Sep-12	Unrealized P/L 14 Sep 2012	17-Sep-12	Unrealized P/L 17 Sep 2012
Straddle 78.68	292,857	282,983	9,874	261,849	31,008
Strangle 76/81	95,448	69,252	26,196	69,169	26,279
DNT 76.5/81	230,000	335,912	105,912	332,259	102,259
ERB 76.5/81	557,910	611,619	53,709	608,783	50,873
DNT 7.95/8.95	230,591	229,361	(1,230)	263,723	33,132

Source: Numerix

## Conclusion

The environment over the summer months and early autumn in northern regions has been characterised by low volatility, leaving many FX investors with the desire to look beyond traditional FX option strategies to take advantage of this environment.

This has led us to a deeper exploration and comparison of the various trading techniques available for today's FX market practitioners looking to benefit from expected low volatility. Clearly, we can see that traditional strategies often entail unlimited risk in cases of sudden 'violent' moves (as it's always the case when selling options). We can also observe that buying DNT options can limit the potential loss to the premium paid, which can be more

desirable for many investors, who may shy away from the concept of 'unlimited risk'.

At the same time, DNT and ERB options can provide increased profit potential, as compared with more traditional vanilla strategies. In this study, we have also seen how the implied volatility of the underlying asset determines the risk/reward profile. Ultimately, we realise that it's important to carefully examine the benefits, risks and mechanics of each option type, to determine the best investing strategy and risk profile for your business.



**Udi Sela**, vice president at Numerix, has worked in the foreign exchange (FX) derivatives markets for 18 years. A senior derivatives trader and trading manager at Citibank and JP Morgan, he has developed expertise in derivatives spanning both vanilla and complex FX options. During the last seven years, Sela has led product development and pre-sales functions within a range of financial software vendors. He holds an MBA in Finance and Technology Management.

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