

# PCTA

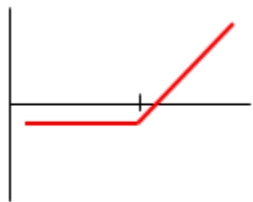
SEP // 20 // 2012

# Bloomberg

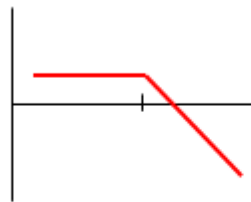
# FX MARKET OPTIONS

- » Why Options? Cannot beat the forward
- » Insurance Policy
- » Risk Reward
- » Leverage
- » Sell for Profit
- » Unknown Hedge – M&A
- » Put/Call Parity

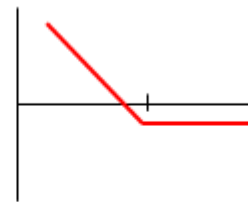
$$+\text{Forward} = +\text{Call} - \text{Put}$$



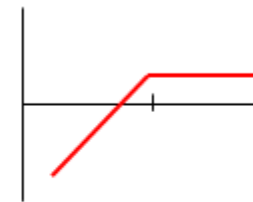
Long Call



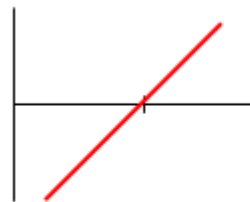
Short Call



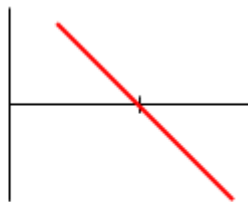
Long Put



Short Put

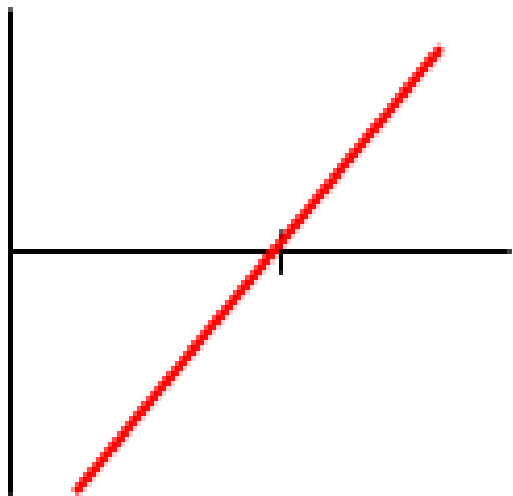


Long FX

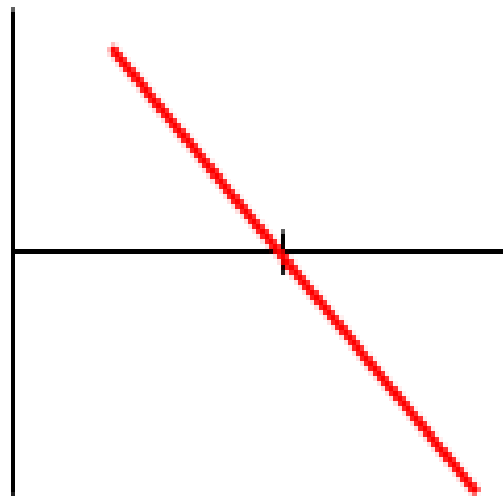


Short FX

# PAY-OFF FX POSITION



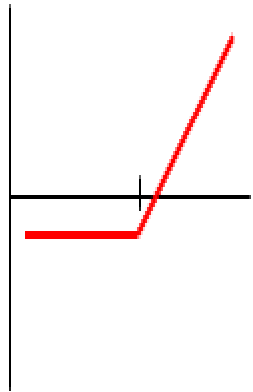
Long FX



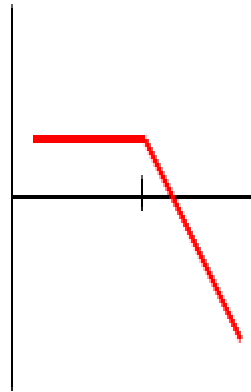
Short FX

OVML <GO>

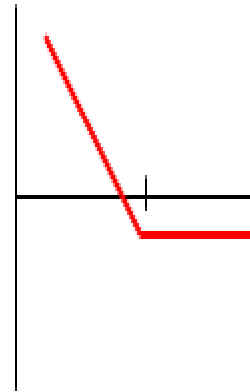
# FX MARKET OPTIONS



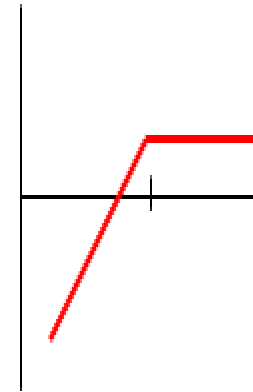
Long Call



Short Call



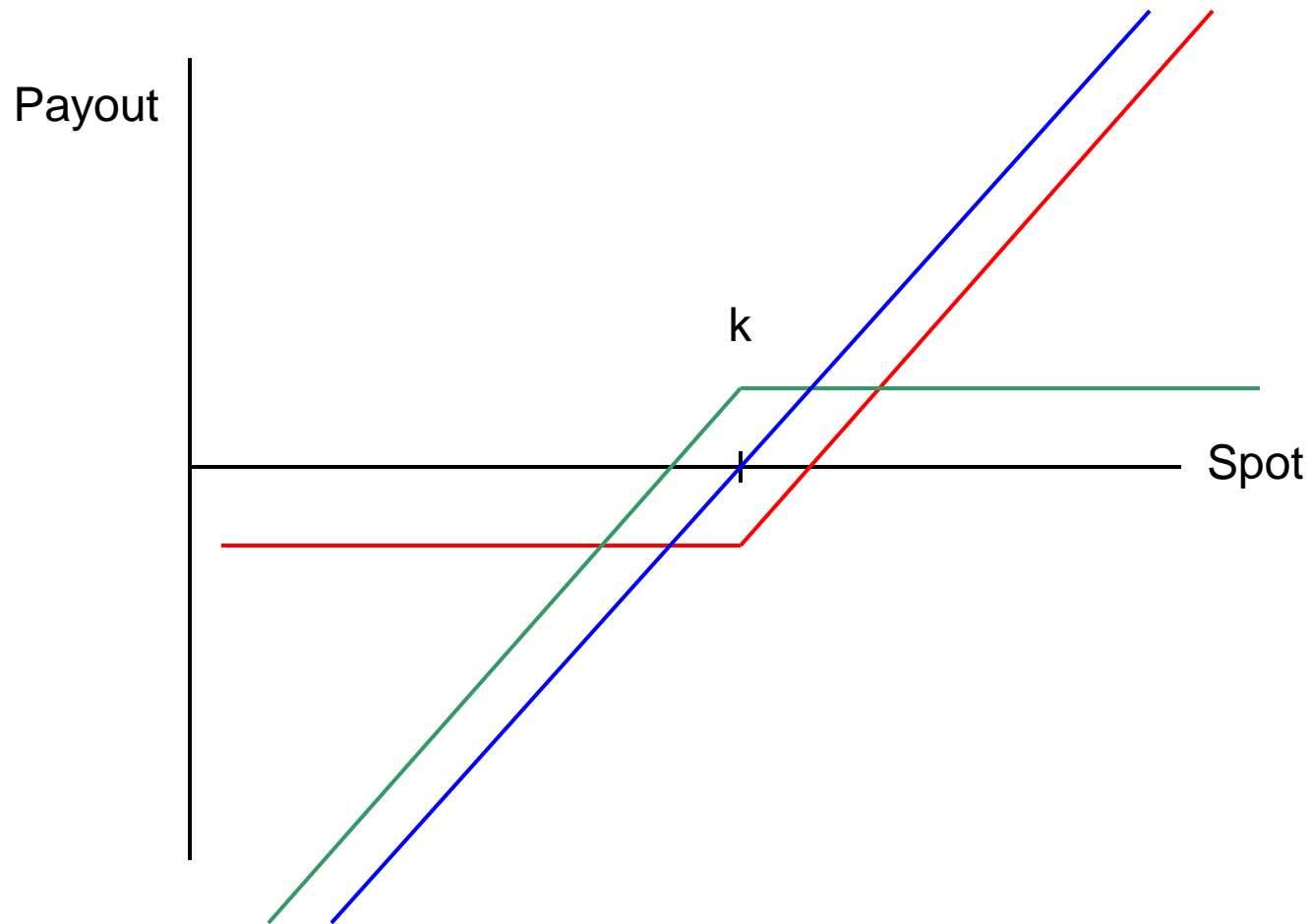
Long Put



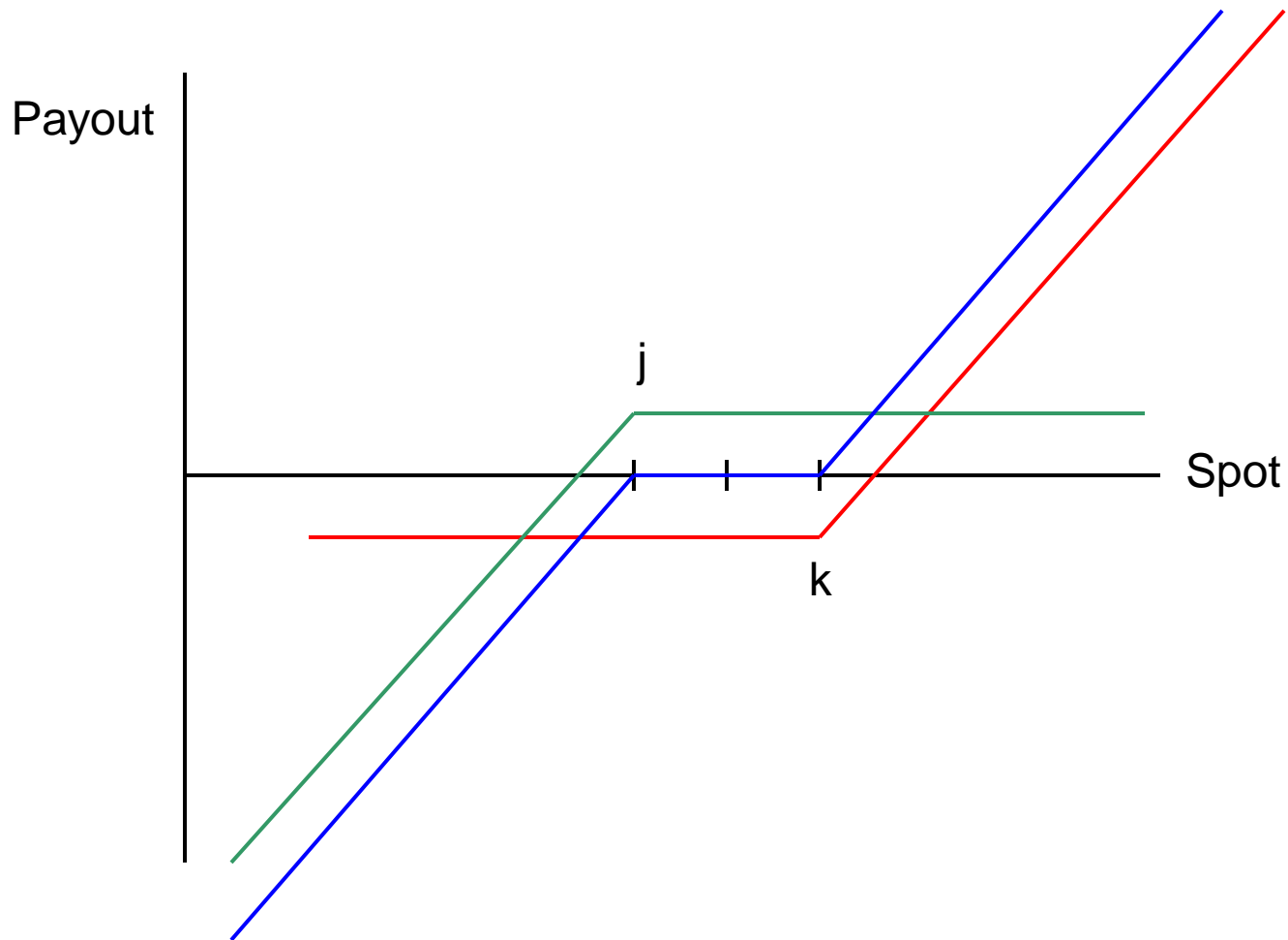
Short Put

OVML <GO>

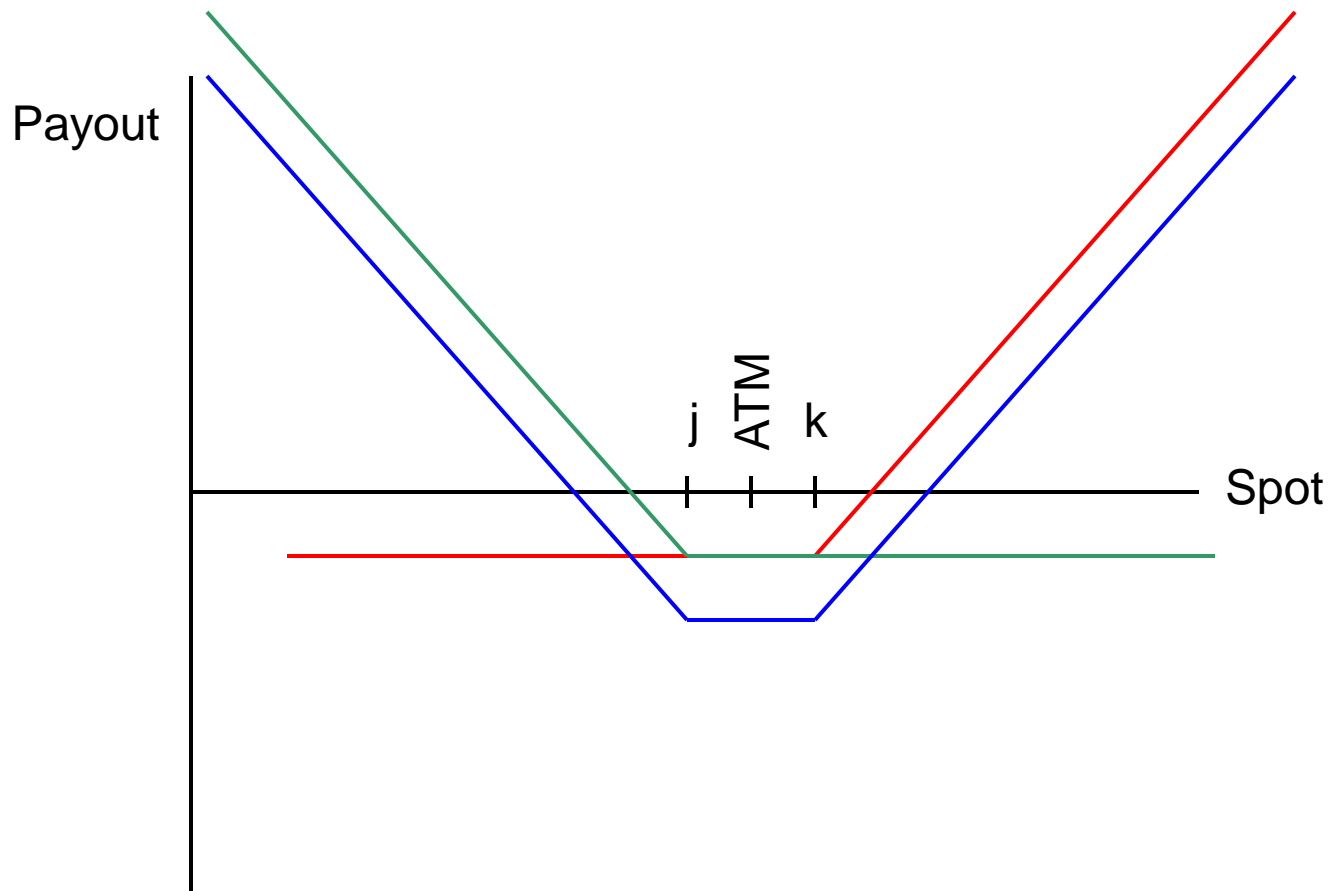
$$+Fwd = Call - Put$$



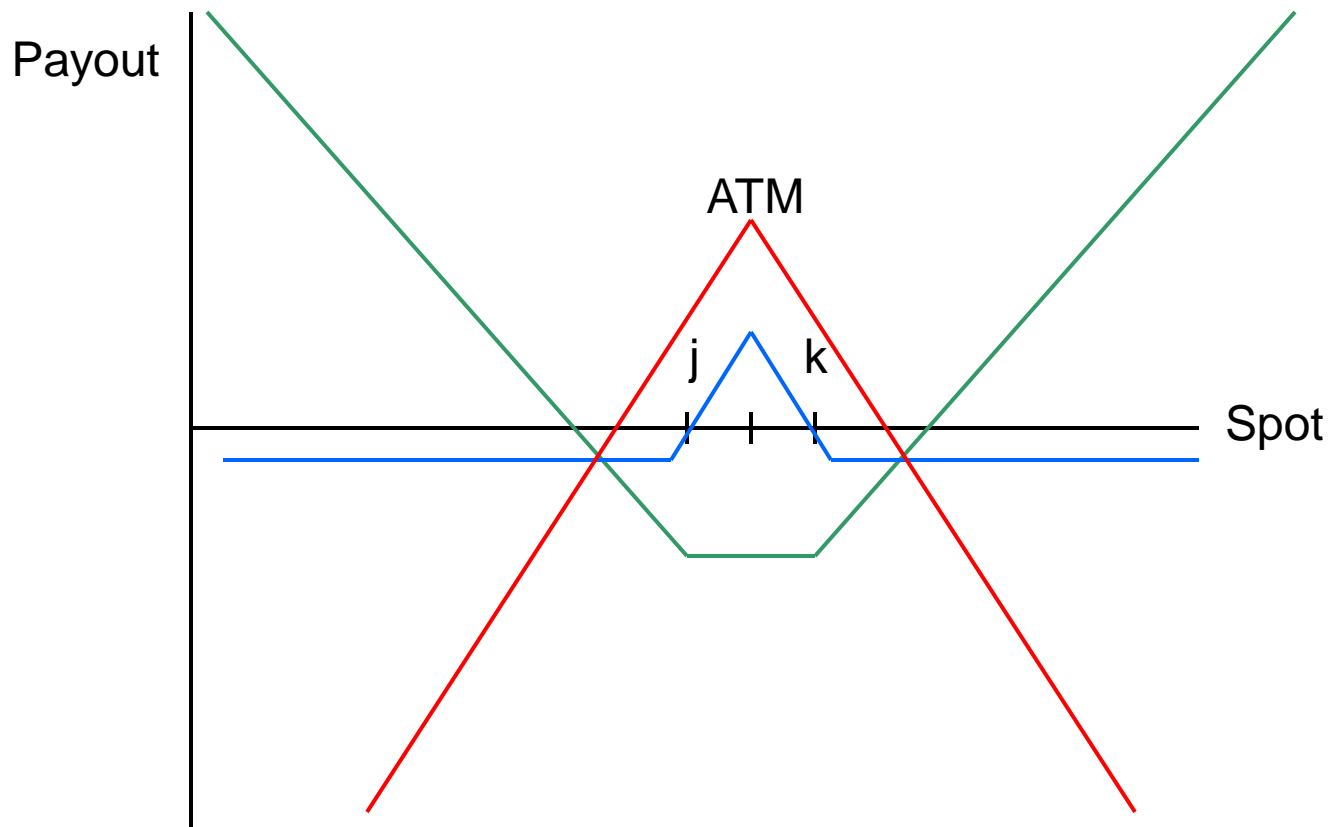
$$C_k - P_j = \text{Risk Reversal}$$



$$C_k + P_j = \text{Strangle}$$



# Strangle – Straddle = Butterfly





# VOL SURFACE CONTRIBUTED SURFACE

## OVDV

Entering the ATMF, RR and BF we build out the surface. Each entry is observable via ALLQ . Note the settings.

GRAB Currency **OVDV**

Click vol price for details

90) Actions 91) Settings 92) Refresh 93) Asset FX Volatility Surface

1) Vol Table 2) 3D Surface 3) Term Structure Analysis 4) Smile Analysis 5) Deposit and Forward Rates

EURUSD 24-Jun-2011 Bloomberg BGN 20) Preference RR/BF Bid/Ask  
Put/Call Mid/Spread

Calendar Weekdays Cutoff New York 10:00

Exp	ATM		25D RR		25D BF		10D RR		10D BF	
	Bid	Ask	Bid	Ask	Bid	Ask	Bid	Ask	Bid	Ask
1D	8.893	10.550	-2.146	-0.980	-0.302	0.529	-3.944	-1.959	-0.313	1.015
1W	13.000	14.085	-3.460	-2.695	0.035	0.580	-5.995	-4.695	0.275	1.145
1M	12.790	13.215	-3.005	-2.705	0.275	0.490	-5.545	-5.035	0.780	1.120
2M	13.000	13.390	-2.995	-2.720	0.310	0.505	-5.540	-5.065	1.000	1.315
3M	13.010	13.385	-2.990	-2.725	0.330	0.520	-5.535	-5.085	1.200	1.500
6M	13.255	13.590	-2.975	-2.740	0.410	0.580	-5.625	-5.220	1.525	1.795
1Y	13.490	13.820	-3.000	-2.765	0.450	0.615	-5.615	-5.220	1.735	2.005
18M	13.345	13.620	-2.775	-2.585	0.450	0.585	-5.255	-4.930	1.680	1.895
2Y	13.240	13.540	-2.685	-2.475	0.395	0.545	-4.975	-4.615	1.565	1.805

Quick Pricer Interpolated - + 100%

98) Launch OVML Bid Ask Mid Deposit

Maturity 1M Delta -9.953C Vol 12.790 13.215 Fwd 1.4216 EUR 1.123%

Expiry 26-Jul-2011 Strike 1.4226 USD Price 1.473% 1.523% Spot 1.4227 USD 0.186%

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000  
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2011 Bloomberg Finance L.P.  
SN 263295 G489-693-2 24-Jun-11 13:53:19 GMT+1:00

OVDV <GO>

# FX MARKET PRICING

- > We use the Garman-Kohlagen extension of Black-Scholes that includes two interest rates, the inputs into the model are;
- > CALL [Strike; Spot; Interest rates; TIME, VOLATILITY]
- > Given that Spot (Forward) and Strike are contract specifications we can then focus on the remaining input TIME and VOL.
- > These are the two important relationships
  - Price to Time,
  - Price to Vol.
- > So price of Calls and Puts is related to  $t$  and  $\sigma$ .

# BLOOMBERG FX COMMUNICATION

## NEWS/INFORMATION

- » Defined filters (G7 Flash, Read), news related functions
- » Analytics
- » Economics

## RISK

- » Book keeping – information sharing, life cycle
- » Scenario risk, what-if, detailed greeks – rega, etc
- » Choice of model, surface, history, Mark to Market

## COMMUNICATION

- » Sharing portfolios, volatilities, pricing requests, ideas
- » Excel upload/download
- » Electronic trading with STP

# ELECTRONIC TRADING FX

FX Trading Manager

Preferences Customize Layout Options

RFQ Trade Affirmation IB

FX Trading Grid

Account <None>

Portfolio <None>

New Tab

EUR/USD		GBP/USD		USD/CAD	
10,000,000.00	5,000,000.00	5,000,000.00	5,000,000.00	5,000,000.00	5,000,000.00
SPOT	SPOT	SPOT	SPOT	SPOT	SPOT
09/20/12	09/20/12	09/20/12	09/20/12	09/19/12	09/19/12
Buy Order - EUR	Sell Order - EUR	Buy Order - GBP	Sell Order - GBP	Buy Order - USD	Sell Order - USD
Sell EUR 1.30656	Buy EUR 1.30658	Sell GBP 1.6258	Buy GBP 1.6260	Sell USD 0.9741	Buy USD 0.9744
loomberg BGAS	loomberg BGDM	loomberg BGDM	loomberg BGDM	loomberg BGDM	loomberg BGDM
loomberg BGDM	loomberg BGDM	loomberg BGDM	loomberg BGDM	loomberg BGDM	loomberg BGDM
loomberg BGEU	loomberg BGEU	loomberg BGEU	loomberg BGEU	loomberg BGEU	loomberg BGEU
loomberg BGNV	loomberg BGNV	loomberg BGNV	loomberg BGNV	loomberg BGNV	loomberg BGNV
loomberg BGSP	loomberg BGSP	loomberg BGSP	loomberg BGSP	loomberg BGSP	loomberg BGSP

FX Trade Blotter

Time	Trader	Ccys	Side	Value Date	Ccy	Amount	Deal Code	Rate
09/18/2012 16:13:49	S. FORD	EUR/USD	Buy	12/31/12	EUR	1,000,000.00	BGAS	1.3080000
09/18/2012 15:10:33	J. NEED	USD/KES	Buy	09/20/12	USD	1,000,000.00	BGEU	85.00
09/18/2012 15:08:56	J. NEED	USD/KES	Buy	09/20/12	USD	1,000,000.00	BGEU	85.00
09/18/2012 15:02:58	J. NEED	USD/KES	Buy	09/20/12	USD	5,000,000.00	BGSP	84.80
09/18/2012 15:01:13	C. LIN	USD/CAD	Buy	09/19/12	USD	1,000,000.00	BGEU	1.0000
09/18/2012 14:57:22	J. NEED	USD/KES	Sell	09/20/12	USD	1,000,000.00	BGDM	84.82
09/18/2012 14:50:45	J. NEED	EUR/USD	Sell	09/20/12	EUR	1,000,000.00	BGEU	1.30505

Trades Positions TCA

FXGO <GO>

# BLACK-SCHOLES OPTION PRICING FORMULA

$$c = S_0 \exp(-r_f T) \mathbb{N}(d_1) - K \exp(-r_d T) \mathbb{N}(d_2)$$

$$p = K \exp(-r_d T) \mathbb{N}(-d_2) - S_0 \exp(-r_f T) \mathbb{N}(-d_1)$$

$$d_1 = \frac{\ln(S_0/K) + (r_d - r_f + \sigma^2/2)T}{\sigma\sqrt{T}}$$

- $S_0$**  is the current spot rate
- $K$**  is the strike price
- $\mathbb{N}$**  is the cumulative normal distribution function
- $r_d$**  is domestic risk free interest rate
- $r_f$**  is foreign risk free interest rate
- $T$**  is the time to maturity (calculated according to the appropriate day count)
- $\sigma$**  is the volatility of the FX rate.

# FX OPTION GREEKS - DELTA

**Delta** – is the change in the value of an option for a change in the market price of the underlying asset. For example, a call option with a delta of 50% means premium will rise by half the amount that the underlying asset goes up. For a put option the premium rises as the underlying asset's price falls.

This change of value, given a change in spot can be as written as;

$$d_1 = \frac{\ln \left[ \frac{S_t}{X} \right] + \left( R_f + \frac{1}{2} \sigma^2 \right) T}{\sigma \sqrt{T}}$$

$$\text{delta}_{\text{call}} = \frac{\partial C}{\partial S} = N(d_1)$$

Market makers will trade options with a 'Delta Hedge' so if they are buying a 1 month 50 delta EUR Call, they will sell 50% of the notional amount of the option in underlying. Therefore if the market moves down they gain an equivalent return on their spot sale as they lose in the option value. If the option bought is a 25 delta Put, what should the buyer do on their hedge?

If there is zero sum gain why do this?

Type: Delta <Help Key> then select definitions

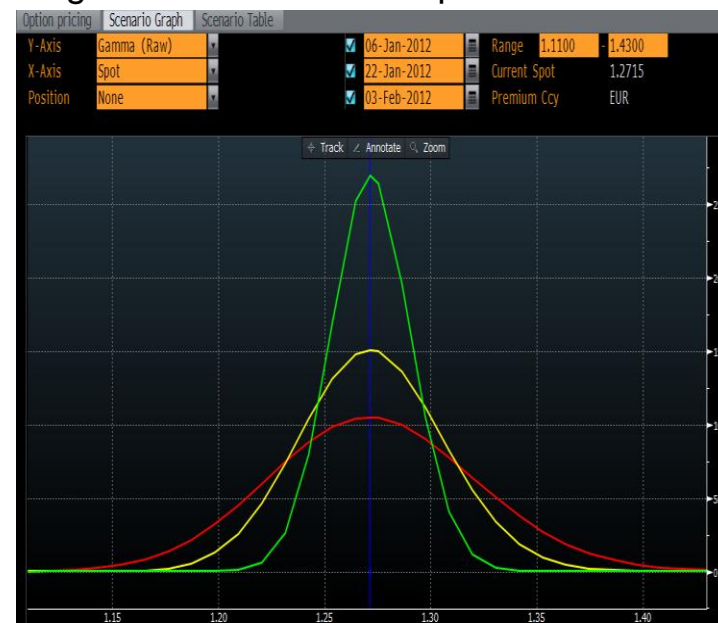
# FX OPTION GREEKS - GAMMA

**Gamma** - the rate of change in delta per unit change in the price of the underlying.  
This rate of change of delta, given a change in spot can be as written as;

$$N'(d_1) = e^{\left[\frac{-(d_1)^2}{2}\right]} \frac{1}{\sqrt{2\pi}}$$

$$\text{gamma}_{\text{call}} = \frac{\partial \text{delta}}{\partial S} = \frac{N'(d_1)}{S\sigma\sqrt{T}}$$

Gamma is at its highest for vanilla options when spot trades around 50delta, the slope of the Delta change is at its steepest. Also gamma is highest for short dated options.



Scenario Graph, second tab on OVML



# FX OPTION GREEKS **GAMMA TRADING**

Report	Spot Ladder	6) Add	7) Edit	Home USD		
Spot	Spot Change	Value Chg Ccy1	Delta Ccy1	Gamma Ccy1	P/L Ccy1	
EURUSD						
1.2982	+2%	676,386	49,439,313	1,624,826	706,643	
1.2918	+1.5%	441,275	47,494,752	7,438,788	471,533	
1.2854	+1%	223,890	40,584,805	22,199,928	254,147	
1.2791	+0.5%	60,458	24,407,078	42,911,101	90,715	
1.2727	+0%	0	-415,894	53,372,790	30,257	
1.2663	-0.5%	68,251	-25,238,611	42,433,951	98,509	
1.2600	-1%	242,667	-41,319,238	21,419,440	272,924	
1.2536	-1.5%	475,292	-48,024,660	6,817,213	505,549	
1.2472	-2%	729,977	-49,812,113	1,358,491	760,235	

## DESCRIPTION

- > Short dated gamma is higher as probability of exercise (Delta) moves faster
- > As the probability increases or decrease the owner of the option can re-hedge his delta.
- > A return back to 50 delta would enable positive revenue on the re-hedge.
- > Theta increases with gamma.

OVRA <GO>



# “STICKY DELTA” or volatility adjusted delta

Takes into account the volatility smile when calculating delta. For example;



# START OF DAY BUY A 6 MONTH 25D PUT STRIKE 1.4100, FOR 17.17% VOL



Deal 1	
Option pricing	
Price date	08-Sep-2011 18:04
Asset	EURUSD
Spot	1.4100
Style	European Vanilla
Direction	Client buys Physical
Call/Put	EUR Put
Expiry	NY 10:00 08-Mar-2012
Delivery	6 months 12-Mar-2012
Strike	1.3100 7.00% OTMF
Notional	EUR 100,000,000.00
Model	Black-Scholes
Vol	BGN 17.17%
Greeks	
Gamma	EUR 2,639,161.42
Vega	225,956.88
Theta	-10,658.08
Rho	-136,465.53
Volga	4,672.02
Vanna	-871,720.46
Annual Yield	-3.8922%
Advanced Greeks	
Results	
Price	% EUR 1.9677% P
Premium	EUR 1,967,731.61 P
Prem date	12-Sep-2011
T.V.	1.4350% P
Delta	Spot -25.4004%
Sticky Delta	-18.0106%
Hedge	25,400,355.09

OVML <GO>

# SPOT DROPPED 1.25%, VOLATILITY UNCHANGED SO RE-PRICING THE OPTION AT THE CLOSE.....16.74%

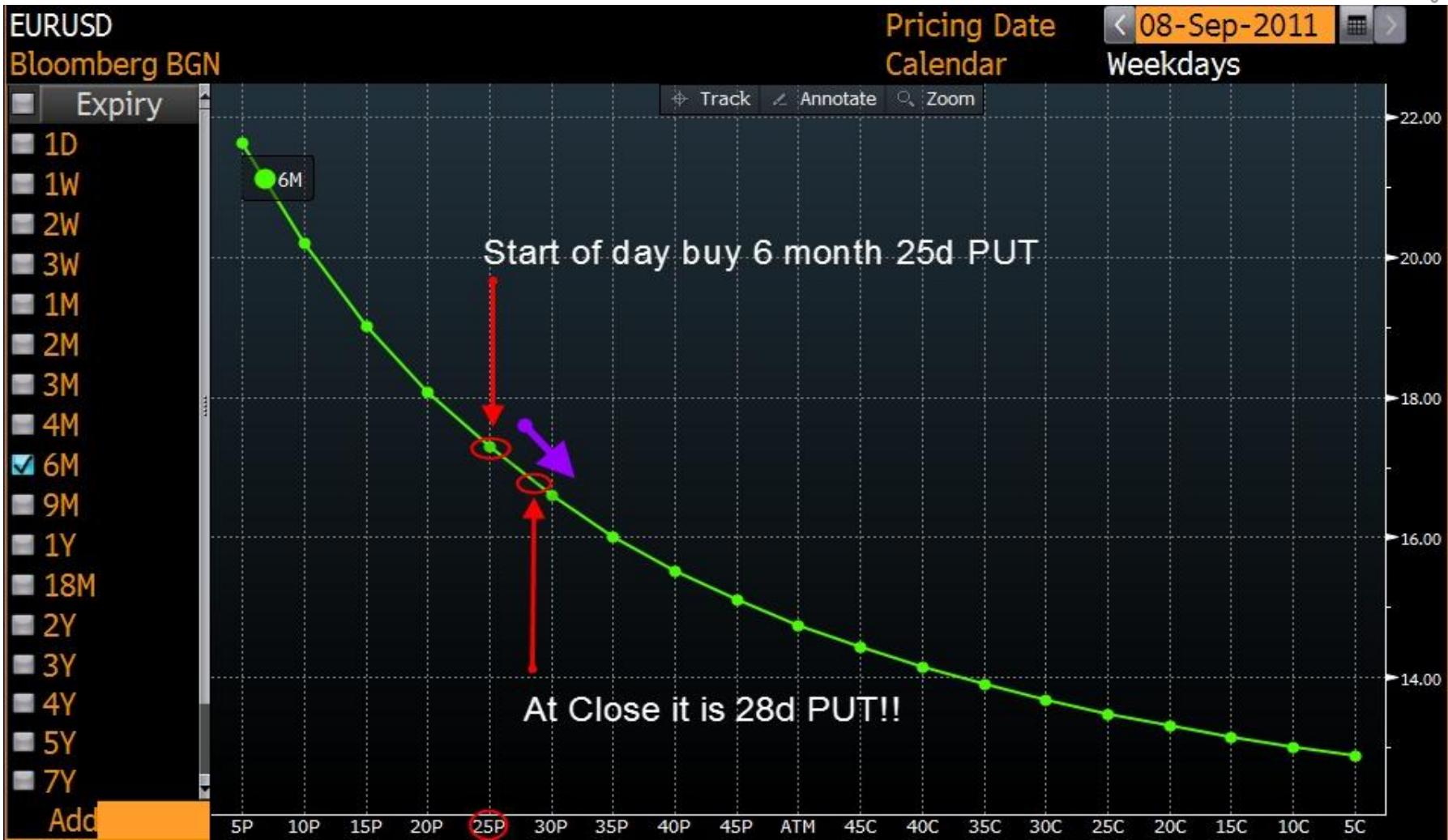


89) Asset		90) Actions		91) Strategies	
Solver (Strike) Load Save Sav					
Deal 1 +					
Option pricing		Scenario Graph		Scenario Table	
Strategy 1					
Leg 1					
Price date	08-Sep-2011		18:04		
Asset	EURUSD				
Spot	1.3923				
Style	European	Vanilla			
Direction	Client buys	Physical			
Call/Put	EUR	Put			
Expiry	NY 10:00	08-Mar-2012			
Delivery	6 months	12-Mar-2012			
Strike	1.3100	5.82% OTMF			
Notional	EUR	100,000,000.00			
Model	Black-Scholes				
Vol	BGN	16.743%			
More market data					
Greeks					
Gamma	EUR	2,865,627.01			
Vega	239,232.20				
Theta	-11,003.55				
Rho	-153,103.87				
Volga	3,626.91				
Vanna	-823,161.77				
Annual Yield	-4.4208%				
Advanced Greeks					
Results					
Price	% EUR	2.2349% P			
Premium	EUR	2,234,935.16 P			
Prem date	12-Sep-2011				
T.V.	1.7657% P				
Delta	Spot	-28.4700%			
Sticky Delta	-20.4946%				
Hedge	28,469,962.50				

Bloomberg // TITLE OF PRESENTATION GOES HERE



# WHAT HAPPENED .. SPOT LOWER .. HIGHER DELTA



Bloomberg // TITLE OF PRESENTATION GOES HERE

# IMPACT

89) Asset ▾ 90) Actions ▾ 91) Strategies ▾		
Solver (Strike) ▾ Load Save Sav		
Deal 1 +		
Option pricing Scenario Graph Scenario Table		
Strategy 1 ▾		
Leg 1 ▾		
Price date	08-Sep-2011	18:04
Asset	EURUSD	
Spot	1.4100	
Style	European	Vanilla
Direction	Client buys	Physical
Call/Put	EUR	Put
Expiry	NY 10:00	08-Mar-2012
Delivery	6 months	12-Mar-2012
Strike	1.3100	7.00% OTMF
Notional	EUR	100,000,000.00
Model	Black-Scholes	
Vol	BGN	17.170%
More market data		
Greeks		
Gamma	EUR	2,639,161.42
Vega		225,956.88
Theta		-10,658.08
Rho		-136,465.53
Volga		4,672.02
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Advanced Greeks		
Results		
Price	% EUR	1.9677% P
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89) Asset ▾ 90) Actions ▾ 91) Strategies ▾		
Solver (Strike) ▾ Load Save Sav		
Deal 1 +		
Option pricing Scenario Graph Scenario Table		
Strategy 1 ▾		
Leg 1 ▾		
Price date	08-Sep-2011	18:04
Asset	EURUSD	
Spot	1.3923	
Style	European	Vanilla
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Call/Put	EUR	Put
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Notional	EUR	100,000,000.00
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Greeks		
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Vega		239,232.20
Theta		-11,003.55
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Delta	Spot	-28.4700%
Sticky Delta		-20.4946%
Hedge		28,469,962.50

Vol loss 17.17% to 16.74% on €230k VEGA. So VEGA loss €98,900.

If using Sticky Delta, hedge is €18m instead of €25mio for 25delta option.

So client recovers,  $1.4100 - 1.3923 = 0.0177$   
On the difference between Sticky and regular, or  $€7m * 0.0177 = €123,900$

A much more reflective hedge, leaving the trader to make their own assumptions on Vol not the surfaces.