



Derivatives Pricing Course

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What does a quant do?

What does a quant do?

- Risk management
- Derivatives pricing models
- Algorithmic strategies
- Optimal execution
- Asset allocation

Sorts of Quants

Model Implementation

- Implements pricing models directly used by traders.
- ~80% Coding.

Model Governance

- Independent model validation.
- Run provided scripts.

Model Research

- Invent new models.
- Only Math.

Sorts of Employers

Investment Banks

Hedge Funds

Commercial Banks

Asset classes

FX

- Smile modelling
- High volume
- Sticky delta rule

Equities

- Jump-diffusion
- Sticky strike rule

Rates

- Most challenging
- Underlying is the curve

Commodities

- High volatility
- Path dependency (Averages)

Credit

Asset classes - FX

British Pound Option (European) Contract Specs

View another product..

Quotes

Settlements

Volume

Time & Sales

Contract Specs

Margins

Calendar

Futures

Options

Type: European Options

Contract Unit	One futures contract for 62,500 British pounds
Minimum Price Fluctuation	\$.0001 per British pound increments (\$6.25/contract).
Listed Contracts	Four months in the March quarterly cycle (Mar, Jun, Sep, Dec) and 2 serial months
Settlement Procedures	Option on physical delivery futures contract

Asset classes - Equity

S&P 500 Options Contract Specs

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Quotes

Settlements

Volume

Time & Sales

Contract Specs

Margins

Calendar

Futures

Options

Type: Standard Options

Contract Unit

One S&P 500 futures contract

Exercise Procedure

American Style.

Settlement Method

Deliverable

Asset classes - Rates

5-Year T-Note Options Contract Specs

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Type: American Options

Minimum Price Fluctuation

One-half of 1/64 of a point (\$7.8125/contract), rounded to the nearest cent/contract. For cabinet transactions only, minimum tick sizes range from \$1.00 to \$7.00, in \$1.00 increments per option contract.

Listed Contracts

At least four consecutive contract months (three serial expirations and one quarterly expiration) plus the next two months in the March, June, September, and December quarterly cycle. Serials will exercise into the first nearby quarterly futures contract. Quarterlies will exercise into futures contracts of the same delivery period.

Settlement Method

Deliverable

Underlying

5-Year T-Note Futures

Asset classes - Commodities

ICE FUTURES EUROPE

BRENT CRUDE AMERICAN-STYLE OPTION

PRODUCT SPECS

DESCRIPTION

The ICE Brent Crude American-style Option Contract is based on the underlying ICE Brent Crude Futures Contract (B) and if exercised will result in a corresponding futures position. The contract is for American-style exercise, allowing the buyer to exercise an option any time up to, and including the expiry day.

MARKET SPECIFICATIONS

TRADING SCREEN PRODUCT NAME

Brent Crude Futures

Exotic features

Cashflows

- *Dividends/Coupons*

Path dependence

- *Strong – Asian*
- *Weak - Barrier*

Dimensionality

- *Rainbow*

Embedded decisions

- *American/Bermudan*

Underlying model

Exotic derivatives

Examples – Flexi Forward

90) Asset ▾	91) Actions ▾	92) Products ▾	93) Views ▾	94) Data & Settings ▾	Option Valuation
31) Solver (Premium) ▾	32) Load	33) Save	34) Trade ▾	35) CVA ▾	36) Send to TR ▾
61) Deal 1	62) +				
51) Pricing	53) Scenario				

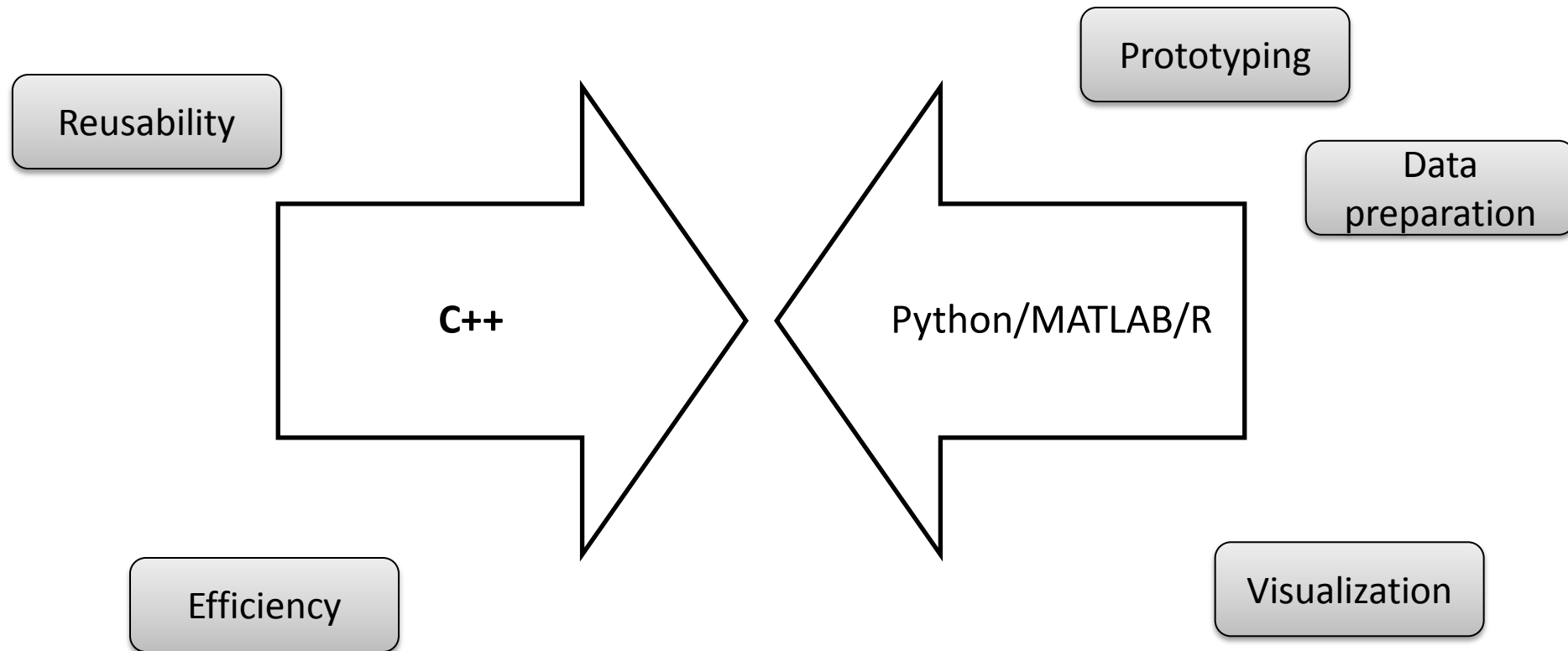
Strategy 1 ▾	
Leg 1 ▾	
Price Date	01/15/16 09:43
Asset	USDRUB
Spot	Mid 76.5386
Style	Flexi Forward ▾
Exercise start	01/15/16
Exercise end	07/18/16
Direction	Client buys US Cash USD ▾
Expiry	6 months mm/dd/yy
Delivery	Moscow 13:30 07/19/16
Rate	80.3487 ATM
Notional	USD 1,000,000.00
Model	BS - PDE ▾
More Market Data	
Vol	BGN 20.391%/22.878%
Points	CMPN Mid 38105.0000
Results	
Price	% USD 4.9771% P 0.0000%
Premium	USD 49,771.42 P 0.00
Prem Date	01/19/16
Delta	Spot 99.7607%
Hedge	-997,607.50

Exotic derivatives

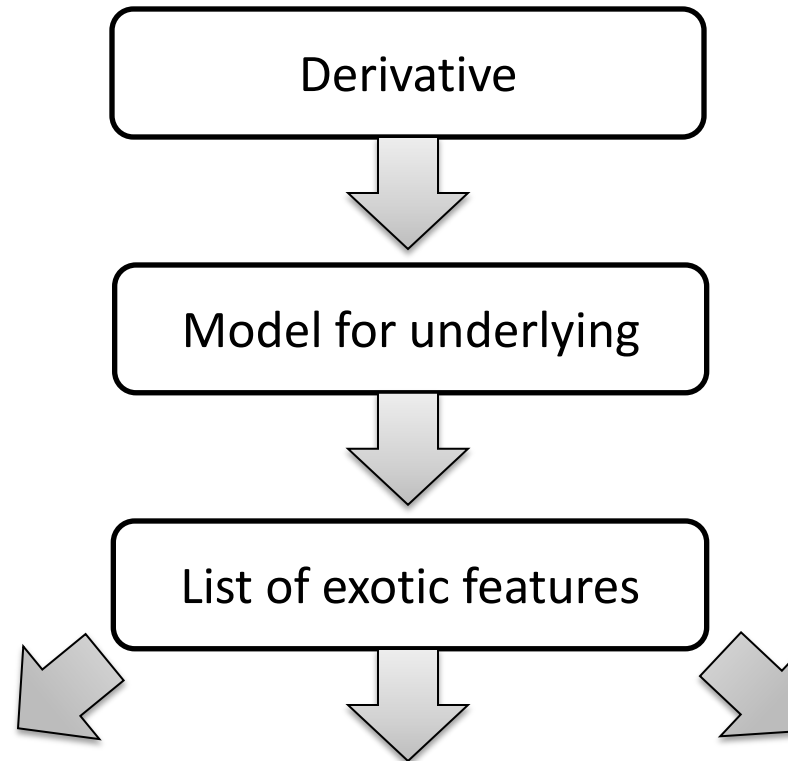
Examples – Fader

90) Asset ▾	91) Actions ▾	92) Products ▾	93) Views ▾	94) Data & Settings ▾	Option Valuation
31) Solver (Premium) ▾	32) Load	33) Save	34) Trade ▾	35) CVA ▾	36) Send to TR ▾
61) Deal 1	62) +				
51) Pricing	53) Scenario	58) Fixings			
Strategy 1 ▾					
Leg 1 ▾					
Price Date	01/15/16		09:46		
Asset	USDRUB				
Spot	Mid ▾	76.5355			
Style	Fader ▾				
Type	Fade In Inside ▾				
Direction	Client buys ▾	Cash USD ▾			
Call/Put	USD ▾	Call ▾			
Expiry	3 months ▾	04/18/16			
Delivery	Moscow 13:30 ▾	04/19/16			
Strike	78.4560	ATMF			
Notional	USD ▾	1,000,000.00			
Upper Barrier	80.3623	5.00% ITMS			
Lower Barrier	72.7087	5.00% OTMS			
Frequency	Weekly ▾				
Amt. Accum.	0.00				
■ Results					
Price	% USD ▾	1.6931% R	1.6931% P		
Premium	USD ▾	16,930.76 R	16,930.76 P		
Prem Date	01/19/16				
Delta	Spot ▾	4.6144%			
Hedge	-46,144.33				

Programming language



General framework



Finite-difference scheme

Closed-form solution

Monte Carlo method

Course plan

- Mathematical background. Main results. PDE vs. Risk-neutral approach. Greek coefficients estimation techniques.
- Vanilla products. Closed-form solution derivation. Greeks closed-form derivation. C++ implementation.
- Exotic derivatives. Product example (early exercise rights). Possible solutions. Finite-difference schemes - overview, basic results.
- Finite-difference schemes - advanced topics. Add new features to the product, discuss efficiency.
- Exotic derivatives. Product example (strong path-dependency). Possible solutions. Monte Carlo methods - overview, basic results.
- Monte Carlo methods - advanced topics. Modify program, reduce variance, compare efficiency.