Lesson IV: Overview

1. Currency futures
2. Currency options
3. How to construct synthetic forwards combining call and put options

Currency Futures

Currency Futures and Options

- *Currency Futures* are standardized contracts drawn either to buy or to sell a fixed amount of foreign currency on a pre-determined date sometime in the future.
- *Currency Options* are derivative contracts that give the buyer the opportunity to buy or to sell the underlying asset at a given price sometime in the future

Forwards vs Futures and Options

- **Forwards**: traded **"OTC"**

  Non- standardized, "tailor-made", flexible contracts

- Currency **Futures** and **Options**: traded on **regulated markets** (CME, COMEX, LIFFE, CBOT)

  Highly standardized, homogeneous contracts

Flexibility vs Standardization

What is the advantage of standardization over flexibility?

The more homogeneous (and the fewer) are the contracts, the higher is the market depth

Terminology

OTC market

Widespread aggregation of dealers who make markets in many different securities. Unlike an exchange on which trading takes place at one physical location, OTC trading occurs through telephone or computer negotiations between buyers and sellers.

Futures vs Forwards

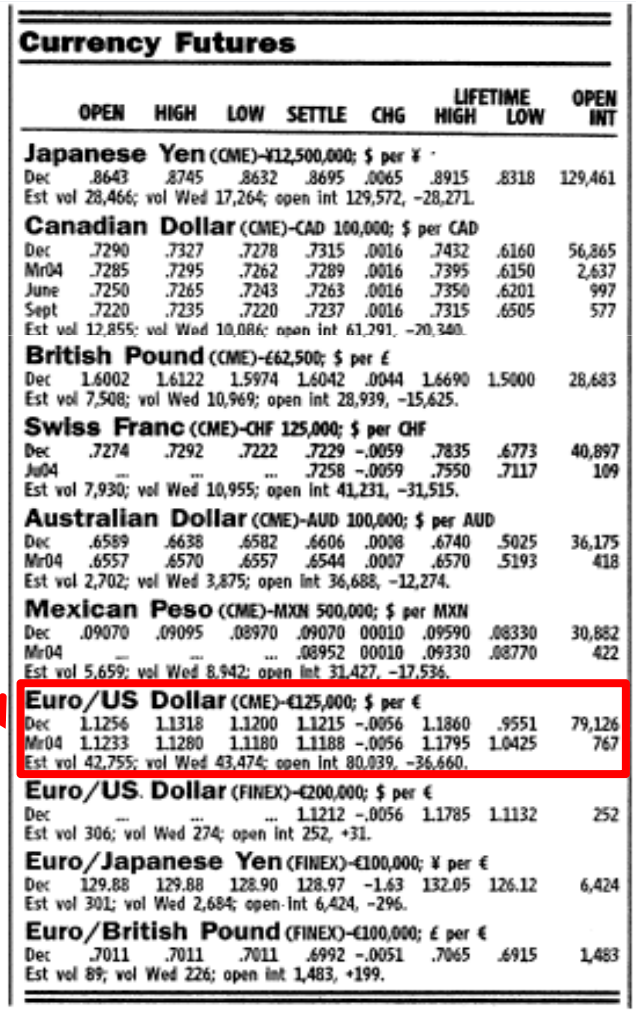
Unlike forwards, currency futures:

- trade for **standardized amounts** (depending on the currency);
- trade for a **limited number of maturity dates** (typically, March, June, September and December);
- settle gains or losses on a daily basis→ **mark-to-market**

Quoting conventions

The settlement price for the Dec contract to buy €125,000 is equal to $125{,}000_{€} * 1.1215_{\$/€} = 140{,}187.5_{\$}$

Source: The Wall Street Journal



Currency Futures

	OPEN	HIGH	LOW	SETTLE	CHG	LIFETIME HIGH	LIFETIME LOW	OPEN INT
Japanese Yen (CME)-¥12,500,000; $ per ¥								
Dec	.8643	.8745	.8632	.8695	.0065	.8915	.8318	129,461
Est vol 28,466; vol Wed 17,264; open int 129,572, -28,271.								
Canadian Dollar (CME)-CAD 100,000; $ per CAD								
Dec	.7290	.7327	.7278	.7315	.0016	.7432	.6160	56,865
Mr04	.7285	.7295	.7262	.7289	.0016	.7395	.6150	2,637
June	.7250	.7265	.7243	.7263	.0016	.7350	.6201	997
Sept	.7220	.7235	.7220	.7237	.0016	.7315	.6505	577
Est vol 12,855; vol Wed 10,086; open int 61,291, -20,340.								
British Pound (CME)-£62,500; $ per £								
Dec	1.6002	1.6122	1.5974	1.6042	.0044	1.6690	1.5000	28,683
Est vol 7,508; vol Wed 10,969; open int 28,939, -15,625.								
Swiss Franc (CME)-CHF 125,000; $ per CHF								
Dec	.7274	.7292	.7222	.7229	-.0059	.7835	.6773	40,897
Ju04	...	...	...	.7258	-.0059	.7550	.7117	109
Est vol 7,930; vol Wed 10,955; open int 41,231, -31,515.								
Australian Dollar (CME)-AUD 100,000; $ per AUD								
Dec	.6589	.6638	.6582	.6606	.0008	.6740	.5025	36,175
Mr04	.6557	.6570	.6557	.6544	.0007	.6570	.5193	418
Est vol 2,702; vol Wed 3,875; open int 36,688, -12,274.								
Mexican Peso (CME)-MXN 500,000; $ per MXN								
Dec	.09070	.09095	.08970	.09070	00010	.09590	.08330	30,882
Mr04	...	...	...	.08952	00010	.09330	.08770	422
Est vol 5,659; vol Wed 8,942; open int 31,427, -17,536.								
Euro/US Dollar (CME)-€125,000; $ per €								
Dec	1.1256	1.1318	1.1200	1.1215	-.0056	1.1860	.9551	79,126
Mr04	1.1233	1.1280	1.1180	1.1188	-.0056	1.1795	1.0425	767
Est vol 42,755; vol Wed 43,474; open int 80,039, -36,660.								
Euro/US. Dollar (FINEX)-€200,000; $ per €								
Dec	...	...	...	1.1212	-.0056	1.1785	1.1132	252
Est vol 306; vol Wed 274; open int 252, +31.								
Euro/Japanese Yen (FINEX)-€100,000; ¥ per €								
Dec	129.88	129.88	128.90	128.97	-1.63	132.05	126.12	6,424
Est vol 301; vol Wed 2,684; open int 6,424, -296.								
Euro/British Pound (FINEX)-€100,000; £ per €								
Dec	.7011	.7011	.7011	.6992	-.0051	.7065	.6915	1,483
Est vol 89; vol Wed 226; open int 1,483, +199.								

Terminology

Open interest

Number of outstanding two-sided contracts at any given time.

Futures vs Forwards: Mark-to-Market I

Forwards: Gains (losses) on the positions are realized (incurred) at the maturity of the contract.

e.g. $F_{1\$/€} = 1.27$

Bgt 1y Fwd contract (1mio €)

a) $S_{1\$/€} = 1.29$ b) $S_{1\$/€} = 1.25$

Futures vs Forwards: Mark-to-Market II

In one year's time, the buyer is to pay \$1.27 mio to purchase 1 mio € (to be received at that time)

a) After 1 year has elapsed, if the future realized spot rate ($S_{1\$/€}$) is 1.29, the buyer will eventually gain \$(1.29-1.27)*1 mio = \$20,000.

b) Conversely, if $S_{1\$/€}$ = 1.25, he will incur a loss equal to \$(1.25-1.27)*1 mio = -\$20,000.

Futures vs Forwards: Mark-to-Market III

Futures: CCP-based → the Clearing House requires both parties of a futures transaction to post margins in a **margin account** held at a brokerage house.

The amount of margins to be posted is typically a % of the futures' notional value. The margins' balance is "updated" daily, depending on the market value of the contract (computed at the daily settlement price).

Futures vs Forwards: Mark-to-Market IV

Whenever the balance falls below a pre-specified threshold (**maintenance level**) after the daily MTM, the involved party will receive a "margin call" to post additional money in the margin account.

Futures vs Forwards: Mark-to-Market V

e.g. 1st June 201X

Bgt GBP futures contract @ $1.55/£ to purchase £ 63,000 in three months

Initial margin = $ 6,000

Maintenance level = $ 5,000

Initial contract value = $(1.55*63,000) = $ 97,650

2nd June 201X

End of day settlement price $1.57/£

Daily gain to be credited to the margin deposit $(1.57*63,000) – 97,650 = 98,910 – 97,650 = $1,260

Futures vs Forwards: Mark-to-Market VI

e.g. 3rd June 201X

End of day settlement price $1.53/£

Daily loss to be debited to the margin deposit $(1.53*63,000) – 98,910 = - $2,520

Margin balance = $(7,260 – 2,520) = $4,740

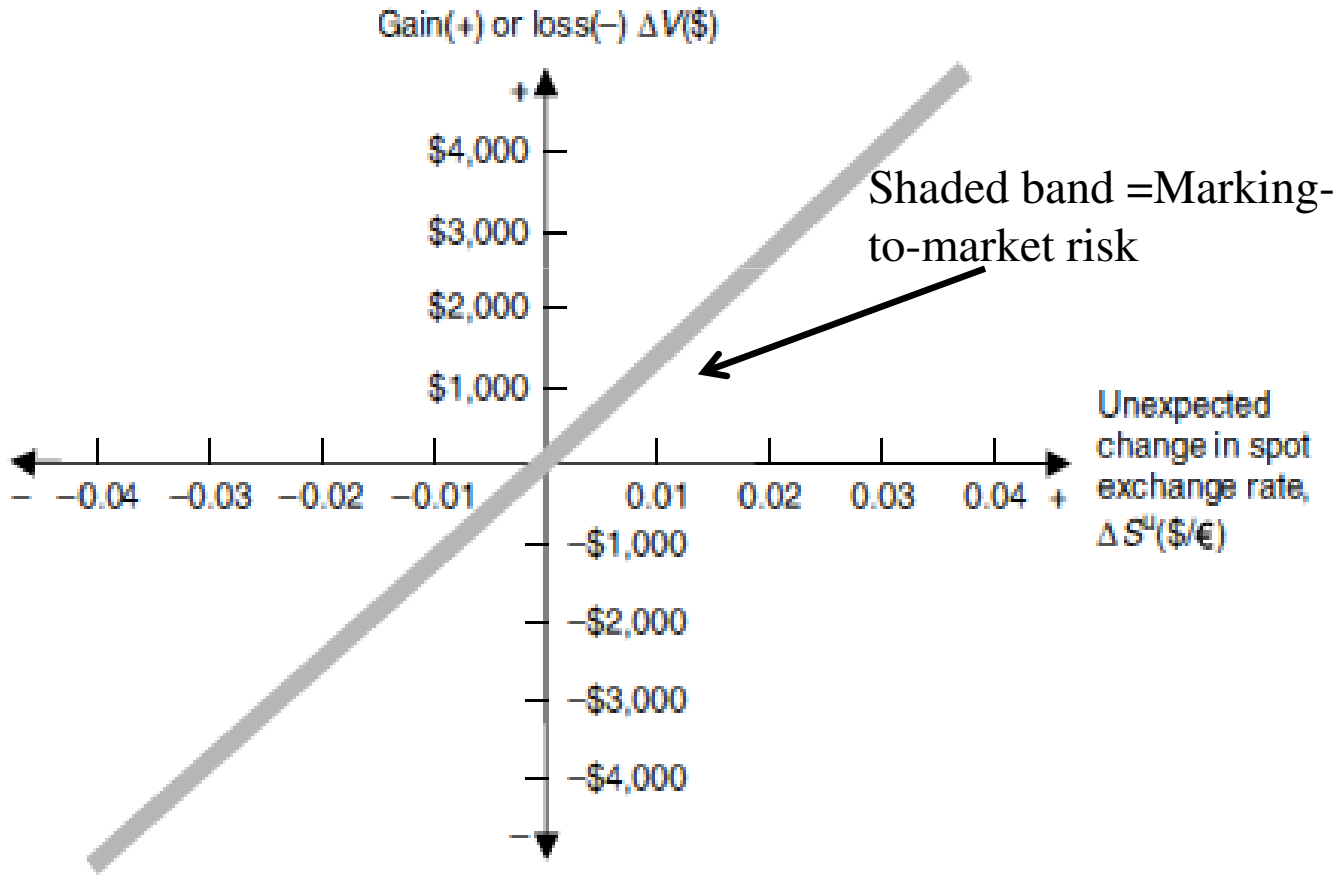
Margin call = $(5,000-4,740) = $260

A **futures** contract is **equivalent** to **entering a forward** contract **each day** and settling each forward contract before opening another one

Watch out

Futures	Forwards
Central counterparty (Clearing House) bearing the settlement risk ⇩ Margins are required	No Central Counterparty: the settlement risk is faced by the two parties involved ⇩ No margins required
Marking-to-market risk ⇩ The amount in the margin account not only depends on the entire path of the futures price from the initial purchase, but also on the interest rates earned in the account or forgone on cash contributions to the account	No marking-to-market risk: gains or losses on the forward positions will be eventually realized at the maturity of the contracts

Futures: Payoff Profile



Currency Options

Options I

Options are derivative contracts that give the buyer the opportunity (not the obligation) to buy or to sell the underlying asset at a given price sometime in the future

Options II

Some points to be stressed:

- Underlying: either currency futures (**futures options**) or spot currency (**spot options**);
- American (exercise up to maturity) vs European options (exercise at maturity);
- Moneyness and intrinsic value;
- Option premium: intrinsic value & time value

Futures options vs Spot options

Futures options: options that give the buyer the right to buy or sell currency futures contracts at the strike/exercise price

Spot options: options that give the buyer the right to buy or sell the currency itself at the strike/exercise price

Moneyness & Intrinsic Value

S= market price of the underlying, K= strike price, Premium= 0

	Out of the money	At the money	In the money
CALL	K > S	K = S	K < S
PUT	K < S	K = S	K > S

Intrinsic Value: extent to which an option is in the money

Option premium

The option premium consists of two parts

- Intrinsic value
- Time value
  - Before expiry, there is always some possibility that the option might end up more in the money (i.e. with a higher intrinsic value)

The mkt value of a currency option I

Factors affecting an option' s market value:

1. **Intrinsic value**: the more the option is in the money, the higher is the option premium;
2. **Volatility of the underlying exchange rate**: the more volatile is the underlying, the greater the chance that the option will be exercised (*ceteris paribus*);
3. **American** vs **European option type**: American options are more "flexible" and consequently more valuable than European options;

The mkt value of a currency option II

4. **Interest rates**: the higher the interest rates, the lower the present value of the exercise price. This should increase (reduce) the mkt value of a call (put);
5. **Forward premium/ discount**: (*ceteris paribus*) the greater is the fwd discount (i.e. the expected decline in the FX value of a currency), the higher (lower) is the value of a put (call) option. The reverse holds for fwd premia;
6. **Length of the period to expiry**: (*ceteris paribus*) the longer the maturity, the greater the chance that the option will move into money

Quoting conventions

The price for the October Call, giving the holder the right to buy € 125,000 at K= $1{,}12_{\$/€}$ is equal to = .0109* $125{,}000_{€}$= $ 1,362.5

Currency

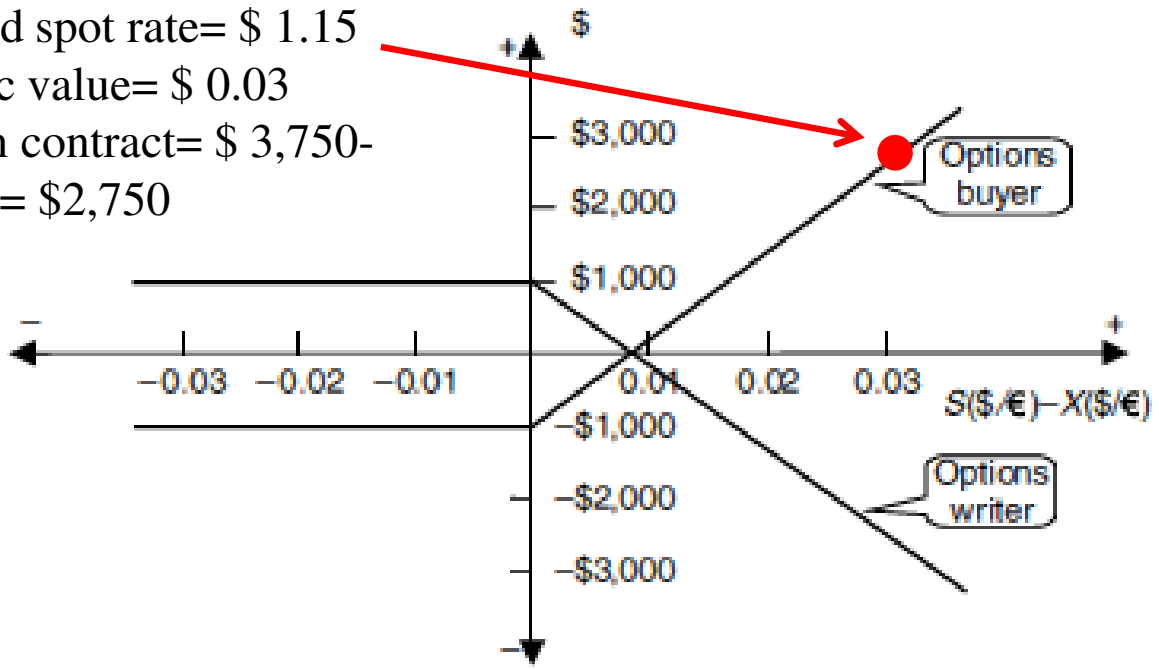
STRIKE	CALLS-SETTLE			PUTS-SETTLE		
Japanese Yen (CME)						
12,500,000 yen; cents per 100 yen						
Price	Oct	Nov	Dec	Oct	Nov	Dec
8600	1.30	1.78	2.06	0.35	0.83	1.11
8650	1.00	1.51	1.80	0.55	1.06	1.35
8700	0.77	1.27	1.56	0.82	1.32	1.61
8750	0.59	1.08	1.36	...	...	...
8800	0.45	0.94	1.18	...	...	2.23
8850	0.32	0.79	1.03	...	...	...
Est vol 2,587 Wd 752 calls 607 puts						
Op int Wed 29,287 calls 32,274 puts						
Canadian Dollar (CME)						
100,000 Can.$, cents per Can.$						
Price	Oct	Nov	Dec	Oct	Nov	Dec
7200	1.31	1.65	...	0.16	0.68	...
7250	0.92	1.51	...	0.27	0.86	...
7300	0.61	1.22	...	0.46	1.07	...
7350	0.39	0.99	...	0.74	1.34	...
7400	0.23	0.80	...	...	1.65	...
7450	...	0.64	...	...	...	...
Est vol 731 Wd 261 calls 75 puts						
Op int Wed 11,585 calls 5,717 puts						
British Pound (CME)						
62,500 pounds; cents per pound						
Price	Oct	Nov	Dec	Oct	Nov	Dec
1580	2.78	...	3.80	0.36	1.10	1.38
1590	2.00	2.88	3.26	0.58	...	1.84
1600	1.38	2.32	2.72	0.96	...	2.30
1610	0.90	...	2.18	1.48	...	2.76
1620	0.56	1.42	1.72	...	...	3.30
1630	0.26	...	1.38	...	...	...
Est vol 302 Wd 132 calls 104 puts						
Op int Wed 3,598 calls 3,858 puts						
Swiss Franc (CME)						
125,000 francs; cents per franc						
Price	Oct	Nov	Dec	Oct	Nov	Dec
7150	1.16	...	1.93	0.37	...	1.14
7200	0.85	...	1.66	0.56	1.08	1.37
7250	0.59	1.12	1.42	0.80	1.33	1.63
7300	0.41	0.92	1.21	1.12	...	1.92
7350	0.29	...	1.03	...	...	2.24
7400	0.20	...	0.87	1.91	...	2.57
Est vol 75 Wd 535 calls 74 puts						
Op int Wed 2,721 calls 1,440 puts						
Euro Fx (CME)						
125,000 euros; cents per euro						
Price	Oct	Nov	Dec	Oct	Nov	Dec
11100	1.69	2.44	2.85	0.54	1.29	1.70
11150	1.37	2.16	2.57	0.72	1.51	1.92
11200	1.09	1.89	2.31	0.94	1.74	2.16
11250	0.86	1.66	2.08	1.21	2.01	2.43
11300	0.66	1.44	1.86	1.51	2.29	2.71
11350	0.50	1.25	1.67	1.85	...	3.01
Est vol 1,909 Wd 1,172 calls 673 puts						
Op int Wed 27,707 calls 20,189 puts						

Source: The Wall Street Journal

Payoff profiles

Call on 125,000 € (std amount), X(strike)= $1.12, premium= $ 1,000

Realized spot rate= $ 1.15
Intrinsic value= $ 0.03
Gain on contract= $ 3,750- $ 1,000= $2,750



How to construct synthetic forwards combining call and put options

Put-Call-Forward Parity I

Deal	Cash Flow t_0	Cash Flow t_1 $S_{\$/€} < X_{\$/€}$	Cash Flow t_1 $S_{\$/€} > X_{\$/€}$
Buy Call	-C	0	Buyer's gain $S_{\$/€} - X_{\$/€}$
Sell Put	+P	Seller's loss $S_{\$/€} - X_{\$/€}$	0
Total Payoff	P-C	$S_{\$/€} - X_{\$/€}$	$S_{\$/€} - X_{\$/€}$

Put-Call-Forward Parity II

A fwd purchase of € against $ is equivalent to…

Deal	Cash Flow t_0	Cash Flow t_1 $S_{\$/€}<X_{\$/€}$	Cash Flow t_1 $S_{\$/€}>X_{\$/€}$
Borrowing $ to buy €	$ borrowed $+\frac{X_{\$/€}}{(1+r_{\$})^T}$	$ owed $-X_{\$/€}$	$ owed $-X_{\$/€}$
Investing in €	$-\frac{S_{0\$/€}}{(1+r_{€})^T}$	€ earned $S_{T\$/€}$	€ earned $S_{T\$/€}$
Total Payoff	$+\frac{X_{\$/€}}{(1+r_{\$})^T}-\frac{S_{0\$/€}}{(1+r_{€})^T}$	$S_{\$/€}-X_{\$/€}$	$S_{\$/€}-X_{\$/€}$

Put-Call-Forward Parity III

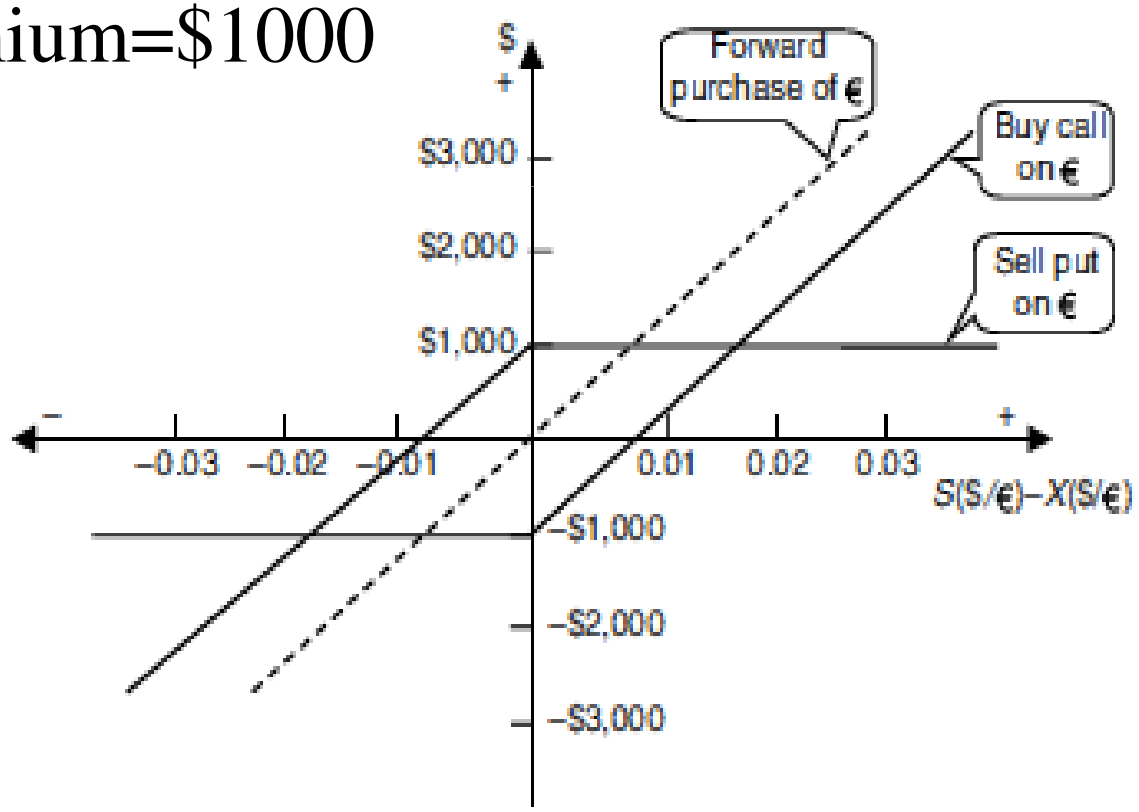
$$P - C = + \frac{X_{\$/€}}{(1+r_{\$})^{T}} - \frac{S_{0\$/€}}{(1+r_{€})^{T}}$$

Option combination's net cost

Fwd purchase of €'s net cost

Payoff profiles

Premium=$1000



To sum up

	Forwards	Futures	Options
Delivery discretion	None	None	Buyer's discretion
Maturity date	Any date	Pre-specified (depending on the Exchange)	Pre-specified (depending on the Exchange)
Contracted amount	Any amount	Pre-specified (depending on the currency and on the Exchange)	Pre-specified (depending on the currency and on the Exchange)
Margin requirements	Informal (if any)	Defined by the Clearing House	Defined by the Clearing House
Central counterparty	No	Clearing House	Clearing House
Major users	Hedgers	Speculators	Both

To put it into practice

	Strike	Price
1 month Call $_{C1/C2}$	C_1 .63/C_2	C_1 .01/C_2
1 month Fwd$_{C1/C2}$		C_1 .624/C_2
r_{C1}		5.5%
r_{C2}		7.5%
$S_{0\ c1/c2}$		C_1 .625/C_2
1 month Put $_{C1/C2}$	C_1 .63/C_2	?