Lesson VI: Currency Derivatives, an Overview

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LIUC Università Cattaneo

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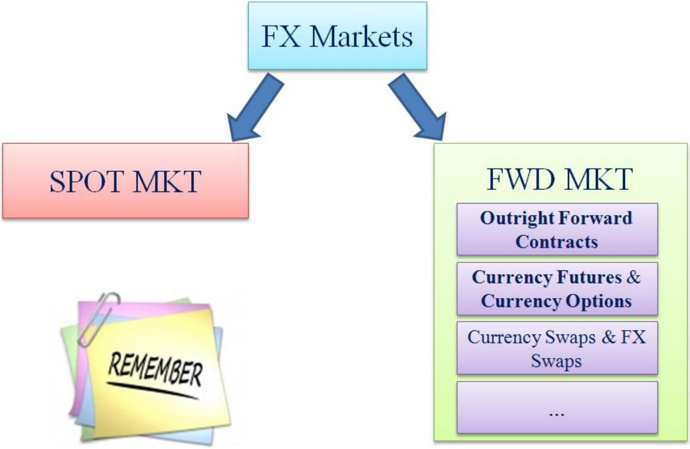
Roadmap

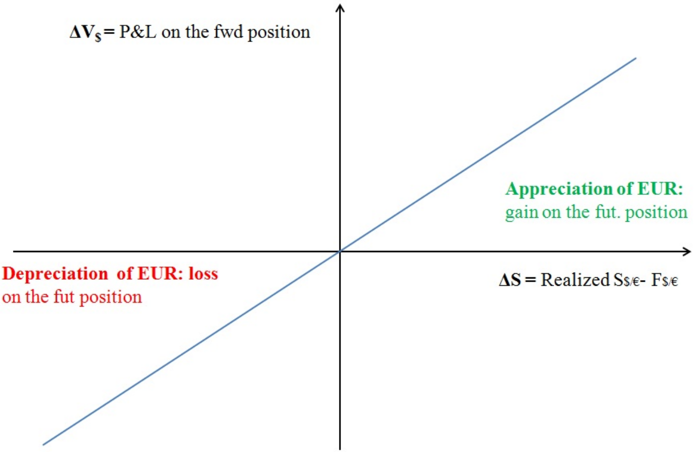

FX Markets
SPOT MKT
FWD MKT
Outright Forward Contracts
Currency Futures & Currency Options
Currency Swaps & FX Swaps
...
REMEMBER

Outright Fwd Contracts: Definition and Payoff

Outright Fwd Contracts: Tailor-made OTC agreement to exchange currencies at a pre-determined price on a future date.

In intuitive terms, this allows to **set now the price** at which a given currency will be **bought or sold** on a given **future date**$\Rightarrow$ at maturity, the payoff of a fwd depends on the **realized spot rate** at that time.

Payoff Profile of a Long Fwd to Buy EUR vs USD



Benefits and Risks of Fwds

- **High Flexibility**
  - **Not** only major currencies
  - **Customizable** maturities and notional amounts
  - **Deliverables** vs **Non deliverables**
- **No CCTP**: Higher settlement risk
- **Reduced mkt liquidity**

Futures: Definition and Comparison with Fwds

Currency Futures: standardized contracts drawn either to buy or to sell a fixed amount of foreign currency on a pre-determined date sometime in the future

Unlike fwds, however, 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**

Focus on the MtM

Futures are CCTP-based $\Rightarrow$ 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 notional amount**
- The margins' **balance is updated daily**, depending on the market value of the contract (computed at the daily settlement price)
- 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

MtM: Digging Deeper into Daily Mkt Practice

Suppose that, on June 1st, you bgt a GBP future contract at 1.55 $\frac{USD}{GBP}$ to purchase GBP 63,000 in three months. Assume further that

- **Required Initial Margin** = USD 6,000
- **Maintenance Margin** = USD 5,000

	June 1st	**June 2nd**	**June 3rd**
Settlement Px	1.55	1.57	1.53
USD Fut.Val	97,650	98,910	96,390
USD Daily PL	0	1,260	-2,520
Mrg.Balance	6,000	7,260	4,740
Mrg.Call	No	No	260

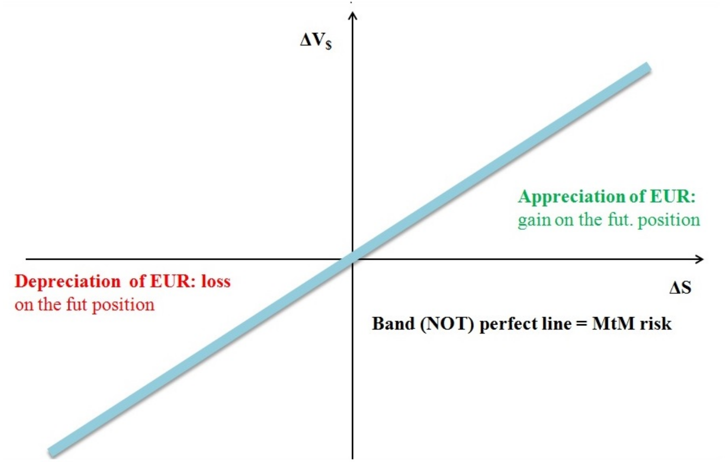
In more practical terms...

A futures contract is equivalent to **entering a forward contract each day** and settling each forward contract before opening another one.
If you conversely buy (sell) a fwd contract **all** the gains (losses) will be eventually realized (incurred) **at maturity**, depending on the future realized spot rate at that time.

MtM and Futures vs Fwds: a Wrap Up

- **Futures**
  - CCTP (Clearing House) bearing the settlement risk $\Rightarrow$ **Margins are required**
  - 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 $\Rightarrow$ **Marking-to-market risk**
- **Fwds**
  - No CCTP: the settlement risk is faced by the two parties involved $\Rightarrow$ **No margins are required**
  - Gains or losses on the forward positions will be eventually realized at the maturity of the contracts $\Rightarrow$ **No marking-to-market risk**

Payoff Profile of a Long Future to Buy EUR vs USD



Benefits and Risks of Futures

- **Low Flexibility**
  - **Mainly** major currencies
  - **Fixed, standardized** maturities and notional amounts
  - **Well-defined** trading time and trading rules
- **CCTP**: No settlement risk
- **High mkt liquidity**

Options: Definition and Overview

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 (either **at or up to** maturity).
Watch out:

- **Call**: right to buy
- **Put**: right to sell
- **European Option**: exercise at maturity
- **American Option**: exercise up to maturity

Moneyness and Intrinsic Value

Assume:

- **S**: market price of the underlying
- **X**: strike price
- **Premium**=0

	In the Money	**At the Money**	**Out the Money**
C	S>X	S=X	S<X
P	S<X	S=X	S>X

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

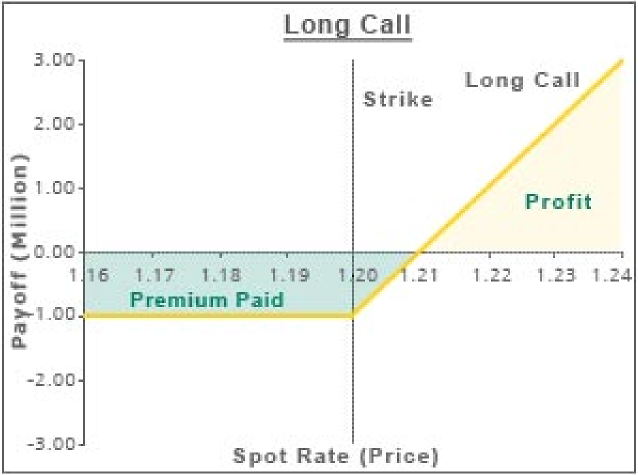
The Drivers of an Option's Mkt Value I

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

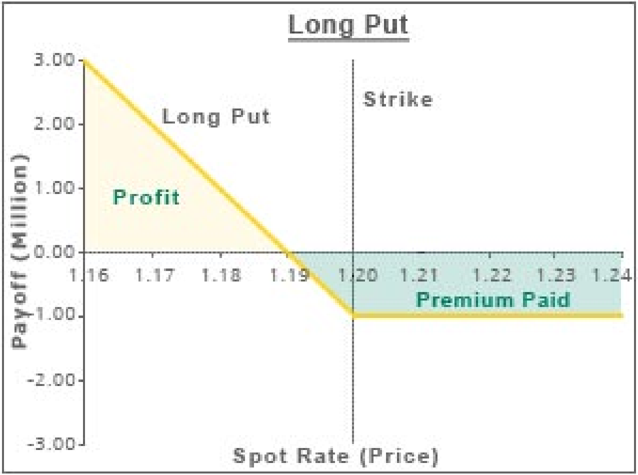
The Drivers of an Option's Mkt Value II

- **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
- **Length of the period to expiry**: (*ceteris paribus*) the longer the maturity, the greater the chance that the option will move into money

Payoff Profile of a Long Call



Payoff Profile of a Long Put



Benefits and Risks of Options

- **Low Flexibility**
  - **Mainly** major currencies
  - **Fixed, standardized** maturities and notional amounts
  - **Well-defined** trading time and trading rules
- **CCTP**: No settlement risk
- **High mkt liquidity**
- **Optionality**

To Sum Up

	Fwds	**Futures**	**Options**
Trading	OTC	Reg. Mkts	Reg. Mkts
Discretion	None	None	Buyer's
Maturity	Any Date	Std Dates	Std Dates
Notional	Any	Std	Std
Margins	None	CH-Defined	CH-Defined
CCTP	No	Yes	Yes
Major Users	Hedgers	Speculators	Both

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**

Building a Synthetic Fwd: Step 1

Suppose that, at time t_0, you decide to:

- **Buy a Call** on the $\frac{USD}{EUR}$ exchange rate (premium: C)
- **Sell a Put** on the $\frac{USD}{EUR}$ exchange rate (premium: P)

Suppose further that the 2 options have:

- **The same maturity**: t_T
- **The same strike price**: $X\frac{USD}{EUR}$

Step 1: Profit and Loss at Maturity

Deal	CF_{t_0}	CF_{t_T} if $S < X$	CF_t if $S > X$
Long Call	-C	0	$S_{\frac{USD}{EUR}}$-$X_{\frac{USD}{EUR}}$
Short Put	P	$S_{\frac{USD}{EUR}}$-$X_{\frac{USD}{EUR}}$	0
Total	**P-C**	$S_{\frac{USD}{EUR}}$-$X_{\frac{USD}{EUR}}$	$S_{\frac{USD}{EUR}}$-$X_{\frac{USD}{EUR}}$

Under **both** scenarios, the **total CF at maturity** will thus be $S_{\frac{USD}{EUR}}$-$X_{\frac{USD}{EUR}}$.

In Simpler Terms...

Notice that this is **equivalent** to the payoff of a fwd contract drawn to purchase EUR with USD at maturity. In alternative terms, at maturity there will be a **USD cash outflow** together with a corresponding **EUR inflow**.

Building a Synthetic Fwd: Step 2

$S_{\frac{USD}{EUR}}$-$X_{\frac{USD}{EUR}}$ is practically equivalent to:

- **A cash outflow**: -$X_{\frac{USD}{EUR}}$
- **Combined with a cash inflow**: $S_{\frac{USD}{EUR}}$

Let's put it all together

- Cash outflow at maturity ⇒ USD-denominated ⇒ conceivable as the **repayment of a USD-denominated loan** (originally stipulated at t_0)
- Cash inflow at maturity ⇒ EUR-denominated ⇒ conceivable as the **proceeds of a EUR-denominated investment** (originally stipulated at t_0)

Step 2: Profit and Loss at Maturity

Deal	CF_{t_0}	CF_{t_T} if $S < X$	CF_t if $S > X$
Loan	$\frac{X_{\frac{USD}{EUR}}}{(1+r_{USD})^T}$	$-X_{\frac{USD}{EUR}}$	$-X_{\frac{USD}{EUR}}$
Inv	$-\frac{S_{\frac{USD}{EUR}}}{(1+r_{EUR})^T}$	$S_{\frac{USD}{EUR}}$	$S_{\frac{USD}{EUR}}$
Tot	$\frac{X_{\frac{USD}{EUR}}}{(1+r_{USD})^T} - \frac{S_{\frac{USD}{EUR}}}{(1+r_{EUR})^T}$	$S_{\frac{USD}{EUR}} - X_{\frac{USD}{EUR}}$	$S_{\frac{USD}{EUR}} - X_{\frac{USD}{EUR}}$

The Put-Call-Fwd Parity

Given that

$$P - C = S_{\frac{USD}{EUR}} - X_{\frac{USD}{EUR}}$$

and

$$\frac{X_{\frac{USD}{EUR}}}{(1+r_{USD})^T} - \frac{S_{\frac{USD}{EUR}}}{(1+r_{EUR})^T} = S_{\frac{USD}{EUR}} - X_{\frac{USD}{EUR}}$$

It must be that

$$P - C = \frac{X_{\frac{USD}{EUR}}}{(1+r_{USD})^T} - \frac{S_{\frac{USD}{EUR}}}{(1+r_{EUR})^T}$$

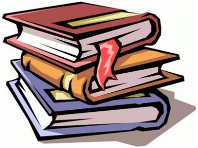
Put-Call-Fwd Parity

Currency Fwds, Futures and Options

- **Currency Fwds**: **tailor-made** agreement to exchange currencies at a pre-determined price on a future date
- **Currency Futures**: **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**: derivative contracts that give the buyer the **opportunity** to buy or to sell the underlying asset at a given price sometime in the future

Over The Counter

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.



Market Maker

Market Maker: liquidity providing intermediary that quotes **both** buying and selling prices for a given financial instrument on a **continuous** basis.

To Put It into Practice I

4.1: A put option on Australian dollars with a strike price of USD 0.80 is purchased by a speculator for a premium of USD 0.02. If the Australian dollars spot rate is USD 0.74 on the expiration date, should the speculator exercise the option on this date or let the option expire?
Draw the buyer's and the seller's payoff charts.

To Put It into Practice II

4.2:A call option on Canadian dollars with a strike price of USD 0.60 is purchased by a speculator for a premium of USD 0.06 per unit. Assume each option calls for the delivery of 50,000 CAD.

- If the Canadian dollar's spot rate is USD 0.65 at the time the option is exercised, what is the net profit to the speculator?
- What would the spot rate need to be at the time the option is exercised for the speculator to break even?
- What is the net profit to the seller of this option?
- Draw the buyer's and the seller's payoff charts.

To Put It into Practice III

4.3: Given the information below (investment period 1 yr), find the put premium

$\mathbf{Call}_{\frac{C_1}{C_2}}$ Premium	0.01 C_1
$\mathbf{Call}_{\frac{C_1}{C_2}}$ Strike	0.63 C_1
$\mathbf{Put}_{\frac{C_1}{C_2}}$ Strike	0.63 C_1
$\mathbf{r}_{C_1}$	0.055
$\mathbf{r}_{C_2}$	0.075
$\mathbf{S}_{0\frac{C_1}{C_2}}$	0.625