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Currency forwards and swaps

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Lesson objectives

- Introduce the concept of currency forwards and FX swaps and currency swaps
- Review the mechanics of those contracts.
- Create synthetic instruments for currency forwards.
- Evaluate cash flows.

Introduction

- Financial instruments can be denominated in different currencies.
- Financial markets offer wide variety of liquid financial instruments denominated in USD .
- However, the range of liquid financial instruments denominated in such currencies as Swiss francs or Swedish crones is relatively small.
- Foreign exchange forward and swap contracts make USD denominated financial instruments available to market participants trading in other currencies.

Currency forwards definition

- Foreign currency forwards are used as a foreign currency hedge when an investor has obligation to pay or receive foreign currency at some point in the future.
- The currency forward represents a binding contract in foreign exchange market which fixes the exchange rate for sale or purchase of currency on a future date.
- Currency forwards also known as outright forwards are over-the-counter financial instruments.

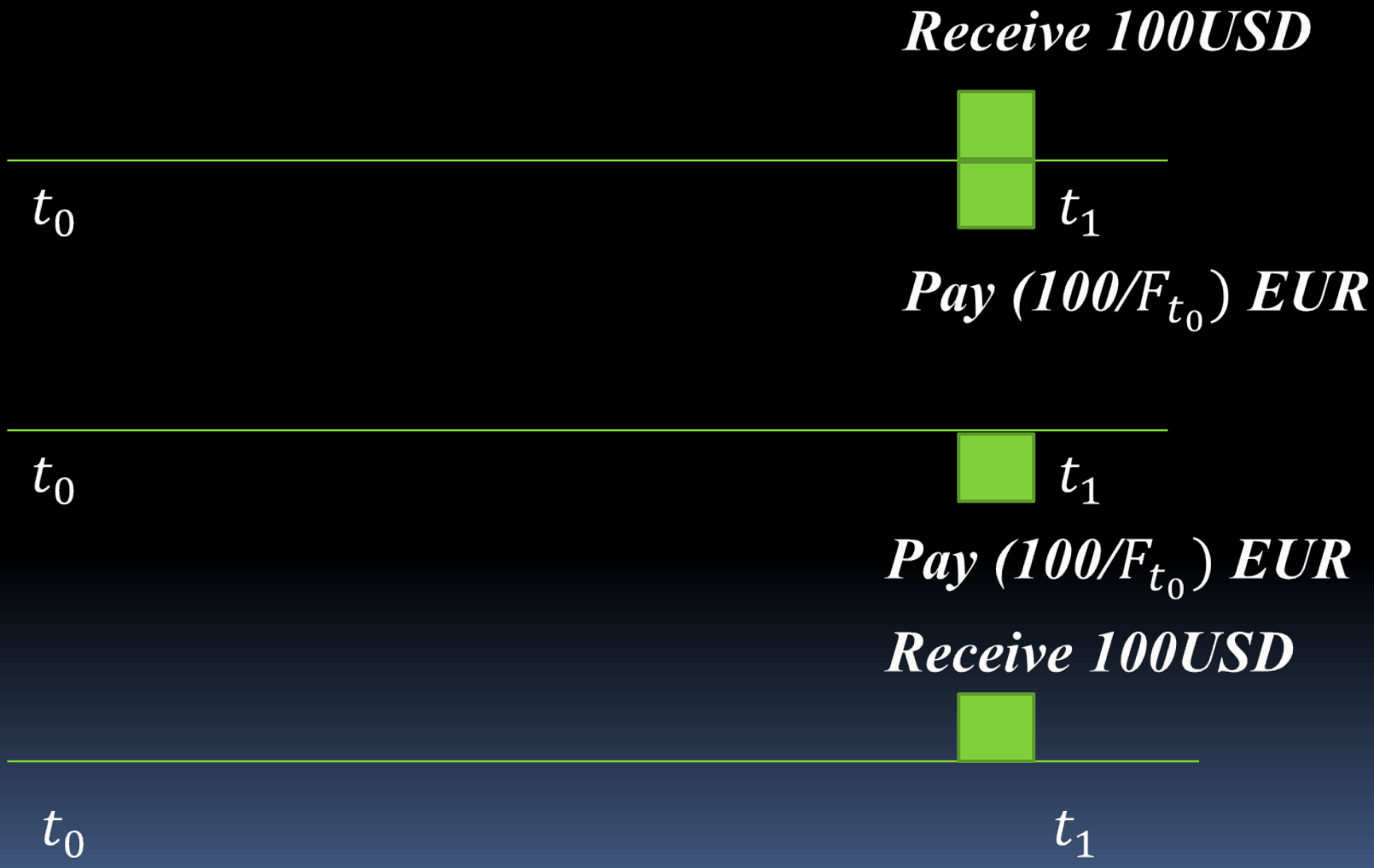
Currency forward contracts

- Let's consider cash flows for a forward contract which supposes purchase(sale) of 100 USD against euro against $100/F_{t_0}$.

- The contract is initiated at t_0 and settlement takes place at t_1. Forward exchange rate F_{t_0} is chosen at time of initiation.

- Value of the contract at initiation is equal to zero.

Forward contract cash flows



Creating synthetic for the currency forward

Money market synthetic for the currency forward

- Cash flows in the lower part of previous chart are equivalent to lending $C_{t_0}^{USD}$ in US dollars to get 100 at date t_1.

- Denoting interest rate by $L_{t_0}^{USD}$ we can calculate present value of 100 USD to determine amount to lend:

$$C_{t_0}^{USD} = \frac{100}{1 + L_{t_0}^{USD}\left(\frac{t_1 - t_0}{360}\right)}$$

Money market synthetic for the currency forward 2

- Cash flow in the upper part of previous chart is equivalent to borrowing $C_{t_0}^{EUR}$ in euros and paying back $100/F_{t_0}$ in t_1.

$$C_{t_0}^{EUR} = \frac{100/F_{t_0}}{1 + L_{t_0}^{EUR}\left(\frac{t_1 - t_0}{360}\right)}$$

- Also at time 0 there is a spot exchange of dollars for euros.
- Thus. borrowing $C_{t_0}^{EUR}$ in interbank market , converting them into dollars and depositing $C_{t_0}^{USD}$ in interbank market is equivalent currency forward.

Bonds synthetic for the currency forward

- Let's denote by $B(t_0, t_1)^{USD}$ the price of default free discount bond that pays 100 USD at time t_1 .

- $B(t_0, t_1)^{EUR}$ is the price of default free discount bond that pays 100 EUR at time t_1.

- Alternative synthetic for currency forward can be generated by a short position (1/F units) in euro discount bond , exchange of euros into dollars at going exchange rate and buying one dollar denominated discount bond.

Pricing of forward contracts

- For deal to go through the initial investment amounts at time t_0 in USD and EUR should be the same.

- Denoting by e_{t_0} the spot exchange rate we can write:

$$C_{t_0}^{USD} = C_{t_0}^{EUR} e_{t_0}$$

- Thus forward exchange rate can be thus determined from this formula

$$F_{t_0} = e_{t_0} \left[\frac{1 + L_{t_0}^{USD} \left(\frac{t_1 - t_0}{360} \right)}{1 + L_{t_0}^{EUR} \left(\frac{t_1 - t_0}{360} \right)} \right] \textit{(covered interest parity)}$$

Pricing of forward contracts 2

- Forward exchange rate can be also determined from alternative treasury bond synthetic:

$$F_{t_0} = e_{t_0}\left[\frac{B(t_0,t_1)^{EUR}}{B(t_0,t_1)^{USD}}\right]$$

- Contractual equation for forward loan is given by following:

FX forward USD against EUR = Borrow EUR at t_0 for maturity t_1 + Using proceeds buy USD against EUR + Deposit USD at t_0 for maturity t_1

Quoting conventions for FX forwards

- Markets quote *forward points* rather than outright forward rates.
- For instance suppose forward EUR/USD quotes are given by :

  bid = 1.0210 ask=1.0220

- Spot exchange rates are given by:

  bid = 1.0202 ask=1.0205

- Traders prefer to quote forward points:

  bid =8 ask=15

Quoting conventions for FX forwards 2

- Covered interest parity condition can be rewritten to express difference between forward and spot rate:

$$F_{t_0} - e_{t_0} \cong (r^d_{t_0} - r^f_{t_0}) \left(\frac{t_1 - t_0}{360} \right) e_{t_0}$$

where $r^d_{t_0}$ is the interest rate in domestic currency and $r^f_{t_0}$ is the interest rate in foreign currency.

- The forward points are called “pips” and written as bid/ask.

Foreign exchange swaps

- Foreign exchange swap is a contract in which one party borrows one currency from and at the same time lends another currency to second party.

- The repayment obligation is used as collateral and the amount of repayment is fixed by the FX forward rate. The FX swap can be considered as riskless collateralized borrowing/lending.

- We can also think of foreign exchange swap as if the two counterparties spot purchase and forward sell two currencies against each other.

Foreign exchange swaps 2

Foreign exchange swaps advantages

- FX swaps are interbank instruments , not available to clients . Counterparty risk is lower and bid ask spread is smaller.
- FX swaps allow to borrow and lend in both currencies without moving prices. With FX swaps traders are not buying and selling deposits but rather exchanging them .
- FX swaps are off-balance sheet items and have minor balance sheet effects.

Currency swaps

- Currency swaps imply exchange of cash flows in different currencies. Thus two different curves are involved in swap pricing instead of one.

- Euro/USD currency swap involves an exchange of principal amount $N^{\$}$ against the principal M^{EUR} and a series of floating interest payments associated with the principal amounts.

- The interest payments are settled at settlement dates $\{t_1, t_2, \ldots\ldots t_n\}$.

Currency swaps 2

- One party will pay floating payments $L_{t_i}^{\$} N^{\$} \delta$ and receive floating payments of size $L_{t_i}^{EUR} M^{EUR} \delta$.

- The two LIBOR rates $L_{t_i}^{\$}$ and $L_{t_i}^{EUR}$ will be determined at $\{t_0, t_1, \ldots . t_{n-1}\}$.

- A small spread s_{t_0} can be added to one of the interest rates to make both parties willing to exchange cash flows.

Currency swaps