International Economics: Lecture 19
Exchange rates in the Short run: Asset approach

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Interest arbitrage & Risk

Interest on dram / dollar denominated assets, $r=10$ / $r^*=5$

Investor should decide in which asset to invest taking account exchange rate risk.

Two investment strategies

1) Riskless arbitrage: 
*Hedge the exposure to exchange rate risk through forward contract.*

2) Risky arbitrage: 
*Wait to use a spot contract when the investment matures.*
Riskless arbitrage: Covered interest parity

Interest on dram / dollar deposits, \( r=10 \) / \( r^*=5 \)

**Forward rate**, \( F_{\text{AMD/\$}}=523.8 \)

Spot rate, \( S_{\text{AMD/\$}}=500 \)

Dram return on dram asset: \( \text{ROR}_{\text{AMD}} = r \)

Dram return on dollar asset: \( \text{ROR}_\$ = \frac{1}{S} \times (1+r^*) \times F - 1 \)

To avoid risk we engage in a forward contract today.

Note: The last strategy requires both *spot*, and *forward* contracts. The two are combined in a *swap* contract. That is why swaps are so prevalent.

No arbitrage condition \( \iff \) **Covered interest parity**

\[
r = \frac{1}{S} \times (1+r^*) \times F - 1
\]

\[
F/S = (1 + r) / (1+r^*) \quad \text{or} \quad F = S (1+r) / (1+r^*)
\]

Exchange rate risk has been “covered”
Riskless arbitrage: Covered interest parity

Interest on dram / dollar deposits: $r = 10 \%$ / $r^* = 5\%$. Forward rate: $F_{\text{AMD} / \text{S}} = 523.8$. Spot rate: $S_{\text{AMD} / \text{S}} = 500$. 

$1 \text{M dram today} \quad \rightarrow \quad \text{Invest in dram asset} \quad \times (1+r) \quad \rightarrow \quad \text{1.1M dram in one year} \quad (1 + r) = F/S \times (1+r^*)$ 

$\downarrow$ Exchange for dollars \quad $S = 500$ 

$1 \text{M/S dollars today} \quad \rightarrow \quad \text{Invest in dollar asset} \quad \times (1+r^*) \quad \rightarrow \quad 2100$ dollars in one year 

$\downarrow$ Exchange for drams \quad $F = 523.8$
Riskless arbitrage opportunities

Invest in dram if \( \text{ROR}_{\text{AMD}} > \text{ROR}_\$ \)

\[
r > \frac{1}{S} \times (1+r^*) \times F - 1
\]

\[
F/S < \frac{1+r}{(1+r^*)}
\]

\[
(F - S)/S < \frac{(r-r^*)/(1+r^*)}{1}
\]

Invest in dram if forward premium/discount is less than interest rate differential.

Otherwise invest in dollar.
Risky arbitrage: Uncovered interest parity

Interest on dram / dollar deposits, \( r = 10 / r^* = 5 \)

**Expected exchange rate**, \( S_{e,\text{AMD/\$}} = 523.8 \)

Spot rate, \( S_{\text{AMD/\$}} = 500 \)

Dram return on dram asset: \( \text{ROR}_{\text{AMD}} = r \)

*Expected* dram return on dollar asset: \( \text{ROR}_\$ = \frac{1}{S} \times (1+r^*) \times S_{e} - 1 \)

We take the risk and don’t hedge.

No arbitrage condition \( \iff \) **Uncovered interest parity**

\[ r = \frac{1}{S} \times (1+r^*) \times S_{e} - 1 \]

\[ \frac{S_{e}}{S} = \frac{(1 + r)}{(1+r^*)} \]

Exchange rate risk hasn’t been “covered”, they were left “uncovered”
Risky arbitrage: Uncovered interest parity

UIP can be seen as a theory of spot rate determination.

\[ \frac{S_e}{S} = \frac{1 + r}{1 + r^*} \]

\[ S = S^e \frac{1 + r^*}{(1+r)} \]

\[ \frac{(S^e - S)}{S} = \frac{r - r^*}{1 + r^*} \]

Higher interest rate currency is expected to depreciate.
Test of UIP

CIP: \[ (1 + r) = \frac{F}{S} \times (1 + r^*) \]

UIP: \[ (1 + r) = \frac{S_e}{S} \times (1 + r^*) \]

\[ \Rightarrow \quad F = S_e \]

Forward rate = expected spot rate
if both CIP and UIP hold

Although
\[ S_e \text{ employed in risky arbitrage,} \]
\[ F \text{ employed in riskless arbitrage,} \]
they should be equal.

CIP assumed to hold, as there is a strong evidence in favor or CIP.

And if \[ F = S_e, \quad \Rightarrow \quad \text{Forward premium} = \text{Expected rate of depreciation} \]
Test of UIP


UIP & Term structure of interest rates

**UIP:** \((S^e - S)/S = (r - r^*) / (1 + r^*)\)

- Lower interest rate currency expected to appreciate.

**Term structure of interest rates** – the relation between security maturity dates and the rates of return

- Usually, longer dated securities have higher rates of return

Therefore, the term structure reveals *how exchange rate expectations are changing* through time.
Term structure of interest rates

LIBOR - average interbank interest rates in London money market at which large banks are lending each another unsecured loans.

**Parallel lines** – Exchange rate changes expected to be constant (appreciate/depreciate against each other at a constant rate).

**Diverging lines** – Higher interest rate currency is expected to depreciate at an increasing rate.

**Converging lines** – Higher interest rate currency is expected to depreciate at a declining rate.
Interest parities vs. Spot & Forward rates

Spot market model: Uncovered interest parity

Forward market model: Covered interest parity

Expected future spot rate $S^e$

Interest rates $r, r^*$

$S = S^e(1+r^*)/(1+r)$

$F = S(1+r)/(1+r^*)$
FX market

Spot rate

AMD/$

ROR$_{AM}D$ = $r = 10\%$

496.4

ROR$_{S}$ = $(S_{e}/S) (1+r^{*}) - 1$

= $(520/S) (1+0.05) - 1$

Rate of return

0.1
FX market

Domestic interest rate increases from 10% to 12%.

\[ \text{ROR}_{\text{AMD}} = r \]

\[ \text{ROR}_S = \left( \frac{S^e}{S} \right) (1 + r^*) - 1 = \left( \frac{520}{S} \right) (1 + 0.05) - 1 \]
Foreign (dollar asset) interest rate increases from 5% to 8%.

\[
ROR_{\text{AMD}} = r = 10%
\]

\[
ROR_{\text{S}} = \frac{S_e}{S} \left(1 + r^*\right) - 1 = \frac{520}{S} \left(1 + 0.08\right) - 1
\]

Rate of return

Spot rate

AMD/$
Expected future exchange rate increases from 520 to 540.

\[ \text{ROR}_{\text{AMD}} = r = 10\% \]

\[ \text{ROR}_s = \frac{S^e}{S} (1+r^*) - 1 = \frac{(540/S)}{(1+0.05)} - 1 \]
Money market

Nominal interest rate, $r$

$M^s$, real money supply

Real money demand, $M^d = (P \times Y^a)/r^b$

Real money balances, $M/P$

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FX & Money markets

\[ \text{ROR}_{\text{AMD}} = r_1 = 10\% \]

\[ \text{ROR}_S = \left( \frac{S_e}{S} \right) (1 + r^*) - 1 = \left( \frac{520}{S} \right) (1 + 0.05) - 1 \]

\[ \frac{M_1}{P_1} \]

\[ \frac{M}{P} \]

\[ \text{Real money demand, } M^d = \frac{P \times Y^a}{r^b} \]

\[ \text{Rate of return} \]

\[ \text{Nominal interest rate, } r \]

\[ \text{M}^S, \text{real money supply} \]
FX & Money markets

1. An increase in Real money supply ....
2. ... lowers the nominal interest rate ....
3. ... and decreases $\text{ROR}_{\text{AMD}}$ ....
4. ... as a result of which Dram depreciates.

\[ \text{ROR}_\text{S} = \left( \frac{S}{S^e} \right) (1 + r^*) - 1 = \left( \frac{520}{S} \right) (1 + 0.05) - 1 \]
FX & Money markets

1. An increase in Real money demand ....
2. ... increases the nominal interest rate ....
3. ... and raises ROR$_{AMD}$ ....
4. ... as a result of which Dram appreciates.

\[
\text{ROR}_{\text{AMD}} = \left( \frac{S^e}{S} \right) (1+r^*) - 1 = \left( \frac{520}{S} \right) (1+0.05) - 1
\]
Thank you and take care,

but remember

Getting an education was a bit like a communicable venereal disease. It made you unsuitable for a lot of jobs and then you had the urge to pass it on.

Terry Pratchett, Hogfather