Part II

The Currency Market and its Satellites
Chapter 3
Spot Markets for Foreign Exchange
Overview

Exchange Rates
- The HC/FC Convention (—ours)
- The FC/HC Convention
- Bid and Ask
- Primary and Cross Rates
- Inverting bid and asks

Major Markets for Foreign Exchange
- How Exchange Markets Work
- Markets by Location and by Currency
- Markets by Delivery Date

The Law Of One Price in Spot Mkts
- Price Differences Across Market Makers
- Triangular Arbitrage and the LOP

PPP Exchange Rates and Real Rates
- PPP Exchange Rates
- The Real Rate or Deviation from APPP
- Is the RER constant? Devs from RPPP

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What have we learned in this chapter?
Our Convention: HC units per unit of FC

◊ **Our quoting convention:** the price, in units of home currency (HC), per unit of foreign currency (FC)—or HC/FC—like we do for bread or umbrellas.

Example

▷ “USD/EUR 1.25” is an American’s natural quote for the EUR. Under our convention, Eurolanders would quote EUR/USD 0.80.

▷ “USD/CAD 0.8333” is an American’s natural quote for the CAD, since the CAD is the currency in the denominator, the one the price is expressed in.

◊ **Semantics**

▷ called “right”, “direct” quote; US: “US terms”

▷ denoted in the text as e.g. \( S_t = CAD/USD \ 1.25 \) where CAD/USD is the *dimension*

▷ pro’s use the inverse of the dimension as the *symbol*:

\[ \text{USDCAD or USD/CAD} = 1.20 \]  

“value of USD in CAD”
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## Symbols v dimensions: examples

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<th>Symbol</th>
<th>Currency Pair</th>
<th>dimension</th>
<th>Trading Terminology</th>
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**Spot Markets**

*P. Sercu, *International Finance: Theory into Practice*

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**Exchange Rates**

- The $\text{HC}/\text{FC}$ Convention
- The $\text{FC}/\text{HC}$ Convention
- Bid and Ask
- Primary and Cross Rates
- Inverting bid and asks

**Major Markets**

- The LOP in Spot Mkts
- PPP Rates and Real Rates
- What have we learned?
Who uses the *weird* (FC/HC) Convention?

“with one Rupee you can buy 1/15th of a bread”?

- **(against USD:) NY traders**
  - traders need a unique language
  - European governments had officially fixed the rate as e.g. DEM/USD 4, their own natural quote

- **(against GBP:) all pro’s & all Brits** (and similarly for ZAR, AUD, NZD, IEP)
  - the pound used to be intractably nondecimal (until 1967)
  - the pound used to play the key role taken by USD after WW2
  - Also US traders still do this; so they use unnatural one for e.g. CHF but natural quote for GBP etc

- **(against EUR:) everybody**
  - the EUR used to be “foreign” even for Eurolanders;
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## Bid and Ask Rates

### Bid and Ask
- You buy at (bank’s) *Ask*, you sell at (bank’s) *Bid*
- Bid-Ask Spread := Ask – Bid $\geq 0$ (why $\geq 0$?)

### Equivalent commission $= \frac{1}{2}$ spread:

### Example

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<th>EUR USD = USD/EUR</th>
<th>1.2345 - 1.2347</th>
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- Buying (at 47) is like paying midpoint (46) + cost 1
- Selling (at 45) is like getting midpoint (46) – cost 1

### Determinants of bid-ask spread
- Retail: spread falls with order size
- Wholesale: spread falls when risk of posting a quote is lower:
  - high liquidity
  - low volatility
  - a normal quantity—not too large
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<th>Instant Execution</th>
<th>Spread</th>
<th>Limit &amp; Stop levels*</th>
<th>March 9, 2007 rate (in pips)</th>
<th>spread, %^2</th>
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<tr>
<td>EURUSD</td>
<td>EUR 100,000</td>
<td>up to 10M</td>
<td>2 pips</td>
<td>2 pips</td>
<td>13,115</td>
<td>1.5</td>
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<td>GBPUSD</td>
<td>GBP 100,000</td>
<td>up to 10M</td>
<td>3 pips</td>
<td>3 pips</td>
<td>19,319</td>
<td>1.6</td>
</tr>
<tr>
<td>EURCHF</td>
<td>EUR 100,000</td>
<td>up to 5M</td>
<td>3 pips</td>
<td>3 pips</td>
<td>16,163</td>
<td>1.9</td>
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<tr>
<td>EURJPY</td>
<td>EUR 100,000</td>
<td>up to 10M</td>
<td>3 pips</td>
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<td>15,489</td>
<td>1.9</td>
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<tr>
<td>USDJPY</td>
<td>USD 100,000</td>
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<td>3 pips</td>
<td>11,810</td>
<td>2.5</td>
</tr>
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<td>USDJP</td>
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<tr>
<td>EURCAD</td>
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**Spreads and Acceptable Orders**

- **Ticker**: The currency pair
- **Size of 1.0 lot**: The amount of currency or its equivalent in the base currency
- **Instant Execution**: The maximum order size in millions of the base currency
- **Spread**: The bid-ask spread in pips
- **Limit & Stop levels**: The limit and stop levels
- **March 9, 2007 rate (in pips)**: The rate at which the currency pair was traded on March 9, 2007
- **spread, %^2**: The spread as a percentage of the March 9, 2007 rate

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**Graph**

- **spread (bp)**
- **max order size (m USD)**
Primary and Cross Rates

- **Primary** rate against reference or base currency (as of WW2: USD)

- **Cross** rate between two non-base currencies

  - Until mid 1980s only calculated from primary rates, never quoted independently:
    - the officially defended rates were primary, not cross
    - the cross-markets did not have enough volume to be competitive against two USD transactions
    - in pre-computer days, keeping track of a $50 \times 50$ matrix was impossible

  - now also quoted directly for important pairs
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Inverting bid and asks

**Rule:** \( \frac{1}{\text{ask}} = \text{bid}, \frac{1}{\text{bid}} = \text{ask} \)

**Why?**

- mathematically, \( \frac{1}{\text{bigger}} = \text{smaller} \) and vice versa

**Example**

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<td>1.9990</td>
<td>1/1.9990 = 0.50025 = ask</td>
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<td>2.0010</td>
<td>1/2.0010 = 0.49975 = bid</td>
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- semantically, when one switches home currency, buying currency 1 becomes selling currency 2

**Example:** Mr X gives 1000 yen to the bank and receives 10 dollars

- to a Japanese this looks like *buying* USD 10 at JPY/USD 100
- to an American this looks like *selling* JPY 1000 at USD/JPY 0.01
Inverting bid and asks

**Rule:** \(1/\text{ask} = \text{bid}, \ 1/\text{bid} = \text{ask}\)

**Why?**

▷ mathematically, \(1/\text{bigger} = \text{smaller}\) and \(\text{vv}\)

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▷ semantically, when one switches home currency, buying currency 1 becomes selling currency 2

**Example:** Mr X gives 1000 yen to the bank and receives 10 dollar

- to a Japanese this looks like *buying* USD 10 at JPY/USD 100
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Inverting bid and asks

◊ **Rule:** \( \frac{1}{\text{ask}} = \text{bid}, \frac{1}{\text{bid}} = \text{ask} \)

◊ **Why?**

▷ mathematically, \( \frac{1}{\text{bigger}} = \text{smaller} \) and vv

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- **Not an organized market** (unlike *eg* NYSE or LSE)

- **Two tiers**: 24-h *wholesale* tier, (informal network of banks and big corporations) and a *retail* tier

- **Wholesale**: 2 kinds of professionals
  - *market makers*: give two-way quotes binding up to an agreed limit (*e.g.* USD 10m or 20m). Purely bilateral.
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What have we learned?

A Reuters conversation

From: GENP
Hi: EUR/USD in 5 pse?
Hi 25.27 +
Mine 5 at 27 val 5/9 +
Tks $ to Citi Bibi

An EBS broking screen

<table>
<thead>
<tr>
<th>Currency Pair</th>
<th>Buy/Sell</th>
<th>Price</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR/USD</td>
<td>Buy</td>
<td>1.28</td>
<td>Sept 3 – 10:25</td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td>3.25 – 27.5</td>
<td></td>
</tr>
<tr>
<td>USD/JPY</td>
<td>Buy</td>
<td>105</td>
<td>5 Sep</td>
</tr>
<tr>
<td></td>
<td>Sell</td>
<td>5.64 – 66.6</td>
<td></td>
</tr>
</tbody>
</table>
## A Panel of Reuters Broking Windows

<table>
<thead>
<tr>
<th>Currency Pairs</th>
<th>Rate</th>
<th>Time</th>
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<th>Rate</th>
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</tr>
</thead>
<tbody>
<tr>
<td>gbp/eur</td>
<td>1.73</td>
<td>64/65</td>
<td>1.73</td>
<td>64/65</td>
<td>64/65</td>
<td>1.73</td>
</tr>
<tr>
<td>aud/eur</td>
<td>0.73</td>
<td>44/45</td>
<td>0.73</td>
<td>44/45</td>
<td>44/45</td>
<td>0.73</td>
</tr>
<tr>
<td>eur/czk</td>
<td>28.7</td>
<td>00/55</td>
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<tr>
<td>nzd/usd</td>
<td>0.64</td>
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<td>0.64</td>
</tr>
<tr>
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<td>8.02</td>
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### Notes:
- **gbp/eur**:
  - Rate: 1.73
  - Time: 64/65
  - Time: 64/65
- **aud/eur**:
  - Rate: 0.73
  - Time: 44/45
  - Time: 44/45
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### Spot Markets

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Markets by Location and by Currency

Diamond: Volume over time and by currency

- **ForeX**
- **OTC derivatives**

- **Major centers:**
  - The big 3: **London**, New York, and **Tokyo** — with LN > NY+TK, and growing faster
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  - Ambitious upstart: Dubai
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💎 Volume over time and by currency

![Graph showing volume over time and by currency]

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  - “immediate” means 2nd working day ("$t + 2$") ($t + 1$ for US-Canada and -Mexico)
  - Less than half of the market

- **Forward:** (rate: $F_{t,T}$) = payment/delivery at some future date ($T > t + 2$)
  - Nowadays up to ten years, but the most active forward markets remain “30”, “90” days (that is, $t + 2$ plus $N/30$ months);

**Example**

- Deal on Wedn April 19, 2000 ⇒ $t + 2$ means Frid April 21; “+ 180 days” means Oct 21, a Saturday, so delivery is Mond Oct 23.
- Actually 185 days.

- Quotes for any “broken” date on request.
- Volume: larger than the spot market.
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- **Arbitrage** (two-way)
  - buy low, immediately re-sell high without risk
  - arb opp: no net investment, no chance of loss, and possibly a gain
  - too nice to be true: selfdestructive
  - two-way trade: sum of transaction costs matters

- **Shopping around** (one way)
  - exogenous motivation to do a particular trade—just choose in what mkt segment you’ll do the trade
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**Bank Y:** USD/EUR xxx52 - 54 | |

- **arb opp:** sure gain without really needing cash
- **triggers massive flows**
- **⇒ No-arb condition:** $\text{Bid}_i \leq \text{Ask}_j \ \forall i, j$—no empty space

Is there an arb opp ...
- between Y and X?  
- between Y and Z?  
- between X and Z?

If there is an arb opp, do we know who is wrong?
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$$
\begin{array}{c}
\text{Bid}_X = 50, \text{Ask}_X = 58 \\
\text{Bid}_Y = 60, \text{Ask}_Y = 68 \\
\text{Bid}_Z = 70, \text{Ask}_Z = 75 \\
\text{Bid}'_X = 55, \text{Ask}'_X = 63 \\
\text{Bid}'_Y = 64, \text{Ask}'_Y = 72 \\
\end{array}
$$

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\[
\begin{array}{c}
\text{X} \quad \text{Z} \\
(50) \quad (70) \\
\hline
(58) \quad (75) \\
\end{array}
\]

\[
\begin{array}{c}
\text{X'} \quad \text{Z'} \\
(55) \quad (63) \\
\hline
(63) \quad (64) \\
\end{array}
\]

\[
\begin{array}{c}
\text{Y} \\
(60) \quad (68) \\
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\[
\begin{align*}
\text{X} & \quad \text{X}' \quad \text{Y} \\
()50 & \quad ()58 & \quad ()60 \quad ()68 \\
()55 & \quad ()63 & \quad ()64 \quad ()68 \\
()70 & \quad ()75 & \quad ()72
\end{align*}
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- \( 55 \) \( 63 \) \( 64 \) \( 72 \) \( 70 \) \( 75 \)

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(50) \quad (58) \\
X & \quad & Z \quad (70) \\
(63) & \quad & (64) \\
X' & \quad & Z' \\
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Y
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Shoppping Around Across Market Makers

Example

What would you do when seeing ...

bank X: USD/EUR xxx56 - 58
bank Y: USD/EUR xxx57 - 59

▷ all buyers go to ... and all sellers to ...
▷ This may be (temporarily) the idea—if bank X has a (delete one:) shortage/excess, and Y a shortage/excess.
▷ But in the medium run X and Y's positions must vary all the time.

Exercise: Skewing the spreads

• Who, among these traders, is
  • keen on buying?
  • keen on selling?
  • just twiddling thumbs?

• Why do wannabuys move both quotes, not just the bid?

• Why do wannasells move both quotes, not just the ask?
Example

What would you do when seeing ...

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<tr>
<td>Bank Y: USD/EUR</td>
<td>57 - 59</td>
</tr>
</tbody>
</table>

▷ all buyers go to ... and all sellers to ...

▷ This may be (temporarily) the idea—if bank X has a shortage/excess, and Y a shortage/excess.

▷ But in the medium run X and Y's positions must vary all the time.

Exercise: Skewing the spreads

• Who, among these traders, is keen on buying?
• Who, among these traders, is keen on selling?
• Who, among these traders, is just twiddling thumbs?

• Why do wannabuys move both quotes, not just the bid?

• Why do wannasells move both quotes, not just the ask?
Shopping Around Across Market Makers

Example

What would you do when seeing...

bank X: USD/EUR xxx56 - 58
bank Y: USD/EUR xxx57 - 59

▷ all buyers go to ... and all sellers to ...

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Triangular Arbitrage and the LOP

◇ **Triangular?** Relations between spot rates quoted in various currencies—e.g. GBP/USD, JPY/USD, JPY/GBP.

**Triangular arbitrage:** Do I make money doing this?:
**Triangular shopping-around:** which of the two gives me the best price?

For either application we need to know the “synthetic” (indirect) rate JPY/GBP.
Triangular Arbitrage and the LOP

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![Triangular Arbitrage Diagram](image-url)
Computing Synthetic Cross-Rates (1)

Concepts introduced in this section:

◊ **Replication**

A *synthetic version* or *replication* of a contract is
- a combination of two or more other transactions
- that achieves the same purpose as the original contract

◊ **Rip-off Rule**

*Law of the Worst Possible Combination* or *Rip-Off Rule*:
- At every single transaction we get the worse rate—hi for buy, lo for sell
- so, in a chain of transactions one always ends up with the worst possible combination
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Example of synthetic rates (1)

Example

Find the cost of synthetically buying GBP against JPY if JPY/USD 101.07 – 101.20 , USD/GBP 1.3840 – 1.3850

▷ Divide or multiply? Look at the dimensions:

\[[\text{JPY/GBP}] = [\text{JPY/USD}] \times [\text{USD/GBP}]\]

▷ Bid or ask? Use the Law of the Worst Possible Combination:

- Synth bid = lowest product = lo \times lo
  
  \[= 101.07 \times 1.3840 = 139.88088\]

- Synth ask = highest product = hi \times hi
  
  \[= 101.20 \times 1.3850 = 140.16200\]
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Example of synthetic rates (2)

Example — imagine Brits quote the logical way?!  

Find the cost of synthetically buying GBP against JPY if  

\[
\begin{align*}
\text{JPY/USD} & \quad 101.07 - 101.20 \\
\text{GBP/USD} & \quad .72202 - .72254
\end{align*}
\]

▷ Divide or multiply? Look at the dimensions:

\[
\frac{\text{JPY}}{\text{GBP}} =
\]

▷ Bid or ask? Use the Law of the Worst Possible Combination:

- Synth bid = lowest quotient  = 

- Synth ask = highest quotient  =
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  =

- Synth ask = highest quotient =

  =
**Triangular Arb: Bounds on Cross-rates**

![Diagram showing bounds on cross-rates with arbitrage conditions.]

**Implication:**

If the synthetic rates are 139.88088 – 140.16200, then ...

- the direct mkt can fully exist only if ...
- if so, the no-arb condition ensures that ...
- and the shopping-around effect implies that ...
Triangular Arb: Bounds on Cross-rates

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– and the shopping-around effect implies that ...
### A trader’s shopping-around spreadsheet

<table>
<thead>
<tr>
<th>Currency</th>
<th>Bid</th>
<th>Ask</th>
<th>Bid</th>
<th>Ask</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR/USD</td>
<td>1.4866</td>
<td>1.4869</td>
<td>1.4868</td>
<td>1.4869</td>
</tr>
<tr>
<td>EUR/JPY</td>
<td>157,9300</td>
<td>157,9400</td>
<td>EBS</td>
<td>1.4868</td>
</tr>
<tr>
<td>EUR/GBP</td>
<td>0.7477</td>
<td>0.7478</td>
<td>Reuters</td>
<td>1.4868</td>
</tr>
<tr>
<td>EUR/CHF</td>
<td>1.6050</td>
<td>1.6053</td>
<td>EUR/GBP</td>
<td>1.9884</td>
</tr>
<tr>
<td>EUR/AUD</td>
<td>1.6673</td>
<td>1.6683</td>
<td>GBP/USD</td>
<td>1.9884</td>
</tr>
<tr>
<td>EUR/CAD</td>
<td>1.4846</td>
<td>1.4853</td>
<td>RD2002</td>
<td>0.7477</td>
</tr>
<tr>
<td>EUR/CZK</td>
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<td>26,080</td>
<td>Via USD</td>
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<td>EUR/EKK</td>
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<td>15,648</td>
<td>EUR/JPY</td>
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<td>EUR/HKD</td>
<td>11,5940</td>
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<td>0.00</td>
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<td>EUR/HUF</td>
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<td>Via USD</td>
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<td>EUR/IDR</td>
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<td>13877</td>
<td>Reuters</td>
<td>157,93</td>
</tr>
<tr>
<td>EUR/ISK</td>
<td>96,75</td>
<td>96,82</td>
<td>EUR/CHF</td>
<td>1.6050</td>
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<tr>
<td>EUR/LTL</td>
<td>3,4526</td>
<td>3,4528</td>
<td>USD/CHF</td>
<td>1.0795</td>
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<tr>
<td>EUR/LVL</td>
<td>0,6973</td>
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<td>EUR/MYR</td>
<td>4,8086</td>
<td>4,8137</td>
<td>Via USD</td>
<td>1,6055</td>
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<td>EUR/NOK</td>
<td>8,0745</td>
<td>8,0765</td>
<td>Reuters</td>
<td>1,6049</td>
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<td>EUR/NZD</td>
<td>1,8950</td>
<td>1,8968</td>
<td>EUR/SEK</td>
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<td>EUR/PHP</td>
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<td>60,257</td>
<td>USD/SEK</td>
<td>6,3700</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

What have we learned?
Spot Markets

P. Sercu,

*International Finance: Theory into Practice*

Outline

**Exchange Rates**
- The HC/FC Convention (—ours)
- The FC/HC Convention
- Bid and Ask
- Primary and Cross Rates
- Inverting bid and asks

**Major Markets for Foreign Exchange**
- How Exchange Markets Work
- Markets by Location and by Currency
- Markets by Delivery Date

**The Law Of One Price in Spot Mkts**
- Price Differences Across Market Makers
- Triangular Arbitrage and the LOP

**PPP Exchange Rates and Real Rates**
- PPP Exchange Rates
- The Real Rate or Deviation from APPP
- Is the RER constant? Devs from RPPP

What have we learned in this chapter?
Issues related to interpretation of $S$ or $Y^*$

Two (related) issues: If price levels are very different, home v abroad, how can we measure ...

– the true meaning of a FC amount to a local? (PPP rate)

– the average price difference? (Real Rate, deviation from Abs PPP)

– the change in the price difference (deviations from Rel. PPP)
PPP Exchange Rates

Example

Your friend makes FDK 2000, which seems little, against your USD 50! Data:

- “Nominal” spot rate is USD/FDK 0.010.
- A Big Meal costs USD 5 here, FDK 250 there.

Calculations:

- at the spot rate her income is $2000 \times 0.01 = \text{USD} 20 \ll 50$.
- but she spends it locally, where prices are possibly different
  - over there, she can buy $2000/250 = 8$ BigMeals
  - 8 Bigmeals would cost $8 \times 5 = \text{USD} 40$ to you here
  - so FDK 2000 means as much to her, over there, as USD 40 to you, here
  - the implied rate (“PPP rate”) is $2000/40 = 0.02$ USD/FDK:

General: PPP rate = \frac{\Pi}{\Pi^*}
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General: PPP rate = \Pi/\Pi^*
### Are PPP rates far from Nominal Rates?

#### The Economist’s Big Mac Standard:

<table>
<thead>
<tr>
<th>Country</th>
<th>Currency</th>
<th>Real Rate of $</th>
<th>PPP Rate of $</th>
<th>Real Value</th>
<th>PPP Value</th>
<th>Difference</th>
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<tbody>
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<td>China</td>
<td>yuan</td>
<td>2.371</td>
<td>0.125</td>
<td>0.295</td>
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<td>0.129</td>
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<td>1.918</td>
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<tr>
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<td>1.750</td>
<td>0.037</td>
<td>0.065</td>
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<td>Dominican Rep</td>
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<td>Sri Lanka</td>
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<td>South Africa</td>
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<td>1.467</td>
<td>0.152</td>
<td>0.222</td>
<td>0.682</td>
<td></td>
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<tr>
<td>Pakistan</td>
<td>rupee</td>
<td>1.433</td>
<td>0.017</td>
<td>0.024</td>
<td>0.698</td>
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<td>Venezuela</td>
<td>bolivar</td>
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<td>0.000</td>
<td>0.001</td>
<td>0.699</td>
<td></td>
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<td>Costa Rica</td>
<td>colon</td>
<td>1.399</td>
<td>0.002</td>
<td>0.003</td>
<td>0.715</td>
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<td>Japan</td>
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<td>1.389</td>
<td>0.009</td>
<td>0.012</td>
<td>0.720</td>
<td></td>
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<td>Singapore</td>
<td>dollar</td>
<td>1.369</td>
<td>0.629</td>
<td>0.861</td>
<td>0.730</td>
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<tr>
<td>Guatemala</td>
<td>quetzal</td>
<td>1.364</td>
<td>0.132</td>
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<td>0.733</td>
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<td>0.327</td>
<td>0.443</td>
<td>0.738</td>
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<tr>
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<td>lari</td>
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<td>0.031</td>
<td>0.041</td>
<td>0.754</td>
<td></td>
</tr>
</tbody>
</table>

#### Spot Markets

P. Sercu, *International Finance: Theory into Practice*

#### Exchange Rates

**Major Markets**
- The LOP in Spot Mktts
- PPP Rates and Real Rates
  - PPP Exchange Rates
    - The Real Rate (dev from APPP)
    - Deviations from RPPP
  - What have we learned?
Are PPP rates far from Nominal Rates?

If we plot log against log, the link seems close:
Are PPP rates far from Nominal Rates?

If we plot untransformed figures, we see big deviations:

![Graph showing deviations from PPP]

Rates are in FC/USD, so a dot below the 45-degree line means the dollar is below PPP.
The Real Rate or Deviation from APPP

▷ RER measures the difference between $S$ and $\hat{S}^{PPP}$:

$$\text{Real XRate} := \frac{S}{\hat{S}^{PPP}}$$

▷ RER is also the ratio between the translated price levels:

$$\text{Real XRate} := \frac{S}{\Pi/\Pi^*} = \frac{S\Pi^*}{\Pi} = \frac{\text{translated } \Pi^*}{\text{home } \Pi}$$

So RER tells us what country is more expensive, and by how much.

▷ Absolute PPP is said to hold if

$$\text{APPP: } RER_t = 1 \iff S_t = \hat{S}_t^{PPP} \iff S_t \times \Pi_t^* = \Pi_t$$
The Real Rate or Deviation from APPP

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Deviations from BigMacParity

Spot Markets

P. Sercu, *International Finance: Theory into Practice*

Exchange Rates

Major Markets

The LOP in Spot Mkts

PPP Rates and Real Rates

PPP Exchange Rates

The Real Rate (dev from APPP)

Deviations from RPPP

What have we learned?
Deviations from BigMacParity

Example

BigMac costs 3.10 in the US and 155 in Freedonia, and the spot rate is 100 Crowns per dollar; complete Freedonia’s PPP rates in the table:

<table>
<thead>
<tr>
<th>Currency</th>
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<th>PPP Rate of $</th>
<th>Real Rate of $</th>
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</tr>
</thead>
<tbody>
<tr>
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<td>155</td>
<td>100</td>
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</table>

Example: 2006 GDPs translated into USD

<table>
<thead>
<tr>
<th>Country</th>
<th>at $S</th>
<th>at $S_{PPP}^{\hat{}}$</th>
<th>Ratio b/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>741 b</td>
<td>1 589 b</td>
<td>2.15</td>
</tr>
<tr>
<td>China</td>
<td>2 225 b</td>
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(http://www.cia.gov/cia/publications/factbook/geos/rs.html)
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Deviations from Relative PPP

**Issue?**

- If Absolute price data are missing, we cannot compute the RER.
  
  But we can still know whether RER is up or down, relative to a base period:

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\]

\[
= (1 + s_{t_0,t}) \frac{1 + infl_{t_0,t}^*}{1 + infl_{t_0,t}} - 1
\]

\[
\approx s_{t_0,t} + [infl_{t_0,t}^* - infl_{t_0,t}]
\]

where \(infl\) and \(infl^*\) can be proxied by local CPI inflation rates if Absolute price levels are missing.

- If the RER has not changed, Relative PPP is said to hold.
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Is the RER constant? (RPPP deviations?)

Real value of 4 currencies, from US perspective, relative to 1965

### Cumulative RPPP, Jan1965=1.00

- DEM-EUR
- JPY
- GBP
- SAR
- THB

### CPI\* x S/CPI_us

- Jan-65
- Jan-66
- Jan-67
- Jan-68
- Jan-69
- Jan-70
- Jan-71
- Jan-72
- Jan-73
- Jan-74
- Jan-75
- Jan-76
- Jan-77
- Jan-78
- Jan-79
- Jan-80
- Jan-81
- Jan-82
- Jan-83
- Jan-84
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- Jan-86
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- Jan-88
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- Jan-93
- Jan-94
- Jan-95
- Jan-96
- Jan-97
- Jan-98
- Jan-99
- Jan-00
- Jan-01
- Jan-02
- Jan-03
- Jan-04
- Jan-05
- Jan-06
Is the RER constant? (RPPP deviations?)

Nominal and RPPP value of GBP against USD, relative to 1965
Is the RER constant? (RPPP deviations?)

Nominal and RPPP value of JPY against USD, relative to 1965

![Graph showing JPY RPPP v actual](image-url)
Is the RER constant? (RPPP deviations?)

Nominal and RPPP value of ZAR against USD, relative to 1965

SAR RPPP v actual

What have we learned?
Is the RER constant? (RPPP deviations?)

Nominal and RPPP value of THB against USD, relative to 1965

[Graph showing THB RPPP v actual from 1965 to 2000]
Things on RERs to be Remembered Forever

diamond RER Behavior

diamond huge swings: halving/doubling in a matter of years

diamond high inertia (autocorrelation) in short run: halflife is like 5 yrs

diamond most of the variability comes from nominal rate, not PPP rate
  - this is good: nominal rate can be hedged

diamond $S$ is hard to predict — claim to be substantiated later
More Things to be Remembered Forever

**Financial Policy Implications**

- RER movements can force a company to radically change its strategy
  - 1970s: VW abandoned export strategy, became multinational producer
  - 1980s: John Deere, International Harvestor lost their export markets

- Even nominal movements can kill a company
  - 1990s: Slite (FI) went belly up because the FIM had devalued

- If rates would move predictably, we could prepare operationally, eg move production, change sourcing & prices

- Since rates move unpredictably, financial hedging seems useful.
  - first we need to show whether/when such hedging adds value
  - then we need to know our *exposure*, which determines the size of the damage and the size of the hedge
  - we need to select the hedge instrument: forwards, futures, options, swaps?
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Outline

Spot Markets
P. Sercu, *International Finance: Theory into Practice*

Exchange Rates

Major Markets

The LOP in Spot Mkts

PPP Rates and Real Rates

What have we learned?

Exchange Rates

The HC/FC Convention (—ours)
The FC/HC Convention
Bid and Ask
Primary and Cross Rates
Inverting bid and asks

Major Markets for Foreign Exchange

How Exchange Markets Work
Markets by Location and by Currency
Markets by Delivery Date

The Law Of One Price in Spot Mkts

Price Differences Across Market Makers
Triangular Arbitrage and the LOP

PPP Exchange Rates and Real Rates

PPP Exchange Rates
The Real Rate or Deviation from APPP
Is the RER constant? Devs from RPPP

What have we learned in this chapter?
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- Exchange rates, in this text, are always shown as \( \text{HC}/\text{FC} \). Market makers quote them as bid-ask, with the spread determined by risk considerations (which?).

- The market is traditionally a bilateral over-the-counter market (“conversations”), but is now becoming more multilateral (Reuters 3000 & EBS auctions).

- There are spot and forward segments.

- Even in purely bilateral markets, prices are (imperfectly) unified across market makers by arbitrage and by shopping-around. True, traders often skew their bids—but just until their desired trade has been achieved.
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⋄ In **triangular arbitrage**, we came across our first example of **replication** or **synthetic versions** of contracts, and discovered the **Law of the Worst Possible Combination**.

⋄ Two complementary notions help us interpret $S$:

- **Translation** at the **PPP rate**, $\hat{S}^{PPP} := \Pi/\Pi^*$, tells us what a FC amount really means over there, expressed in terms you understand: how much should I make *here* to be able to spend as much as that amount buys *there*.

- The **real rate**, $RER := S/\hat{S}^{PPP} = [S\Pi^*/\Pi]$, tells me how much more expensive the foreign country is.

⋄ There are two related PPP notions:

- If $RER=1$, **Absolute PPP** is said to hold.
- If the $RER$ is constant, **Relative PPP** is said to hold.

If absolute price data are missing, we can still approximate the % change in the $RER$ by the % changes in the spot rate and the two CPIs: 
$$(1 + s)(1 + \text{inf}^*)/(1 + \text{inf}) - 1.$$
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- Swings are **big**—the rate can double or even triple in a few years
- For mainstream countries, most of the variation of the $RER$ comes from the nominal rate, and these are **hard to predict**.

Implications for the CFO:

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- Variations in $S$ may also hurt you via capital losses
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