

Lecture Notes for Chapter 7

International Financial Markets and Institutions

Chapter 7

The behavior of the spot and forward exchange rates

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7.1 Overview

- Looking at the actual behaviour of exchange rates.
- Building and testing simple models based on one key idea:
 - Think of a commodity (anything: bubble gum, chips, Benz's, burgers). Suppose that commodity costs CAD 100 in Canada and USD 120 in the US.
 - Then, if there are *no market frictions* (transport costs, taxes, etc), the *no-arbitrage principle* implies that the value of the commodity in the US converted into CAD, i.e.,

$$\frac{\text{CAD}}{\text{USD}} S_t \times \text{USD}120$$
 must be the same as the CAD value of the commodity in Canada.
 - I.e.,

$$\frac{\text{CAD}}{\text{USD}} S_t \times \text{USD}120 = \text{CAD}100.$$

- In reality there are frictions such as shipping costs, taxes. To expect the above relationship to hold for every single commodity for every pair of countries would be folly.
- But its an interesting idea to start from. Taking it as our theoretical starting point, we shall explore some questions that are important for people in the real world.

7.2 Main Issues

Question	Answer
1. Is there real exchange rate risk (that is, do prices fail to change to offset exactly the changes in the nominal exchange rate).	Yes
2. Can one forecast accurately the future spot exchange rate using past values of the exchange rate (weak form of predictability).	No
3. Is it possible to forecast accurately the future spot exchange rate using the current forward rate (Unbiased Expectations Hypothesis; semi-strong form of predictability).	No
4. Can one forecast the exchange rate accurately using other variables suggested by macroeconomic theories of exchange rate determination (semi-strong form of predictability).	No
5. Can one forecast the future spot exchange rate using private information (strong form of predictability).	Perhaps

In the table above, the answer “No” indicates that while there might be some evidence of predictability, this evidence is not strong.

7.3 Motivating problems

Motivating Problem 7.1 (Real exchange rate risk)

You work in the treasury office of International Harvester, a manufacturer of heavy equipment. Its main competitor is a Japanese firm, Komatsu, which has only a small market share.

When you talk to your boss about hedging against changes in the USD/JPY exchange rate, your boss replies that, “Hedging is not important because in the long run changes in the exchange rate are offset by changes in relative prices; thus, it all averages out in the long run.”

- Do you agree with the opinion of your boss?

Motivating Problem 7.2 (Forecasting exchange rates)

It is your first day of work at Fletcher Challenge, a forestry firm in Canada. As you walk into the office, your boss introduces you to the other members of the Fletcher Challenge treasury team.

You are beaming brightly in your new business attire, dreaming about how you are going to spend your signing bonus.

Two minutes later, you hear a voice say that, "Our new BComm recruit will now tell us what the value of CAD/NZD will be a year from now. We will use this estimate for capital budgeting decisions."

Your boss looks at you expectantly. You are seeking help (and cover), but the only thing you can hide yourself under is today's *Financial Times*. What is your response?

- Is it possible to forecast the future value of the spot exchange rate using the following sources of information?
 - * The past values of the spot exchange rate?
 - * The current forward rate?
 - * Macroeconomic variables such as the domestic and foreign inflation rates, interest rates, national income etc.?

7.4 Real exchange rate risk

Example 7.1 (Real exchange rate)

P_t^* be the UK commodity price level/index in GBP.

P_t the US commodity price level/index in USD.

$$P_t^* = \text{GBP}100.$$

$$P_t = \text{USD}140.$$

$$S_t = \frac{\text{USD}}{\text{GBP}}1.4.$$

What is UK commodity price level converted into USD?

$$S_t P_t^* = \frac{\text{USD}}{\text{GBP}}1.4\text{GBP}100 = \text{USD}140$$

Is this is equal to the commodity price level in the US?

Yes.

$$P_t = S_t P_t^*.$$

Therefore,

$$S_t \frac{P_t^*}{P_t} = 1.$$

The UK price level has the same USD value as the US price level in the US—the real exchange rate is 1.

Definition 7.1 (Real exchange rate)

- The real exchange rate is defined as the nominal exchange rate, deflated by the domestic and foreign price level:

$$\text{Real exchange rate at } t = S_t \frac{P_t^*}{P_t}.$$

- **Main issue:** do price changes (at home and abroad) and exchange rate changes offset each other.
 - * If yes, then do not have to worry about fluctuations in the nominal exchange rate, for they will be offset by changes in prices implying that the real effect is zero.
 - * If not, then changes in the exchange rate will have real effects—exchange rate fluctuations will change the relative prices of goods at home and abroad; that is, there is real exchange rate risk.

Example 7.2 (Changes in exchange rates and prices)

The current price of gold is USD 330.

The Pound exchange rate is USD/GBP 1.65.

If there are no arbitrage opportunities, what is the gold price in the UK?

- The gold price in UK must be $\left(\frac{\text{USD } 330}{\text{USD/GBP } 1.65} \right) = \text{GBP } 200$.
- That is, the price of the gold in the US must be the same as Britain, after translation into USD.

Price of gold in the US at $t = S_t \times \text{Price of gold in Britain at } t$.

- Another way of stating this is that the *relative price* of gold in the US and in Britain must equal the exchange rate:

$$S_t = \frac{\text{Price of gold in the US at } t}{\text{Price of gold in Britain at } t} = 1.65.$$

Now, suppose that the exchange rate changes to USD/GBP 1.60. If there are no arbitrage opportunities, what will happen to the relative gold price in the US and Britain?

$$S_{t+1} = \frac{\text{Price of gold in the US at } t+1}{\text{Price of gold in Britain at } t+1} = 1.60.$$

7.4.1 Commodity Price Parity

Definition 7.2 (Commodity Price Parity (CPP))

In frictionless commodity markets, in the absence of arbitrage opportunities, P_{kt} , the price of commodity k at time t in one country, must equal $S_t \cdot P_{kt}^*$, the price of the same commodity in another country, expressed in terms of the same currency:

$$P_{kt} = S_t \cdot P_{kt}^*.$$

- Clearly, if CPP holds for all goods produced in an economy then we need not care about fluctuations in nominal exchange rates.

Question: Should we expect CPP to hold for all goods?

Answer: While CPP may hold for easily traded and homogenous commodities such as gold and silver, it is unlikely to hold for other commodities such as cars or houses which are difficult to trade across countries.

- Reasons why CPP may be violated
 - * Transactions costs;
 - * Tariffs and non-tariff barriers to trade, which constrain arbitrage;
 - * Imperfect competition arising from exclusive dealership contracts, costs for entering new markets, etc.

Example 7.3 (Violations of CPP)

- Would you expect CPP to hold for the Big Mac hamburger?
 - * See *The Economist* magazine for comparison of Big Mac prices in different countries.
- Would you expect CPP to hold for *The Economist* magazine itself?
 - * Compare the price of *The Economist* magazine in different countries (given on the front cover) with the exchange rates (published on the last few pages of *The Economist*).
- Would you expect CPP to hold for the various items of furniture sold by IKEA in different countries?
 - * Compare prices by getting IKEA catalog from different countries.

7.4.2 Absolute Purchasing Power Parity

Question: Even if CPP does not hold, is the *general* price level in one country related to the price level in another country, after being translated into a common currency? That is, is one country more expensive than another?

Definition 7.3 (Absolute Purchasing Power Parity hypothesis)

The *absolute* version of the Purchasing Power Parity (PPP) hypothesis states that P_t , the price of a representative basket of goods at time t in a particular country, should equal the price of a representative basket of goods in another country, translated into a common currency:

Price at home = Price abroad, in terms of HC

$$P_t = S_t \cdot P_t^*.$$

- ▶ Empirical evidence shows that there are large violations of Absolute PPP because
 - The prices of identical goods in the two baskets may vary across countries (violations of CPP);
 - The composition of the representative baskets might be different across countries.

7.4.3 Relative Purchasing Power Parity

Question: Even if the *level* of prices is not the same across two countries, are *changes* in the price level in one country related to changes in the exchange-rate adjusted price level in another country?

Definition 7.4 (Relative PPP hypothesis)

According to the *relative* PPP hypothesis, changes in the price of a representative basket of goods at time t in a particular country, should equal the changes in the exchange-rate adjusted price of a representative basket of goods in another country:

$$\frac{P_{t+1}}{P_t} = \frac{S_{t+1}}{S_t} \frac{P_{t+1}^*}{P_t^*}.$$

- Relative PPP can be restated:
 - * With the exchange rate change on the left-hand side:

$$\frac{S_{t+1}}{S_t} = \frac{P_{t+1}/P_t}{P_{t+1}^*/P_t^*},$$

Note that the percentage change in the nominal exchange rate

$$\frac{S_{t+1}}{S_t} - 1,$$

can be approximated by $\ln(S_{t+1}/S_t)$.

Check this with some simple examples!

- * Defining inflation rates with $I_{t,t+1} = \ln(P_{t+1}/P_t)$ denoting the (continuously compounded) inflation rate:

$$\ln\left(\frac{S_{t+1}}{S_t}\right) = \ln\left(\frac{P_{t+1}/P_t}{P_{t+1}^*/P_t^*}\right) = \ln\left(\frac{P_{t+1}}{P_t}\right) - \ln\left(\frac{P_{t+1}^*}{P_t^*}\right)$$

$$\underbrace{\ln\left(\frac{S_{t+1}}{S_t}\right)}_{\text{percentage change in the exchange rate}} = \underbrace{I_{t,t+1}}_{\text{domestic inflation}} - \underbrace{I_{t,t+1}^*}_{\text{foreign inflation}}.$$

7.4.4 Empirical evidence on PPP

This is a very active field of research.

- Regression tests of relative PPP based on the following equation, with the null hypothesis that the slope coefficient $b = 1$, and the intercept $a = 0$, reject PPP.

$$\ln \left(\frac{S_{t+1}}{S_t} \right) = a + b \left(I_{t,t+1} - I_{t,t+1}^* \right) + e_{t+1}.$$

- Running this regression using dataset II for the empirical case, with HC = DEM and FC = USD, we obtain the results $a = -0.006378802$, $b = 0.286436001$. The R^2 of the regression is 0.001208819.
- More powerful tests (Abuaf and Jorion [1990]) find that cumulative deviations from Relative PPP tend to halve after three years; that is:

- * cumulative deviations from relative PPP have some tendency to correct themselves in the long run; or,
 - * the variance of PPP deviations does not increase proportionately with time.
- But recent work by Imbs, Mumtaz, Ravn and Rey (2004) suggests that previous work overestimates the time it takes for cumulative deviations from relative PPP to correct themselves.
 - The basic idea is that deviations from relative CPP differ a lot across sectors of the economy. For example, deviations from CPP for clothes prices behave differently from those for software. Not taking account of this heterogeneity properly when looking at a price index leads to an overestimate in the time it takes deviations from relative PPP to disappear.
 - Corrected estimates for the time it takes for cumulative deviations from relative PPP to halve are around 1 year—quicker than the old estimate of 3 years.

- This is good news, because the smaller half-life estimate can be explained more easily via realistic market frictions. The larger estimate would have required severe market frictions, e.g. unrealistically high shipping costs to resolve.

► **Conclusion:**

- Relative PPP may have some power in the long run (years rather than several months), and in times of high inflation,
- but in the short run there are large deviations that halve every year.

7.4.5 Conclusion about real exchange rate risk

- There are large, frequent, and persistent deviations from PPP, implying that there is real exchange rate risk;
 - * that is, changes in the nominal spot rate are *not* completely offset by changes in prices at home and abroad.
 - Hence, changes in the nominal spot rate will have an impact on the competitive position of firms.
 - Also, changes in the nominal spot rate will have an impact on the returns realized from investing in foreign-currency denominated securities.
- ▶ Thus, cannot ignore fluctuations in the nominal exchange rate.