Chap. 7 Parity Conditions and Currency Forecasting

• Forecasts based on the Law of One Price.
• Forecasts based on Relative Purchasing Power Parity.
• Inflation and the Real Rate of Interest
• Forecasts based on the International Fisher Effect.
• Forecasts based on the Forward/Futures Rate.
• Other Forecasting Models

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The Law of One Price

• Identical goods sell for the same price worldwide.
• If different prices exist (say for gold: in New York at $300/oz. vs. London at $310/oz), where will buyers get their gold? The New York market would mostly attract buyers, while the London market would mostly attract sellers.
• Also, arbitrage would occur: shorting in London, buying in NYC. Soon the two market prices would reach a similar price.

The Law of One Price and Purchasing Power Parity

• Purchasing power parity often means that with a given amount of, say, dollars, converting those dollars into another currency buys the same “market basket of goods” in the foreign country that it would in the U.S.A.
• This is the law one price. However we will find that this “law” is not universal like the law of gravity.

Violations to the Law of One Price

• Haircuts
• Taxi rides
• Restaurant Meals (Big Macs)
• Apartments
• Cement Blocks?
• Agricultural Products (most countries have protectionist policies).

Violations to the Law of One Price

• Law of one price does not hold for nontradable goods even within the United States!
• Rents in New York City vs. Loachapoka, AL
• Big Macs in Alaska vs. Auburn
• Big factors: shipping considerations, perishability.
Purchasing Power Parity

• In this text and this course we will assume that PPP only holds for tradable goods and NOT for nontradable goods that, say, a tourist pays for: rents, meals, transportation, personal services, etc. The text calls this version relative PPP.
• Extending PPP to nontradable goods to get the law of one price for every thing is called absolute PPP.

Relative Purchasing Power Parity

• The text refers to RPPP as just PPP:
• Based on converting Swiss francs & Pesos to some common currency (e.g. the $): if the cost of living in Switzerland is twice as expensive as Mexico today, then RPPP says Switzerland will be twice as expensive next year.
• Relative PPP does not predict any convergence in the cost of living between two countries. In fact it assumes there will be no convergence!

Forecasting with Absolute PPP

• The law of one price extended to a market basket of goods (including a Big Mac for lunch after shopping). Absolute PPP says the currency with the cheaper market basket is expected to appreciate relative to the currency with the more expensive goods and services (after converting to a common currency).
• The Economist’s Big Mac Index is attempting to forecast future exchange rates based on the cost of the Big Mac. The magazine must be assuming that Absolute PPP is valid.

Forecasting with Absolute PPP

• Sometimes Absolute PPP appears to be useful, and perhaps it may be over a long period of time: as cheap countries like Mexico become more developed and more expensive.
• However, there is little evidence that the currency of an expensive country like Switzerland or Japan is more likely to suffer a devaluation than the currency of a cheap counke Mexico or Malaysia.

Forecasting with Absolute PPP

• There are sometimes, however, situations where it appears that Absolute PPP has some predictive power.
• However, usually in these cases, the (temporarily) expensive countries are expensive because they have suffered recent inflation. The currency hasn’t fallen yet because it is either pegged or there is a “dirty” float.
• Brazil and Mexico are recent examples.
Forecasting with (Relative) PPP

- **PPP** says the currency with the higher inflation rate is expected to depreciate relative to the currency with the lower rate of inflation.

- **A simple (rule-of-thumb) version of the PPP is**

  \[
  \frac{e_1 - e_0}{e_0} = i_h - i_f
  \]

  where:
  - \(e_1\) = expected future spot rate,
  - \(e_0\) = spot rate,
  - \(i_h\) = expected home inflation, and
  - \(i_f\) = expected foreign inflation. *Uncertainties are represented by italics.*

Relative Purchasing Power Parity

- **To understand relative PPP, consider Brazil with 10% inflation and Argentina with no inflation (Argentina uses a currency board).**

  - A market basket of goods worth 1,000 Reals today will cost 1,100 Reals next year. In Argentina, a 100 Peso Argentine basket will cost still cost 100 Pesos one year later.

  - Argentines will now find Brazil 10% more expensive and Brazilians will find Argentina 10% less expensive.

Forecasting with Relative PPP

- **The more accurate version of the PPP for the one-period spot rate is**

  \[
  e_1 = e_0 \left(1 + i_h \right)/(1 + i_f)
  \]

  - the percent change is

  \[
  \frac{e_1}{e_0} - 1 = \frac{1 + i_h}{1 + i_f} - 1
  \]

  - In the previous example, we would expect the peso to depreciate by \((1.02)/(1.12) - 1 = -8.93\%\).

  - The Mexican view: the dollar appreciates by \((1.12)/(1.02) - 1 = 0.0980 = 9.80\%\).

Forecasting with (Relative) PPP

- **\((e_1 - e_0)/e_0 = i_h - i_f\)**

  - E.g., if you expect Mexico to have 12% inflation this year and the U.S. only 2%, the difference is what you expect the Peso to depreciate by: 10%.

  - Note that reversing the home currency means that Mexicans would expect the Dollar to appreciate by 10%!

  - Exhibit 7.3 shows a relationship between changes in exchange rates and relative inflation rates. Yen: lowest inflation, held value best.

Relative Purchasing Power Parity

- **Assuming that there is free trade between the countries, Argentines will buy less in Brazil, and Brazilians will buy more in Argentina.**

  - This means Brazilians will demand more Pesos and Argentines will demand fewer Reals, the exchange equilibrium between the currencies should results in a cheaper Real (or more expensive Peso). Potentially the peso could rise by ten percent (in Brazilian terms) which would leave the relative cost of Brazilian/Argentine goods unchanged.
PPP: Real Exchange Rates

- PPP predicts that real exchange rates \( e_t \) stay the same. (that is, exchange rates adjust to differences in inflation)
- \( e_t' = e_t'(1 + i_h)/(1 + i_f) \) is constant.
- This property is usually violated in the short run but appears to hold up in the long run.
- Look at the 9 graphs in Exh. 7.4: the dark steady lines represent a constant real (inflation-adjusted) exchange rate. The blue, wiggly lines are the actual rates.

PPP: Real Exchange Rates

- Suppose Mexico has 12% inflation, we have 2%. From the previous example, we found that we could expect the Peso to fall from $0.10 to $0.091. Plugging in the PPP prediction
  \[ e_t' = e_t' (1 + i_h)/(1 + i_f) = 0.09107 (1 + .12)/(1 + .02) = .10 \]
- If the peso falls more than 0.09107, we say it had a fall in the real exchange rate, if it stays at 10 cents we say it has risen in real terms.

Ex: Suppose Mexico has 12% inflation, we have 2%. From the previous example, we found that we could expect the Peso to fall from $0.10 to $0.09107.
- If the peso stays unchanged at 10 cents in nominal, find the change in real terms.
- \( $(.10 - .09107)/.09107 = .098 \) ................or 9.8% real appreciation

Inflation and “Real” Interest Rates

- We often make a distinction between the normal everyday contract rate of interest, and the interest rate that is adjusted for any loss of purchasing power caused by inflation.
- The everyday contract rate is called the nominal interest rate, denoted in the text as “r”.
- The rate reduced to reflect loss of purchasing power is the real rate, denoted as “a”.
- Irving Fisher popularized the use of the real rate and thus the relationship was named after him.

A simple version of this “Fisher Effect” is \( a = r - i \), where \( a \) is the expected real rate, \( r \) is the nominal rate, and \( i \) is expected inflation.
- Under current conditions this would be: the T-bond YTM is 6.5%, inflation is expected to 2%, therefore the expected real rate on the T-bond is 4.5% (awfully high). Note: the real rate is usually the residual of the nominal rate and inflation.

The T-bill rate is more like 5%, so the real T-bill rate is expected to be 3%.
- Note that each nominal rate has its own corresponding real rate.
- There is, however, a compounding effect that is reflected in the full, more correct formula:
  \( (1+a) = (1 + r)/(1 + i) \)
- or \( (1+r) = (1 + a)(1 + i) = 1 + a + i + a^2i \)
- \( r = a + r + a^2r \) where \( a^2i \) is analogous to compounding between \( i \) and \( a \).
Inflation and “Real” Rates

- Example: Suppose we expect Russia to have 100% inflation next year and we want to increase our purchasing power by 5% (real return). What (nominal) rate does a Russian bank need to offer you?

\[ 1 + r = (1 + a)(1 + i) \]

\[ r = \frac{(1 + a)(1 + i) - 1}{1 + i} \]

\[ r = \frac{(1 + 0.05)(1 + 1.00) - 1}{1 + 1.00} = 2.10 - 1 = 1.10 \]

\[ r = 110\% \]

Note you need 100% to buy what you bought last year, 5% to buy 5% more goods, and another 5% to pay for the inflation on the extra goods.

PPP: Real Interest Rates

- Suppose Mexico has 12% inflation, we have 2%. From the previous example, we found that we could expect the Peso to fall from $0.10 to $0.091. Plugging in the PPP prediction. Suppose we borrow pesos at 16% when the peso was at 10 cents and falls to 8 cents. What is the USD cost of borrowing? In real terms?

\[ r_{usd} = \frac{(1 + r_{mex})}{(e_1/e_0)} - 1 \]

\[ = \frac{1.16(0.08/0.10)}{1} = 0.072 = -7.2\% \]

\[ = 0.928/(1.02) - 1 = -0.0902 = -9.02\% \]

The International Fisher Effect (IFE)

- A syllogism:
  - 1) FE: differences in nominal interest rates reflect different expectations of inflation,
  - 2) PPP: the inflation rate differential between two countries predicts the future exchange rate
  - 3) IFE: therefore differences in nominal interest rates predict future exchange rate.

The International Fisher Effect (IFE)

- IFE requires both PPP and FE
- Another way of stating IFE is we assume that PPP holds and that the real rate “a” is the same in all countries.
- Thus we have two questionable assumptions: PPP is true and real rates are the same everywhere.
Forecasting With the IFE

• The IFE says the currency with the higher interest rate is expected to depreciate relative to the currency with the lower rate of interest.
• A simple (rule-of-thumb) version of the IFE is

\[ \frac{e_f - e_0}{e_0} = r_h - r_f \]

where

- \( e_f \) = expected future spot rate,
- \( e_0 \) = spot rate,
- \( r_h \) = home interest rate,
- \( r_f \) = foreign interest rate. Uncertainties are represented by italics.

Forecasting With the IFE

• \[ \frac{e_f - e_0}{e_0} = r_h - r_f \]
  
  • E.g., if you see that Mexico has 19% interest and the U.S. only 5%, the difference is what you expect the Peso to depreciate by: 14%.
  
  • Note that reversing the home currency means that Mexicans would expect the Dollar to appreciate by 14%!

PPP and IFE

• To see why IFE is a combination of Fe and PPP replace \((1 + r)\) below with \((1 + a)(1 + i)\)

\[ e_f = e_0 \frac{(1 + r_h)^t}{(1 + r_f)^t} \]

\[ \frac{e_f}{e_0} - 1 = \frac{(1 + r_h)^t}{(1 + r_f)^t} - 1 \]

- In the previous example, we would expect the peso to depreciate by \((1.05)/(1.19) - 1 = -11.76\%\).

- The Mexican view: the dollar appreciates by \((1.19)/(1.05) - 1 = 0.0980 = 13.33\%\).

Forecasting with the IFE

• The general version for “t” periods is

\[ e_t = e_0 \frac{(1 + r_h)^t}{(1 + r_f)^t} \]

\[ \frac{e_t}{e_0} - 1 = \frac{(1 + r_h)^t}{(1 + r_f)^t} - 1 \]

- In the previous example, if the Peso was worth ten cents today, we would estimate that the peso would be worth

\[ \$0.10 \times \frac{(1.05)^1}{(1.19)^1} = \$0.08824 \text{ in one year} \]

\[ \$0.10 \times \frac{(1.05)^2}{(1.19)^2} = \$0.07785 \text{ in two years} \]

\[ \$0.10 \times \frac{(1.05)^3}{(1.19)^3} = \$0.06870 \text{ in three years} \]

Forecasting with the IFE

• Note: the future spot rate predicted by IFE is lower than the rate predicted by PPP. This was of course a function of the examples’ choices of values for “r” and “i”. However, we normally find that real rates tend to be higher in LDCs like Mexico and Brazil, where the political risk and the chances of currency controls, poor financial policies is thought to be higher than in developed countries.

• This means that IFE-based predictions for the Peso and Real will be too low.
**Forecasting with the IFE**

- Another source of violation of the same real rate assumption is monetary policy. If the local central bank is “fighting” an overheating economy (the U.S), real rates may tend to be too higher than the usual. Rates would be lower if the central bank was dealing with a sluggish economy (Japan and Switzerland).
- Exhibit 7.8 is demonstrates how the constant “a” assumption is violated for less stable nations.

**Forecasting with the Forward Rate**

- **The unbiased forward rate:** In this theory, the forward rate may not be an accurate predictor of the future spot rate but it is at least unbiased. That is, the average of its mistakes tends toward zero.
  - Stated as: \( f_t = E(e_t) \)
  - The trouble is that we expect the forward rate to be set by IRP, so this relationship is almost impossible to distinguish from IFE.

**Forecasts based on the Forward or the Future Rates**

- If a currency sells at a forward discount (like Mexico’s), then the forward rate is “predicting” that the Peso will fall.
- There is a reasonable likelihood that the Peso will fall because (1) the discount means interest rates are higher in Mexico; (2) higher interest rates could mean higher expected inflation, and (3) higher inflation could mean a fall in the Peso.

**Forecasts based on the Forward or the Future Rates**

- IFE has a problem with forecasting as real rates tend to be higher for LDCs, and, when a central bank in a developed country is fighting inflation/hot economy.
- The forward rate is set by these same interest rates so the forward discount for the Peso will tend to overstate the future depreciation.
- Potential arbitrage? Buying cheap forward Peso and shorting expensive spot peso?

**Forecasts based on the Forward or the Future Rates**

- Commodity futures are a different situation.
- For some commodities such as gold, that is held for investment purposes, storage costs are very low, and it is not perishable. Perhaps other metals as well: platinum, silver? For these commodities, IRP usually holds.
- Most other commodities are perishable or expensive to store: IRP still applies (the opportunity cost of capital), but the other factors can dominate.

**Forecasts based on the Forward or the Future Rates**

- Remember that for all financial assets, the forward/futures rate is determined by the spot rate and the differences in interest rates (IRP).
- The spot rate (like a price on the stock market) already reflects all relevant public information that may affect the future spot price.
- So why should the forward rate on any financial futures contain any additional information?
Forecasts based on the Forward or the Future Rates

- If the forward moves up to "predict a future gain in the exchange rate", does the spot market eventually follow?
- That would be a case of the tail wagging the dog. The two markets should move together through IRP.

Comparing the 3 parity equations

- IRP: interest rates, (with the spot rate) set today’s forward rate.
- PPP: inflation rates predict the future spot rate.
- IFE: interest rates (as proxy for expected inflation) may also be used to predict the future spot rate.
- You might argue that IFE is a lazy man’s PPP, or you might argue that the market, through setting the nominal rate, does a better job of forecasting inflation than any economic model.

Five Key Relationships

Other Currency Forecasting Methods

- MODEL-BASED FORECASTS:
  - A. Fundamental analysis relies on key macroeconomic variables and policies which most like affect exchange rates. (ex: trade deficits, savings rates, interest rates, government deficits)
  - B. Technical analysis relies on use of
    - 1) historical volume and price data
    - 2) Charting and trend analysis
    - “The trend is your friend”

Problem Sets:

- Questions: 4, 5
- Problems: 3-6, 8-12, 14 (either text)