Economics 165
Winter 2001-2002
Problem Set 3 Solutions

Problem 1: Consider purchasing power parity (PPP)

A. *Explain how arbitrage in international commodity markets brings about absolute PPP. Show that absolute PPP implies relative PPP. Construct a counterexample to show that the reverse does not hold.*

Absolute PPP is the notion that the cost of identical baskets of goods should be the same. Hence, if absolute PPP holds and a Big Mac costs $2 in the U.S. and C$4 in Canada, then it must be the case that the exchange rate between dollars and Canadian dollars is $0.50 per C$. If this were not the case (say, a Canadian dollar is worth $0.60) then an arbitrage opportunity exists. Here, we could make money by purchasing Big Macs in the U.S. at a cost of $2 and selling them in Canada for C$4. When we convert our revenue back into dollars we get $2.40 per Big Mac. Hence we make a profit of 40 cents per burger. If we continue to buy Big Macs in the U.S. and sell in Canada, we will drive up the U.S. price and drive down the Canadian price until no profit can be made. (Alternatively, you could think of our actions as driving up the value of a dollar and driving down the value of a Canadian dollar until absolute PPP is achieved.)

Absolute PPP requires $P = EP^F$. If we take the log of both sides we get $\ln P = \ln E + \ln P^F$. Now if we differentiate both sides we will get (%change in P) = (% change in E) + (% change in P^F) or **(%change in E) = (% change in P) – (% change in P^F)**. This is exactly the relative PPP condition. Hence, absolute PPP implies relative PPP.

The converse (relative PPP implies absolute PPP) is not true. Imagine at time one E = 1, P = 1 and $P^F = 2$. Absolute PPP is violated. Then at time 2, E = 2, P = 2 and $P^F = 2$. In this case, (% change in E) = 100%; (% change in P) = 100%; and (% change in P^F) = 0, so relative PPP is satisfied. Still, at both time 2 and time 1 absolute PPP is violated.

B. *Pick a commodity, find its price in at least two countries, and calculate the exchange rate implied by absolute PPP. How does it compare to the actual exchange rate? Which currency seems to be over/undervalued?*

Once again, let's take a look at the Big Mac. According to *The Economist* the price of a Big Mac (on average) in the U.S. is $2.51 and in Britain it is 1.90 pounds sterling. Absolute PPP would imply an exchange rate of (2.51/1.90) = **1.321 dollars per pound sterling**. Recently the exchange rate has been somewhere in the neighborhood of **$1.41 dollars per pound sterling**. Hence in reality, absolute PPP does not hold since it would cost more to buy a Big Mac in Britain ($2.68) than in the U.S. ($2.51). One conclusion could be that the **pound is overvalued versus the dollar**. Another possibility is that the higher price in Britain is justified since British food (your next best alternative) is god-awful.

C. *Describe how you would use time series of national price indices to test relative PPP.*

Take a time series of price level for a country, generate its lag, subtract the lag of the price from the price and divide by the lag. Hence generate a new series which is equal to $(P_t - P_{t-1})/P_{t-1}$. Do the same for the price level in the foreign country. Now do the same for the exchange rate. See if you can reject the hypothesis that (% change in E) – (% change in P) + (% change in P^F) = 0.