Economics 426
5. Goods Market Integration: International Pricing (continued)

Next we see some leading explanations for the large, persistent swings in real exchange rates that we observe in most countries. To start, let us think of goods and services as being grouped into traded and non-traded groups, labelled T and N. So the domestic CPI is:

$$P = P_T^{1-n} P_N^n,$$

where the superscript n is the share of nontraded goods and services in the domestic consumption basket. See FT 11.1 for further details. Notice that the index number has 'constant returns to scale' since the exponents sum to 1: be sure you see why this makes sense.

Now we can write the real exchange rate as:

$$\begin{aligned} q &= \frac{SP^*}{P} \\ &= \frac{SP_T^{*1-n} P_N^{*n}}{P_T^{1-n} P_N^n} \\ &= \frac{SP_T^*}{P_T} \times \left(\frac{P_T P_N^*}{P_T^* P_N} \right)^n, \end{aligned}$$

where I have kept this as simple as possible by assuming that the share of non-traded goods, n, is the same in both countries. Now, research on international prices can be separated into two streams, depending on which of these two terms it focuses on, so let us look at these terms in turn.

Departures from the Law of One Price

You can see that the first possible explanation for big swings in q is that the law of one price does not hold. If the LOP did hold, then $P_T = SP_t^*$. But what is the evidence on this connection between traded goods prices across countries?

First, when researchers classify goods in the CPI into the T and N categories they can construct the first term in our decomposition. Doing that shows that the variance of the LOP departure is at least 50% of the variance of q. So at least half the mystery of departures from PPP is due to departures from the LOP.

Second, the same conclusion holds when we focus on the persistence of LOP deviations. We can construct the term:

$$\frac{SP_T^*}{P_T}$$

for any single traded good or category of them, then see how persistent the resulting ratio is. It turns out that it often is very persistent, though not as persistent as q.

When you tell friends that prices are persistently different in different countries they might reply that this finding is not surprising because of the costs of transportation. For example, groceries are expensive in Yellowknife. So to see whether that also explains international differences, we can imagine using intra-national price differences as a sort of control group.

Engel and Rogers did just this in a classic study of the LOP. They studied 14 goods in 23 US and Canadian cities between 1978 and 1994. First, they converted all prices to USD. Next, they calculated:

$$\text{std dev}\left[\Delta ln(\frac{SP_T^*}{P_T})\right]$$

for each good and each city, over time. Notice that this set of statistics thus includes the volatilities of relative prices between cities within the same country. The highest standard deviations were found for fuel, public transit, and women's apparel.

Finally, they ran a linear regression of these standard deviations (14×23 of them) on (a) the distance between the two cities and (b) a dummy variable equal to 1 if the two cities were in different countries. Crossing the border was associated with higher relative price volatility, and distance was too, so they asked what sort of extra distance would have to apply between two cities in the same country in order to mimic the greater volatility they would have if they were in different countries. The answer was 1780 miles, a very large border effect.

One way to think about these border effects is to take our original expression and rewrite it in logarithms. If the LOP held, then:

$$\ln P_T = \ln S + \ln P_T^*,$$

so that the local price would respond 1:1 to changes in the exchange rate or in the foreign price. Researchers often investigate the extent to which these responses do *not* happen, by running regressions like this:

$$\ln P_T = \beta_0 + \beta_1 \ln S + \beta_2 \ln P_T^* + \beta_3 Z,$$

where Z is anything else that might change over time and affect the local price.

Some studies investigate the identical product sold by the same firm in different locations or currencies. In this case P_T is the export price and P_T^* is the price in the producer's country. The extra variable Z is the transport cost. Classic studies along these lines have looked at automobiles, books, and magazines. They usually find that the export price is not simply the producer-country price adjusted for the exchange rate. Instead, there seems to be evidence of *pricing to market*. How can producer's carry that off?

A different group of studies looks at commodities like fruits and vegetables that typically are sold by different firms in different countries. Now P_T^* might be the US wholesale price and P_T the Canadian wholesale or perhaps retail price. These studes are said to measure *exchange-rate pass-through* and the coefficient β_1 measures the rate of pass-through.

Most studies of pass-through find that β_1 is roughly 0.5, so about half of a change in the exchange rate shows up in local currency prices. We can discuss what might explain this low value.

Who cares what the pass-through rate is? It turns out that it matters a lot to monetary policy, especially in smaller, very open economies. The readable article by Bailliu and Bouakez provides an excellent discussion of this topic. There is some evidence that the value of β_1 has fallen over time. That means that a given depreciation, say, will have less effect on domestic inflation than it used to. And some economists have suggested that the decline is due to the low overall inflation rate in many countries over the past 20 years. Pass-through tends to be higher in countries with high inflation rates. What is the highest inflation rate that you have experienced?

The Balassa-Samuelson Effect

Remember the second term in our decomposition also can explain why price levels differ across countries and PPP does not hold. That term is:

$$\left(\frac{P_T P_N^*}{P_T^* P_N}\right)^n.$$

To study this term, imagine an economy with sectors N and T and suppose that workers can move between the two sectors, so that the nominal wage is the same in both sectors. Denote output by Y and suppose for simplicity that we ignore capital, so the production function is:

$$Y = AL,$$

where A is TFP in this sector. I am omitting the sector subscripts for ease of reading. Let L be the number of workers hired. Profit is given by:

$$PY - WL = P(AL) - WL.$$

It won't surprise you that maximizing profit leads to the real wage (as paid by the firm) being equal to the marginal product of labour:

$$\frac{W}{P_N} = A_N \quad \text{and} \quad \frac{W}{P_T} = A_T,$$

which gives us our key result:

$$\frac{P_T}{P_N} = \frac{A_N}{A_T}.$$

Let us ignore departures from the LOP, just for simplicity. Then the real exchange rate is:

$$q = \left(\frac{A_N A_T^*}{A_N^* A_T}\right)^n.$$

This is the Balassa-Samuelson model, which relates international price differences to productivity differences.

With four terms on the right-hand side it looks like anything could happen to the real exchange rate. It is helpful to look at two especially interesting examples.

Example 1: $A_N = A_N^* = 1$

This is the example emphasized by Feenstra and Taylor, though our derivation is a bit different from theirs. In this case, productivity in the nontraded sector is both constant and equal across countries. You can think about how realistic this simplification is. The idea is that one person with scissors administers a haircut in each country. This example usually is used to apply to very different economies, where the difference in productivity in the traded sector is much larger than in the non-traded sector.

In this example, then:

$$q = \left(\frac{A_T^*}{A_T}\right)^n.$$

Imagine that India is the home country and the US is the foreign country. Then $A_T < A_T^*$ and $q > 1$: prices are higher in the US than in India. This is the key Balassa-Samuelson result: price levels are lower in poorer countries.

We can also predict what may happen to the real exchange rate over time:

$$\Delta \ln q = n(\Delta \ln A_T^* - \Delta \ln A_T).$$

If traded-goods productivity rises in India over time (relative to the value in the US), then India will experience a real appreciation (a fall in q).|

Example 2: $A_T = A_T^*$

In our second, illustrative example, let us assume that traded-goods productivity is the same in two countries. Then

$$q = \left(\frac{A_N}{A_N^*}\right)^n.$$

Imagine the home country is Japan and the foreign (starred) country is the US. These are both very rich countries, and they have similar productivity in sectors like manufacturing that are largely traded. But suppose that productivity in the non-traded sector is lower in Japan than in the US, so $A_N < A_N^*$. In Japan, serving tea or pumping gasoline is more labour-intensive than in the US. You can see that $q < 1$: prices will be higher in Japan than in the US. Again this seems to match reality, which is why we study this economic reasoning.|

The main implication of the Balassa-Samuelson model is that productivity differences show up in relative prices. It is interesting to notice that exactly how these differences materialize can depend on the policy regime that is in place for the *nominal* exchange rate. To see this, we shall again ignore LOP departures. And recall that:

$$\Delta \ln q = \Delta \ln S + \pi^* - \pi.$$

First imagine that two countries have a common currency or a firmly fixed nominal exchange rate, so that $\Delta \ln S = 0$. Then imagine an emerging economy that is pegged to the USD. Suppose the two economies have the same productivity in sector N (or, a weaker assumption, that there is no growth in their relative productivity in sector N). Then

$$\Delta \ln q = \pi^* - \pi = n(\Delta \ln A_T^* - \Delta \ln A_T).$$

So the theory makes predictions for the inflation-differential across countries. The same idea would apply for countries that share the Euro.

Second, imagine that two countries both target inflation, successfully, at the same rate. Then $\Delta \ln q = \Delta \ln S$, so productivity differences that are reflected in a real appreciation or depreciation will show up in a nominal appreciation or depreciation. The interesting prediction here is that the two countries can have the same monetary policy goals, yet their nominal exchange rate can trend up or down over time.