1. **Balassa-Samuelson.** Consider a world where aggregate prices are a geometric weighted average of tradable and nontradable goods prices, and that the weights of nontradables in both economies are the same.

1.1 Derive the expression for the real exchange rate as a function of the relative price of nontradables, and of the ratio of foreign to domestic prices for traded goods (expressed in a common currency).

Define a real exchange rate as

\[ q_t = s_t - p_t + p_t^* \]  \hspace{1cm} (1)

where \( s \) is the log exchange rate defined in units of home currency per unit of foreign.

Now suppose the price index is a geometric average of traded and nontraded good prices.

\[ p_t = \alpha p_t^N + (1 - \alpha) p_t^T \]

\[ p_t^* = \alpha^* p_t^{N*} + (1 - \alpha^*) p_t^{T*} \]  \hspace{1cm} (2)

where the * denotes the foreign country, and lowercase letters denote logged values of corresponding uppercase letters. Now Then substituting (2) into (1) and re-arranging yields:

\[ q_t = (s_t - p_t^T + p_t^{T*}) - \alpha(p_t^N - p_t^T) + \alpha^*(p_t^{N*} - p_t^{T*}) \]  \hspace{1cm} (3)

Equation (3) indicates that the real exchange rate can be expressed as the sum of three components: (i) the relative price of tradables, (ii) the relative price of nontradables in terms of tradables in the home country, and (iii) the corresponding relative price in the foreign country. For the case where the weights of nontradables in the aggregate price index are identical, the second and third terms can be collapsed into a intercountry relative price of nontradables, viz.:

\[ q_t = (s_t - p_t^T + p_t^{T*}) - \alpha(\hat{p}_t^N - \hat{p}_t^T) \]  \hspace{1cm} (4)

where the circumflex denotes the intercountry log difference.

1.2 Without imposing purchasing power parity on the relative price of traded goods, expressed in a common currency, solve for the real exchange rate as a function of productivity differentials.

If the relative price of nontradables is determined by the relative productivity levels in the two sectors:
then equation (4) becomes:

\[
q_t = (s_t - p_t + p_t^*) - \alpha(a_t^T - \hat{a}_i^N)
\]

1.3 Suppose purchasing power parity cannot be assumed for the relative price of traded goods, expressed in a common currency. Suppose this variable depends upon aggregate demand. What variables will then appear to be related to the real exchange rate?

In this case, anything that affects the relative price of traded goods – such as the need to equilibrate the trade balance, or demand shocks – will then affect the real exchange rate, in addition to the intercountry relative productivity differential.

2. **Absolute vs. relative PPP.** Consider the fact that absolute purchasing power parity does not hold, at least not over the sample spanning the past forty years and including both the developed and developing countries.

2.1 Show that this is true. Download the “price level” for the US, Germany, Korea, Brazil, China and India for 1970, and 2000, from the Penn World Tables (see the link on the course website).

2.2 Does this finding make sense? You might assume for simplicity that nontradables sector productivity has to be the same over time.

Yes, recall:

\[
q_t = (s_t - p_t + p_t^*) - \alpha(a_t^T - \hat{a}_i^N)
\]

Let PPP hold for traded goods, and set

\[
q_t = -\alpha(a_t^T)
\]

So as long as US productivity in the tradable sector remains higher than that in other countries, the value of the dollar should be higher than that of the other countries, holding all else constant.

3. **FEERs et al.** Is the Fundamental Equilibrium Exchange Rate (FEER) model based upon a flow or stock concept of the exchange rate determination? What about the IMF’s “Macroeconomic Balance” approach?

A standard FEER calculation solves for a real exchange rate that is consistent with a current account balance that is deemed to be sustainable. The IMF’s macroeconomic balance approach will solve for the exchange rate consistent with a current account that is implied by savings and investment flows that are “normal” for the country, given its demographic and structural characteristics. In both cases, flows determine the equilibrium exchange rate.
4. **Model evaluation.** What is the major innovation of the Mark-Sul paper, in terms of obtaining more precise estimates of the “reversion coefficient”? What do the results suggest for (a) the determinants of money demand in the OECD countries, and (b) the rate at which the exchange rate closes the gap between fundamentals and the exchange rate?

The main innovation is to use cross-currency information to gain more precise estimates of the coefficient relating the exchange rate change to the gap between the exchange rate and the (monetary) fundamentals.

The results suggest that in the OECD countries, the exchange rate is cointegrated with nominal money stocks and incomes (GDPs) with unit elasticities. The rate at which the gap is closed is the reversion coefficient, which – depending upon the estimation technique and the base currency – ranges from 0.19 to 0.37. This means the gap between the exchange rate and the fundamental is closed at a rate between 19 to 37% per quarter.