Exchange Rate Determination, Devaluation and Elasticities Approach

1. Supply, Demand, and Exchange Rates: Floating

2. Supply, Demand, and Exchange Rates: Fixed
3. Devaluation ($E' > E$)

3.1. Imports

3.2 Exports
4. The Marshall-Lerner Conditions

Let the US be the home country, and the foreign country be Japan. As noted on page 295 of Caves, et al. (2007), the US trade balance, $TB^*$, in units of foreign currency, e.g., yen (¥), is given by:

$$TB^* = \left( \frac{P}{E} \right) \times EX - \left( \frac{P^*}{E^*} \right) \times IM$$

(0)

(where $EX$ is the same as the $X$ in the textbook, and $IM$ is the same as the $M$ in the textbook). Overbars indicate fixed values. Multiply both sides by $E$, and divide by $P$, to obtain:

$$\frac{E \times TB^*}{P} = TB = EX - \left( \frac{E^*}{P^*} \right) \times IM$$

(1)

$TB$ is the trade balance in nominal domestic currency terms; $TB/P$ is the trade balance denominated in US widgets. Define the trade balance ($\tilde{TB}$) in domestic widget terms as the difference between exports ($EX$) denominated in US widgets and imports ($IM'$) denominated in US widgets:

$$\frac{TB}{P} = \tilde{TB} = EX - IM'$$

(2)

However, imports are the foreign (*) country’s exports, so:

$$IM' = (E^*/P) \times EX^* = qEX^*$$

(3)

where $q$ is a real exchange rate, measured in terms of number of home widgets needed to purchase one foreign widget. Then the trade balance is functionally defined as:

$$\tilde{TB} = EX - qEX^*$$

(4)

(As in the textbook, we take the income levels as exogenously fixed.) To determine the response of the trade balance to a change in the real exchange rate, take the partials with respect to the real exchange rate:

$$\frac{\partial \tilde{TB}}{\partial q} = \frac{\partial EX}{\partial q} - \left( q \frac{\partial EX^*}{\partial q} + EX^* \right)$$

$$\frac{\partial \tilde{TB}}{\partial q} = \left( \frac{\partial EX}{\partial q} - q \frac{\partial EX^*}{\partial q} \right) - EX^*$$

(5)

$$\frac{\partial \tilde{TB}}{\partial q} = \text{(volume effect)} + \text{(value effect)}$$

One wants to know if $\frac{\partial \tilde{TB}}{\partial q}$ is greater than or less than zero. Solve for:

$$0 < \frac{\partial EX}{\partial q} - q \frac{\partial EX^*}{\partial q} - EX^*$$

(6)
Multiply both sides by the quantity \((q/EX)\) to obtain:

\[
0 < \frac{\partial EX}{\partial q} \frac{q}{EX} - q \frac{\partial EX^*}{\partial q} \frac{q}{EX^*} - \frac{EX^*}{EX} \quad (7)
\]

Define the first term as \(\varepsilon_{EX}\), the export demand elasticity. Further note that if initial trade is balanced, then \(EX = qEX^*\) such that \(q/EX = 1/EX^*\).

\[
0 < \varepsilon_{EX} - \frac{\partial EX^*}{\partial q} \frac{q}{EX^*} - 1 \quad (8)
\]

Finally, define the import demand elasticity:

\[
- \frac{\partial EX^*}{\partial q} \frac{q}{EX^*} \equiv \varepsilon_{IM}
\]

then one obtains the Marshall-Lerner-Robinson condition:

\[
1 < \varepsilon_{IM} + \varepsilon_{EX} \quad (9)
\]

which is appropriate for export supply and import supply elasticities that are infinite.

Caveats:
1. What if export supply and import supply elasticities are not infinite?
2. What if initial trade is not balanced?
3. Recall, prices of exports are fixed in domestic currency terms; prices of the foreign country’s exports are fixed in foreign currency terms.

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