The Balance of Payment and the Rate of Exchange (Marshall-Lerner condition)

Srikanta Kundu

Indian Institute of Management, Sirmaur, Himachal Pradesh

April 14, 2025

Introduction

Impact on Balance of Payment:

An increase (depreciation) in exchange rate can affect the BoP by-

- Increasing Export.
- Decreasing Import.
- Change in Exchange Rate itself.

The final out come depends on the sensitivity of the above three changes

Assumptions

- Rate of exchange has been fixed politically at a certain level, and it is now going to change.
- Prices remains constant.
- Prices of export and imports are constant and equal to unity.

Notations

- X : value of export in domestic currency
- M : Value of imports in foreign currency
- B : Balance of Payment surplus in domestic currency.
- r : Exchange rate (Unit of domestic currency per unit of foreign currency 86:1)
- $|e_x|$: Elasticity of demand for exports
- $|e_m|$: Elasticity of demand for imports

Definitions

- Export elasticity:
  - e_x: Percentage change in export due to 1% change in exchange rate.
    $e_x = \frac{r}{X} \cdot \frac{dX}{dr}$
    As the impact is positive
    $|e_x| = \frac{r}{X} \cdot \frac{dX}{dr}$

- Import elasticity:
  - e_m: Percentage change in import due to 1% change in exchange rate.
    $e_m = \frac{r}{M} \cdot \frac{dM}{dr}$
    As the impact is negative
    $e_m = -\frac{r}{M} \cdot \frac{dM}{dr}$

Derivations

- By definition: $B = X - r \cdot M$
- Since X and M are functions of r, B is also a function of r.

Differentiating both side with respect to r

$$
\begin{aligned}
\frac{dB}{dr} &= \frac{dX}{dr} - M\frac{dr}{dr} - r\frac{dM}{dr} \\
&= \left(\frac{dX}{dr} \cdot \frac{r}{X}\right) \cdot \frac{X}{r} - M - \left(\frac{r}{M}\frac{dM}{dr}\right) \cdot M \\
&= |e_x|\frac{X}{r} - M - |e_m| \cdot M \\
&= M\left[|e_x|\frac{X/r}{M} + |e_m| - 1\right]
\end{aligned}
$$

- Now a Devaluation (an increase in r) improve the balance of payments surplus if $\frac{dB}{dr} > 0$

Derivations

Devaluation is said to be successful if $\frac{dB}{dr} > 0$

$$\begin{aligned} \frac{dB}{dr} > 0 \quad \text{if} \quad & M\left[|e_x|\frac{X/r}{M} + |e_m| - 1\right] > 0 \\ \text{or if} \quad & \left[|e_x|\frac{X/r}{M} + |e_m| - 1\right] > 0 \\ \text{or if} \quad & \left[|e_x|\frac{X/r}{M} + |e_m|\right] > 1 \end{aligned}$$

- If we assume that the trade is initially balanced to start with, then $B = X - r \cdot M = 0$, i.e., $X = r \cdot M$ or, $X/r = M$.
- Thus the condition becomes $|e_x| + |e_m| > 1$
- This condition is known as Marshall-Lerner condition for successful devaluation.