Foreign Trade, Devaluation and Elasticities: A Model Approach

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Introduction

From the theory of the international economics it is known that the expenditure-switching policies primarily work by changing relative prices. The main form of such a policy is a change in exchange rates, i.e. a devaluation or a revaluation of the domestic currency. Direct controls can also be classified under this heading and are usually applied to restrict imports. Consumers will then try to buy domestic goods instead of imported goods, and hence direct controls can be viewed as a switching device.

We shall, however, concentrate on a discussion of devaluation (Slovakia has experienced it in 1993) to show how important is the theory to indicate the desired economic policy.

Trade balance and the devaluation: the model

The traditional approach to the effects of devaluation on the balance of trade runs in terms of elasticities (Bo Sodersten). The core of the traditional approach is contained in so-called Marshall-Lerner condition, which states that the sum of elasticities of demand for a country’s export and of its demand for imports has to be greater than unity for a devaluation to have a positive effect on a country’s trade balance (A.P. Lerner). If the sum of these elasticities is smaller than unity, a country can instead improve its balance of trade by revaluation.

Bo Sodersten showed us that if we want to express this condition in terms of formula, it can be set out as follows:

\[ dB = kX_t(e_{1m} + e_{2m} - 1) \]  \hspace{1cm} (1)
where $dB$ is the change in the trade balance, $k$ the devaluation in percentage, $X_f$ the value of exports expressed in foreign currency, $e_{1m}$ the devaluing country's demand elasticity for imports (first country in the next text, reason for 1), and $e_{2m}$ the second country's (say the rest of the world) demand elasticity for export from the devaluing country (Slovakia).

It is easy to see from the expression (1) that the sum of the two critical elasticities has to be larger than unity for the trade balance to improve because of a devaluation. If the sum is less than unity, an appreciation should instead be used to cure a deficit in the trade balance.

We in Slovakia have experienced that the devaluation leads to an increase in the price of imports. What the effect of this price increase will be depends on the elasticity of demand for imports. The larger it is, the greater will be the fall in the volume of imports. The value of the demand elasticity of imports depends, of course, on what type of goods the devaluing country imports. If a country primarily imports necessities, raw materials and goods needed as inputs for its industries (Slovakia is a typical country), the demand elasticity of imports may be very low, and a devaluation may not be a very efficient means of correcting deficit.

We want to mention that the Marshall-Lerner condition set out in formula (1) is built on some strict simplifications. It assumes, roughly, that the supply elasticities are large and that the trade balance is in equilibrium when devaluation takes place.

Let us start by setting out the following equation for the trade balance:

$$B_{1f} = x_1P_{2m} - m_1P_{2x} = X_{1f} - M_{1f}$$  \hspace{1cm} (2)

where $B_{1f}$ denotes the devaluing country's trade balance in foreign currency, where $x_1$ and $m_1$ are devaluing country's volume of exports and imports, respectively; $P_{2m}$ and $P_{2x}$ are the prices of imports and exports in second country (rest of the world); and $X_{1f}$ and $M_{1f}$ are the value of exports and imports in country one (devaluing), both denoted in foreign currency. \(^1\)

Next we need to get is the differentiating of equation (2). Differentiating gives

\(^1\)The principle of this approach was first developed by S.S. Alexander
\[ dB_{1f} = dx_1 P_{2m} - dP_{2m} x_1 - dm_1 P_{2x} - dP_{2x} m_1 \]

\[ = X_{1f} \left( \frac{dx_1}{x_1} + \frac{dP_{2m}}{P_{2m}} \right) + M_{1f} \left( -\frac{dm_1}{m_1} - \frac{dP_{2x}}{P_{2x}} \right) \]  \hspace{1cm} (3)

Now we define these four elasticities:

\[ s_{1s} = \frac{dx_1}{dP_{1s}} \frac{P_{1s}}{x_1}, \text{ the elasticity of home export supply} \]  \hspace{1cm} (4)

\[ e_{2m} = -\frac{dx_1}{dP_{2m}} \frac{P_{2m}}{x_1}, \text{ the elasticity of foreign demand for exports} \]  \hspace{1cm} (5)

\[ s_{2m} = \frac{dm_1}{dP_{2x}} \frac{P_{2x}}{m_1}, \text{ the elasticity of foreign supply of imports} \]  \hspace{1cm} (6)

\[ e_{1m} = -\frac{dm_1}{dP_{1m}} \frac{P_{1m}}{m_1}, \text{ the elasticity of home demand for imports} \]  \hspace{1cm} (7)

We observe from the way in which these four elasticities have been defined that they will all be positive – barring Giffen goods.

The theory assumes that we have price equalization between the two countries - expected case in market economies - through the exchange rate, \( r \), so that we get

\[ P_{2x} = P_{1m} r \]  \hspace{1cm} (8)

Differentiating equation (8) totally and adding in equation (8) gives

\[ P_{2x} + dP_{2x} = P_{1m} r + drP_{1m} \]
\[ \frac{P_{im} + dP_{im}}{P_{im} + dP_{im}} r - k(P_{im} + dP_{im})r = (P_{im} + dP_{im})r(1 - k) \quad (9) \]

In equation (9) we have introduced the devaluation coefficient \( k \), which shows the relative change in the exchange rate. We can define \( k \) in the following way:

\[
k = \frac{-P_{im} dr}{P_{im} + dP_{im} r} = \frac{dr}{r} \frac{1}{1 + \frac{dP_{im}}{P_{im}}} \approx -\frac{dr}{r} \left(1 - \frac{dP_{im}}{P_{im}}\right) \approx -\frac{dr}{r} \quad (10)
\]

From equation (9) we can get

\[
\frac{dP_{2x}}{P_{2x}} = -k + \frac{dP_{im}}{P_{im}} (1 - k) \quad (11)
\]

In a completely analogous way we deduce that

\[
\frac{dP_{2m}}{P_{2m}} = -k + \frac{dP_{1x}}{P_{1x}} (1 - k) \quad (12)
\]

The relative changes in volumes and prices can now be expressed in terms of elasticities and the devaluation coefficient \( k \). Using equations (5) and (12) we get

\[
\frac{dx_1}{x_1} = -e_2m \frac{dP_{2m}}{P_{2m}} = -e_2m \left[-k + \frac{dP_{1x}}{P_{1x}} (1 - k)\right] \quad (13)
\]

But \( dx_1/x_1 = s_{1x}(dP_{1x}/P_{1x}) \). By substitution we get
\[
\frac{dx_i}{x_i} = e_{2m} k - \frac{e_{2m}}{s_{1x}} (1 - k) \frac{dx_i}{x_i}
\]

From this follows

\[
\frac{dx_i}{x_i} = \frac{e_{2m} k}{1 + (e_{2m} / s_{1x})(1 - k)} = \frac{s_{1x} e_{2m} k}{s_{1x} + e_{2m} (1 - k)}
\]

(14)

In an analogous way we can derive

\[
\frac{dP_{2m}}{P_{2m}} = - \frac{ks_{1x}}{s_{1x} + e_{2m} (1 - k)}
\]

(15)

\[
\frac{dm_i}{m_i} = - \frac{ks_{2m} e_{1m}}{e_{1m} + s_{2m} (1 - k)}
\]

(16)

\[
\frac{dP_{2x}}{P_{2x}} = - \frac{ke_{1m}}{e_{1m} + s_{2m} (1 - k)}
\]

(17)

Now using the last four expressions we get the effect of a devaluation on the trade balance:

\[
 dB_{1j} = k \left[ X_{1j} \frac{s_{1x} (e_{2m} - 1)}{s_{1x} + e_{2m} (1 - k)} + M_{1j} \frac{e_{1m} (s_{2m} + 1)}{e_{1m} + s_{2m} (1 - k)} \right]
\]

(18)

What does the (18) says? Expression (18) shows that the effects of the devaluation are somewhat more complicated than shown in equation (1); i.e. if we do not assume that supply elasticities are infinitely large the situation becomes somewhat more complex. If, to take an extreme example, we assumed that the supply elasticities were equal to zero there would be no improvement in the trade balance because of increasing exports but some improvement because of fall in demand for imports.
Generally speaking, we can say that if the elasticities are larger than unity, then the larger they are, both on the supply side and the demand side, the larger will be the improvement in trade balance.

Sindy Alexander showed the way to arrive at formula (1) from (18). It is as follows: if supply elasticities tend to infinity, then

\[
\frac{e_{2m} - 1}{1 + (e_{2m} / s_{1m})(1 - k)} \to e_{2m} - 1
\]

If, furthermore, \( k \) is small, we get

\[
\frac{e_{lm}[1 + (1 / s_{2m})]}{(e_{lm} / s_{2m}) + 1 - k} \to \frac{e_{lm}}{1 - k}
\]

But if \( k \) is small and if we assume that trade is balanced before the devaluation, we get

\[
 dB_{1f} = kM_{1f}(e_{2m} + e_{lm} - 1)
\]

We have now set out the main parts of the elasticity approach to devaluation. The dubious aspect of this approach is that it is built on a parital type of theorizing and that it does not take into account consideration of general equilibrium.

**Conclusions**

Demand and supply elasticities are conventionally defined *ceteris paribus*, i.e. other prices and incomes are supposed to be constant, but in devaluation prices and incomes will certainly change. Therefore, the use of partial elasticities in connection with devaluation can easily be misleading. What one would like to know is the value of the "total" elasticities, i.e. the value of an elasticity when all the factors involved in the devaluation change. Such a total elasticity measures how quantities are affected by price changes when everything likely to change has
done so. This is, however, not an operational concept, as it will never be possible to know in advance the values of such elasticities.

The result of devaluation depends not only on partial elasticities but also on the aggregate behavior of the economic system. In the literature is known an alternative approach to the effects of devaluation in macro terms. It is known as the absorption approach.

Literature


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