

On Two Formulae for Calculating the Effective Rate of Protection

by

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In the literature on effective tariff protection, two formulae have been used, more or less equivalently. One defines effective protection as the percentage difference between value added at domestic prices and value added at world prices. The other defines it as the percentage difference in value added *per unit of output* at the two sets of prices.

The first definition has been used by Balassa (1965) Bhagwati and Desai (1970) and Lewis and Guisinger (1968), whereas the second definition seems to have been used by Basevi (1966), Corden (1966) and Leith (1967 and 1968). There is some ambiguity in the works of the last three authors as to the meaning of value added per unit of output at domestic prices. Part of the confusion arises because *none* of these authors explicitly defines this concept. Leith (1967) implicitly defines this as value added at domestic prices divided by the value of output at domestic prices [5, foot-note 14, p. 60, equation (A-5 and A-6) p.70]. Basevi (1966) implicitly used this definition at one place [2, p. 140] but at another he implicitly defines value added per unit of output at domestic prices as value added at domestic prices divided by the value of output *at world prices*. [2, p. 148]. The last definition also seems to have been used by Corden (1966).

In this note we show that (a) the two definitions of effective protection are not equivalent, (b) the effective protection rates based on the two definitions do not differ by a mere linear transformation which would leave the rankings of different industries unchanged and (c) the computational formula used to represent the second concept, in fact, represents the first one.

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Let the value added in the j th industry at world prices be denoted by V_j and that at domestic prices be denoted by V'_j . Then under the first method, the effective rate of protection (\bar{t}_j) is defined as:

$$\bar{t}_j = \frac{V'_j - V_j}{V_j} \dots \dots \dots (1)$$

under the second method the tariff protection (t_j) is defined as:

$$t_j = \frac{v'_j - v_j}{v_j} \dots \dots \dots (2)$$

where v_j and v'_j are co-efficients of value added *per unit of output* at domestic and world prices, i.e.

$$v_j = \frac{V_j}{X_j} \text{ and } v'_j = \frac{V'_j}{X'_j}$$

where X'_j and X_j are the values of output of sector j at domestic and world prices, respectively.

Let the nominal protection on the j th good be m_j per cent. Thus, we have :

$$\frac{X'_j}{X_j} = (1 + m_j) \dots \dots \dots (3)$$

$$\text{since, } t_j = \frac{v'_j - v_j}{v_j} \quad \text{from (2)}$$

$$= \frac{[V'_j / X'_j] - [V_j / X_j]}{[V_j / X_j]} - 1$$

$$= \frac{\bar{t}_j + 1}{1 + m_j} - 1$$

$$\text{or } \bar{t}_j = (1 + m_j) t_j + m_j \dots \dots \dots (4)$$

This shows that \bar{t}_j is not equal to t_j unless the nominal protection, m_j , is zero. Also, since m_j in general will be different for different industries, the two effective rates are not related by a linear transformation which would leave the rankings of the industries unchanged.

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The definition implied in (1) is conceptually the correct one, since it provides a measure of the percentage increase in the rewards to the primary factors. No such claim can be made for the definition implied in (2). However, many researchers have used this definition, presumably on the assumption that, since most input-output tables are available as co-efficients matrices, it is a more convenient definition to use. Even so, it is easy to see that the definition implied in (1) can be transformed in terms of co-efficients rather than absolute values.

It is surprising that the authors, who purport to use definition (2), often use an incorrect formula which results in the effective rate of protection being computed according to (1):

The formula used for deriving the effective rate of protection, defined in (2), is sometimes given as follows:

$$Q_j = \frac{v'_j}{1 + m_j} - 1 \dots \dots \dots (5)^1$$

$$\frac{1}{1 + m_j} - \sum_i \frac{a'_{ij}}{(1 + m_i)}$$

where $a'_{ij} = \frac{X'_{ij}}{X'_j}$, are the input co-efficients at domestic prices.

This definition does not correspond to definition (2) because:

$$v_j = 1 - \sum a_{ij} = 1 - (1 + m_j) \sum_i \frac{a'_{ij}}{1 + m_i}$$

where $a_{ij} = \frac{X_{ij}}{X_j}$, are the input co-efficients at world prices, and thus:

$$t_j = \frac{v'_j}{1 - (1 + m_j) \sum_i \frac{a'_{ij}}{1 + m_i}} - 1 \dots \dots \dots (6)$$

It can be shown through further manipulation that:

$$t_j = \frac{Q_j - m_j}{(1 + m_j)} \dots \dots \dots (7)$$

Substituting (7) into (4), we get:

$$\tilde{t}_j = (1 + m_j) \frac{(Q_j - m_j)}{(1 + m_j)} + m_j = Q_j,$$

which shows that Q_j represents the concept of effective protection implicit in (1), even though it is supposed to represent the concept implied in (2).

¹ See: Besevi (1968) p. 149, equ. (Leith (1967) p. 70 and Leith (1968) equ. p. 590.

To our knowledge formula (6) has not been used to compute the effective rate of protection. Thus no damage seems to have been done to the main body of empirical work on the subject. However, as many economic formulae tend to be mechanically applied, it is well to point out the pitfalls of such usage.

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List of symbols used:

- V_j = Value added in the j th sector at world prices
 V'_j = Value added in the j th sector at domestic prices
 X_j = Value of output of sector j at world prices
 X'_j = Value of output of sector j at domestic prices
 X_{ij} = Value of inputs into j from i at world prices
 X'_{ij} = Value of inputs into j from i at domestic prices

The other symbols used can be expressed in terms of the symbols defined on page 191.

$$v_j = \frac{V_j}{X_j} \qquad v'_j = \frac{V'_j}{X'_j}$$

$$a_{ij} = \frac{X_{ij}}{X_j} \qquad a'_{ij} = \frac{X'_{ij}}{X'_j}$$

$$m_j = \frac{X'_j - X_j}{X_j}$$

$$\bar{t}_j = \frac{V'_j - V_j}{V_j}$$

$$t_j = \frac{v'_j - v_j}{v_j}$$

$$Q = \frac{V'_j}{\frac{1}{1+m_i} - \sum_i \frac{a'_{ij}}{(1+m_i)}} - 1$$