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FACTOR PRICE RATIO ON TRADE
BALANCE

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The Effects of an Exogenous Factor Price Ratio on Trade
Balance^{x)}

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Abstract: The production structure of the economy is assumed to be such as is typical of the pure theory of international economics, with the exception that products are divided into traded and non-traded goods. When full utilization of capital and labour is reached through the managements of domestic expenditure, trade balance can be expressed as a function of an exogenous factor price ratio. Some effects of capital accumulation and nominal prices are also discussed. Finally, empirical evidence is set forth for the theory proposed in the article.

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1. Introduction

Links between trade theory or the pure theory of international economics and the balance of payments theory have been rare. The purpose of this article is to fill in the gap between those theories to some extent and to consider disequilibrium in the trade balance within the framework of pure theory. The small economy assumption is made, so that the terms of trade are fixed. Accordingly, aggregation over traded commodities is possible and the products of the whole economy can be divided into two groups, traded goods and non-traded goods. This division has earlier been used, e.g., by Salter (1959), Pearce (1961), Dornbush (1973) and Helpman (1976). The main emphasis in their papers has been on the effectiveness of the policy instruments and in the monetary phenomena of the balance of payments.

In the present article a factor price ratio, or more precisely, the inflexibility of that ratio in respect to the demand for and supply of factors, is seen as a cause of disequilibrium in the trade balance. The inflexibility of wages downwards, effects of labour unions, regulation of the nominal rate of interest, incomes policy and general political targets in respect to the distribution of income between capital and labour give some grounds for taking the factor price ratio as an exogenous variable or as a variable whose value is arbitrary from the point of view of this study.

Introducing the assumptions of linear homogeneous production functions and cost minimization usual in the pure theory of international trade, the capital-labour ratios for both kinds of production are given when a factor price ratio is given. Under these conditions, full use of capital and labour resources and equilibrium between the demand for and supply of non-traded goods may presuppose a level of domestic expenditure that does not lead to equilibrium in foreign trade or between the demand for and supply of traded goods. The effectiveness of the allocation of resources is not necessarily disturbed by the conditions assumed above.

2. Relative price effects

The demand for and supply of both non-traded goods (Q_n) and traded goods (Q_t) are in equilibrium in Figure 1 when the product price ratio is P_0/P_0 . The points Y_0 on the transformation curve in Figure 1 and on the contract curve in Figure 2 indicate the same amounts of produced goods. K and L are the economy's capital and labour resources, assumed to be fixed. As can be seen from Figure 2, non-traded goods are assumed to be labour-intensive and traded goods capital-intensive at all factor price ratios.

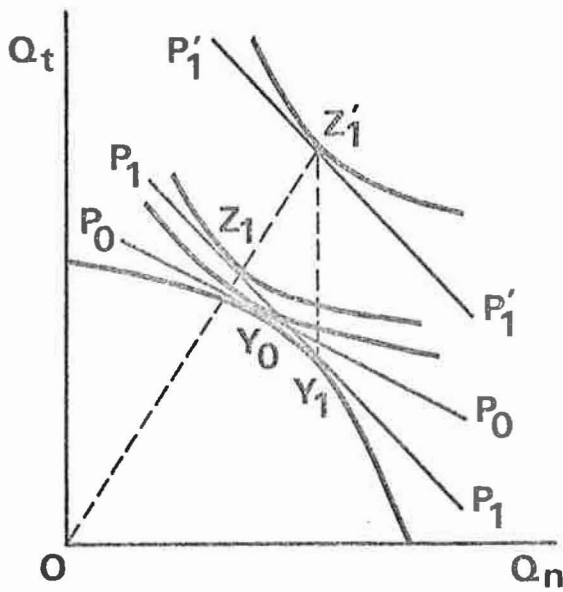


Figure 1.

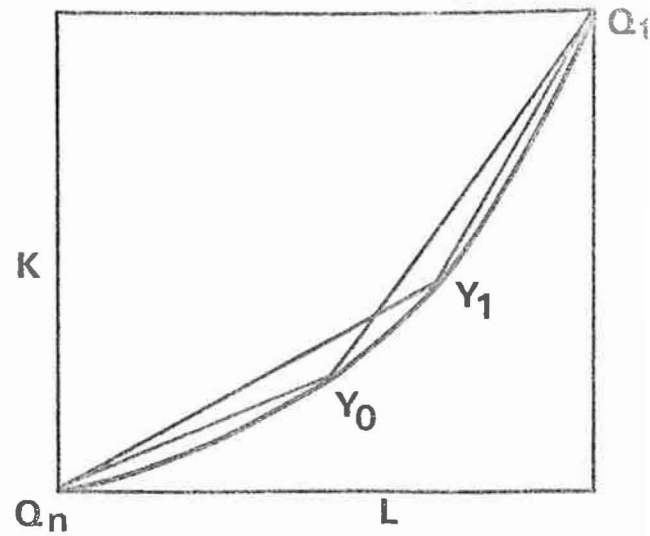


Figure 2.

Assume now that the relative price of labour increases. As a result, both sectors shift toward more capital-intensive methods. The full use of resources presupposes that the labour-intensive sector is expanded and the capital-intensive sector restricted. A new equilibrium can be, e.g., point Y_1 in Figure 2. This new production point Y_1 in Figure 1 presupposes that the new product price ratio is P'_1-P_1 . In this situation the demand point is Z'_1 , and the demand for traded goods exceeds the supply of them while in the case of non-traded goods supply exceeds demand. This disequilibrium in the non-traded goods sector can be solved by increasing domestic expenditure, so that the budget-line will be $P'_1-P'_1$. The difference between Z'_1 and Y_1 shows the new deficit in foreign trade.

From the above example a more general conclusion can be drawn: If full utilization of the resources of an economy is maintained, a deficit (surplus) in its trade balance is the larger (smaller), the higher is the relative price of the factor used intensively in producing non-traded goods¹⁾.

We can notice that the economy works on the contract curve and thus its resources are efficiently utilized, although the factor price ratio is independent of demand for and supply of the factors of production.

3. A dynamic aspect

In addition to the comparative-static analysis a dynamic aspect can be pointed out. It might be possible for a deficit in foreign trade to result in a growth of the capital stock of the economy. If, now, the non-traded goods are labour-intensive, an increase in the relative price of labour will lead to a new equilibrium with a higher capital stock. This follows from the fact that the capital intensive sector is expanded and labour-intensive sector is restricted when capital resources increase and labour resources are fixed (Figure 3).

1) A mathematical illustration of this theorem is given in an appendix.

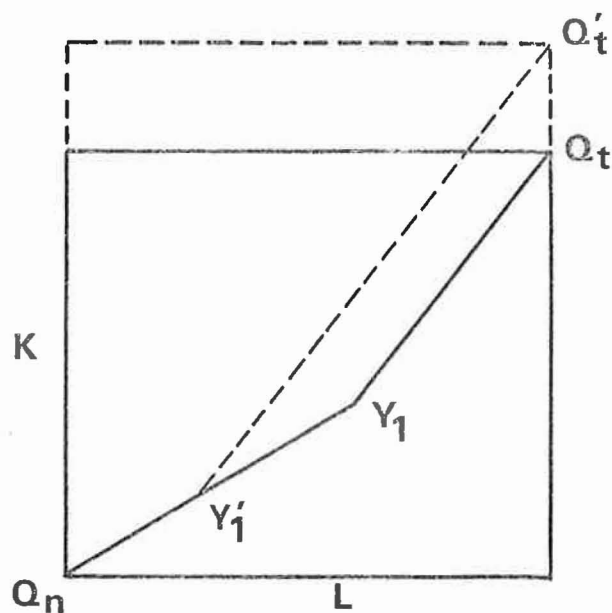


Figure 3.

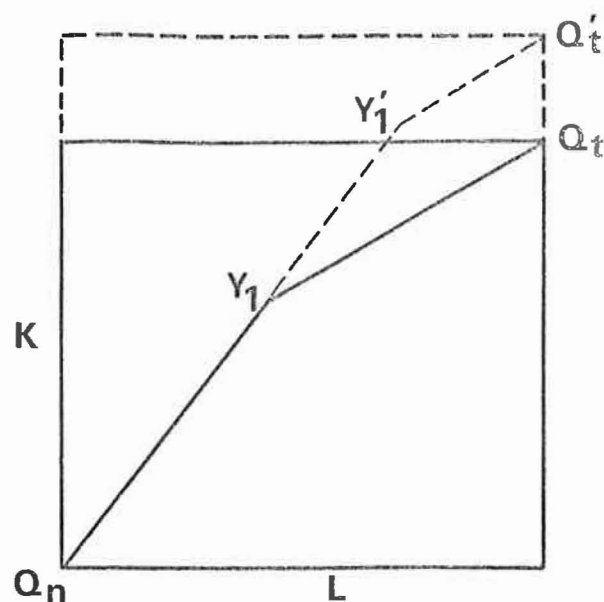


Figure 4.

If, on the other hand, the non-traded goods are capital-intensive, then increase in the relative price of capital will result in increasing trade deficits (Figure 4).

If we furthermore assume that saving and, accordingly, investment is an increasing function of the relative return on capital, the case considered in Figure 3 may not occur, while the case considered in Figure 4 is strengthened.

4. Price level effects

Under the conditions assumed in the preceding discussion, a change in exchange rate is a useless instrument for the attainment of equilibrium in foreign trade. Monetary factors

can be successful only if they have effects on the price ratio of the production factors.

Efforts to move from a disequilibrium to an equilibrium or from Y_1 to Y_0 in Figures 1 and 2 may cause trouble in practice, because a change in the factor-price ratio is hardly possible without a change in the general price level. If the price of traded goods is unchanged (a fixed exchange rate), the production of traded goods will not be expanded as assumed above. The possible result is that both capital and labour are underutilized.

In order to succeed in moving from Y_1 to Y_0 , a change in the factor price ratio should be combined with a change in exchange rate. Let us assume that the non-traded goods sector is capital-intensive. In order to reduce the trade deficit, both an increase in wages and devaluation would be required in this case. This is against the general view that these two measures are likely to eliminate each other. The practical explanation of the above result is obvious. An increase in the price of traded goods is essential in order for this sector to be able to buy resources from the non-traded goods sector.

The aspects mentioned above seem to imply that changes in the factor price ratio will cause lesser disturbances in the utilization of the resources in a flexible than in a

fixed exchange rate system. In other words, disturbances in the utilization of resources are less in the fixed exchange rate system, the less is the change in the general price level resulting from a change in the factor price ratio.

5. An empirical note

The phenomena presented in section 4 may be rather pronounced in the short term. Therefore, and for some other reasons, too, the theory presented in section 2 can explain only an average state of things over a long period. It can be noticed that there will be no pressure from the demand for the factors of production against the exogenous factor price ratio if domestic expenditure is managed as assumed.

Finland's trade balance has been in the deficit almost permanently since the liberalization of her foreign trade toward the end of the 1950's. At present, this experience could be seen, with good reasons, as part of a growth policy. However, when future economic developments were considered in the past, it was pointed out that the forecast foreign trade deficits had to be accepted to some extent, against wishes, because unemployment would otherwise be too high. The same seems to be the case even today; deficits are considered undesirable for capital accumulation but acceptable for the maintenance of employment.

Simultaneously with the foreign trade deficits, inflation and a regulation of nominal interest rates have produced a low real rate of interest, often even a negative one. It is largely accepted that this has made it difficult, in Finland's institutional framework, to achieve full employment. Furthermore, when forestry, mining and manufacturing (excluding food, tobacco, beverages and printing) are included in the traded goods sector, that sector's share in total employment is clearly smaller than its share in total domestic product¹⁾. In other words, the traded goods are capital-intensive and the non-traded goods are labour-intensive in Finland. We can conclude, that all of these facts are consistent with the theory presented in section 2.

1) The ratio a_t/a_n has varied in the vicinity of 0.75 without any obvious trend. a_i = the ratio between man years and the GDP ($i=t,n$). t =traded goods sector, n =nontraded goods sector. In this respect, Finland's economic structure seems to be far more clear-cut than Sweden's. See, Edgren, Fax  n and Odhner (1969, p. 143).

APPENDIX

Let's assume the following production functions.

$$(1) \quad Q_n = A_n K_n^{\alpha_n} L_n^{\beta_n}, \text{ for non-traded goods.}$$

$$(2) \quad Q_t = A_t K_t^{\alpha_t} L_t^{\beta_t}, \text{ for traded goods.}$$

$$\alpha_i + \beta_i = 1, \quad i = n, t.$$

The value of a marginal product equals the marginal cost of the factor for both factors and goods.

$$(3) \quad A_n \alpha_n K_n^{\alpha_n - 1} L_n^{\beta_n} \cdot P_n = R$$

$$(4) \quad A_n \beta_n K_n^{\alpha_n} L_n^{\beta_n - 1} \cdot P_n = W$$

$$(5) \quad A_t \alpha_t K_t^{\alpha_t - 1} L_t^{\beta_t} \cdot P_t = R$$

$$(6) \quad A_t \beta_t K_t^{\alpha_t} L_t^{\beta_t - 1} \cdot P_t = W$$

The full utilization of resources is assumed.

$$(7) \quad L_n + L_t = L$$

$$(8) \quad K_n + K_t = K$$

The equations (1)-(8) can be written as follows.

$$(1') \quad 1 = A_n a_{nKN}^{\alpha_n} a_{nLN}^{\beta_n}$$

$$(2') \quad 1 = A_t a_{tKT}^{\alpha_t} a_{tLT}^{\beta_t}$$

$$(3') \quad \alpha_n P_n = R a_{nKN}$$

$$(4') \quad \beta_n P_n = W a_{nLN}$$

$$(5') \quad \alpha_t P_t = R a_{tKT}$$

$$(6') \quad \beta_t P_t = W a_{tLT}$$

$$(7') \quad a_{nLN} Q_n + a_{tLT} Q_t = L$$

$$(8') \quad a_{nKN} Q_n + a_{tKT} Q_t = K$$

where parameters a_{IJ} are input-output coefficients

$$a_{nKN} = \frac{K_n}{Q_n}, \quad a_{tKT} = \frac{K_t}{Q_t}, \quad a_{nLN} = \frac{L_n}{Q_n}, \quad a_{tLT} = \frac{L_t}{Q_t}.$$

The exogenous factor price ratio is $h = \frac{R}{W}$.

Replacing the input-output coefficients in equations (1') and (2') by their expression in equation (3')-(6'), we have

$$(9) \quad \frac{P_n}{P_t} = \frac{A_t}{A_n} \frac{\alpha_t}{\alpha_n} \frac{\beta_t}{\beta_n} h^{\alpha_n - \alpha_t}$$

Denote $\mu = \frac{A_t}{A_n} \frac{\alpha_t}{\alpha_n} \frac{\beta_t}{\beta_n}$, Hence,

$$(9') \quad \frac{P_n}{P_t} = \mu h^{\alpha_n - \alpha_t}$$

The value of the domestic demand ($\tilde{E}$) is the instrument variable for economic policy. The demand for the non-traded goods is $n\tilde{E}$ and the demand for the traded goods is $t\tilde{E}$; $t=1-n$.

The equilibrium condition for the non-traded goods is $n\tilde{E} = P_n Q_n$ or $\tilde{E} = P_n Q_n / n$. Replacing P_n in this equation by it's expression in equation (9') we have

$$(10) \quad \tilde{E} = \frac{\mu}{n} h^{\alpha_n - \alpha_t} P_t Q_n$$

where P_t is exogenous (defined by international markets and foreign exchange rates).

Trade deficit equals the difference between the demand for and supply of the traded goods or

$$(11) \quad M - X = t\tilde{E} - P_t Q_t = \frac{t\mu}{n} h^{\alpha_n - \alpha_t} P_t Q_n - P_t Q_t$$

Let's assume $\alpha_t > \alpha_n$ i.e. the traded goods are capital intensive and the non-traded goods are labour intensive. Thus the conclusion on page 5 implies

$$(12) \quad \frac{\partial (M - X)}{\partial h} < 0$$

This is true, if $\partial Q_n / \partial h < 0$ and $\partial Q_t / \partial h > 0$.

Because of the full utilization of resources, these conditions can be written $\partial(Q_n/Q_t) / \partial h < 0$.

According to equations (7') and (8'), we have

$$(13) \quad \frac{Q_n}{Q_t} = \frac{a_{LT}^L K - a_{KT}^L L}{a_{KN}^L L - a_{LN}^L K}.$$

Therefore

$$(14) \quad \frac{\partial(Q_n/Q_t)}{\partial h} = \frac{(a_{LT}^L K - a_{KT}^L L)(a_{KN}^L L - a_{LN}^L K) - (a_{LT}^L K - a_{KT}^L L)(a_{KN}^L L - a_{LN}^L K)}{(a_{KN}^L L - a_{LN}^L K)^2}$$

This derivative is negative, because

$$1) \quad \frac{\partial a_{LI}}{\partial h} > 0, \quad I=T, N \quad \text{and} \quad \frac{\partial a_{KI}}{\partial h} < 0, \quad I=T, N$$

according to properties of production functions and cost minimization.

$$2) \quad a_{KN}^L L - a_{LN}^L K < 0 \quad \text{and} \quad a_{LT}^L K - a_{KT}^L L < 0$$

according to assumptions

$$\frac{K_n}{L_n} < \frac{K}{L} \quad \text{and} \quad \frac{K}{L} < \frac{K_t}{L_t}.$$

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