TARIFF PROTECTION IN THE U.K.,
PRICE-COST MARGINS
AND
CONSUMER WELFARE

A thesis submitted to the
University of Surrey
in fulfilment of the requirements for the degree of
Doctor of Philosophy
in
Economics
by
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To the loving memory of my mother
This thesis undertakes theoretical and empirical analyses to estimate the welfare effects of tariffs on U.K. imports of manufactured products. The analyses differ from the standard model of tariffs and welfare by explicitly allowing for product differentiation between imports and home products and for home firms' prices exceeding their costs of production.

The theoretical analysis makes use of a simple partial equilibrium model to examine the effects of tariffs on home industry's profit and on the welfare of consumers of home and foreign products. A prediction of the model is that tariffs may generate welfare gains as well as losses.

Estimation of the welfare gains and losses required quantitative information about the manner in which home firms' prices and output are affected by tariffs. This information was obtained with the help of multiple regression analyses involving a sample of forty U.K. industries.

The regression estimates of the price-output response of home firms were then used to estimate the welfare effects of a hypothetical cut in U.K. tariffs. The calculations suggest that tariff reduction may generate welfare losses well in excess of any corresponding welfare gain.
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# CONTENTS

## CHAPTER 1: TARIFFS AND ECONOMIC WELFARE: TRADITIONAL THEORY

1.1 Introduction ........................................... 1
1.2 The Traditional Theory of Tariffs ................. 2
  1.2.1 The 'Small' Country Case ...................... 3
  1.2.2 The 'Large' Country Case .................... 7

## CHAPTER 2: OLIGOPOLY AND PROTECTION

2.1 Home Firm is a Monopoly, Foreign Firms are Price Taker ........................................... 12
2.2 Oligopolistic Market with Product Differentiation ......................................................... 15
2.3 Summary and Conclusions .......................... 23

## CHAPTER 3: SURVEY OF THE RELEVANT LITERATURE

3.1 Import Competition, Domestic Market Structure, and Price-Cost Margin ............................ 26
  3.1.1 Import Competition and Price-Cost Margin ................................................................. 27
  3.1.2 Concentration and Price-Cost Margin ............................................................................ 28
  3.1.3 Barriers to Entry and Price-Cost Margin .................................................................... 31
  3.1.4 Report on the Empirical Findings ................................................................................. 34
3.2 Protection and Employment .......................... 39

## CHAPTER 4: IMPORT-COMPETITION, PROTECTION, PRICE-COST MARGINS AND OUTPUT OF U.K. MANUFACTURING INDUSTRIES

4.1 The Models ............................................... 45
4.2 The Variables and Data .............................. 46
4.3 Statistical Results ..................................... 49

(iv)
### CHAPTER 5: ESTIMATES OF THE WELFARE EFFECTS OF THE TARIFFS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Formulation of the welfare effects</td>
<td>59</td>
</tr>
<tr>
<td>5.2</td>
<td>Data Employed</td>
<td>67</td>
</tr>
<tr>
<td>5.3</td>
<td>The Estimates</td>
<td>72</td>
</tr>
<tr>
<td>5.4</td>
<td>Extensions and Limitations of the Analyses</td>
<td>80</td>
</tr>
</tbody>
</table>

### APPENDIX A

<table>
<thead>
<tr>
<th>App</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX A</td>
<td>83</td>
</tr>
</tbody>
</table>

### APPENDIX B

<table>
<thead>
<tr>
<th>App</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX B</td>
<td>85</td>
</tr>
</tbody>
</table>

### APPENDIX C

<table>
<thead>
<tr>
<th>App</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX C</td>
<td>89</td>
</tr>
</tbody>
</table>

### APPENDIX D

<table>
<thead>
<tr>
<th>App</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX D</td>
<td>96</td>
</tr>
</tbody>
</table>

### BIBLIOGRAPHY

<table>
<thead>
<tr>
<th>App</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bibliography</td>
<td>98</td>
</tr>
</tbody>
</table>
CHAPTER 1

TARIFFS AND ECONOMIC WELFARE:

Traditional Theory

1.1 Introduction:

Tariff policy has in most countries been a widely discussed issue, because it is believed to have important implications for the welfare of the countries concerned. Tariffs have been imposed at various times in history. During the eighteenth century and at the beginning of the nineteenth century tariffs were used primarily to raise government revenue, but since that time other motives have also played a part.

At the beginning of the present century and up to World War I, England and other European countries were free trading nations. However, the period between the two wars, particularly the period of the Great Depression, witnessed an increase in the use of tariffs and other trading impediments (1). Since World War II and until the early 1970s, the trend, especially among leading industrial nations, has been towards trade liberalisation. The Bretton Woods Conference held in 1944 was the starting point for a new world economic order. The "International Monetary Fund" (IMF, established in 1944) and the "International Bank for Reconstruction and Development" (IBRD, established in 1946) were all designed to take care of international economic affairs among the nations.

The establishment of these organisations was followed by the signing of the "General Agreement on Tariffs and Trade" (GATT, established in 1947); the latter provided the framework for international negotiation for tariff reduction.

The rules of GATT have two main provisions. They require that:

(i) any proposed change in the tariffs (or any other type of commercial policy) of a member country should not be undertaken without prior consultation of other parties to the agreement, and

(ii) the contracting parties should work towards the reduction of tariffs and other international trade impediments, and these efforts must be conducted within the framework of GATT.

The major principle of GATT is the maintenance of non-discrimination. This requires that a member country's tariffs, on a particular commodity, should not discriminate between other member countries.

Our major interest here is to study the effects of protection on the welfare of a country. These effects are likely to vary according to the method of analyses employed. Let us commence with a review of the "traditional model" for analysing the welfare cost of tariffs.

1.2 The Traditional Theory of Tariffs:

The traditional theory of tariffs has been formulated in the framework
of perfect competition, by which all the products in market are homogeneous, and there are no barriers to entry. In this theory the costs or gains of protection stem from the following sources:

(a) A misallocation of resources among producers
(b) A misallocation of expenditure among consumers
(c) The terms of trade effect

In the first instance let us ignore the effect of terms of trade. This means we are only concerned with "small" countries, whose tariffs do not affect the world price of the commodity in question.

1.2.1. The 'Small' Country Case:

The analysis can be presented with the use of Fig.(1). Importables are shown along the horizontal axis, while prices are represented vertically. The supply curve for the importables of domestic producers is SS'. The domestic demand curve for the product is dd'. This represents the demand for imports and domestic production combined. It is a compensated demand curve. This means that consumers are compensated against the loss of utility in their income. Thus the price change has only a substitution effect. OP is the world price. At this price home consumption is OC, of which OK is produced by domestic producers, and the rest is supplied by imports KC. With a tariff of PP'/OP per cent, the home market price will increase to OP'. This price rise will encourage the domestic producers to increase their output to OK', while home consumption will be reduced to OC', and imports will fall to K'C'. Now consider
the welfare effects of the tariff; the consumer surplus is reduced by \( PP'EF \). This is partly offset by an increase in producers' surplus \( PP'HG \), and revenues collected by the government \( HJDE \).

Therefore, two triangles \( GHJ \) and \( DEF \) represent the net welfare loss. These are called the production cost and the consumption cost respectively.

An alternative way of explaining the net welfare costs is as follows:

The production cost is the excess of the domestic cost of producing the amount of \( KK' \) compared with the cost of importing the same amount. Correspondingly, the consumption cost measures the loss of utility when consumption decreases by \( CC' \) over and above the saving in the cost of importing that amount. The above argument may easily be extended to deal with the case of a domestic monopoly. The main point is that, since the country is a price taker in world market, the monopolistic marginal revenue will equal the average revenue. Consequently, the price and output of the monopolist would be the same as that of the perfectly competitive industry, analysed above.

The two above-mentioned costs may be formulated as follows: If \( dC \) is the decrease in consumption, \( dQ \) is the increase in the production of home products, \( P_w \) is the world price of the product, and \( t \) is the tariff rate, expressed as a proportion of the world price. We can write:

\[
\text{Consumption cost} = \frac{1}{2} dC t P_w \quad \text{(1)}
\]
\[
\text{Production cost} = \frac{1}{2} dQ t P_w \quad \text{(2)}
\]
Therefore:

\[
\text{Total Costs} = \frac{1}{2} (dC + dQ) tP_W
\]  

(3)

The decrease in the values of imports \((dM)\), resulting from the imposition of a tariff is equal to the sum of the decrease in consumption \((dC)\) - the direct price effect - and the increase in production \((dQ)\) - the substitution effect. Thus:

\[
dM = dC + dQ
\]  

(4)

Substituting equation (4) into (3) we have:

\[
\text{Total costs} = \frac{1}{2} (dM) tP_W
\]  

(5)

where \(dM = e_m \left( \frac{dP}{P_W} \right) M\)

(6)

Therefore:

\[
\text{Total costs} = \frac{1}{2} \left( e_m \frac{dP}{P_W} \right) M tP_W
\]

\[
= \frac{1}{2} e_m t^2 P_W M
\]  

(7)

where \(e_m\) is the price elasticity of imports, and \(M\) is the volume of imports before tariff imposition. It is well known that the price elasticity of imports is a weighted average of the price elasticity of domestic demand and of domestic supply. This is proven as follows:

We had:

\[
dM = dC + dQ
\]  

(4)

where \(dC = e_c \frac{dP}{P_W} C\)

(8)
\[ dQ = e_Q \frac{dP}{P} \cdot Q \] (9)

Therefore:

\[ dM = \frac{dP}{P} \left( e_C - e_Q \frac{Q}{M} \right) \] (10)

Dividing both sides by \( M \), we obtain:

\[ \frac{dM}{M} = \frac{dP}{P} \left( e_C - e_Q \frac{Q}{M} \right) \] (11)

so that:

\[ e_m = \frac{dM}{dP} \frac{M}{P} = e_C - e_Q \frac{Q}{M} \] (12)

where \( e_c \) is the price elasticity of demand for the product, and \( e_Q \) is the price elasticity of the domestic supply of the product.

1.2.2. The "large" country case:

Up to this point the analysis has considered the case of a "small" country, which is a price taker in the world market. Relaxing this assumption leads to the possibility that the tariff will improve the country's terms of trade. This "terms of trade" effect is a source of welfare gain to the country and must be set against the two elements of welfare loss discussed above. This case is presented in Fig.(2). Imports are shown on the horizontal axis and prices on the vertical axis. The foreign supply curve is \( HH' \). The domestic demand for imports is shown by \( DD' \); this is obtained by subtracting the domestic supply of the product from the home demand for the product. \( OW \) is the import price under free trade. The amount imported is \( OM \). Now suppose a tariff of \( \frac{WU}{OW} \) per cent is imposed. The tariff-inclusive foreign supply curve is \( VV' \). The equilibrium
FIGURE 2
domestic price will now be $OZ_1$ the foreign price will be $OZ$ and the quantity of imports will be $OM_1$. In comparison with the free trade situation the foreign price has been lowered by $Z_1W$. The amount of duty collected by the government will be $ZZ_2GJ$. Against this is the welfare loss $WZ_1GQ$, showing the loss to consumer surplus (net of the gain to produce surplus). This means that the country has a welfare gain if $ZWKJ$ exceeds $GKQ$. The essence of the above argument is that a "large" country may benefit from imposing an appropriate rate of tariff. The present study is concerned with the U.K. manufacturing industries in 1963 and 1968. At that time the U.K. had not yet become a member of European Economic Community (EEC). The imports of the manufacturing goods to the U.K. in comparison with the world demand for these goods were not at that time large enough to characterise the U.K. as a large country. We are therefore faced with a "small" country case with respect to the purpose of this research.

The analysis has so far dealt with the simple case of only one imported good. Extending the analysis to the case of two or more imported goods raises two problems, discussed among authors by H.G. Johnson (1971). Firstly, tariffs may lead to substitution between foreign goods and domestic goods, and secondly, some goods may begin to be produced for the first time. However, as Johnson had shown an evaluation of the effects of these two possibilities requires information concerning the substitution elasticities among different foreign and domestic goods. As such information cannot readily be obtained for the U.K. we will therefore abstract from
these problems in this study.

The standard model assumes that domestic firms set their prices equal
to marginal costs, which - in equilibrium - equals the long-run average
cost. This assumption, however, is at variance with empirical
evidence (1), which suggests that, firms are able to raise their prices
above long-run marginal costs, and thereby earn excess profits. In

In view of such evidence it seems desirable to extend the welfare
analysis of tariff and explicitly allow for situations in which firms
set their prices above the competitive level. This is the subject
of the next chapter.

This chapter extends the analysis of tariffs and their welfare effects by incorporating the role of large domestic firms, whereas in the traditional theory of tariffs, concerned with situations of pure competition, the equilibrium market price always equals the long-run marginal costs of production. The existence of large firms in the economy suggests that prices are likely to exceed the marginal cost even in the long-run. The ability to raise price above the marginal cost may be greater the greater the market power of the firm. Market power in the present context should allow for the degree of foreign competition. Imports are likely to exert an important negative influence on profit margins. Conversely, tariff may increase the margins.

The important implication of the above argument is that if the home industry is dominated by few large firms, the imposition of tariffs may generate welfare gains as well as losses.

The task of this chapter is to analyse these gains and losses. Ideally, such analysis requires a model of tariffs in the context of an oligopolistic market. In practice, however, such a model would face the problem that an oligopolistic firm's reaction to tariffs may depend on the reactions expected from home and foreign rivals. Archibald (1959) has argued that the number of competing firms is not an important factor. What is important is the firm's presumption of its rivals behaviour. The firm concerned may simply ignore the
entire matter, or, alternatively, it may attempt to anticipate the
nature of its competitor's reactions. In order to avoid the
problem of interdependency, we will assume that the home industry
consists of either a monopoly, or in the instance of an oligopoly,
the firms pursue a policy of joint profit maximisation. With
regard to the relationship between the home firms and the foreign
rivals, we will consider two alternative cases.

2.1 Home Firm is a Monopoly, Foreign Firms are Price Followers

Here, we assume that home and foreign firms produce homogeneous
products. The dominant home firm seeks to maximise its profits
subject to the constraints of import competition. Foreign suppliers
behave as atomistic firms: they perceive their average revenue curve
in the home market to be perfectly elastic at each price and set their
marginal cost equal to their price. In Figure (1) prices and tariffs
are shown along the vertical axis, while output and imports are
measured on the horizontal axis. DD' is the domestic demand curve for
the commodity.

Initially, we will consider the case to be linear, the non-linear case
will be explained later. In the absence of imports, DD' is also the
average revenue curve facing the home firm: MC is the marginal cost
curve for the domestic producer. SF is the supply curve of foreign
firms. The average revenue curve for the home producer is now
obtained by the horizontal differences between DD' and SF. The
resulting curve is shown by HH', the corresponding marginal revenue
curve is rr'. Before the imposition of tariffs, the home firm produces
OQ₀ and sets the price at OP₀. Given the price, the foreign producers
sell the amount \( Q_0 Q_1 \). Now consider an ad-valorem tariff of, say, \( \frac{P_0 P_1}{Q_0} \) per cent. The tariff shifts \( SF \) to \( S'F' \), and consequently the excess demand curve will shift upward to \( JJ' \). Following the shift in the excess demand, the marginal revenue curve \( rr' \) will also shift upward to \( UU' \). The profit maximising price for the home firm will now be \( OP_d \) and at this price the home firm can increase its production to \( Q_2 \). Given this price \( (OP_d) \), the foreign suppliers (behaving as atomistic firms) will lower their price (the tariff exclusive price) to \( OP_f \), and the quantity of imports will also be reduced to \( Q_2 Q_3 \), \( (Q_2 + Q_3 Q_1 \) less than its free trade level). In comparison with the free trade situation the foreign price is reduced by \( P_0 P_f \). The amount of duty collected by the government will be \( P_0 P_f KL \), against this is the loss of consumer surplus represented by the area \( P_0 P_3 N_3 M_1 \). Moreover, what is new is that the tariff increases the profit of the home firm by \( (P_0 P_3 N_3 M_2 + W_0 M_2 M_2 W_2) \), and that this may, together with the effect of the "Terms of Trade", offset and even exceed the loss of consumer surplus. Thus we find that the tariff brings a net gain (loss) in welfare accordingly:

\[ W_0 M_0 M_2 W_2 + P_0 P_3 K_0 L > M_3 N_3 M_1 \]

The results here are not surprising in view of the analyses of J. Bhagwati and V.K. Ramasawi (1963) and Johnson (1971) which argued that in the presence of domestic distortion tariffs may increase or decrease welfare. That is, free trade is not optimal, and thus tariffs as a second distorting factor may help the attainment of an optimum situation (1).
a linear case, price and output will both rise, but in non-linear cases other outcomes are possible. For example, in a constant elasticity case (explained in Appendix A), where the elasticity of foreign supply equals the elasticity of home demand, the tariff will not affect the price, so the output will increase. However, there are other cases in which the non-linearity of foreign supply and domestic demand is accompanied by changeability in these price elasticities. In such a case as Finger (1973) has argued an upward shift of demand may coincide with a sufficiently large reduction of the elasticity of demand, that the monopolist's marginal revenue curve shifts downward and it becomes profitable for the monopolist to further restrict its output or reduce its price.

2.2. Oligopolistic Market With Product Differentiation

In the previous model we assumed that home and foreign products were homogeneous - that was in keeping with the assumption of the standard theory of tariffs. However, this assumption seems at variance with the conditions in the U.K. case. Casual observations show that the competing imports are often differentiated from the home goods. It therefore seems desirable to relax the assumption of product homogeneity and this will also allow us to distinguish between groups of consumers according to whether they consume home or foreign goods.

To simplify the analysis we will make the following assumption in addition to those which have already been imposed by the previous model.

(i) All imports consist of a single homogeneous product.

(ii) The C.I.F. price of import is independent of the home price.
The latter assumption enables us to avoid the problem of interdependent pricing discussion under oligopoly. This is justified if foreign firms' sales to the U.K. are a small proportion of their total sales. The price-quantity relationship for the home products and imports are shown in Fig.(2). Quantities produced and imported are shown on the horizontal axis; prices and tariffs are along the vertical axis. D_1D_1 is the demand curve for home products when the price of foreign products equal their C.I.F. price. Before the imposition of a tariff the marginal revenue curve intersects the marginal cost curve (MC) at C_1. Therefore, the price is set at Q_2P_1 and the quantity is Q_2Q_1. At this price the demand curve for foreign goods is shown by F_1F_1. As can be seen, the foreign suppliers sell the amount of Q_2M_1.

Let us now suppose that a tariff of \( \frac{W_1W_2}{Q_2W_1} \) per cent is imposed. The price of imports rises to Q_2W_2. This will reduce the imports of Q_2M_2. There will consequently be a loss of consumer surplus equal to W_2W_1TS. Of this, W_1W_2TR will be offset by the collection of tariff duties by the government. The remaining segment TRS is a welfare loss for the country. (1) The rise in the import price will also shift the home firms' demand curve to D_2D_2. Those firms may now increase their output and/or increase their price in order to maintain maximum profits. The policy to pursue will depend on the consequent change in the price elasticity of the shifted demand curve.

Initially, we can assume that the elasticity is not affected by the shift of the curve. Considering firms do not increase their price,

(1) The assumption of import prices being independent of home prices enables us to abstract from the terms-of-trade effect. Relaxation of this assumption will necessitate the inclusion of the effect of the terms-of-trade in our analysis: W_1W_2TR will be the lower bound of the government revenue, while W_1W_2TS will be the upper bound of the loss of consumer surplus to the consumers of foreign goods.
but merely increase their output. This means that consumers who had bought the home products before the tariff will not suffer any loss of welfare. The firms' profit will increase by $C_1H_2C_2'$ indicating a welfare gain for the country. Thus the net welfare change will be a gain or loss according to $C_1H_2C_2' < \text{TRS}$.

We will now allow for the possibility that the tariff induces an increase in the price of the home producers as well as in their output. Let the price rise to $0_p^*$. The increase in the profit will now be $C_1^2C_2^2 + P_2A_2^3C_3H_3C_2^2$. The total loss of consumer surplus is $P_3A_3H_3^2$ suffered by consumers of home produced goods plus $W_1W_2TS$ suffered by consumers of foreign produced goods. The net welfare effects will, therefore, be a gain or a loss according to $C_1H_3C_3 > A_2H_2 + \text{TRS}$. Clearly, the likelihood of a welfare gain (loss) is smaller (greater) than that in the previous case where the home price was not affected by the tariff. Thus, as in the homogeneous products model, we can state that the possibility of a welfare loss increases the greater the increase in the home firm's price and the smaller the increase in its output.

Up until now we have assumed that home producers perceive their demand curve as smooth, continuous and downward sloping. However, it is interesting to note that the same results will be obtained under an alternative model, namely the kinked demand curve model.

The kinked demand curve argument is that a firm in an oligopolistic setting views its average revenue curve as consisting of two parts.
The firm believes that its rivals have asymmetric response to price changes. It believes that they will quickly match its own price reductions, but only hesitantly and incompletely (if at all) follow its price increases. This pattern of expected behaviour produces a kink in the perceived demand curve facing the oligopolist. The argument is presented with the use of Figure (3). Output is shown on the horizontal axis, while price is on the vertical axis. $D_1$ is the perceived demand curve by the individual firm, while the $D_1D_1$ curve shows the amount of demand going to a firm when all firms are charging the same price.

As the average revenue curve is kinked at point $K$, the associated marginal revenue curve will be discontinuous below this point. Consequently there is a "gap" between the two segments $(r_1, r_1', r_1')$ of the marginal revenue. As Stigler (1947) argues, the length of the discontinuity in marginal revenue is proportional to the differences between the slopes of the demand curve on the two sides of the kink. He also states that the discontinuity will be larger the more similar the products, because customers will shift more rapidly to the low-price firms. The marginal cost curve is shown by $MC$. If the marginal cost curve intersects the marginal revenue curve in either of the two segments, the price and the output will be determined in accordance with the profit-maximisation conditions. However if the cost curve cuts the discontinuous part of the marginal revenue curve the price-output combination will coincide with the kink at $K$.

Now let us turn to the effect of trade and tariffs. To simplify the analysis we hold to the assumptions set out for the previous model.
The analysis is presented with the help of Figures (4a) and (4b). Figure (4a) shows the output of the home firms, while (4b) shows imports. $d_iK_1D_1$ is the kinked demand curve for the home products, which is regarded as the average revenue curve by home producers. The lower part of the kinked demand curve $(K_1D_1)$ expresses the behaviour of all firms (foreign and domestic) in the market. Thus a price change in the lower part of the curve will stimulate retaliatory reactions of foreign firms, while in the upper part $(d_iK_1)$ a price rise will not necessarily be copied. The relevant marginal revenue curves are $r_1r_1$ and $r_1'r_1$. $MC$ is the marginal cost curve. $FF$ is the demand curve for imports. Before the imposition of a tariff the kink is at price $O_{dP_1}$. Home firms produce $O_{dQ_1}$ and total imports are $O_{fM_1}$. Now supposing a tariff of $\frac{W_1W_2}{O_{fM_1}}$ per cent is imposed. The price of imports rises to $O_{fW_2}$ and the demand for imports falls to $O_{fM_2}$. The result is a loss of $W_1W_2TS$ in the consumer surplus of those who consumed foreign goods. Of this amount $W_1W_2TR$ will be offset by the collection of tariff duties by the government. The remaining segment $TRS$ is a welfare loss for the country. This loss should be set against any losses or gains obtained from the induced changes in the price and/or the output of home firms.

The increase in the price of imported goods results in an increase in the demand for home produced goods. This will shift the two parts of the kinked demand to a new position. The effect on price and/or output of the home producers will therefore depend on how these shifts come about, or in other words, where the new kink is set up. Initially, we assume that the kink shifts in such a way that home price remains
FIGURE 4
unchanged. The output of the home producers will therefore increase to $O_2$. Since the cost is assumed to be constant, the result will be an increase in the profits of home firms, by an amount $C_1 K_1 K_2 C_2$. The net welfare effect will be a gain or a loss according to:

$$C_1 K_1 K_2 C_2 > < TRS$$

However, the kink may shift to such a position that the expansion of output is accompanied by a price increase. This is shown on the Figure when the kink is at $K_3$. The increase in the profit will now be $C_1 K_1 K_2 C_2 + E P K_3 Z - Z K_2 C_2 C_3$. The total loss of the consumer surplus is $E P K K_3$ suffered by consumers of home produced goods, plus $W_1 W_2$ suffered by consumers of foreign produced goods. The net welfare effect will therefore be a gain or loss according to

$$C_1 K_1 Z C_3 > < TRS + Z K_3 K_2$$

As can be observed, a rise in the home price brings an additional loss of consumer surplus (suffered by those who consume home products) and reduces the level of domestic output. It is therefore justified to state that the larger the increase in the home price, the larger the loss of consumer surplus and the smaller the level of home products. In other words, the likelihood of a welfare loss will be smaller (greater) the smaller (greater) the increase in the home price. The same conclusion can be drawn from the analysis of the former model.

2.3 Summary and Conclusions

In our first model we have shown that in a market where products are homogeneous and foreign firms take the price set by the domestic
monopoly, the imposition of tariffs may increase the profits of home firms as well as reducing the consumer surplus. The increase in the profit occurs through an increase in the price or/and an expansion in the firm's output. The derived conclusion seems consistent with those found by J. Bhagwati and V.K. Ramasawi (1963) and H. Johnson (1971) that tariffs in the presence of domestic distortion may increase or decrease welfare.

In our second model, we relaxed the assumption of product homogeneity. Correspondingly, consumers were divided into two groups according to whether they preferred home or foreign goods. As in the homogeneous product case, price and/or output could both be affected by the tariff. The analysis of the model indicated that welfare gain (loss) would be smaller (greater) if the home price was not affected by the tariff. Finally, we showed that the same conclusion could be reached from a third model, namely that involving the kinked demand curve.

In brief, the analysis of our three models showed that the imposition of a tariff may generate either a welfare gain or a loss. The welfare gain is the result of the impact of tariff on the profits of the home firms. The increase in the profits occur through either an expansion of the home firms' output or an increase in their price or a combination of both. Furthermore, the analyses showed that the likelihood of a gain (loss) is smaller (greater) if the price of domestic firms is affected by the tariff.

Our main purpose now is to use the above analysis to estimate the welfare effect of tariffs in the United Kingdom. To do this we will
need to run some econometric tests in order to examine the effects of tariff and import-competition on the prices and output of home firms. But before carrying out such tests we will review the empirical work undertaken in the field by other economists.
CHAPTER 3

SURVEY OF THE RELEVANT LITERATURE

The theoretical analysis of the previous chapter indicated that in an oligopolistic market tariffs may either increase or decrease home welfare depending on the effects of the tariffs on the price and output of domestic firms. This chapter surveys the relevant economic literature to discover what the empirical evidence indicate about the effects of tariffs and import competition.

Strictly speaking, the empirical literature is not directly concerned with the effect on home price. However there are a considerable number of investigations into the effects on the price-cost margin. Since protection is unlikely to have any systematic effect on the firm's costs, the results for the price-cost margins may be considered as indicative of the effects on home prices.

3.1 Import Competition, Domestic Market Structure, and price-cost margin:

Economic theory suggests that the structural feature of an industry influences the performance - price, output, and profits - of the firms in the industry. During the last three decades several empirical studies have examined the relationship between the market structure and profitability. Initially, these investigations were concerned only with the closed economy, indicating that profitability is influenced only by the structure of the domestic market. More recent studies have also incorporated foreign competition and protection as contributory factors. Here we will primarily survey the latter type of studies.
3.1.1. **Import Competition and Price-Cost Margin**

Import competition may reduce the market power of the dominant firms in a given industry. In effect, this represents entry by foreign competitors and therefore distorts domestic seller concentration.

The effect of foreign entry on home firms' prices and consequently on their price-cost margins to a great extent depends on the existing product differentiation between home and foreign goods. In a situation that imported and domestic products are homogeneous, a substantial amount of imports or the threat thereof may encourage domestic firms to set import-entry forestalling prices approaching competitive prices. This view was first advocated by Esposito and Esposito (1971). The implication of this view is that imports have a negative impact on the price-cost margin of import competing industries.

In the presence of product differentiation the behaviour of competitive import prices may have no significant effect on the price of domestically produced manufacturers. This view is backed by the empirical findings of Coutts, Godley, and Nordhaus (1978). However the effect of foreign entry on home firms' concentration may contribute to a reduction in the home firms' profitability.

In brief, if import competition is believed to have a negative effect on the home firms' profitability, tariffs will conversely be expected to exert a positive effect on price-cost margins. We are, therefore, faced with a choice of using either imports or tariffs as a measure of
the intensity of foreign competition.

There is further the question of which type of tariff rates can most suitably be employed. Some economists, like Mcfetridge (1973) and Hitiris (1978), advocated the choice of effective tariff rates in preference to the nominal tariff rates. The argument is, that tariffs simultaneously provide subsidies to the domestic production of the goods on which they are levied, and impose taxes on the domestic goods which are inputs. Thus, a tariff on inputs used in the import competing industries constitutes a subsidy on imports. Effective protective rates emphasize the importance of tariffs, taxes and subsidies, on the final products and intermediate inputs. They are therefore a measure of the afforded degree of protection most relevant for the study of profits.

The opposing views are based on the fact that the effective tariff rate is usually calculated under conditions of perfect competition, and therefore cannot be an appropriate measure, used in a study based on the conditions of an oligopolistic market.

3.1.2. Concentration and Price-Cost Margin

Given the cost conditions of the firms and the market demand, we expect that prices will be higher under conditions of monopoly than under conditions of competitions. In an oligopolistic situation we expect to observe a positive relationship between industry price and the degree of seller concentration. The reason for expecting such a positive relationship is that the higher the level of seller
concentration, the more likely it is that the dominant firms will be
able to collude, tacitly or expressly, to raise prices above the
long-run average cost.

The theoretical relationship between the market power of firms and
the degree of concentration has been shown by T.R. Saving (1970).
He made use of a model in which an industry consists of a few large
firms that function as a cartel and a large number of smaller firms.
The operating assumption is that the dominant firms set the price
and allow the smaller firms to sell at that price. Thus the latter
firms behave as atomistic firms in perfect competition. Let there
be \((n)\) minor firms and \((K)\) dominant firms. Market demand \((D)\) is a
function of the market price \((P)\).

\[
D = f(P) \quad (1)
\]

The quantity supplied by the \((n)\) smaller firms \((S_n)\) is a function of
the price \((P)\).

\[
S_n = g(P) \quad (2)
\]

As the market is cleared at all times, the demand function for the
large firms \((D_K)\) is the difference between (1) and (2).

\[
D_K = f(P) - g(P) \quad (3)
\]

Now assuming that \(f\) and \(g\) are continuously differentiable, we have:

\[
\frac{dD_K}{dP} = f'(P) - g'(P) \quad (4)
\]
and so the elasticity of demand facing large firms is:

\[ \eta_K = \frac{f(P)}{D_K} \eta_D - \frac{g(P)}{D_K} E_n \]  

(5)

Where \( \eta_K \) and \( \eta_D \) are respectively the demand elasticities for the large firms and for the market, and \( E_n \) is the supply elasticity for the smaller firms.

Equation (5) may be related to Lerner's (1933) measure of monopoly power. Lerner's measure is defined as:

\[ \lambda_K = \frac{P - MC_K}{P} \]  

(6)

Where \( \lambda_K \) is the K firms Lerner index and \( MC_K \) is the joint marginal cost for the K largest firms. If we assume that joint profits are maximised at all times, (6) becomes:

\[ \lambda_K = \frac{P - P \left\{1 + \frac{1}{\eta_K}\right\}}{P} = - \frac{1}{\eta_K} \]  

(7)

Since the R.H.S. of (7) is simply the negative invers of (5), the Lerner's index may be written as:

\[ \lambda_K = \frac{1}{\left[ \frac{f(P)}{D_K} \eta_D \right] + \left[ \frac{g(P)}{D_K} E_n \right]} \]  

(8)

Defining the concentration ratio as the percentage of industry sales accounted for by the K firms \( C_K = \frac{D_K}{D} \), equation (8) can now be expressed in terms of \( C_K \) (industry concentration ratio).
Therefore given the framework of the dominant firms' model, the degree of monopoly power is positively related to the concentration ratio.

3.1.3. Barriers to Entry and Price-Cost Margin

Concentration itself may be a parameter. In fact it may be influenced by barriers to entry to the industry. Established firms may create entry barriers to deter new-comers to the industry. These barriers may directly and indirectly enable established firms to earn excess profits. As Bain (1956) suggested the conditions of entry may have a significant influence on the pricing behaviour of existing firms. Given significant barriers the price can exceed the minimum long-run average cost.

Entry barriers arise from the following sources: scale economies, product differentiation, absolute cost advantages, and capital requirements.

(a) **Scale Economies**:

Production and distribution costs per unit of output may decline as the scale of plant or firm is expanded. The smallest scale of operation at which a plant or firm may achieve the lowest attainable unit cost is referred to as the minimum optimal scale of the plant or the firm. An entrant to industries where the minimum optimal scale

\[
\lambda_k = \frac{-c_k}{\eta_D + \frac{1}{n} \{c_k - 1\}}
\]
is significantly large would anticipate higher than minimum attainable costs (due to suboptimal scale). This is likely to deter entry. This entry-barrier may enable the established firms to raise their prices at least somewhat above their minimum attainable average costs without attracting entry. Thus relatively large minimum optimal scales may make for high concentration and high margin.

(b) **Product Differentiation Advantages**:

Product differentiation is propagated by differences in the design or quality of competing products and by the sales and advertising efforts of sellers. Buyers may have a preference for the products of established firms as compared with the products of new entrants. This may itself be a source of barriers to entry.

Economic theory suggests that as a consequence of product differentiation, the seller gains some independent jurisdiction over his price, relative to the price of his rivals, which he would not have if the competing products were part of a single homogeneous, standardised commodity. Thus, firms producing such products may raise their prices somewhat above those of their rivals without losing all of the customers.
(c) **Absolute Cost Advantages**:

Established firms may also have an absolute cost advantage over potential firms. The long-run average cost curve of the new entrant (showing the relation of the scale of operation to unit costs of a firm) would then lie above that for the established firms. The sources of absolute cost advantages are as follows:

(i) Established firms may control superior production techniques.

(ii) There may be imperfections in the markets for productive factors purchased by all firms which permit established firms to employ such factors at relatively lower prices.

(iii) Strategic factor supplies; established firms may have control over factors such as new materials.

(d) **Capital Requirements**:

Capital costs are fixed costs which are incurred regardless of the level of output. These costs differ between industries. High capital requirements thus insulate existing firms from the potential competition of new-comers. We may expect capital intensive industries to make for higher concentration and higher price-cost margins.

Here we report the findings of eight studies which have examined the relationship between price-cost margin (or profit margin) and market structural factors in an open economy.


Most of the above studies employed multi-variate regression analysis in order to explain the relationship in question. However, E. Pagoulatos and R. Sorensen (1976) used joint generalised least squares (1) in addition to multi-variate regression analysis in their investigation.

In general, an industry's profit ratio is measured by one of the two following fractions:

---


Price-cost Margin = \frac{(Total Industry Sales - (Payroll + Depreciation + Other Fixed and Variable Costs))}{Total Industry Sales}

Profit Margin = \frac{(Net Output - (Payroll + Depreciation + Other Variable Costs))}{Net Output}

However in some of the above-mentioned studies, the adopted measures were slightly different from those given above. L. Esposito and F. Esposito (1971) took profit (after tax) as a percentage of net worth (instead of total sales) to measure profit ratio. E. Pagoulatos and R. Sorensen (1976) defined price-cost margin as the net return (valued added - payroll - depreciation) expressed as a percentage of industry sales. J. Jones, L. Laudadio, and M. Percy (1977) took the ratio of profits plus interest to total assets in order to measure industry profit ratio.

The empirical results of the above-mentioned studies are summarised as follows:

Import Competition or Trade Protection

The effect of foreign competition on price-cost margin has been tested either by using the import/sales ratio or the tariff rates.

Esposito and Esposito (1971), Khalilzadeh-Shirazi (1974), Pagoulatos and Sorensen (1976), and J. Jones, L. Laudadio and M. Percy (1977) found the import-sales ratio had a significant negative effect on industry price-cost margins. Though Hart and Morgan (1977) found
McFetridge (1973) seems to have been the first who investigated the effect of tariff protection. Using the effective rate as a measure of protection, he failed to find any significant effect on the profit margin. On the other hand, T. Hitiris (1978) who also used the effective rate measure, found a highly significant relationship with the price-cost margins. H. Bloch (1974) was concerned to see whether the effects of tariffs were interdependent with those of concentration. He found that the interdependence is such that the price-cost margin tends to be higher when tariffs and concentration are both high, but high tariffs and low concentration have no significant influence on the margins.

Concentration:

Overall, concentration showed a positive, consistent, and statistically significant relationship with price-cost margin in almost all the studies concerned. There is, however, some evidence of multicollinearity between concentration ratio and the capital intensity factor. The other important outcome of these studies is the appearance of less significant results for small economies. This is shown in the empirical findings of E. Pagoulatos and R. Sorensen (1976). The study in part tries to explain the relationship between price-cost margin and concentration for five EEC countries (France, Italy, Netherlands, Germany, and Belgium). The results of the study suggest that domestic industry concentration does not necessarily reflect the degree of monopoly power in small relatively "open" economies.
Barriers to Entry

With the exception of H. Bloch (1974), E. Pagoulatos and R. Sorensen (1976), and T. Hitiris (1978), the other aforementioned studies included scale economies in their analyses in order to explain the changes in price-cost margins. L. Esposito and F. Esposito (1971) took the ratio of average plant size to total industry output as a measure of scale economies\(^1\). Average plant size was calculated for the largest plants supplying approximately fifty per cent of the industry. D. McFetridge (1973) took the percentage of industry shipments accounted for by the largest four establishments as a measure of scale economies. J. Khalilzañeh-Shirazi (1974) took the size of the "mid-point" plant as a percentage of industry net output to measure scale economies\(^2\). Size is determined by employment. The same technique was employed by Jones, Laudadio, and Percy (1977). However, due to data constraints there was a slight difference in their calculation of the average plant size for Canada and America. The authors took the average plant size of the largest establishments accounting for 50 per cent and 80 per cent of the industry output for the U.S.A. and Canada respectively. These were expressed as percentages of industry output. Hart and Morgan (1977) took the medium size of enterprise by employment as a measure of scale economies.

\(^1\) Camanor and Wilson (1967) were the first who used this method

\(^2\) L. Weiss (1963) was the first one who employed this method to estimate "minimum optimal scale".
Esposito and Esposito (1971) collected varying results. The relationship between scale economies and price-cost margin was negative and significant for producer good industries but not for the consumer good industries. McFetridge (1973) and Hart and Morgan (1977) found insignificant relationship between scale economies and price-cost margin. Jones, Laudadio and Percy (1977) found a positive and significant relationship for consumer good industries only for the American sample. For other samples the results were insignificant. Since there was evidence of multicollinearity between scale economies and concentration ratio, the authors regarded their results with caution. Khalilzadeh-Shirazi (1974) found the relation very significant.

Product differentiation is measured as the percentage of advertising expenditure on total industry sales. All of the above-mentioned studies, with the exception of Hitiris (1978) found support for the hypothesis and there is a positive relationship between industry's price-cost margin and its advertising intensity.

Capital requirement, often expressed as the ratio of an industry's capital assets on sales, has also been used in some of the studies e.g. Esposito and Esposito (1971), Khalilzadeh-Shirazi (1974), Jones, Laudadio and Percy (1977) and Hart and Morgan (1977). Most of these studies found a statistically significant relationship with the price-cost margin. The interpretation of this result, however, is problematical, because of evidence of multicollinearity between this factor and the concentration ratio.
In assessing the effects of protection on the output of a firm, the measurement of output appears as a problem. Ideally, one would like to employ a physical measure in quantifying the real change in output. But such a measure has little practical use in a study concerned with a group of commodities. The alternative is to either use the money value of output (total sales) or an input factor related to output, such as the level of employment or capital. Neither of the above measures (for the following reasons) can adequately express the real change in output. The price of a product may change and consequently increase the total revenues, but such an increase could have also occurred if the level of output had risen. Therefore, it is difficult to specify the reason for which the value of output has risen. One can directly relate employment to output, but a change in employment can also be due to changes in factors like productivity or capital intensity, and not necessarily to the change in output.

However, in economic literature one does not often come across empirical studies which investigate the effect of protection on industries’ output. Thus this section surveys some relevant economic literature to observe the impact of protection on employment. The empirical evidence of the effects of protection on employment may be classified into two groups. The first group considers the effect of protection on employment, as the outcome of a direct relationship between the number of job losses, and the import/output or tariff ratio. From this group of studies we will mention three pieces of
work, two conducted by the International Labour Office (ILO) and one by the Organisation of Economic Co-operation and Development (OECD).

In the second type of studies, employment is an endogenous variable which may be related to international trade, labour productivity, consumption, and various other factors. From this group two recent studies will be mentioned.

The first ILO study (1968) attempted to assess the number of employment opportunities lost, as the result of increasing imports from developing countries. The study treated the imports of manufacturers and semi-manufacturers from developing countries as competitors of the product of domestic manufacturers in the developed countries. This was undertaken for the period 1961-65 and dealt with eight selected groups of industrial products in the three major industrial areas, namely North America, the EEC, and the EFTA. The study considered the direct employment effects only; the indirect effects from other inter-industry relations were not taken into account. Its procedure assumed that, during the period under study, everything else but imports and employment remained unchanged.

The results suggest a displacement of less than 0.2% of the total manufacturing employment in each industrial area.

The second study of the ILO (1971) aimed at estimating the effect of removal, or reduction of trade barriers (against imports of
Manufacturers of developing countries on employment in the developed countries. These estimates were based on Professor Balassa's (1968) study of the probable increase in imports of manufactures from developing countries to the U.S.A., the U.K., the EEC, and the EFTA. He forecasted the increase in imports due to the elimination of tariffs. The ILO study showed that the Kennedy round had only negligible effects. For the hypothetical case of the total elimination of tariffs, the results were rather interesting. For example, in the U.S.A. the decrease in employment caused by the increased importation of manufactures from developing countries, amounted to less than 0.16% of the total manufacturing employment. The results for the U.K., EEC, and EFTA, were a decrease of 0.027%, 0.083%, and 0.071% respectively in the total employment of the manufacturing industries.

A similar approach was taken in the study by J. Little, T. Scitovski, and M. Scott (1970) for the OECD Development Centre. The authors attempted to measure the level of unemployment in the OECD countries, which would result from a hypothetical expansion in imports of manufactures from the developing countries. The results showed a loss of 750 thousand jobs in these countries. The lost jobs consisted of a reduction of 0.5% and 4.9% in the employment of the manufacturing sectors in the U.S.A. and the U.K. together with EEC countries, respectively.

In a more recent study E.E. Leamer, R.M. Stern and C.F. Boun (1977) took a different approach to study the effect of foreign competition on manufacturing employment in the industrial countries. They
assumed that the level of employment in an industry can be explained partly by a set of "resource variables" and partly by a set of "resistance factors". The "resource variables", such as factor endowments, determine the special productive capacities of the country, while the "resistance factors", such as tariffs and transportation costs, determine the country's access to international markets. The authors' general hypothesis was that, countries economise on their relatively scarce resources. Thus relative scarcity of resources and openness of markets determine the allocation of production across industries. Their model is specified as follows:

\[ nQ = a + bX + (\gamma + \lambda X)/(1 + t) \]

Where \( Q \) = output, \( X \) = level of resource variables, and \( t \) = a measure of tariff.

The authors argued that the relationships involving resource levels, tariffs, and output can also be applied to factor inputs. Thus they estimated the above equation with a measure of employment as the dependent variable. The model was tested with reference to 20 industries in each of the world's 18 major industrial countries. They used tariffs from the post Kennedy Round (1972) as a measure of the degree of openness.

The results were the estimated tariff elasticities with respect to employment shares for each industry in the 18 countries. For a number of industries the signs were incorrect. However, these
incorrect signs did not appear to be consistent in all countries. The exceptions to this were leather products, pottery, electrical machinery, and transport equipment. The results had the correct signs (positive) for the remaining industries, which indicated a positive relationship between tariffs and employment.

V. Cable (1978) examined the effect on unemployment in the U.K. industries, which resulted from the increased competition of LDC's imports. The author tried to decompose employment changes and to quantify the separate influences of trade flows as well as the changes in other factors. This decomposition rests on the use of two identities:

\[ O = C + X - M \]  

\[ P = \frac{O}{E} \]

Where \( O \) = output, \( C \) = domestic consumption, \( X \) = exports, \( M \) = imports, \( P \) = productivity of labour, defined as output per man year, and \( E \) = employment.

Substituting (2) into (1) and differentiating with respect to time, gives an expression for the change of employment, which Cable approximated by:

\[ E_t - E_{t-1} = \frac{1}{P_{t-1}} (C_t - C_{t-1}) + \frac{1}{P_{t-1}} (X_t - X_{t-1}) \]

\[ - \frac{1}{P_{t-1}} (M_t - M_{t-1}) - E_t \left\{ \frac{P_t}{P_{t-1}} - 1 \right\} \]
The four terms on the right-hand side represent the employment changes due to a shift in domestic consumption, exports, imports, and productivity, respectively. The four factors are assumed to be independent of each other. The model was tested for 34 three digit SIC industry groups for the period 1970-75. These industries are selected on the criteria that the LDC's share of U.K. consumption is at least 2%.

In over half of the cases considered, the employment effect of LDC trade was positive. But only in few cases the effects were of significance. In the aggregate estimates, the potential change in employment, as a result of trade with the rest of the world, was much higher than that with the LDC's.

The aim of the above studies has primarily been to show that the effect of the LDC's import competition on the industrialised countries' employment is less significant than the effects of other contributory factors. This, however, is not the concern of our study, but it nevertheless helps us to understand that there is a positive relationship between tariff rates and the industries' level of employment.

In brief, the survey provided us with enough evidence to indicate a positive relationship between trade protection and the industry profit and output. The same effects were suggested in our second theoretical model in the previous chapter. The next step is to test the hypothesis econometrically. This will be undertaken in the next chapter.
This Chapter aims to quantify the effects of import competition and protection on the price-cost margins and output of the United Kingdom manufacturing industries. This analysis will cover each of the years 1963 and 1968. The methodology used builds upon those of the earlier studies discussed in Chapter 3.

4.1 The Models:

The relationship between price-cost margins, output and the independent variables will be estimated with the following equations:

\[ \Pi = a_0 + a_1 CR + a_2 CLR + a_3 GD + a_4 AR + a_5 DIC \]

\[ V = b_0 + b_1 CR + b_2 ODI + b_3 DIC \]

where \( \Pi \) is the price-cost margin, \( V \) is the money value of output produced and consumed in U.K., \( CR \) is the seller concentration, \( CLR \) is the capital intensity, \( GD \) is the growth of demand, \( AR \) is the advertising intensity, \( DIC \) is the degree of import competition (or alternatively tariff protection), and \( ODI \) is the correction for the industry size (imports of OECD countries), while \( a_0, \ldots, a_5 \) and \( b_0, \ldots, b_3 \) are the estimated coefficients of the explanatory variables. The tests will be undertaken with a sample of 40 non-food manufacturing industries; the selection of the sample was
based mainly on the availability of data\textsuperscript{1}. The reasons for limiting the analysis to the non-food industries are two-fold. Ideally, the tests should incorporate a measure of the price elasticity of demand for each industry, since the domestic response to foreign competition may depend on the elasticities. Unfortunately, lack of systematic information on elasticities makes this rather difficult. However, we do know that food industries have comparatively lower price elasticities than non-food industries and consequently a sample including both groups may give misleading results. The exclusion of food industries reduces the problem. The second reason for excluding food industries was that our chosen source of tariff (Kitchin, 1975) does not provide any figures for food industries, although the required tariff rates could have been obtained from other sources. This however could cause inconsistencies and it seemed desirable not to resort to this solution.

4.2 The Variables and Data:

The variables used in the regression analysis are defined as follows. The sources of data are described in Appendix C.

**Price-Cost Margin**

Price-cost margin is defined as the percentage of gross returns (before tax) on the sales of the industry. It can be formulated

\textsuperscript{1} Nationalised and government owned industries were excluded because these industries may follow somewhat different pricing policies from the privately owned industries.
Price-cost margin = \frac{(I + GTP + TSP) - (W + SA)}{S}

where I = factor income, GTP = gross trading profits of private companies, TSP = total trading surplus of public corporations, W = wages and salaries, SA = stock appreciation and S = total sales of the industry.

Output

It would be desirable to use a quantitative measure of output. However data for such a measure is not readily available in the published sources. The other problem is that the quantitative measures are unlikely to be uniform in a study concerned with a group of industries. We, therefore, had the choice of measuring the output by its money value in either gross or net terms. Gross output, however, appeared to be the better choice. Because (as explained on page 51) our corrective measure for the industry size is the imports of the OECD. Consequently, we decided to measure industry output by the money value of the gross domestic output consumed at home.

Seller concentration

Among the various measures for seller concentration the Herfindahl (1950), and the n-firm concentration ratios are best known. The Herfindahl measure is designed to incorporate information on the market share of all firms. It can therefore be regarded as a weighted average, where the weights used are the firms' shares. In the n-firms ratios, n most frequently takes on the value of

1 Herfindahl index (H) is defined as follows:

H = \sum_{i=1}^{n} S_i^2

where \( S_i \) is the share of the ith firms and there are n firms in the industry.
3 to 5, though values of 8, 12 and 20 have also been used. The practical choice of the measure of concentration is usually determined by the nature of the data available. For the present study the most readily available measure is the share of the five enterprises with the largest sales on total industry sales.

Capital intensity

Capital intensity is ideally measured by the ratio of capital assets to total employment. The problem in calculating such ratios for U.K. industries is that data on capital assets are available only for the "quoted" companies. Because of this we decided to compile a proxy measure by using instead the data on capital expenditures. This procedure may be justified on the grounds that there may be a close relationship between capital expenditure and capital assets. Using the capital expenditure data we estimated a proxy measure of capital intensity for each industry; these rates are the capital/labour ratios.

The estimated relationships between the "quoted" companies capital assets \( F \) and their corresponding capital expenditure \( C \) for 1963 and 1968 are as follows:

\[
1963 \quad F = 124.01 + 10.84 \ C \\
(6.15) \quad R^2 = 0.72 \text{ and corrected } R^2 = 0.70
\]

\[
1968 \quad F = 120.18 + 9.98 \ C \\
(4.83) \quad R^2 = 0.61 \text{ and corrected } R^2 = 0.58
\]

t-values are in parentheses

Proxy variables for capital intensity have been used in all previous studies of the U.K. industries. We can for example mention Holterman, S.E. (1973), Khalilzadeh Shirazi, J. (1974) and Hitiris, T. (1978).
Growth of Demand

The rate of growth of demand should, ceteris paribus, positively affect industry price-cost margins through increases in market prices, and the possible relaxation of competitive pressures. This effect is ideally expressed by the ex-ante shift of demand schedule. As lack of information inhibited the use of such a measure, we employed instead the ex-post change in the value of industry sales. This is calculated by the annual rates of growth of sales (at current prices) between 1958 and 1963, and between 1963 and 1968. These served as proxies for the growth of demand in the two periods under consideration.

Advertising Intensity

Advertising by the established firms can forestall the entry of new firms by influencing their cost conditions. In other words the new entrants would have to bear the high costs of advertising in order to achieve a desired level of sales. Furthermore, advertising can create brand loyalty and so discourages the entry of new competitors. Thus advertising by differentiating products, acts as a barrier to entry and the relationship between advertising and profitability is expected to be positive, reflecting the relationship between product differentiation and profitability. In this study, advertising intensity is measured by the ratio of advertising expenditures over industries' total sales.

Foreign competition

It is generally understood that free trade increases the competition between foreign and domestic producers, while protection has the opposite effect. This suggests that our analysis may use a measure of either import competition or of tariff protection. But it may also be interesting to employ each in turn. The intensity of import
competition may be measured by the ratio of total competing imports to the home consumption of that commodity which is produced domestically.

Tariff protection is measured here by the nominal tariff rates. The reasons for using nominal rates in preference to the effective rates was discussed in Chapter 3: briefly, since the effective protection concept holds only under conditions of perfect competition in the home market, the effective rates are unsuitable for studies of price-cost margins in oligopolistic markets. The use of tariff rates involves a practical problem. As the statistical analysis is at the industry level and as the original tariff data relates to commodities (or commodity groups) a choice had to be made between using unweighted or weighted averages of the original data. The weighted averages may use either imports or home production as weights. However as those variables may themselves be influenced by the tariff the weighted average may have a systematic bias. On the other hand, the use of unweighted rates has its own shortcoming in that, unweighted averages may depend on the amount of detail in the original tariff schedule, though unlike the weighted average these are unlikely to have a systematic bias. For the present study we made a pragmatic decision, and employed weighted nominal tariff rates, as they are readily available.

Correction for the industry size

Some industries are greater than others. This may be due to reasons other than differences in the industries' concentration or in their import intensities. One important reason could be the
differences in the consumption of different commodities. It thus seemed appropriate to take a corrective measure to explain the differences in the consumption of various chosen commodities. Practical obstacles prevented us from choosing this corrective measure on the basis of U.K. consumption of these commodities. This is because the dependent variable in our model is the industry's sales in the U.K. An alternative would have been a measure of consumption from other western countries on the grounds that the pattern of consumption in those countries is likely to be similar to that in the U.K. In search for the best obtainable measure we decided to employ the imports of OECD countries as proxies for the consumption of the chosen commodities in these countries. This decision is however based on the assumption that the demand functions are similar for the U.K. and for the other OECD countries.

OECD imports are exclusive of U.K. and Japan's imports. The reasons for this are:

(i) to include the U.K. imports may give rise to certain biases;
(ii) Japan was not a member of OECD in 1963 and was excluded in an attempt to keep the member groups consistent.

4.3 Statistical Results:

We employed OLS (ordinary least square) multivariate regression analysis to examine the effect of the market structure factors on industry price-cost margins and output. The regressions were tried in the linear and log-linear forms. The results for the former were more significant and consistent and therefore only these results are reported.
Correlation coefficients between the independent variables were examined for 1963 and 1968. The results are presented in Table 1.

Using Fisher's Z transformation we tested the null hypotheses¹, that the correlation coefficients at the population level are equal to zero. The test showed little correlation between the variables except for those between concentration and capital intensity, growth of demand and capital intensity and between tariff rates and import competition.

The high correlation between seller concentration and capital intensity is not surprising and is consistent with similar findings in the aforementioned studies²; it suggests that capital intensity may be a barrier to entry and makes for higher seller concentration. The implication of this high correlation is the possibility of multicollinearity in the regression analyses.

The high correlation between the tariff rates and import intensity is also important because it shows that there is a negative

---

1 The confidence interval at the 95% level is

\[ Z - 1.96 \sqrt{\frac{1}{N-3}} \leq Z \leq Z + 1.96 \sqrt{\frac{1}{N-3}} \]


2 Chapter 3, pp.34.
### Table 1

**Correlation Coefficients Between the Explanatory Variables, for the Sample of Forty Non-Food Manufacturing Industries, 1963 and 1968**

<table>
<thead>
<tr>
<th></th>
<th>CR</th>
<th>CLR</th>
<th>GD</th>
<th>AR</th>
<th>ICR</th>
<th>TR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLR</td>
<td>0.409* (0.434*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GD</td>
<td>0.229 (0.060)</td>
<td>0.330* (0.469*)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR</td>
<td>-0.017 (-0.05)</td>
<td>0.083 (0.097)</td>
<td>0.123 (-0.008)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICR</td>
<td>-0.006 (0.035)</td>
<td>0.168 (0.106)</td>
<td>-0.136 (-0.027)</td>
<td>-0.098 (-0.079)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR</td>
<td>0.014 (0.088)</td>
<td>-0.080 (-0.162)</td>
<td>0.045 (0.150)</td>
<td>-0.170 (-0.104)</td>
<td>-0.519* (-0.415*)</td>
<td></td>
</tr>
<tr>
<td>ODI</td>
<td>-0.148 (-0.022)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.050 (0.032)</td>
</tr>
</tbody>
</table>

**Notes:**

The correlation coefficients for 1968 in parentheses. Starred coefficients are different from zero at the 5% significance level.

- Seller concentration CR, is the ratio of the share of the five leading firms over the industry total sales.
- Capital intensity CLR, is the ratio of capital expenditure on total number of employees of each industry.
- Growth of demand GD, is the annual rate of growth of sales at current prices.
- Advertising intensity AR, is the ratio of advertising expenditure on total sales of each industry.
- Import/home consumption ICR, is the ratio of the industry's imports (at c.i.f. prices) over its total sales of the commodities produced and consumed domestically.
- Tariff rate TR, is the weighted nominal rate calculated by Kitchin (1975).
- Correction for the industry size ODI, is the total imports of OECD countries (at current prices) with exclusion of U.K. and Japan.
relationship between the chosen tariff rates and the relevant import/home consumption ratios. The high correlation between tariffs and import intensities however would not cause any multicollinearity since these variables are used as alternatives in the relevant regression equations.

Table 2 reports the estimated equations, explaining the price-cost margins.

The coefficients for the tariff rates (TR) are positive and significant for both years (eqs. 1 and 3), indicating that protection allows domestic industries to raise prices and earn higher rates of profit than they could have under free trade\(^1\). Correspondingly the negative and statistically significant impact of import-competition (eqs. 2 and 4) suggests that an increase in imports may force firms to lower their prices\(^2\).

The coefficients for seller concentration are positive but statistically insignificant. The insignificant results have been caused by multicollinearity between the seller concentration and the capital intensity. The re-estimation of the equations with the exclusion of capital intensity confirmed that Seller concentration and price-cost margins are positively related.

\[^1\] The same outcome is shown in the study by Hitiris T. (1978)

\[^2\] This relationship for the first time was shown in the study by Esposito, L. and Esposito, F. (1971).
### Table 2

<table>
<thead>
<tr>
<th>EQUATION</th>
<th>YEAR</th>
<th>CONSTANT</th>
<th>CR</th>
<th>CLR</th>
<th>GD</th>
<th>AR</th>
<th>ICR</th>
<th>TR</th>
<th>R²</th>
<th>C-R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1963</td>
<td>2.508b</td>
<td>0.024</td>
<td>17.427a</td>
<td>0.627a</td>
<td>0.450b</td>
<td></td>
<td>0.203b</td>
<td>0.65</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.72)</td>
<td>(0.82)</td>
<td>(2.73)</td>
<td>(4.93)</td>
<td>(1.68)</td>
<td></td>
<td>(1.76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1963</td>
<td>5.470a</td>
<td>0.022</td>
<td>19.529a</td>
<td>0.598a</td>
<td>0.315</td>
<td>-0.068b</td>
<td></td>
<td>0.66</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.47)</td>
<td>(0.74)</td>
<td>(3.03)</td>
<td>(4.71)</td>
<td>(1.21)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1968</td>
<td>3.589b</td>
<td>0.004</td>
<td>9.80b</td>
<td>0.196c</td>
<td>0.826a</td>
<td></td>
<td>0.199b</td>
<td>0.43</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.38)</td>
<td>(0.10)</td>
<td>(1.90)</td>
<td>(1.65)</td>
<td>(2.42)</td>
<td></td>
<td>(1.72)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1968</td>
<td>6.248a</td>
<td>0.016</td>
<td>8.203b</td>
<td>0.235b</td>
<td>0.732b</td>
<td>-0.058b</td>
<td></td>
<td>0.44</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.40)</td>
<td>(0.43)</td>
<td>(1.68)</td>
<td>(2.09)</td>
<td>(2.16)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

- t-values are in parentheses - a, b and c indicate level of significance at 1%, 5% and 10% respectively by using a one tail t test.

- Seller concentration CR, is the ratio of the share of the five leading firms over the industry total sales.

- Capital intensity CLR is the ratio of capital expenditure on total number of employees of each industry.

- Growth of demand GD, is the annual rate of growth of sales at current prices.

- Advertising intensity AR, is the ratio of advertising expenditure on total sales of each industry.

- Import/home consumption ICR, is the ratio of the industry's imports (at its c.i.f. prices) on its total sales of commodities produced and consumed at home.

- Tariff rate TR, is the weighted nominal rate provided by Kitchin (1975).
The reason for a positive relationship between seller concentration and profitability is well known, namely: high concentration enables collusion among the dominant firms, which consequently refrain from excessive competition, raise their prices and earn excess profits. There is also a contesting view that higher profitability in concentrated industries is due to their higher efficiency. The coefficients for capital intensity, growth of demand, and advertising intensity are all positive and statistically significant for both years, 1963 and 1968.

Table 3 presents the equations explaining industry output. The results show a positive and statistically significant relationship between tariffs and industry output (Table 3, equations 1 and 3). This indicates that protection enables domestic firms to expand their production. Correspondingly a negative and statistically significant impact of import-competition (Table 3, equations 2 and 4) may force firms to restrict their production.

The coefficients for seller concentration are negative and significant in all the equations. This is an interesting outcome, as it gives support to the argument that dominant firms may collude in keeping their output low, in order to raise or maintain their prices.

The other interesting outcome is the positive and highly significant relationship between U.K. industries' output and OECD imports. This supports our hypothesis that, the differences in the output of the chosen industries are partly related to the differences in the
### Table 3


<table>
<thead>
<tr>
<th>Equation</th>
<th>Year</th>
<th>Constant</th>
<th>CR</th>
<th>ODI</th>
<th>ICR</th>
<th>TR</th>
<th>$R^2$</th>
<th>$C-R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1963</td>
<td>78.782&lt;sup&gt;c&lt;/sup&gt; (1.43)</td>
<td>-1.854&lt;sup&gt;c&lt;/sup&gt; (-1.59)</td>
<td>0.538&lt;sup&gt;a&lt;/sup&gt; (6.69)</td>
<td>8.333&lt;sup&gt;b&lt;/sup&gt; (1.74)</td>
<td>0.61</td>
<td>0.58</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1963</td>
<td>170.155&lt;sup&gt;a&lt;/sup&gt; (3.53)</td>
<td>-1.793&lt;sup&gt;c&lt;/sup&gt; (-1.51)</td>
<td>0.559&lt;sup&gt;a&lt;/sup&gt; (6.86)</td>
<td>-1.819&lt;sup&gt;c&lt;/sup&gt; (-1.31)</td>
<td>-</td>
<td>0.60</td>
<td>0.57</td>
</tr>
<tr>
<td>3</td>
<td>1968</td>
<td>136.453&lt;sup&gt;b&lt;/sup&gt; (2.05)</td>
<td>-3.236&lt;sup&gt;b&lt;/sup&gt; (-1.97)</td>
<td>0.359&lt;sup&gt;a&lt;/sup&gt; (9.74)</td>
<td>8.883&lt;sup&gt;c&lt;/sup&gt; (1.61)</td>
<td>0.74</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1968</td>
<td>264.552&lt;sup&gt;a&lt;/sup&gt; (4.44)</td>
<td>-2.881&lt;sup&gt;b&lt;/sup&gt; (-1.79)</td>
<td>0.364&lt;sup&gt;a&lt;/sup&gt; (10.08)</td>
<td>-3.201&lt;sup&gt;b&lt;/sup&gt; (2.07)</td>
<td>-</td>
<td>0.75</td>
<td>0.73</td>
</tr>
</tbody>
</table>

**Notes:**
- t-values are in parentheses - a, b, and c indicate level of significance at 1%, 5% and 10% respectively by using a one-tail t test;
- Seller concentration CR, is the ratio of the share of the five leading firms over the industry sales;
- Correction for the industry size ODI, is the total imports of OECD, countries (at current prices) with exclusion of U.K. and Japan.
- Import/Home consumption ICR, is the ratio of the industry's imports (at its c.i.f. prices) on its total sales of commodities produced and consumed at home.
- Tariff rate TR, is the weighted nominal rate provided by Kitchin (1975)
consumption of the commodities that these industries produce.

In brief, the above results suggest that home firms might take advantage of the tariff protection and increase their prices as well as their production. Correspondingly an increase in import-competition may lead to a decrease in the prices and in the level of output.

We are now able to use these results to estimate the welfare effects of tariffs. This will be carried out in the next chapter.
CHAPTER 5

ESTIMATES OF THE WELFARE EFFECTS OF THE TARIFF

This chapter aims to estimate the welfare effects of the tariff. The procedure will draw upon the theoretical analysis of chapter 2 and will make use of the regression estimates reported in chapter 4.

5.1 Formulation of the Welfare Effects:

The welfare effects are illustrated in Figure 1 which is a reproduction of Figure 2, chapter 2.

$D_1D_1$ is the compensated demand curve for home products under free trade, i.e. when the domestic price of the imports is $O_xW_1$.

$D_2D_2$ is the corresponding demand curve under the tariff situation, (the tariff is assumed to be such as to raise the domestic price of the imports to $O_2W_2$).

$O_dP_1$ is the price of home products when there is no tariff on the imports.

$O_dP_2$ is the price of home products under tariff protection.

$CC$ is the home producers' marginal cost curve.

$FF$ is the compensated home demand curve for foreign products under free trade, i.e. when price of the home product is $Q_1P_1$. 
FIGURE 1
As explained in chapter 2 the imposition of tariffs initially causes a loss in consumer surplus only to those who consume the foreign goods; consumers of home products would suffer a loss only if the tariffs induced an increase in the price of home products. Moreover, these two items of welfare costs may be offset by a possible benefit in the form of additional profits of the home firms. In terms of Figure 1, the net welfare effect is an increase in home country welfare if:

\[ P_1P_2A_3H_3 + C_1H_1H_3C_3 > P_1P_2A_3H_2 + TRS \]

where \( (P_1P_2A_3H_3 + C_1H_1H_3C_3) \) shows the increase in the home firms' profits resulting from the tariff, \( P_1P_2A_3H_2 \) is the loss of consumer surplus for consumers of home goods, TRS is the net loss of surplus for consumers of foreign goods.

The above can be simplified and the condition for a welfare gain may be written as:

\[ C_1H_1H_3C_3 > A_3H_2H_3 + TRS \]

The net effect of eliminating tariffs is the converse of the above. Tariff elimination will increase home country welfare if:

\[ A_3H_2H_3 + TRS > C_1H_1H_3C_3 \]

The above analyses clearly indicate that the elimination of tariffs may create welfare losses as well as gains. This implies that there will be an optimum tariff for each industry which will maximise the net welfare gain. Thus the welfare estimates of tariffs could be made with reference to either:

(i) the optimum rate of tariff for each industry and
However, the main purpose is to compare the welfare estimates from the present model with that of the traditional theory. This can be done most readily by the latter alternative. Thus in this study we will keep to the latter only, i.e. examine the welfare effect of moving from the existing tariffs to free trade.

The task now is to express each of the above three areas in terms of empirically measurable variables.

The area TRS can be approximated as:

\[
TRS = \frac{1}{2} dM \cdot dP
\]

\[
= \frac{1}{2} dM \cdot T \cdot P
\]

where \( dP \) is the decrease in home price of foreign goods due to the elimination of tariffs;

\( dM \) is the corresponding increase in imports;

\( t \) is the tariff rate \( \left( \frac{dP}{P_W} \right) \);

\( P_W \) is the world price of the imports

\( T \) is \( \frac{t}{1+t} \left( \frac{dP}{P} \right) \) which is the proportionate decrease in the price of foreign goods.

We know that:

\[
dM = e_m \left( \frac{dP}{P} \right) M
\]

where \( e_m \) is the compensated price elasticity of import demand (ignoring the sign). We assumed that this elasticity is constant and independent of the price of the home products.
Substituting (3) into (2) we can write:

\[
TRS = \frac{1}{2} \left\{ e_m \frac{dP}{P} \right\} M.P.T
\]

\[= \frac{1}{2} e_m T^2 M.P \quad (4)
\]

Alternatively equation (4) can be expressed in terms of the world price of the imports.

\[
TRS = \frac{1}{2} e_m \frac{t^2}{(1+t)^2} M.P_W (1+t)
\]

\[= \frac{1}{2} e_m \frac{t^2}{1+t} M.P_W \quad (5)
\]

In order to estimate TRS we will use previous researchers empirical estimates of \( e_m \).

Next let us consider the area \( A_{3\overline{2}3} \). This can be approximated as:

\[
A_{3\overline{2}3} = \frac{1}{2} A_{33} \times H_3 H_2 \quad (6)
\]

Where \( A_{33} \) is the change in the price of home products due to the elimination of tariffs, \( H_3 H_2 \) is the change in the consumption of home goods, due to that change in price.

\( A_{33} \) can be estimated as:
\[ A_3 H_3 = dP_d = \frac{P_d \, d\Pi}{1 - \Pi} \]  
(7)

where \( \Pi \) is the price-cost margin under the tariff and \( d\Pi \) is the change in the price-cost margin resulting from the elimination of tariffs.

The change in production \( H_3 H_2 \) can be measured as:

\[ H_3 H_2 = e_d \, \Omega \left( \frac{dP_d}{P_d} \right) \]  
(8)

where \( e_d \) is the compensated price elasticity of demand for home products (ignoring the sign), and \( \Omega \) is the Level of home production under the tariff.

Substituting (7) and (8) into (6) we can write:

\[
A_3 H_2 H_3 = \frac{1}{2} \frac{P_d}{1 - \Pi} \times e_d \, \Omega \, \frac{dP_d}{P_d}
\]

\[
= \frac{d\Pi}{1 - \Pi} \times e_d \, \Omega \, \frac{P_d \, d\Pi}{1 - \Pi}
\]

\[
= \frac{1}{2} e_d (\Omega \cdot P_d) \frac{d\Pi^2}{(1 - \Pi)^2}
\]

(9)

The value of \( d\Pi \) can be obtained from the regression equation (1) in chapter 4 which equals a\( _5 \cdot \Sigma (2) \). We can thus rewrite (9) as follows:

\[
A_3 H_2 H_3 = \frac{1}{2} e_d (\Omega \cdot P_d) \frac{a_5^2 \cdot \Sigma^2}{(1 - \Pi)^2}
\]

(10)

---

(1) Price-cost margin \( \Pi \) is defined as:

\[ \Pi = \frac{P_d - C}{P_d} = 1 - \frac{C}{P_d} \]

where \( P_d \) is the domestic price under the tariff, \( C \) is the cost of production of one unit of home commodities. We thus have:

\[
\frac{d\Pi}{dP_d} = \frac{C}{P_d^2} = \frac{1 - \Pi}{P_d}
\]

or \[
\frac{dP_d}{P_d} = \frac{d\Pi}{1 - \Pi}
\]

and finally:

\[ dP_d = \frac{P_d \, d\Pi}{1 - \Pi} \]

---

Con'td.
It is interesting to show that under certain conditions the price elasticity of demand for home products (e_d) may be equal to the price elasticity of demand for imports (e_m). In order to present this condition we employed the following Cobb-Douglas utility function:

\[ U = A q^\alpha m^\beta \]

where \( U \) is the utility enjoyed by the consumers, \( q \) is the consumption of home products and \( m \) is the consumed imports, while \( \alpha \) and \( \beta \) are respectively the exponents of \( q \) and \( m \), which can be expressed as utility elasticities

\[ \begin{align*}
\alpha &= \frac{dU}{U} \frac{dq}{q} \quad \text{and} \\
\beta &= \frac{dU}{U} \frac{dm}{m}
\end{align*} \]  

(1)

We then showed (Appendix D) that, when \( \alpha \) equals \( \beta \), the price elasticity of demand for home products equals the price elasticity of demand for imports.

Finally we turn to area \( C_1H_1H_3C_3 \). This can be measured as:

\[ C_1H_1H_3C_3 = H_1H_3 \times H_1C_1 \]  

(11)

where \( H_1H_3 \) is the change in home output resulting from the elimination of the tariff, and \( H_1C_1 \) is the profit per unit of home production under free trade.

\[ \text{Cont'd..} \]

(2) From chapter 4 we have:

\[ \Pi = a_0 + a_1CR + a_2CLR + a_3GD + a_4AR + a_5DIC \]

where \( \Pi \) is the industry price-cost margin under the tariff, \( CR, CLR, GD, AR \) and \( DIC \) are respectively the Seller Concentration, Capital Intensity, growth of demand, advertising intensity and degree of import competition (or tariff protection). Using \( t \) as the nominal tariff rate, we can have the following specification from the above equation:

\[ \Pi = a_0 + a_1CR + a_2CLR + a_3GD + a_4AR + a_5t \]

we now have

\[ \frac{d\Pi}{dt} = a_5 \quad \text{or} \\
\frac{d\Pi}{dt} = a_5dt \]

Due to the elimination of tariffs \( dt = t \) and thus we have: \( d\Pi = a_5t \)

(1) See Appendix D.
\( H_1 H_3 \) can be obtained from the regression equation (2) of chapter 4. Denoting this by \( dQ \) we have

\[
dQ = \frac{b_3 t (1 - II) - Q P_d \delta_II}{P_d (1 - II)}
\]

(12)

as \( \delta II = a_5 t \) we get

\[
dQ = \frac{b_3 t - b_3 II t - a_5 Q P_d t}{P_d (1 - II)}
\]

(13)

From chapter 4 we have:

\[
V = b_0 + b_1 CR + b_2 ODI + b_3 DIC \text{ (equation 2, chapter 4)}
\]

where \( V \) is the money value of home production under the tariff and is equal to \((Q . P_d)\), \( Q \) is the level of home production consumed domestically, \( P_d \) is the price of home goods under tariffs, and \( CR \), \( ODI \) and \( DIC \) are respectively the seller concentration, correction for the industry size and degree of import competition (or tariff protection). Using \((t)\) as the nominal tariff rate, we can have the following specification from the above equation.

\[
V = b_0 + b_1 CR + b_2 ODI + b_3 t
\]

We can now have:

\[
\frac{dV}{dt} = b_3 = \frac{dQ}{dt} \cdot P_d + \frac{dP_d}{dt} \cdot Q
\]

Due to the elimination of tariffs \( dt = t \) and thus we have:

\[
b_3 = \frac{dQ \cdot P_d + Q dP_d}{t}
\]

Thus

\[
dQ = \frac{b_3 t - Q P_d \delta_II}{P_d}
\]

Knowing that \( dP_d = \frac{P_d \delta II}{1 - II} \) we can write:

\[
dQ = \frac{b_3 t \cdot Q P_d \delta_II}{P_d (1 - II)} = \frac{b_3 t (1 - II) - Q P_d \delta_II}{P_d (1 - II)}
\]

- 66 -
$C_{1H_1}$ is the amount of the profit per unit under free trade and is given by the relationship

$$C_{1H_1} = \frac{II^* P^*}{l - n}$$  \hfill (14)

where $II^*$ is the price-cost margin in free trade, and $P^*$ is the corresponding price of the home products. We know that

$$II^* = II - dII$$ \hfill (15)

$$P^* = P_d - dP_d$$ \hfill (16)

Substituting (15) and (16) into (14) we get

$$C_{1H_1} = \left(\frac{P_d - dP_d}{l - n}\right)\left\{\frac{II}{l - \Pi}\right\}$$

As $dII = a_5t$ we can write:

$$C_{1H_1} = \left(\frac{P_d}{l - n}\right)\left\{\frac{II - a_5t}{l - \Pi}\right\}$$  \hfill (17)

Substituting (17) and (13) into (11) we get:

$$C_{1H_1} C_3 = \left\{b_3t - b_3 II t - QP_d a_5t\right\}\left\{\frac{II - a_5t}{l - n}\right\}$$

$$\frac{(1 - \Pi)^2}{(l - \Pi)^2}$$  \hfill (18)

5.2 Data Employed:

In order to estimate the welfare effects of tariff elimination we need data on the price-elasticity of demand for imports and home products, tariff rates, imports, industries' output and price-cost margins. Data on the tariffs, the imports, the output, and the price-cost margins are the same as in the previous chapter\(^1\). The remaining data are detailed information is available in Appendix C.
Price-elasticities:

Ideally we need estimates of price elasticities for home products and for competing imports, disaggregated for each U.K. industry (or commodity group). Unfortunately, such detailed data are not available for all the industries concerned.

Stern, Francis and Schumacher (1976) provide a rather comprehensive set of estimates collected from various studies for a group of different countries, including the U.K. However, there are three problems in applying these estimates for the U.K.

(i) The estimates are only available for certain groups of industries. Hence to complete the data for the U.K. we can make use of the estimates given for other countries. Critics might be sceptical about using the elasticity estimates of other countries for the U.K., because the share of U.K. imports in its consumption might be different from the share of other countries' imports in their consumption. Alternatively, we can use the aggregated price elasticity which is readily available for the U.K. The aforementioned study contains a range of the aggregated estimates (collected

---

from various studies) as well as the best suggested estimates\(^{(1)}\). Naturally, our choice was the best estimate of the price elasticity of imports for non-food manufactures.

(ii) The second problem is that the chosen price elasticity is an estimate derived from an ordinary demand curve, whereas our study requires a compensated price elasticity of import demand. Hence we use the following formula to calculate the compensated price elasticity\(^{(2)}\):

\[ e_m = e'_m + \alpha \eta \]

where \( e_m \) is the compensated price elasticity of import demand, \( e'_m \) is the price elasticity of the ordinary demand curve, \( \alpha \) is the proportion of total expenditure spent on imports, and \( \eta \) is the income elasticity of import demand.

We calculate \( \alpha \) by dividing the value of U.K. imports of non-food manufacturers by the total domestic consumption of these commodities. For \( \eta \) we use the estimate given in the study by Hauthaker and Magee (1969). By substituting the relevant values for \( e'_m \), \( \alpha \), and \( \eta \) into the above formula, the value of \( e_m \) was estimated to be -1.02.

---

\(^{(1)}\) Stem, R.M. et al (1976) compiled the results of nine separate estimates given for the price elasticity of U.K. demand of non-food manufactures. The value of the estimates range from -0.66 to -6.00 and the best suggested estimate is -1.22 ibid, pp 16

We also require an estimate of the price elasticity of compensated demand for home products. Unfortunately, such an estimate is not readily available, and its direct estimation, though useful, would be to some extent outside the scope of this study. However as we have shown before, under certain conditions (described in Appendix D), the price elasticity of demand for imports can be used for the price elasticity of demand for home products.

Given that there are problems concerning the estimate of the price elasticity, it would be interesting to use an alternative measure in addition to the one described above. Such an alternative estimate might be inferred from the concept of the assumed profit maximisation of the home producers.

Economic theory suggests that in a profit maximising monopoly, the price elasticity of demand is equal to the inverse of the monopoly's price-cost margin\(^{(1)}\). We therefore have:

\[ e_d = \frac{1}{\Pi} \]

\(^{(1)}\) The following expression gives the marginal revenue of a monopoly:

\[ MR = P \left( 1 - \frac{1}{e_d} \right) \]

where MR is the marginal revenues, P is the price and \( e_d \) is the price elasticity of demand.

We know that a profit maximising monopoly uses the following relationship to set its price:

\[ MR = MC \]

where MC is the marginal cost. We would therefore have:

\[ MC = MR = P \left( 1 - \frac{1}{e_d} \right) \]

\[ e_d = \frac{P}{P-MC} \]

\( \text{cont'd..} \)
where \( e_d \) is the price elasticity of demand for home products, and \( \Pi \) is the price-cost margin of home producers. In order to estimate \( e_d \) we use the value of \( \Pi \) from our regression equation: the average value of \( \Pi \) for the years 1963 and 1968 is approximately 10.5 per cent. We thus obtain

\[
e_d = \frac{1}{\Pi} = \frac{1}{0.105} = 9.5
\]

Admittedly, this estimate of \( e_d \) seems rather high in comparison with our previous estimate (1.02). This may be for the following reason. The estimate of the price-cost margin \( \Pi \) pertains to the industries as a whole, whereas the above formula applies only to those firms that act as profit maximisers. The implication of this is that the average price-cost margin employed above might be an underestimation of the required margin and as a result we may have overestimated the relevant price elasticity (\( e_d \)).

It would, therefore, be more appropriate to employ the price-cost margins of the dominant firms in each industry, i.e. a few firms with the greatest share of the industry's total sales. Such a procedure is, however, inhibited by the lack of necessary data for 1963 and 1968.

---

(1) Cont'd...

By definition we have:

\[
\Pi = \frac{P - MC}{P}
\]  

(iv)

where \( \Pi \) is the price-cost margin. Substituting (iv) into (iii) will give the following:

\[
e_d = \frac{1}{\Pi}
\]  

(v)
5.3 The Estimates:

The analysis of the preceding section will now be used to estimate the welfare effects of a hypothetical elimination of the tariffs. Equations (5) and (10) will be used to estimate the welfare gains while equation (18) will be used to estimate the welfare loss.

Bringing these together the net welfare effect is:

\[
\text{Net welfare effect} = \frac{1}{n} \sum_{i} \frac{t^2}{1 + t} \frac{M.P_w}{e_d} \frac{a^2}{(1 - \Pi)^2} + \left( b_3 t - b_3 \Pi t - Q_0 \frac{a_5 t}{(1 - a_5)} (1 - a_5) \right) \frac{(1 - \Pi)^2}{(1 - \Pi)^2} \tag{19}
\]

If our empirical estimates show that this expression to be positive (negative) we will state that tariff elimination will increase (decrease) home welfare.

Our interest is not only in the absolute magnitude of the welfare estimates but also in how they compare with the estimates that may be obtained from the traditional model of tariffs. The latter makes no distinction between the consumers of foreign and home goods. Moreover it abstracts from the effect on the profits of home producers. The implication of the latter point is that all consumers are assumed to experience the same proportionate decline in prices, and thus the welfare gain is dependent only on the increase in imports. Accordingly the traditional measure of the welfare gain is\(^{1}\):

\begin{align*}
\end{align*}
Net welfare gain = \( \frac{2}{M_{iN}} \frac{t}{1 + t} M_{P_W} \) \hspace{1cm} (20)

The three separate components of equation 19 (equations 5, 10 and 18) and the net welfare effects are shown in tables 1 and 2. The only difference between the tables is the application of two different price elasticities (-1.02 in table 1 and -9.5 in table 2). Hence, the gain of consumer surplus in table 1 \((A_1)\) is much smaller than that in table 2 \((A_2)\).

A comparison between the results of this model and those obtained from the application of the traditional model, gives rise to interesting implications. With regard to the consumer, our model shows an overall higher gain of consumer surplus \((A_1 > a_{11} \text{ and } A_2 > a_{21})\). This is because our model allows for the gains to the consumers of home goods as well as the gains to the consumers of foreign goods.

In contrast with the traditional model, this study shows a loss of welfare caused by the fall in home production and profit. The loss of welfare derived from our model (in both tables) outweights the welfare gains of the tariff elimination. The estimates of welfare loss, expressed as percentages of home industry output, range from 0.819% to 1.275% and from 0.597% to 1.045% for 1963 and 1968 respectively.

Finally, it would be interesting to compare the outcome of this study with those of previous studies. Such a comparison will however be neither easy nor accurate. The difficulty in accuracy arises from the differences between the methodologies used and the objectives pursued in this and other studies. For example, some studies are undertaken within a general equilibrium framework,
TABLE 1
WELFARE EFFECTS OF TARIFF ELIMINATION AS PERCENTAGE OF DOMESTIC INDUSTRY OUTPUT

<table>
<thead>
<tr>
<th></th>
<th>1963</th>
<th>1968</th>
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<tr>
<td>$A_1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of which</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$a_{11}$</td>
<td>Net gains to the consumers</td>
<td>+0.055</td>
</tr>
<tr>
<td>$a_{12}$</td>
<td>Net gains to the consumers of foreign goods</td>
<td>+0.032</td>
</tr>
<tr>
<td></td>
<td>Net gains to the consumers of home goods</td>
<td>+0.023</td>
</tr>
<tr>
<td>$B_1$</td>
<td>Loss of profits to home producers due to decrease in output</td>
<td>-1.331</td>
</tr>
<tr>
<td>$C_1$</td>
<td>Net Welfare effects</td>
<td>-1.275</td>
</tr>
</tbody>
</table>

Note: The price elasticity used in the calculation of the gains to consumers in the compensated price elasticity of import demand. This has also been used as an estimate for the price elasticity of demand for the home product. The magnitude of the estimated elasticity is -1.02.

$a_{11}$ is the difference between the total gains to the consumers of foreign goods and the government's loss of tariff revenue (in terms of Fig.1, page 60, $a_{11} = TRS = W_1W_2TR - W_1W_2TS$).

$a_{12}$ is the difference between the total gains to the consumers of home goods and the loss of profits, resulting from the price change, to home producers (in terms of Fig.1, page 60, $a_{12} = A_2H_2H_3 = P_1P_2A_2H_2 - P_1P_2A_3H_3$).
TABLE 2

WELFARE EFFECTS OF TARIFF ELIMINATION AS PERCENTAGE OF DOMESTIC INDUSTRY OUTPUT

<table>
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<th>1968</th>
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<td>$A_2$ of which $a_{21}$</td>
<td>Net gains to the consumers</td>
<td>+0.512</td>
</tr>
<tr>
<td>$a_{22}$</td>
<td>Net gains to the consumers of foreign goods</td>
<td>+0.298</td>
</tr>
<tr>
<td></td>
<td>Net gains to the consumers of home goods</td>
<td>+0.214</td>
</tr>
<tr>
<td>$B_2$</td>
<td>Loss of profits to home producers due to decrease in output</td>
<td>-1.331</td>
</tr>
<tr>
<td>$C_2$</td>
<td>Net welfare effects</td>
<td>-0.819</td>
</tr>
</tbody>
</table>

Note: The price elasticity ($e_d$) used in the calculations of the gains to consumers is derived from the well known relationship between the elasticity and the profit margin $\Pi$ of the profit maximising home firm

$$e_d = \frac{1}{\Pi} = \frac{1}{0.105} = 9.5$$

The above elasticity has also been used for the price elasticity of demand for imports. $a_{21}$ is the difference between the total gains to the consumers of foreign goods and the government's loss of tariff revenue (in terms of Fig.1, page 60, $a_{21} = TRS = W_1W_2TR - W_1W_2TS$).

$a_{22}$ is the difference between the total gains to the consumers of home goods and the loss of profits, resulting from the price change, to home producers (in terms of Fig.1, page 60, $a_{22} = A_2H_2H_3 = P_1P_2A_2H_2 - P_1P_2A_2H_3$).
whereas our model is based on a partial equilibrium analysis. The objective of some studies is to estimate the static and dynamic consequences of trade liberalisation, while our study is concerned only with the former. Tariff elimination (or reduction) by one country is often assumed to be a part of a multilateral trade policy followed by a group of countries, whereas our study assumes a unilateral tariff elimination. However, whilst acknowledging the existence of these problems, we decided that a limited comparison of findings may give a more comprehensive view of our results. As a consequence we chose to compare our findings with two recent studies; namely, Batchelor, R. and Minford, P. (1977) and Cambridge Economic Policy Group (CEPG, 1977).

The intention in the study by Batchelor and Minford is to compare the short and the long-run costs of devaluation and import controls. Our interest here, is to make a comparison between the findings of this study as regards to the welfare costs of tariff protection, with those of our own study. The authors calculate the short-run welfare loss of tariffs on the basis of an imperfect competition model. The model assumes that, in the short-run, when a tariff is imposed, the price of the import substitute need not increase by the same percentage as the import price. This is because there is only a limited switch out of imports into the domestic substitute. However, for the calculation of long-run welfare losses, the import-substitute price is raised by the same percentage as the import price. Thus, by using different price elasticities for the short and the long-run (-1.2 for the short-run and -8.1 for the long-run), the authors
calculate the costs of protection for different tariff levels\(^{(1)}\).
For an eight per cent increase in the existing tariff rate, the
costs of protection, as a percentage of U.K. GDP, amounts to 0.04%
in the short-run, and to 0.22% in the long-run\(^{(2)}\).

The average rate of tariffs in our study is approximately 8.1
per cent (averaged over 1963 and 1968 for the chosen industries).
Our study shows that the elimination of tariffs, i.e. the reduction
of tariffs by the average rate of about 8.1 per cent, would benefit

\(^{(1)}\) In this study the welfare loss of a tariff at rate \(T\) is,
\[
W = \frac{1}{2} \eta T^2 V
\]
Where \(W\) is the welfare loss, \(\eta\) is the corresponding
elasticity of import demand with respect to tariff, \(V\) is
the value of imports prior to the tariff. Only the value
of \(\eta\) differ according to whether we are considering a
short-run limited substitution environment or a long-run
competitive environment. In terms of the demand, supply
and substitution we have;
\[
\eta_S = (1 - \tau) \sigma
\]
\[
\eta_L = \varepsilon_S + (\varepsilon_d - \varepsilon_S) / m
\]
Where \(\eta_S\) and \(\eta_L\) are respectively the short-run and the long-
run elasticities of imports, \(\tau\) is the reaction coefficient
of home price with respect to the increase in the price of
competitive imports, \(\sigma\) is the price elasticity of import
substitutions, \(\varepsilon_S\) and \(\varepsilon_d\) are respectively the long-run
elasticities of supply and demand, and \(m\) is the share of
imports in the British market.

\(^{(2)}\) In this study the existing rate of tariffs (on average) is
about 5 per cent, the 8 per cent increase is in addition
to the existing rate, Op. cit, pp.68.
the consumers of imported goods by 0.033\% (averaged over 1963 and 1968 and expressed as percentage of the value of domestic output) when price elasticity is -1.02, and 0.30\% when price-elasticity is -9.5^{(1)}. As the above figures show, there is close correspondence between our estimates and those of the aforementioned study.

A comparison of the outcome of our study with that of the CEPG is a rather more difficult task. The comparison we intend to make is based on the estimate given by CEPG (1977). According to the CEPG, average rate of tariff, on imports entering domestic expenditure, would have to be about 31\% in order to raise the volume of U.K. GDP by 10\%^{(2)}. Our model does not give any direct estimate of changes in the domestic producers' output. In order to make possible a comparison between the CEPG and our own estimates, we therefore need to calculate the change in the volume of output for our model, when the existing tariffs are all raised to 31\%^{(3)}. The change in the volume of output is given by equation (13)

(1) It should be noted that we only compare the gain of consumer surplus to the consumers of imported goods with the estimates of Batchlor and Minford. This is because their study does not differentiate between imported goods and the goods which are produced domestically.


(3) As mentioned before, the average rate of tariff in our study is about 8.1 per cent. Hence, the increase of the existing rate to 31 per cent would mean to increase the existing rate by 300\% on average.
We therefore have:

\[ \frac{\partial Q}{\partial t} = \frac{b_3 t - b_3 t^t - a_5 Q P_d t}{P_d (1 - \Pi)} \]  

(21)

\[ \frac{\partial Q}{Q} \times 100 = \frac{b_3 t - b_3 t^t - a_5 Q P_d t}{Q P_d (1 - \Pi)} \times 100 \]  

(22)

We then used equation (22) to calculate the percentage change in the level of domestic output, when the existing tariffs are all raised to 31%. Our estimate shows an average (over 1963 and 1968) increase of about 38% in the level of domestic output.

It is obvious that our estimate of the tariff-induced change of domestic output is much higher than that of the CEPG. The difference may be partially explained by the following reasons.

(i) The CEPG's estimate is derived from a macroeconomic model designed within a general equilibrium framework, whereas our model is based on a partial equilibrium analysis. Hence we have assumed that there are sufficient resources to increase the industries' output.

(ii) Our model assumes that the industries' costs are constant. Relaxation of this assumption may reduce the level of output that the industries are prepared to produce in order to maintain maximum profits.

(1) Equation (13) is as follows:

\[ \frac{\partial Q}{\partial t} = \frac{b_3 t - b_3 t^t - a_5 Q P_d t}{P_d (1 - \Pi)} \]

where \( t \) is the difference between 31% and the existing tariffs of the industries. The other characters are defined as before.

---

(1) Equation (13) is as follows:

\[ \frac{\partial Q}{\partial t} = \frac{b_3 t - b_3 t^t - a_5 Q P_d t}{P_d (1 - \Pi)} \]

where \( t \) is the difference between 31% and the existing tariffs of the industries. The other characters are defined as before.
However, the extent of the difference between our study and that of the CEPG (1977), causes us to be cautious about our estimate of the change in domestic output.

5.4 Limitations and Extensions of the Analyses:

The above estimates of the welfare effects of the tariff have gone beyond the estimates that could have been obtained from the application of the traditional theory of tariffs, by incorporating such likely phenomena as product differentiation between foreign and home products and pricing in excess of marginal costs. However, our procedure has involved some simplifying assumptions, some of which may be mentioned.

Firstly, in estimating the profits of the home firms, no distinction was made between the private costs and the social costs. However, if the protected industries were to draw resources from industries where prices exceed the social marginal cost, the private marginal cost of the protected industry may exceed the social cost. In such a case our procedure would in general under-estimate the adverse effect of tariff removal. There may, however, be an important exception to this point. One reason for the excess of private over social cost is that the protected firms may use imported inputs that are subject to tariffs. This may be of importance in the event of a general reduction in tariffs. A general tariff cut will mean that the firms concerned will experience a downward shift in its cost curve as well as its demand curve. This may induce a decrease in the price charged to home consumers and would add to the welfare gains of tariff reduction. In such a case our procedure might have led to an under-estimation of the welfare gain of tariff removal.
Secondly, we implicitly assumed that there are sufficient resources to increase industry output. In reality the resources are scarce. It would, therefore, be more realistic to consider an upward sloping cost curve in the place of the simplifying horizontal cost curve.

Thirdly, we have assumed that the home output is sold entirely in the home market. Allowing for the possibility that a proportion of the output may be exported leads to two further considerations:

(a) If the tariff brought about a decrease in the home price of the home product there would (in the absence of price-discrimination) also follow a decrease in the export price. In other words, the welfare gain by way of the additional surplus to the consumers of home products might partly be offset by a reduction in the export profits. To this extent the study might have over-estimated the welfare gains of removing tariffs.

(b) Tariff elimination by the home country may be part of an agreed exercise in multilateral tariff elimination (or reductions). In such case home firms would face reduced tariffs in export markets. By ignoring this possibility the study might have under-estimated the welfare gains of tariff elimination.

Finally, our study is based on a partial equilibrium analysis. A more complete study would involve a general equilibrium analysis: two implications of such an extension may be mentioned. A decrease in tariffs for the industries concerned will release resources from these
industries. If these resources can be employed in some firms which can earn super-normal profits, these gains should be added to our calculation; by ignoring these gains we have underestimated the benefits of tariff reduction. However, some of the released resources may not be employed elsewhere. In such case it would be necessary for the government to implement a monetary and fiscal policy to maintain full employment with price stability. This in turn, would mean that the analysis must take account of the possible effects of trade liberalisation on the exchange rate, and other macroeconomic variables such as the rate of interest.

A more complete analysis of the welfare effects of tariff elimination would need to take these limitations into consideration.
This appendix proves that in a particular case of constant elasticity schedule the tariff may have no effect on the industry price. In other words, this appendix is to show that in such a case, the elasticity of excess demand curve will not be affected by the tariff. Thus the profit-maximizing price will remain unchanged. Consider a system described by the following equations:

\[ Q_d = AP_d^\alpha \]  
\[ Q_s = BP_s^\beta \]  
\[ D_E = Q_d - Q_s \]  
\[ P_d = P_s (1 + t) \]

\( Q_d \) is the home demand for the product, \( P_d \) is the home price, \( \alpha \) is the price elasticity of home demand, \( Q_s \) is the foreign supply of the product, \( P_s \) is the world price, \( \beta \) is the price elasticity of foreign supply, \( D_E \) is the demand for the monopolist's product, and \( t \) is the ad-valorem rate of tariff. Eq. (1) states that the home demand is a function of the home price, (2) reveals that the foreign supply is a function of the price received by foreign firms, (3) defines the demand for the monopolist's product and (4) expresses that the price in the tariff imposing country will exceed the world price by the amount of tariff.

From the above equations we can formulate the price elasticity of the excess demand curve. Denoting the elasticity by \( E_x \) we have:
By using equations (1) to (4) we get,

\[
\frac{dD}{dP} = \frac{dQ_d}{dP} - \frac{dQ_s}{dP} = \alpha P_d \alpha - 1 - \beta B P_d \beta - 1 \tag{6}
\]

Now substitute (6) into (5), shows that

\[
E_x = \left[ \alpha P_d \alpha - \beta B P_d \beta \right] \left[ \frac{1}{AP_d \alpha - B P_d \beta} \right] \tag{7}
\]

Now if \(|\alpha| = \beta\) e.g. (7) can be simplified to:

\[
E_x = \alpha
\]

Since \(\alpha\) is a constant, we have:

\[
\frac{dE_x}{dt} = 0
\]

In other words when the price elasticity of home demand (ignoring the sign) equals the elasticity of foreign supply, the price elasticity of excess demand will equal each of these and be independent of the tariff rate.
Throughout this study it was often necessary to aggregate or
disaggregate different classification in order to fit U.K. 1963
input-output classification. This appendix gives the correspondence
between the 1963 U.K. input-output classification and other
classifications used in this study.
## Assumed Correspondence Between United Kingdom Input-Output Classificants with United Kingdom Census of Production S.I.C. and United Nations S.I.T.C.

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This Appendix discusses the sources and description of the data used in the regression analyses. The data are shown in statistical tables below.

1. **Price-Cost Margin:**

Price-cost margin is the gross profit before tax expressed as a percentage of the sales of the industry. Gross profit and other trading income is defined as factor income (except income from employment) plus gross trading profits of companies minus stock appreciation. Sales are defined as the total commodity supply. These definitions and the data for gross profit and total sales are taken from the United Kingdom Input-Output Tables for 1963 and 1968, Central Statistical Office (1970 and 1973).

2. **Output:**

Output is measured by the money value of the domestic output consumed at home. This was calculated by subtracting the value of import and export of each commodity from its total sales value. Sales of commodity are defined as above. The relevant figures are taken from U.K. Input-Output Tables for 1963 and 1968, Central Statistical Office (1970 and 1973).

3. **Seller Concentration:**

Seller concentration, is measured by the share of the five largest enterprise in the industry's total sales. The data for sales of the five leading enterprises were taken from the census of production (Summary Tables) for 1963 and 1968, Board of Trade (1970) and Department of Trade and Industry, Business Statistics Office (1972).
4. **Capital Intensity**: 
Capital intensity is measured by the ratio of the industry capital expenditure over its total number of employees. Capital expenditure is defined as the total acquisition of land and new or existing buildings, plant and machinery and vehicles less disposal. 

Data on these items were obtained from the United Kingdom Census of Production (Summary Tables) for 1963 and 1968, Board of Trade (1970) and Department of Trade and Industry Business Statistics Office (1972).

5. **Growth of Demand**: 
Growth of demand is measured by the annual rate of growth of sales (at current prices) between 1958 and 1963 and between 1963 and 1968. Sales figures are taken from U.K. Input-Output Tables (1963 and 1968) and U.K. Census of Production (Summary Tables) for 1958 and 1963.

6. **Advertising Intensity**: 
Advertising intensity is measured by the ratio of advertising expenditure over industries' total sales. Advertising expenditures are taken from the U.K. Census of Production (Summary Tables) for 1963 and 1968.

7. **Foreign Competition**: 
Foreign competition is measured by either import competition or tariff protection.

Import competition is measured by the ratio of import/home consumption, where consumption is that of the home production only.

Tariff protection is measured by the weighted nominal tariff rate. The relevant tariff rates are taken from the study by Kitchin, P.D. (1975).

8. **Correction for the Industry Size**

The chosen corrective measure is the imports of OECD countries exclusive of the imports of U.K. and Japan. OECD imports are taken from Statistics of Foreign Trade, OECD (1963 and 1968) Trade by Commodities, Series B.
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This appendix derives the conditions under which the price elasticity of import demand is equal to the price elasticity of demand for home products. Let us consider the following Cobb-Douglas utility function for a consumer who consumes home products as well as imported goods.

\[ U = A q^a m^b \]  

(1)

Where \( U \) is the utility enjoyed by the consumer, \( q \) is the consumption of home products and \( m \) is the consumed imports, while \( a \) and \( b \) are the exponents of \( q \) and \( m \) respectively. These components (\( a \) and \( b \)) can be expressed as the utility elasticities of the consumption of home products and of imports respectively.

The equality of the price elasticity of home demand and that of the import demand requires the following relationship:

\[
\frac{e_q}{e_m} = \frac{e_d}{e_m} = \frac{\frac{dP_d}{dP}}{\frac{dP_m}{dP}}
\]

(2)

\[
\frac{dP_d}{dP} = \alpha \frac{q}{P_d} = \frac{dP_m}{dP} = \beta \frac{m}{P_m}
\]

\[ \ln U = \ln A + \alpha \ln q + \beta \ln m \]

\[ \frac{d\ln U}{d\ln q} = \frac{\frac{dU}{U}}{\frac{dq}{q}} = \alpha \]

\[ \frac{d\ln U}{d\ln m} = \frac{\frac{dU}{U}}{\frac{dm}{m}} = \beta \]
Where \( e_d \) is the price elasticity of home demand, \( e_m \) is the price elasticity of import demand, \( P_d \) is the price of domestic products and \( P_m \) is the price of imports.

Assuming that the price of a commodity (domestic or foreign product) is equal to the marginal utility derived from its consumption, \( P_d \) and \( P_m \) can be calculated as follows:

\[
P_d = \frac{dU}{dq} = A\alpha q^{\alpha-1} m^\beta
\]
\[
P_m = \frac{dU}{dm} = A\beta m^{\beta-1} q^\alpha
\]

It follows from the above that:

\[
\frac{dP_d}{dq} = A\alpha (\alpha-1) q^{\alpha-2} m^\beta
\]

and similarly we can write:

\[
\frac{dP_m}{dm} = A\beta (\beta-1) m^{\beta-2} q^\alpha
\]

Substituting (3), (4), (5) and (6) into (2) give the following:

\[
\left[ A\alpha (\alpha-1) q^{\alpha-2} m^\beta \right] \frac{m}{A\alpha q^{\alpha-1} m^\beta} = \left[ A\beta (\beta-1) m^{\beta-2} q^\alpha \right] \frac{m}{A\beta m^{\beta-1} q^\alpha}
\]

\[
\alpha - 1 = \beta - 1
\]

and finally

\[
\alpha = \beta
\]


- 103 -


SCHUMACHER, D. (1977). "Increased Trade with the Third World, German Workers will have to switch jobs but not lose them", *DIW Wochenbericht*, No.5.


