An Input-Output Analysis
of the De-Industrialisation
of the U.K. Economy, 1963-1973 *

I. Introduction

This paper has two aims: (i) to estimate output and price elasticities of sectors as well as the whole economy, and (ii) to find out the reasons why the phenomenon of de-industrialisation, i.e. the decline in the share of output of the manufacturing sector in the whole national output, has been observed in advanced countries such as the U.K. in recent decades. We use, for this purpose, input-output tables which are combined with sectoral production functions (of the Cobb-Douglas type) to represent the supply side. Personal consumption of goods and services is regarded as endogenous.

To estimate output and price elasticities, we confine ourselves to the case of sectoral exogenous demands all changing proportionately. If the elasticities of outputs with respect to a proportional change in the exogenous demands are found to be all equal to 1, so that the price elasticities are all 0, the economy may be said to be a perfect fixprice economy, while when they all take on 0 and the price elasticities are all 1, it is a perfect flexprice economy, or, according to Keynes, an economy which is under a "true inflation". Comparing our estimates for the U.K., 1963-1973, with those for Japan, 1960-1973, and Italy, 1965-1975, calculated in the same way, we find that price elasticities are generally higher in Italy and Japan than in Britain; so that a flex-

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price neoclassical model would better fit Japan and Italy than a fix price Keynesian one, while the opposite would be true for the British economy.

As for the de-industrialisation, we discuss it from the viewpoint of the distribution of value added rather than the distribution of the working population among sectors. By using input-output tables we obtain the total income of sector i at factor cost as:

\[
\text{the value added ratio} \times \text{(output of industry i)} = \text{(the value added ratio)} \times \text{(the inter-industrial output matrix multipliers)} \times \text{(the exogenous demands)},
\]

which is equal to:

\[
\text{(the sectoral income multipliers)} \times \text{(the exogenous demands)}.
\]

Therefore the fluctuations of the sectoral income can be reduced to the fluctuations in the two factors: multipliers and multiplicands (the exogenous demands). Although, as will be seen, the aggregate multiplier has declined in the period with which we are concerned, the sectoral multipliers have changed in such a way that agriculture and the manufacturing industry will decline and the public administration sector will increase. There are a number of factors which may induce such changes: (i) tax effects, (ii) consumption effects, (iii) exogenous (or final) demand effects, (iv) import substitution effects, and (v) technology effects. By the use of the available input-output tables for the U.K. these effects are quantitatively identified and their significance compared with each other. Among the five items above, although it is found by simulations that (i) and (iv) have fairly large effects on the values of the sectoral and aggregate multipliers, their effects upon the distribution of national income among industries are seen to be generally small; it is found that the movement of sectoral shares of income through time is explained to a large extent by the final demand effects.

Section II describes the model. Section III presents estimates of the various multipliers, Section IV analyses those which we call the "fixprice" multipliers into the five effects mentioned above and Section V analyses the process of de-industrialisation in the U.K., 1963-1973.

II. The model

The model used is a conventional Leontief model with endogenous consumption. Coefficient \( \alpha_i \) represents a value input coefficient,

\[
\alpha_i = \frac{p_j x_{ij}}{p_i x_i}, \quad i, j = 1, \ldots, n_i
\]

that is, the value of output i which is necessary to produce one unit value of output j, where \( x_{ij} \) is the total physical input of commodity i for production of the total physical output of j, \( x_i \) and \( p_j \) are prices of respective commodities i and j. Obviously, the physical input coefficient is defined as \( \xi_{ij} = x_{ij}/x_i \). Of course, in the actual input-output tables industries produce a number of heterogeneous outputs, but throughout this paper we proceed with our analysis as if each industry produced a single output. Following Klein we make an assumption which is consistent with Leontief's empirical findings and theoretical model; that is, constant are value input coefficients (rather than physical ones) as
well as the import coefficients $\beta_i$ and share of wages $\gamma_i$ of each industry $i$. We also assume that competitive pricing prevails. It has been shown that these two assumptions together imply that the industrial production functions are of the Cobb-Douglas form:

$$\begin{align*}
x_i &= G_i x_1^{\alpha_{i1}} \cdots x_n^{\alpha_{in}} \gamma_i m \beta_i,
\end{align*}$$

(2)

where $G_i$ is the productivity coefficient, $l$ the labour input, and $m_i$ the input of imported goods. With (2) we obtain (1) as the marginal productivity equation (or competitive pricing rule) for $x_i$. We also have similar equations for $l_i$ and $m_i$. Thus

$$\begin{align*}
\beta_i &= \frac{q_i m_i}{p_i x_i}, \\
\gamma_i &= \frac{w_i l_i}{p_i x_i},
\end{align*}$$

(3)

where $q_i$ represents the price of the composite commodity 'imports of industry $j$' and $w_i$ the wage rate in industry $j$.  

As for consumption expenditure decisions we assume that they may be represented by a Linear Expenditure System (Stone (1954)). Let $b_i$ be the marginal propensity to consume, $e_i$ the proportion of the total consumption expenditure which is spent on the output of industry $i$, $\pi_i$ the share of profit in the output of $i$, $\eta_i$ the proportion of profits distributed to individuals, and $t_i$ and $t_i$ the tax rates on wages and profits respectively. Then we can assume the demand for good $i$ which will arise from an increase in the output of industry $i$ will be proportional to

$$c_i = e_i b_i \{1 - t_i\} \gamma_i + \eta_i \{1 - t_i\} x_i.$$

(4)

In the following we assume $\gamma_i$, $e_i$, $b_i$, and $t_i$ to be constant and write the augmented input-output coefficients as

$$\alpha_{ij} = \alpha_{i1} + c_i,$$

(5)

Now the basic equations of input-output analysis are put in the form:

$$p_i x_i = \sum p_j x_j + p_i c_i + p_i D_i, \quad i = 1, \ldots, n,$$

(6)

or

$$X_i = \sum (\alpha_{ij} + c_i) X_j + p_i D_i, \quad i = 1, \ldots, n.$$

(7)

\footnote{1 We can extend our analysis to a more realistic case of allowing for joint production and market imperfections. See Klein (1952).}

In view of (1) and (3) the 'indirect' production function can be derived from the 'direct' production function (2) as:

$$x_i^{\alpha_i} = H_i \left( \frac{p_i^*}{p_i} \right)^{\alpha_i},$$

(8)

where $\alpha_i = 1 - \sum \alpha_{ij} - \beta_i - \gamma_i$ and $H_i$ is an appropriate constant. We are now provided with two sets of $n$ equations (7) and (9) representing the demand side and the supply side, respectively. They are connected with each other by $n$ definitional equations (8). The variables contained in the whole three sets of $n$ equations are $X_1, \ldots, X_n, X_1 \ldots, x_n, p_1, \ldots, p_n, q_1, \ldots, q_i, w_1, \ldots, w_n, D_1, \ldots, D_n$ so that by regarding the prices of the imported goods $q_i$'s, wage rates $w_i$'s and exogenous demands $D_i$'s as given, the equations (7) - (9) are altogether able to determine the values of outputs $X_i$'s and the prices $p_i$'s.

Three kinds of multipliers, total, real and fiscal, can be derived in the following way. Since total income generated in industry $j$, $y_j$, is equal to the value of gross output minus the value of inputs other than labour, including outlay taxes paid by industry $j$, and is distributed among workers and capitalists, we have

$$y_j = \{1 - (1 + t_j) (\sum \alpha_{ij} + \beta_j)\} p_j x_j = v_j p_j x_j,$$

(9)

where $t_j$ is the average outlay tax for industry $j$ and $v_j$ stands for the value-added ratio, $\gamma_j + \pi_j$. From this we obtain the effect of $dD_j$ upon $y_j$ as

$$\frac{dy_j}{dD_j} = v_j \left[ 2 p_j x_j + \frac{2}{3} \frac{p_j}{x_j} \right], \quad j = 1, \ldots, n.$$

(10)

In this expression we can obtain derivatives $\partial p / \partial D_j$ from (7) - (9) and, therefore, derivatives $\partial x_j / \partial D_j$ from (9). On the right-hand side of (11) the first term of the part in square brackets gives the

\footnote{2 For the sake of simplicity the derivative has been made here at the industry level. It can, however, equally be made at the firm level. See Morishima-Murata (1972) pp. 257-59.}

\footnote{3 Regarding $q_i$'s and $w_i$'s as given, (9) gives $x_i$ as a function of commodity prices $p_i$'s. Substituting the $x_i$'s thus obtained into (8), we have the values of output $X_i$'s as functions of prices. The input-output (or demand-supply) equations (7) can be regarded as the prior-determination equations, and from them we obtain $\partial p / \partial D_j$, $j = 1, \ldots, n$. See Morishima-Murata (1972) pp. 259-61.}
nominal increase in p.x, due to \( \frac{\partial p}{\partial D_k} \) with \( x_i \) being unchanged and the second term the real increase in it due to \( \frac{\partial x_i}{\partial D_k} \) with \( p_i \) unchanged. The total effect on \( y_j \) which includes the nominal increase gives the total multiplier, while the real multiplier is obtained by eliminating the nominal effect from the total one. Thus we may write:

\[
\left( \frac{\partial y_j}{\partial D_k} \right)_h = v_i \left( \frac{\partial p}{\partial D_k} x_i + p_i \frac{\partial x_i}{\partial D_k} \right), \quad j = 1, \ldots, n. \tag{12}
\]

and

\[
\left( \frac{\partial y_j}{\partial D_k} \right)_h = v_i p_i \frac{\partial y_j}{\partial D_k}, \quad j = 1, \ldots, n. \tag{13}
\]

which represent the total and the real sectoral-income multipliers, respectively.

Let us now imagine a proportional change in the final demands, i.e.

\[
dD_1 : dD_2 : \ldots : dD_n = D_1 : D_2 : \ldots : D_n.
\]

Then

\[
dD_j / dD = D_j / (\Sigma p_i D_i),
\]

where \( dD = \Sigma p_i dD_i \). We then have

\[
\left( \frac{dy_j}{dD} \right)_h = \Sigma_i \left( \frac{\partial y_j}{\partial D_i} \right)_h \frac{D_i}{\Sigma p_i D_i}, \quad j = 1, \ldots, n,
\]

\[
\left( \frac{dy_j}{dD} \right)_h = \Sigma_i \left( \frac{\partial y_j}{\partial D_i} \right)_h \frac{p_i D_i}{\Sigma p_i D_i}, \quad j = 1, \ldots, n,
\]

These give the total and the real multiplier effects of a proportional change in the final demands.\(^5\)

Being provided with these we can easily calculate the elasticities of output and price, \( e_y \) and \( e_p \), respectively, in response to a change in effective demand measured in terms of money, \( y_j \). When final demands increase proportionately, the effective demand for industry \( j \) changes by

\[
dy_j = \left( \frac{dy_j}{dD} \right)_h dD \tag{14}
\]

in money terms, while the real output by

\[
dx_j = \left( \frac{dx_j}{dD} \right)_h dD, \quad dD = \Sigma \left( \frac{dx_j}{dD} \right)_h D_k / \Sigma p_i D_i. \tag{15}
\]

We then have from (13) and (10)

\[
dx_j = \left( \frac{dx_j}{dD} \right)_h dD = \left( \frac{dy_j}{dD} \right)_h dD / (v_i p_i) = \frac{x_i}{y_j} \frac{dy_j}{dD} dD.
\]

Therefore, in bearing (14) in mind, we find that the ratio of the real multiplier to the corresponding total multiplier gives the elasticity of output:

\[
e_y = \frac{y_i}{x_i} \left( \frac{dy_j}{dD} \right)_h = \frac{dy_j}{dD} \tag{16}
\]

Also, it can be seen that the ratio of the difference between the total and real multipliers to the total multiplier gives the elasticity of price:

\[
e_p = \frac{y_i}{x_i} \left( \frac{dy_j}{dD} \right)_h = \frac{dy_j}{dD} \tag{17}
\]

Of course, \( e_y + e_p = 1 \) for \( j = 1, \ldots, n \), because \( v \) is constant in (10).

Let us next derive the fixprice multipliers. Let \( A \) be the matrix of augmented input coefficients \( (\alpha_i + c_j) \); then equations (7) can be written in matrix form as

\[
\begin{align*}
\begin{bmatrix}
x
\end{bmatrix} = \begin{bmatrix}
\hat{p} \\
\end{bmatrix} A \begin{bmatrix}
x
\end{bmatrix} + \begin{bmatrix}
\mathbf{D}_i
\end{bmatrix}, \quad (7')
\end{align*}
\]

where \( x \) and \( \mathbf{D} \) are column vectors of dimension \((n\times1)\) with components \( x_i \) and \( D_i \) respectively, and \( \hat{p} \) a diagonal matrix of dimension \((n\times n)\) with diagonal elements \( p_i \). Differentiating (7') with respect to \( \mathbf{D} \), we have

\[
\begin{align*}
\begin{bmatrix}
\frac{dx}{dD}_i
\end{bmatrix} = \begin{bmatrix}
\frac{dx}{dD}
\end{bmatrix}_h \frac{dx}{dD} + \Delta_k \tag{15}
\end{align*}
\]

on the assumption that all prices remain unchanged. Here \( \Delta_k \) is a column vector of dimension \((n\times1)\) having 1 as the \( k \)-th component and zeros elsewhere, and subscript \( h \) attached to \( dx/dD \) represents that \( \hat{p} \) is kept constant in differentiation. With \( (dx/dD)_h \) thus obtained, the fixprice sectoral-income multipliers are given as

\[
\left( \frac{dy_j}{dD} \right)_h = v_i p_i \left( \Sigma_i \left( \frac{dx_j}{dD} \right)_h D_i / \Sigma p_i D_i \right), \tag{16}
\]

when final demands are increased proportionately.
These 'fixprice' multipliers may be compared with the 'real'
multipliers. Removing the assumption that prices are fixed, let us
differentiate (7) with respect to $D$. Then,
\[
\begin{align*}
\frac{dx}{dD} &= \hat{p}^{-1}A\frac{dp}{d\tilde{D}} + \hat{p}^{-1} \left[ A \frac{dp}{d\tilde{D}} x - \hat{p}^{-1} \frac{dp}{d\tilde{D}} Ax \right] + A
\end{align*}
\]  
Solving, we obtain $dx/d\tilde{D}$, $k = 1, \ldots, n$, which can be shown to equal
those $dx/dD$ which are used in the formula (13) for calculating the real
multipliers. Considering (15) we can see that the solutions to (17) may
be written as
\[
\begin{align*}
\frac{dx}{d\tilde{D}} &= \left( \frac{dx}{dD} \right)_\tilde{D} + (I - \hat{p}^{-1}A\hat{p})^{-1} \hat{p}^{-1} \left( A \frac{dp}{d\tilde{D}} x - \hat{p}^{-1} \frac{dp}{d\tilde{D}} Ax \right),
\end{align*}
\]  
on the right-hand side of which the first term represents the effects on
sectors physical outputs which an increase in $D$ would give rise to if
prices could be held constant in spite of the increase, i.e., the fixprice
sectors-physical-output multipliers. On the other hand, the second
term on the right-hand side gives the indirect effect of an increase in $D$
upon sectoral outputs through the channel of price changes. These
effects may further be split into two parts as is seen in (18). The matrix
$\hat{p}^{-1}A\frac{dp}{d\tilde{D}}$ gives the effects through the increases in output prices
on the augmented physical input coefficients $\hat{p}^{-1}A\hat{p}$, while the matrix
$\hat{p}^{-1} \frac{dp}{d\tilde{D}}$ the effects through the increases in input prices. Any
(i, j) element of the difference between the two matrices tells us, if
positive, that the output price $p_i$ will rise more than the input price $p_j$.

Hence, industry $j$ will use a greater quantity of commodity $i$ per unit
production of commodity $j$, so that the price effects on the sectoral-
output multipliers are positive; that is the fixprice sectoral-physical
output multipliers (the complete expression of (18)) is larger than the
corresponding fixprice output multipliers (the first term of (18)).
Conversely, if it is negative, the input price $p_i$ will rise more than the
output price $p_j$; and the fixprice multipliers will be smaller than the
corresponding fixprice multipliers.

If there were no errors in our estimation of the aggregate
consumption function, then it is seen that the fixprice sectoral-income
multipliers $\left( \frac{dy}{dD} \right)_i$ would be proportional to the sectoral incomes $y_i$
$j = 1, \ldots, n$. Let the column vector of sectoral incomes $y_i$ be denoted
by $y$ which is $y = \hat{y}x$, where $\hat{y}$ is a diagonal matrix with value-added
ratios, $v_i = y_i + \pi$, on the diagonal. Considering (7) (which assumes
that the aggregate consumption function is estimated accurately) and
(8), we have
\[
y = \hat{y}(I - A) \hat{p}D.
\]
We know, however, from (15) and (16) that
\[
\left( \frac{dy}{dD} \right)_i = \hat{y}(I - A) \hat{p}D (\Sigma pD).
\]
(Note that we assume that $D$'s change proportionately.) Hence,
\[
\begin{align*}
y &= \left( \frac{dy}{dD} \right)_i, \\
Y &= \left( \frac{dy}{dD} \right)_i, \\
\end{align*}
\]  
where $Y$ stands for the national income, i.e., $\Sigma y$. Thus, by calculating
the ratios of the fixprice sectoral-income multipliers to the fixprice
national-income multiplier for various years, we can trace out how the
distribution of the national income among industries has changed in
these years.

III. Estimates of multipliers and output and price elasticities

Input-output tables for the United Kingdom, Japan and Italy are the
main source from which the coefficients of our model are estimated, along
the lines presented in section II above.\footnote{For the estimation of $\lambda$, $\beta$, $\eta$ and the marginal propensity to consume, $h$, it was necessary to make use of a variety of sources (details of the estimation procedures are available on request). It is worthwhile mentioning that the estimates for $h$ were: .68 for the U.K., .55 for Japan, and .48 for Italy.}

I. Fixprice multipliers

Results are presented in Table 2, at a five-sector aggregation level
for (I) 'agriculture', (II) 'manufacturing' (III) 'non-manufacturing indus-
tries', (IV) 'services', and (V) 'public administration'. Two features of
the aggregate national income multipliers are rather striking. First, its low level throughout the decade, with a maximum of 1.316 in 1963, is consistent with macro-economic observations, say, on the basis of the Klein-Goldberger model by Goldberger (1959). Secondly, its steady fall between 1963 and 1970, followed by an increase in 1971 and 1972, and by another fall in 1973 to its 1970 level of 1.188. These values are compared with a similar estimate, 1.333, of the income multiplier for the U.K., 1954 by Morishima and Nosse.7

Table 2

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<td>1.232</td>
<td>1.188</td>
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* Figures in brackets give the percentages of sectoral real multipliers to the corresponding national income multipliers.

Turning now to consider the dynamics of sectoral multipliers over the period, we can see how all four private sector multipliers were lower in 1973 than in 1963, and only that for public administration was higher. Two features of the results are particularly interesting: firstly, that manufacturing is the only sector in which the decrease has been monotonic. Thus it would seem that the factors which in some years positively affected the multipliers in other sectors, did not have a relevant influence on manufacturing. Secondly the multiplier for services shows a considerable decrease over the period, and this does not seem to agree with conventional views simply interpreting the decline of manufacturing as stemming from a substitution of services for goods.

If there were no errors in our estimation of the aggregate consumption function, then, as formula (19) above shows, the ratio between the sectoral and national fixprice multipliers would be identical to the ratio between the sectoral and national value added. Thus, the comparison between the percentages given in the parentheses in Table 2 and the industrial shares of national income given in Table 1 enables us to obtain some idea of the significance of our error in estimating the aggregate consumption function. This is found to be of negligible size reaching a maximum, for manufacturing, of only 0.8% of the actual share of the sector.

2. Real and total multipliers

Let fixprice, real and total multipliers concerning sector i be denoted by \( \mu, \mu^r, \) and \( \mu^t, \) respectively. They of course satisfy the identities:

\[
\mu^r = \mu, \quad \mu^t = \mu^r + (\mu^r - \mu).
\]

In these, the difference between real and fixprice multipliers \( \mu^r - \mu \)
represents the price effect on the real income, while the difference between total and real multipliers, \( \mu^t - \mu^r \), represents the purely inflationary price effect on the nominal income. They are referred to as the real price effect and the inflationary price effect, respectively. Tables 3 and 4 show our estimates of real and total multipliers at the five-sector aggregation level, from which the real and nominal price effects can at once be derived. Of course the total price effect is obtained by adding up the two price effects.

Both real and total multipliers are shown to follow quite closely the general pattern of the fixprice multipliers, and all the remarks made on the last can be extended to the first two.

### Table 3

**REAL INCOME MULTIPLIERS FOR THE U.K.**

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<td>.256</td>
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<tr>
<td><strong>Total</strong></td>
<td>1.260</td>
<td>1.197</td>
<td>1.156</td>
<td>1.156</td>
<td>1.207</td>
<td>1.160</td>
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### Table 4

**TOTAL INCOME MULTIPLIERS FOR THE U.K.**

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<td>.032</td>
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<tr>
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<td>.507</td>
</tr>
<tr>
<td>Non-Manufacturing</td>
<td>.440</td>
<td>.418</td>
<td>.378</td>
<td>.388</td>
<td>.417</td>
<td>.405</td>
</tr>
<tr>
<td>Services</td>
<td>.582</td>
<td>.537</td>
<td>.508</td>
<td>.562</td>
<td>.561</td>
<td>.510</td>
</tr>
<tr>
<td>Public Administration</td>
<td>.336</td>
<td>.352</td>
<td>.347</td>
<td>.389</td>
<td>.409</td>
<td>.389</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2.082</td>
<td>1.968</td>
<td>1.873</td>
<td>1.947</td>
<td>1.992</td>
<td>1.863</td>
</tr>
</tbody>
</table>

Purely inflationary effects have accounted for a considerable portion of the total aggregate multiplier, being almost constant around 58%-39% of the latter throughout the period. Thus it would seem that total demand expansion policies have been consistently likely to give rise to considerable inflationary pressure in the sample years. At the sectoral level, the share of inflationary effects in the multiplier has undergone some interesting changes. It has steadily decreased in each year in manufacturing from 27% in 1963 to 21% in 1973, while it has steadily increased in public administration from 38% to 41% over the period (except 1971).

#### 3. Output and price elasticities

In view of the formulas for the output and the price elasticities above we may write:

\[ e_p = \frac{\mu^*}{\mu^*} \]

Since estimates of the real and the total multipliers are now provided, it is easy to calculate the elasticities. The results at the five-sector level are presented in Table 5 for price elasticities (output elasticities can be easily obtained as the complement to one of the price elasticities). These show that in the U.K. economy the agriculture and manufacturing sectors are fixed-price type sectors with low price elasticities, while the service sectors are of flexible price type with high price elasticities.

### Table 5

**PRICE ELASTICITIES FOR THE U.K.**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>.258</td>
<td>.299</td>
<td>.299</td>
<td>.274</td>
<td>.330</td>
<td>.308</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>.271</td>
<td>.255</td>
<td>.233</td>
<td>.230</td>
<td>.226</td>
<td>.210</td>
</tr>
<tr>
<td>Non-Manufacturing</td>
<td>.389</td>
<td>.398</td>
<td>.376</td>
<td>.378</td>
<td>.372</td>
<td>.355</td>
</tr>
<tr>
<td>Services</td>
<td>.563</td>
<td>.543</td>
<td>.533</td>
<td>.517</td>
<td>.581</td>
<td>.645</td>
</tr>
<tr>
<td>Public Administration</td>
<td>.380</td>
<td>.391</td>
<td>.396</td>
<td>.394</td>
<td>.397</td>
<td>.406</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>.395</td>
<td>.390</td>
<td>.383</td>
<td>.406</td>
<td>.394</td>
<td>.377</td>
</tr>
</tbody>
</table>
These results are confirmed by the detailed results at the 35-industry level. The average price elasticities over the six sample years take on a very low value (i.e., below 0.13) for such industries as coke ovens, instrument engineering, shipbuilding, aerospace equipment, other vehicles, leather, clothing and footwear, timber and furniture; a considerably low value (i.e., between 0.15 and 0.25) for agriculture, forestry and fishing, coal mining, other mining and quarry, food, drink and tobacco, mineral oil refining, non-ferrous metals, motor vehicles, textiles, bricks, other manufacturing, gas, communications; and a fairly low value (i.e., between 0.25 and 0.35) for iron and steel, mechanical engineering, electrical engineering, other metal goods, and paper and printing. The national average of the price elasticities over the six years is 0.39; the elasticities for the two service industries are clearly above the average, the distributive trades taking on 0.44 and miscellaneous services 0.64. The remaining industries (chemicals, construction, electricity, water, transport) have elasticities between 0.35 and 0.44.

In comparison with the results for Japan and Italy, presented in tables 6 and 7, it is observed that the Japanese and the Italian economy are generally more price elastic than the British, so that we may categorically say that the former two are of a 'flexprice' type, while the latter is more or less on the 'fixprice' side.

We may see, in particular, that:

— for agriculture price elasticities are extremely high in Italy, lower in Japan and lowest in Britain, so that, owing to diminishing returns to scale, an increase in demand has substantial inflationary effects in the first two countries;

— manufacturing is a 'fixprice' sector in all three countries; its price elasticities are considerably lower than those of the other sectors in each country in all years;

— for non-manufacturing price elasticities are somewhat higher in Italy than in Japan;

— the service industries show an extremely high price elasticity for Japan, lower for Italy and lowest for Britain: we may therefore observe that, of the two 'flexprice' economies, the Japanese one tends to develop demand-pulled inflationary pressures mainly in the service sector, while the Italian one in the agricultural sector;

— public administration shows lower than average price effects in each country, but this fact should be interpreted with care as this sector includes in Britain and Japan 'ownership of dwellings', so that its price elasticities result from the aggregation of a strongly 'fixprice' sector (public administration), with a strongly 'flexprice' sector (ownership of dwellings).

### Table 6

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>.546</td>
<td>.585</td>
<td>.473</td>
<td>.485</td>
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<tr>
<td>Manufacturing</td>
<td>.357</td>
<td>.344</td>
<td>.574</td>
<td>.268</td>
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<tr>
<td>Non-Manufacturing</td>
<td>.528</td>
<td>.551</td>
<td>.372</td>
<td>.504</td>
</tr>
<tr>
<td>Services</td>
<td>.931</td>
<td>.938</td>
<td>.981</td>
<td>.809</td>
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<tr>
<td>Public Administration</td>
<td>.435</td>
<td>.241</td>
<td>.211</td>
<td>.160</td>
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<td>Total</td>
<td>.629</td>
<td>.657</td>
<td>.691</td>
<td>.634</td>
</tr>
</tbody>
</table>

### Table 7

<table>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>1.093</td>
<td>.929</td>
<td>.916</td>
<td>.866</td>
<td>.917</td>
<td>.833</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>.362</td>
<td>.347</td>
<td>.321</td>
<td>.326</td>
<td>.346</td>
<td>.349</td>
</tr>
<tr>
<td>Non-Manufacturing</td>
<td>.607</td>
<td>.562</td>
<td>.564</td>
<td>.504</td>
<td>.695</td>
<td>.470</td>
</tr>
<tr>
<td>Services</td>
<td>.680</td>
<td>.680</td>
<td>.680</td>
<td>.680</td>
<td>.675</td>
<td>.664</td>
</tr>
<tr>
<td>Public Administration</td>
<td>.421</td>
<td>.340</td>
<td>.353</td>
<td>.351</td>
<td>.320</td>
<td>.246</td>
</tr>
<tr>
<td>Total</td>
<td>.621</td>
<td>.573</td>
<td>.538</td>
<td>.552</td>
<td>.532</td>
<td>.577</td>
</tr>
</tbody>
</table>
IV. An analysis of the price multipliers by simulation experiments

It is clear from the exposition of our model in section II above that the values of income multipliers depend on:

(i) the technological coefficients \( \alpha, \beta, \gamma \);
(ii) the portion of business profits distributed to individuals, \( \eta \);
(iii) the direct and indirect tax rates, \( t_1, t_2, t_3 \);
(iv) the marginal propensity to consume \( b \);
(v) the coefficients of allocation of consumption expenditure among goods \( \kappa \); and
(vi) the structure of final demand, represented by ratios \( \frac{p_i d_i}{\Sigma p_i d_i} \), for \( k = 1, ..., n \).

In this section we are concerned with the quantitative assessment of the influences on income multipliers of the factors (i), (ii), (v), (vi). We shall not be concerned here with the relevance of \( \eta \) since this parameter showed very little variability throughout the period. Nor shall we discuss changes in the marginal propensity to consume, which we estimated as being constant over the period 1959-1977 by using a mixed time series-cross section method.

To assess the influences of the various factors on the price multipliers, a number of simulations have been performed. We have computed the values of the multiplier for an hypothetical economic system having (say) the 1963 technology, demand and consumption structures but, as for the direct and indirect tax rates, having those which were actually observed in 1968.

The difference between this hypothetical multiplier (\( \mu_3 \)) and the actual multiplier for 1963 (\( \mu_4 \)), then, gives us a measure of the importance of direct and indirect tax rates in explaining the change in sectoral multipliers between 1963 and 1968. After that, the importance of consumption structure has been measured by the difference between a second hypothetical multiplier for a system with the 1963 technology and final demand structures, but with the 1968 tax rates and con-

\* In view of (8) and (10) the endogenous consumption coefficients can be written as:

\[ c_t = \eta, b \left[ (1 - t_2) \gamma_1 + \eta \right] - \eta, b \left[ 1 - \theta + \gamma_2 \right] (\alpha_0 a_0 + \beta) - \gamma_1. \]

8 The magnitudes of the tax, consumption, final demand, import substitution and technology effects, into which the sectoral and aggregate multipliers are analysed, are not independent of the order of the simulation experiments being made. For example, if hypothetical multipliers \( \mu_4 \) are first calculated on the basis of the 1963 technology, tax rates and final demands and the 1968 consumption pattern, the consumption effects \( \mu_4 - \mu_3 \) will generally be different from the effects calculated above at \( \mu_3 - \mu_2 \). A similar observation was made by MOKO (1962) for the income and substitution effect on consumer demand. He showed that the order of the simulations does not significantly affect the magnitudes of these effects, provided that shocks make very small changes. Such observation was confirmed by varying the order of the simulations in an application of our model to Italy, where it was also found that the results of the simulations were practically unaffected if, in each simulation, only one factor was altered instead of more than one at the same time; see PACE (1983) ch. III.
<table>
<thead>
<tr>
<th>Year</th>
<th>Sector</th>
<th>Total Change</th>
<th>Tax Effect</th>
<th>Consumption Effect</th>
<th>Total Demand Effect</th>
<th>Import Substitution Effect</th>
<th>Structural Technological Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>Agriculture</td>
<td>-0.88</td>
<td>-0.52</td>
<td>-0.35</td>
<td>-0.33</td>
<td>+0.09</td>
<td>+0.23</td>
</tr>
<tr>
<td>to Manufacturing</td>
<td>-3.55</td>
<td>-0.60</td>
<td>-0.19</td>
<td>-0.24</td>
<td>-0.28</td>
<td>+0.07</td>
<td>+0.20</td>
</tr>
<tr>
<td>1968</td>
<td>Non-Manufacturing</td>
<td>-1.79</td>
<td>-1.35</td>
<td>-0.24</td>
<td>-0.39</td>
<td>-0.24</td>
<td>+0.17</td>
</tr>
<tr>
<td>Services</td>
<td>-2.82</td>
<td>-2.60</td>
<td>-0.44</td>
<td>-0.29</td>
<td>-0.24</td>
<td>+0.17</td>
<td>+0.14</td>
</tr>
<tr>
<td>Public Administration</td>
<td>+0.70</td>
<td>-0.38</td>
<td>+0.63</td>
<td>+0.44</td>
<td>+0.15</td>
<td>+0.14</td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td>-5.46</td>
<td>-1.16</td>
<td>+0.56</td>
<td>-1.55</td>
<td>-0.25</td>
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<tr>
<td>1968</td>
<td>Agriculture</td>
<td>-2.26</td>
<td>-0.28</td>
<td>+0.22</td>
<td>+0.11</td>
<td>+0.01</td>
<td>-0.32</td>
</tr>
<tr>
<td>to Manufacturing</td>
<td>-1.77</td>
<td>-0.87</td>
<td>-0.03</td>
<td>+0.35</td>
<td>-0.98</td>
<td>-0.24</td>
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</tr>
<tr>
<td>1970</td>
<td>Non-Manufacturing</td>
<td>-2.09</td>
<td>-0.58</td>
<td>-0.03</td>
<td>+0.34</td>
<td>-0.41</td>
<td>+0.19</td>
</tr>
<tr>
<td>Services</td>
<td>-1.67</td>
<td>-0.78</td>
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<td>+0.34</td>
<td>+0.24</td>
<td>+0.17</td>
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</tr>
<tr>
<td>Public Administration</td>
<td>+1.37</td>
<td>-0.37</td>
<td>+0.87</td>
<td>+0.72</td>
<td>-0.09</td>
<td>+0.14</td>
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<tr>
<td>Total</td>
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<td>-2.76</td>
<td>+0.33</td>
<td>+0.19</td>
<td>-2.09</td>
<td>+0.25</td>
<td></td>
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<tr>
<td>1970</td>
<td>Agriculture</td>
<td>-0.07</td>
<td>+0.13</td>
<td>-0.09</td>
<td>-0.12</td>
<td>-0.03</td>
<td>+0.04</td>
</tr>
<tr>
<td>to Manufacturing</td>
<td>-1.10</td>
<td>+0.08</td>
<td>+0.06</td>
<td>-0.72</td>
<td>+0.81</td>
<td>-1.33</td>
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</tr>
<tr>
<td>1971</td>
<td>Non-Manufacturing</td>
<td>+0.14</td>
<td>+0.23</td>
<td>-0.14</td>
<td>-0.36</td>
<td>-0.17</td>
<td>-0.16</td>
</tr>
<tr>
<td>Services</td>
<td>+2.11</td>
<td>+0.56</td>
<td>+0.28</td>
<td>+0.30</td>
<td>-0.06</td>
<td>+0.16</td>
<td></td>
</tr>
<tr>
<td>Public Administration</td>
<td>+0.76</td>
<td>+0.07</td>
<td>+0.03</td>
<td>+0.75</td>
<td>+0.00</td>
<td>+0.04</td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td>+1.08</td>
<td>+0.08</td>
<td>+0.33</td>
<td>+0.68</td>
<td>-0.34</td>
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<tr>
<td>1971</td>
<td>Agriculture</td>
<td>+0.15</td>
<td>-0.10</td>
<td>-0.11</td>
<td>-0.60</td>
<td>-0.03</td>
<td>+0.35</td>
</tr>
<tr>
<td>to Manufacturing</td>
<td>-1.22</td>
<td>+0.42</td>
<td>+0.01</td>
<td>+0.31</td>
<td>-0.42</td>
<td>+0.70</td>
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<tr>
<td>1972</td>
<td>Non-Manufacturing</td>
<td>+1.56</td>
<td>+0.94</td>
<td>+0.06</td>
<td>+0.16</td>
<td>+0.13</td>
<td>+0.27</td>
</tr>
<tr>
<td>Services</td>
<td>+0.94</td>
<td>+0.16</td>
<td>+0.03</td>
<td>+0.33</td>
<td>-0.29</td>
<td>-1.00</td>
<td></td>
</tr>
<tr>
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<td>+0.26</td>
<td>+0.02</td>
<td>+0.96</td>
<td>-0.08</td>
<td>-0.02</td>
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</tr>
<tr>
<td>Total</td>
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<td>+2.43</td>
<td>+0.03</td>
<td>+0.60</td>
<td>+0.68</td>
<td>+0.31</td>
<td></td>
</tr>
<tr>
<td>1972</td>
<td>Agriculture</td>
<td>+0.00</td>
<td>+0.03</td>
<td>-0.03</td>
<td>-0.80</td>
<td>-0.45</td>
<td>+0.23</td>
</tr>
<tr>
<td>to Manufacturing</td>
<td>-1.92</td>
<td>+0.19</td>
<td>-0.37</td>
<td>+0.27</td>
<td>-0.75</td>
<td>+0.56</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>Non-Manufacturing</td>
<td>-1.33</td>
<td>-0.38</td>
<td>-0.44</td>
<td>-1.12</td>
<td>-1.26</td>
<td>+1.09</td>
</tr>
<tr>
<td>Services</td>
<td>-1.21</td>
<td>-0.11</td>
<td>-0.01</td>
<td>-1.20</td>
<td>-0.40</td>
<td>+0.51</td>
<td></td>
</tr>
<tr>
<td>Public Administration</td>
<td>-0.48</td>
<td>-0.36</td>
<td>-1.51</td>
<td>-1.16</td>
<td>-5.93</td>
<td>+3.20</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-12.73</td>
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<td>-2.29</td>
<td>-2.09</td>
<td>-9.67</td>
<td>+3.51</td>
<td></td>
</tr>
</tbody>
</table>

Note: All figures multiplied by 100.

Finally, final demand, consumption and technology effects have been relatively less important up to 1972, but became of considerable magnitude in 1972-73. Thus we may conclude that the dynamics of the multiplier has been dominated up to 1972 by a policy variable (taxation), but that its fall in 1972 has been caused by changing structural features of the system and in particular by import substitution effects.

Turning now to consider the relevance of the various effects at the sectoral level, we can see how taxation has generally affected all sectors in the same direction. This is particularly interesting since for a part of the decade (1966-71) the government tried to stimulate manufacturing and penalise services via the well-known Selective Employment Tax (SET). Examination of our results for the period 1963-68 suggests, however, that while the second objective was fully attained, the total effect of direct and indirect taxation on the manufacturing sector was also negative.

On the technological side import substitution effects have analogously influenced the different sectors in a similar fashion, being negative in general and being of greater relevance for manufacturing and services than for the other sectors. Residual technological effects, on the other hand, although showing a varying pattern from year to year have been positive for all sectors, except manufacturing, over the whole period (1963-73). Among the largest is the effect on the service sector.

On the demand side, over the whole period, consumption effects have been favourable for public administration and unfavourable for the other sectors. It is seen that they have been particularly negative for services, clearly reflecting the stronger impact on this sector of the process of substitution in consumption of publicly-provided goods and services for those provided by the private sector. Final demand effects, on the other hand, show a varying pattern reflecting the changes in the mix, within final demands, among autonomous consumption, investment, export and government expenditure. Over the decade, however, they broadly tend to follow the pattern of the consumption effects.

V. A simulation analysis of the change in sectoral shares

Having analysed, in the last section, the influence of a number of factors on the value of sectoral multipliers, we now turn to analyse their influence on the changes in the ratios of sectoral multipliers to the total national income multiplier. This, as it was discussed above (see 19), is equivalent to analysing the changes in sectoral shares in the total value added.
The method we have employed can be summarised as follows. Recalling that, for any year \( t \),
\[
y_t = \hat{v}_t (I - A_t)^{-1} E_t,
\]
where \( E_t = \hat{y}_t D, \hat{v}_t \) is the diagonal matrix of the sectoral value-added ratios, then the change in the sectoral income from \( t \) to \( t+1 \) will be given by:
\[
\Delta y_t = \Delta H_t E_{t+1} + H_t \Delta E_t,
\]
where \( H_t = \hat{v}_t (I - A_t)^{-1} \).

But, as we did in section IV above, we can decompose the change in the augmented inverse \( H \) into the changes attributable to taxation, consumption structure, import substitution and other effects, i.e.
\[
\Delta H = \Delta H_c + \Delta H_e + \Delta H_m + \Delta H_d,
\]
where the suffixes have the known meaning, and \( \Delta H_k \) is the change attributable to the residual factors.

Thus, for the \( i \)-th sector we may write:
\[
\Delta y_i = (\Delta H_i E_{t+1})_i + (\Delta H_e E_{t+1})_i + \ldots + (\Delta H_m E_{t+1})_i + (H_i \Delta E_t)_i,
\]
where the suffix \( i \) attached to a vector indicates its \( i \)-th element, and the last term shows the portion of change which is attributable to changes in the scale and the structure of the final demand vector. Now the change in sectoral shares between the two years is
\[
\Delta s_i = \frac{y_{t+1}}{Y_{t+1}} - \frac{y_{t}}{Y_t},
\]
where \( Y_{t+1} = \Sigma y_{t+1} \). It can be rewritten as
\[
\Delta s_i = (\Delta y_i - \Delta Y_i \frac{y_i}{Y_i}) + Y_{t+1}
\]
or, by (20) as:
\[
\Delta s_i = \left[ ((\Delta H_i E_{t+1})_i - u \Delta H_e E_{t+1} \frac{y_i}{Y_i}) + \ldots + ((\Delta H_m E_{t+1})_i - u \Delta H_m E_{t+1} \frac{y_i}{Y_i}) + ((H_i \Delta E_t)_i - u H_i \Delta \frac{y_i}{Y_i}) \right] Y_{t+1}
\]
where \( u \) is the summation vector whose elements are all 1. This equation decomposes the change in sector \( i \)'s share into effects attributable to taxation, consumption structure, import substitution, residual technological and final demand effects. The results of such analysis of changes in the shares over the whole period (1963-73) is presented in Table 9: the most notable changes in the period are found in the manufacturing sector, the share of which is estimated to decrease by 3.51 points (against the actual decrease by 3.36 points), and in the public administration sector with an estimated increase of 4.03 points in its share (against the actual increase by 4.16 points).

### Table 9

**Simulation Analysis of Share Changes: The U.K., 1963-1973**

<table>
<thead>
<tr>
<th></th>
<th>Annual Change</th>
<th>Estimated Change</th>
<th>Taxation Effect</th>
<th>Consumption Effect</th>
<th>Final Demand Effect</th>
<th>Import Substitution Effect</th>
<th>Residual Technological Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>-0.600</td>
<td>-0.540</td>
<td>-0.238</td>
<td>-0.077</td>
<td>-0.441</td>
<td>+0.194</td>
<td>+0.021</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>-3.360</td>
<td>-3.511</td>
<td>+0.096</td>
<td>-0.216</td>
<td>-2.606</td>
<td>+0.085</td>
<td>-0.870</td>
</tr>
<tr>
<td>Non-Manufacturing</td>
<td>+0.410</td>
<td>+0.406</td>
<td>+0.199</td>
<td>+0.058</td>
<td>+0.317</td>
<td>-0.028</td>
<td>-0.025</td>
</tr>
<tr>
<td>Services</td>
<td>-0.630</td>
<td>-0.382</td>
<td>-0.123</td>
<td>-0.245</td>
<td>-0.331</td>
<td>+0.004</td>
<td>+0.313</td>
</tr>
<tr>
<td>Public Admin.</td>
<td>+4.160</td>
<td>+4.028</td>
<td>+0.066</td>
<td>+0.596</td>
<td>+3.000</td>
<td>-0.253</td>
<td>+0.561</td>
</tr>
</tbody>
</table>

Our results suggest that changing consumption and final demand patterns have been the principal factors affecting changes in the shares: the sum of the two effects accounted alone for 90.7% of the rise in the share of the public administration sector and for 80.7% of the fall in that of manufacturing. Residual technological effects were also important in both sectors, while the import substitution effects upon the sectors other than agriculture are all small. The taxation effects upon the manufacturing sector and that upon public administration are also small.

**London**

**Bologna**

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REFERENCES


Origins and Impact of the Welfare State, 1883-1983 *

I. From Nightwatch State to Welfare State 1883-1983

The capitalist epoch began around the time of Marx's birth, and until the 1880s, when he died, the state's role was primarily passive and permissive. Classical political economy advocated policies of laissez-faire, and these were generally pursued in both the social and the economic field. It was an era when technology offered large prospects for profit, when international markets were much more open to competition than in the preceding merchant capitalist epoch, when profits were untaxed, and there was an unlimited supply of cheap labour at more or less subsistence wages.

The distribution of the gains from capitalist development was unequal. The bourgeoisie grew in size. They and older landowning and professional elites were enriched. In the working class, average subsistence needs increased as the urban-rural ratio rose, but illiteracy, population pressure, a repressive poor law, legal constraints on union activity and political disfranchisement kept them hungry, insanitary, ragged and exploited.1

The state was a nightwatchman whose expenditure was concentrated on soldiery and police protecting property and the national frontiers. It seemed inevitable that such a system should someday crack, as its ultimate legitimacy was so threadbare.

Since then capitalism has not collapsed and the state's role has grown significantly in four main dimensions:

* A shorter version of this paper was presented at the Marx-Keynes Schumpeter Symposium at the University of Gothenburg in September 1983 and I am grateful to the participants for comments on the draft. I am also grateful to Friedrich Kien and Ralf Meller for extensive discussions on this topic.

1 I am here simply making the point which seems incontestable, that inequality increased. I am not suggesting that working class standards did not increase in absolute terms from 1820 to the 1880s.