AN INQUIRY INTO DEINDUSTRIALISATION IN THE UK : THE TRANSITION TO A SERVICE-ORIENTED ECONOMY

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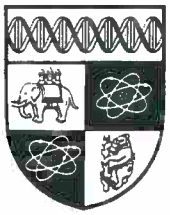

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AN INQUIRY INTO DEINDUSTRIALISATION IN THE UK : THE TRANSITION TO A SERVICE-ORIENTED ECONOMY*

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This paper is a revised version of my report at '1992 Warwick/Birmingham Workshop on Industrial Strategy'.

I. Introduction

Deindustrialisation seems to be a common phenomenon for advanced countries to some extent. In particular, in the UK continuing decline in industrial competitiveness against other advanced countries named the 'British disease'. The UK has lagged behind other advanced countries and there was a continues transition of resources from manufacturing sectors to service producing sectors. The UK's economy has experienced deindustrialisation[1)] over the past decades. The peak of employment in UK manufacturing was 1966. After that time employment in the manufacturing sector has gradually declined. 'Between 1966 and 1977, nearly 1.9 million jobs were lost in manufacturing, while a further 2.2 million were lost between 1977 and 1987'(Bazen (1989), p.11). Employees in employment in the manufacturing industries has declined to 5,097 thousand in 1988, which is under a quarter of total employees.[2)] Also the contribution of manufactures to the export surplus, and the UK's share of world market in manufactures have declined. If the expansion of activity and employment elsewhere in the economy is not enough to absorb the labour flooding out from the manufacturing sector, deindustrialisation may lead to unemployment.

In contrast to manufacturing sectors, the decline in relative size of UK's services has not happened. 'Services have not been so affected by the increasing import penetration which have become so evident with manufacturing'(Sargent (1979), p.103). And we can easily see that this tendency also applies after 1979 too. The service sector in the UK has created new jobs and grown in contrast with the manufacturing sector.

Not only transport and travel but also other services, which is composed of financial services and a miscellany of others, have maintained their positive contribution to the UK's economy.[3] After examining performance in foreign trade in manufacturing and in services, Sargent supported 'the claim that the UK has been developing a comparative advantage in services' and suggested that ' the advantage may be more than marginal in its significance' (Sargent, p.106). For the service industries, 'the marginal productivity of capital has held up better in relation to the average than has been the case for manufacturing'. Therefore, 'they still retain a capacity to absorb capital which manufacturing may have exhausted'(pp. 115-6). Lastly, Sargent reached the following conclusion; 'consequently the rate of growth of employment in manufacturing should at least rise relatively to services, even though it remains smaller or negative. Deindustrialisation, in other words, will decelerate'.(p. 116)

In general, deindustrialisation does not necessarily mean the decline of the international competitive power of manufactures. Deindustrialisation might allow the reallocation of resources from manufacturing sectors to service sectors so that service sectors could contribute to raising the quality of manufactures. Expansion of the service sector of the economy, which produces about three-fifths of private sector output, might stimulate the productivity in the manufacturing sector by means of coordinated investment and technical progress. Therefore as Sargent mentioned, because of comparative advantage in services, in the future, it is 'possible that trade in services may

benefit more than trade in goods from further liberalisation'?(Blackaby(1979), p. 3) In this paper, I want to examine this problem from a different point of view.

After the Second World War, Japan's economy has experienced considerable structural change. In the high economic growth era, Japan strengthened its international competitiveness through heavy and chemical industrialisation, by seeking to economies of scale. The expansion of the heavy and chemical industries meant that fewer resources were available for other sectors, generally for primary industry, which still employed around 50 percent of the labour force at the end of the War. The proportion of the labour force engaged in secondary industry, especially in manufacturing, has grown rapidly. Heavy and chemical industrialisation has been successfully established. Such modernisation of industrial structure has also necessarily resulted in a massive transformation in the structure of the manufacturing sector. The composition of Japanese exports has reflected the changing structure of production. For example, textiles and fiber, which was the most important export merchandise in the past, nowadays, has become entirely insignificant. Instead, machinery products, including motor vehicles, are flooding into the world. We can see the rapid structural change of Japan's economy across industries but also at the company level.

In addition, following the US and UK's economies, the greatest growth has been in the industries that produce services; they now employ around sixty per cent of the labour force. The largest relative expansion in the tertiary sector has occurred since the First Oil Crisis,

1973. Companies were forced to select new technology which could be expected to reduce energy and labour costs in order to increase productivity of their products and so to strengthen international competitiveness. Changes in the allocation of inputs, materials and labour force, have resulted in changes of industrial structure and also changes in the interdependence of industries. The locomotive of Japan's economy has changed from the heavy and chemical industry to the processing and assembly industries. Deindustrialisation was the meaning of re-allocation of resources aiming at a transition to a more service-oriented industrial structure. Japan's economy has gradually changed to a deindustrialised situation as the decade proceeded after the first oil crisis. In Japan, the term 'deindustrialisation' or the 'deindustrialised society' was thought as a desired situation which could free workers from routine and hard jobs and open the way to creative jobs. They regarded the more service-oriented economy, such as the US and UK, as an advanced one, at that time. And it seems likely that Japan's manufactures have strengthened international competitiveness through deindustrialisation in contrast to the UK's experience so far.

In this paper, I attempt to understand the importance of interdependence between industries, particularly manufacturing and service sectors. The main question I address is, to what extent has deindustrialisation benefited the UK's economy compared with Japan? In doing so, I chiefly use the input-output analysis in order to clarify the change of interdependence between the above two sectors. In the next section, I present an outline of an input-output system and some

results from that. Secondly, I explore the analytical framework by following Miyazawa(1963, 1975), which divided the original Leontief inverse into partial multipliers. In section IV, I deduce the other results from input-output analysis.

My analysis is based on the specially compiled 27 sector input-output tables for the duration of one decade.[4] I must admit that the following analysis is nothing more than a sketch when two countries' performance are compared, because of the lack of the completely consistent correspondence of the data in terms of constant prices and of inevitable difficulties in making comparison between countries. Therefore my prime attention is put on *the rate* of change in the figures, though I believe that my analysis identifies some interesting characteristics of the process of deindustrialisation.

II. An overview of input-output analysis

As Curwen(1990) mentioned, there might be a mismatch problem between unemployment and vacancies when industrial structure rapidly changes. Decision-making to allocate inputs for the modernisation of companies is decentralised to the level of individual establishments, and this decision-making causes the change of industrial structure, and also, the change of economic performance as a whole is attributed to the change of industrial structure, which reflects technological change in the long-run. Therefore, the industry-level analysis, well-known input-output analysis, makes it possible and useful to compare the different economic performances.

The basic formulation of the input-output system is the following,

$$\mathbf{X} = \mathbf{A}^*\mathbf{X} + \mathbf{F} \qquad (1)$$

Where **X** is the vector of commodity output (gross domestic output vector), $\mathbf{A}^*$ is the input coefficient matrix (n x n matrix), and **F** the final demand vector. That is to say,

$\mathbf{X} = (X_1, X_2, .., X_j, .., X_n)'$

$a_{ij} = x_{ij}/X_j$: input coefficient of industry j with respect to product i, and x_{ij} is the amount bought by sector j from sector i (i,j = 1,2,..,n),

$\mathbf{A}^* = (a_{ij})$

$\mathbf{F} = (F_1, F_2, .., F_j, .., F_n)'$

Equation (1) can be solved for **X** in terms of **F**, where a_{ij} and $\mathbf{A}^*$ are based on domestic inputs (for example the commodity by commodity domestic use matrix in Table 4 of Input-output tables for the United Kingdom 1984 version). Solving (1) gives the well known Leontief equation,

$$\mathbf{X} = (\mathbf{I} - \mathbf{A}^*)^{-1}\mathbf{F} \qquad (2)$$

Where I is the identity (or unit) matrix of order n x n and the matrix $(\mathbf{I} - \mathbf{A}^*)^{-1}$ is the Leontief inverse, each cell of which, b_{ij}^*, may be interpreted as the amount of gross output of the i-th sector's commodity needed both directly and indirectly to produce one unit of j-th sector's commodity for final output. So this shows the ultimate total effects of final demand. The Leontief inverse

$$(\mathbf{I} - \mathbf{A}^*)^{-1} = \mathbf{B}^* = (b_{ij}^*) \qquad (3)$$

can be called 'the Leontief matrix multiplier'. The value of b_{ij}^* shows the extend of interdependence between each sectors. The column sum, Σ

$_{i}b_{ij}$*, indicates the amount of inputs directly or indirectly needed to produce one unit of product j.

Table 1

Table 1 summarises the outline of the coefficients of the Leontief inverse matrices and the market share of production in two countries.[5] In Japan the average value of $\Sigma_{i}b_{ij}$*, the column sum of b_{ij}*, slightly fell from 2.0097 in 1975 to 2.0093, by 0.021 per cent. In manufacturing sectors, rubber, electronic machinery, precision instruments, and motor vehicle industries increased their value of $\Sigma_{i}b_{ij}$* and also these industries increased their output share. In contrast with Japan's case, in the UK's manufacturing sector *all industries* experienced a decline in the value of $\Sigma_{i}b_{ij}$*, except the petroleum refining industry, and the average of $\Sigma_{i}b_{ij}$* has changed from 1.845 in 1974 to 1.767 in 1984 by -4.309 per cent. The only exception, the petroleum refining industry, experienced a loss of output share (-0.203 per cent point). In addition, the most heavily weighted industry in terms of output share (11.353 per cent in 1984, excluding public administration), the finance, insurance and real estate industry , which has rapidly grown by 5.907 per cent points in this period, has experienced a decline in its value of $\Sigma_{i}b_{ij}$* from 1.681 to 1.548. Therefore, it is a matter of interest whether rapid expansion of the service industries, including finance, has contributed to an improvement in the UK economy by replacing the manufacturing sector and also whether the service sector has stimulated

to raise the quality and to strengthen competitiveness of manufactures.

III. Internal multiplier and external multiplier

According to Miyazawa's partitioned multiplier model, the above inter-industry transaction and inter-dependence matrix allows further examination of the inter-relation between the physical goods production sector, mainly manufacturing sector (The P sector, subscript p), and the service production sector (S sector, subscript s)[6]. I intend to investigate the meaning of industrial structure changing, deindustrialisation, by means of the partitioned input-output model. This framework will provide a rich basis for analysis of interdependence between manufacturing (physical goods production sector) and service sector because it is capable of qualifying differences between different countries, differences which may cause important variations in economic performance.

In order to investigate the meaning of change of industrial structure from this point of view, following Miyazawa(1963, 1975) and The Economic Planning Agency (1990), we partition the transaction matrix (x_{ij}) into four parts. Clearly, each part of transaction matrix (x_{ij}) shows the inputs of two grouped sectors which are needed to produce their products, respectively. So, instead of usual formulation as the equation (1), we get the partitioned input-output system as the following, (where $n = r + s$),

$$\begin{bmatrix} X_1 \\ \cdot \\ X_r \\ -- \\ X_s \\ \cdot \\ X_n \end{bmatrix} = \left[\begin{array}{ccc|ccc} a_{11} & .. & a_{1r} & a_{1s} & .. & a_{1n} \\ \cdot & & \cdot & \cdot & & \cdot \\ a_{r1} & .. & a_{rr} & a_{rs} & .. & a_{rn} \\ \hline a_{s1} & .. & a_{sr} & a_{ss} & .. & a_{sn} \\ \cdot & & \cdot & \cdot & & \cdot \\ a_{n1} & .. & a_{nr} & a_{ns} & .. & a_{nn} \end{array}\right] \begin{bmatrix} X_1 \\ \cdot \\ X_r \\ -- \\ X_s \\ \cdot \\ X_n \end{bmatrix} + \begin{bmatrix} F_1 \\ \cdot \\ F_r \\ -- \\ F_s \\ \cdot \\ F_n \end{bmatrix} \qquad (1)'$$

That is to say, we partition the input coefficient matrix A* into four parts as the following;

$$A^* = \begin{bmatrix} A & A_1 \\ S_1 & S \end{bmatrix} \qquad (4)$$

A : the physical inputs coefficient matrix (r x r) in goods-producing sector

S_1: the service inputs coefficient matrix (s x r) in goods-producing sector

A_1: the physical inputs coefficient matrix (r x s) in service sector

S : the service inputs coefficient matrix (s x s) in service sector

Therefore, (1) or (1)' is rewritten as the following

$$\begin{bmatrix} X_p \\ X_s \end{bmatrix} = \begin{bmatrix} A & A_1 \\ S_1 & S \end{bmatrix} \begin{bmatrix} X_p \\ X_s \end{bmatrix} + \begin{bmatrix} F_p \\ F_s \end{bmatrix} \qquad (5)$$

Solving above equation, we get

$$X_p = (I - A)^{-1}A_1X_s + (I - A)^{-1}F_p \qquad (6\text{-a})$$

$$X_s = (I - S)^{-1}S_1X_p + (I - S)^{-1}F_s \qquad (6\text{-b})$$

Further, arranging above equations, we get

$$X_p = B_2X_s + BF_p \qquad (7\text{-a})$$

$$X_s = T_2X_p + TF_s \qquad (7\text{-b})$$

Where

$B = (I - A)^{-1}$: spreading effect in P sector's industries (the internal multiplier of P sector)

$B_1 = S_1(I - A)^{-1}$: directly needed service inputs by spreading effect in P sector

$B_2 = (I - A)^{-1}A_1$: spreading effect in P sector induced by physical input in S sector's industries

$T = (I - S)^{-1}$: spreading effect in S sector (the internal multiplier of S sector)

$T_1 = A_1(I - S)^{-1}$: directly needed physical inputs by spreading effect in S sector

$T_2 = (I - S)^{-1}S_1$: spreading effect in S sector induced by service input in P sector.

The above four sub-multipliers, B_1, B_2, T_1, and T_2 'reveal the coefficients of induced effects on output activities' and are called the "production-generating process in succession"'(Miyazawa(1975), p.61).

Furthermore, the external matrix multiplier of the S sector is shown as

$$(I - T_2B_2)^{-1}$$

Then,

$M = (I - T_2B_2)^{-1}T$: total spreading effect of S sector

Substituting X_p into X_s , the solution of our two-sector input-

output model is given by:

$$\begin{bmatrix} X_p \\ X_s \end{bmatrix} = \begin{bmatrix} B + B_2MB_1 & B_2M \\ MB_1 & M \end{bmatrix} \begin{bmatrix} F_p \\ F_s \end{bmatrix} \qquad (8)$$

The above equation corresponds to the original system of equation (2). By decomposing 'the original Leontief inverse in terms of the combined effects of internal and external matrix multipliers and their induced sub-matrix-multiplier', we can clarify 'some inherent properties of the interaction between the P and S sectors'(Miyazawa, pp.62-3).

From the above partitioned system we can extract the facts of the process of changing industrial structure for the past decade.[7] The sum of elements of Leontief inverse coefficients and the internal and external multipliers for each year are reported in Table 2. Those values indicate the extent of multiplier effects. I would like to stress the change of multiplier effects including interdependence of sectors. Furthermore, Figure 1 presents an outline of the important features of these multipliers as the decade proceeded.

Table 2

Figure 1

In Japan, basic industries, which had rapidly expanded in the high economic growth era, have been faced with difficulty in seeking more expansion. Such mature industries are now forced to improve the quality

of their product through inputting more service factors. On the other hand, growing industries in sector P (including rubber, electrical machinery, precision instruments, and motor vehicles), have increased physical inputs as well as improving quality. In sector P as a whole, the internal multiplier has been slightly reduced ($\Delta B = -1.371\%$), mainly because of technological change. However, the value of directly needed service inputs induced by physical production has been rising ($\Delta B_1 = 5.908\%$). Its value is quite larger than the change in B_2, which shows the effects on sector P's production induced by sector S's increase in physical input; $\Delta B_2 = -8.249\%$. The value of T_1, which is directly needed physical inputs induced by service production, has decreased by 1.069%, its value (the sum of elements of $T_1 = 0.9813$ in 1985) is much smaller than B_1 (= 5.4374 in 1985). Despite expansion in service production, sector P's effect on sector S is still dominant so we can say that the latter is largely dependent upon the former activity.

On the other hand, UK's change of industrial interaction is very different from that of Japan. The internal multiplier of the P sector shows a considerable fall ($\Delta B = -8.490\%$). The main reason for that change might be recognised as the result of import penetration in the UK.[8] Although sector S has expanded its relative share of production to a greater extent than in Japan, the internal multiplier increased by a little bit larger value than in Japan ($\Delta T = 2.063\%$). The industry, showing the greatest expansion, finance, did not increase its internal multiplier; the column sum of b_{ij} of finance industry was reduced by

0.052 to 1.3497. In contrast with Japan, most industries in the P sector experienced a decline in the values of the column sum of b_{ij}, except for food and petroleum refining industries. The value of directly needed service inputs induced by physical production rose at 1.3 times of Japan (ΔB_1 = 7.772%). However, the effect on inputs of sector P, which take place in sector S at the beginning of time and induce the production of sector P, B_2 and T_1, have declined. The UK's external multiplier of sector S, $(I - T_2B_2)^{-1}$, increased by 0.261%, which is larger than Japan's change, 0.055%, and also the change of the total spreading effect of sector S, $M = (I - T_2B_2)^{-1}T$, is a little bit larger than Japan. However the value of M itself is still smaller than for Japan. Despite of some artificiality, the reader might be able to deduce other useful and broad insight from above numerical results.

If deindustrialisation successfully advanced, the resource allocation will progress along with the production possibility curve and there will not be redundancy of resources. If not so, the economy should be forced to be staying inside area of the production possibility curve. From the above analysis, the external multiplier could improve the situation to stimulate the productivity of other sector. In Figure 2-a, the service sector's external effect through the multiplier will move the situation H to the direction of G and vice-versa. In general, we can assume that the external multiplier effect will stimulate to move the industrial structure to any point between S and G on the production possibility curve.

Figure 2-a, b

These movement should correspond with the firm's rational behaviour which it individually aims to maximize profit through the cost reduction. As Robinson (1958) insisted, we can assume that the marginal cost of the service section might be more rapidly increasing than of the production section in the representative firm, which produces goods. Although this firm is obliged to the inevitably increasing cost in order to achieve the further growth, it would be possible to avoid such cost increase by means of separating and externalizing the service section. Figure 2-b describes that behaviour. The curve pp' and ss' are the production opportunity curve and service section's cost curve of the representative firm, respectively. And outputs of two section are measured in terms of the imputed prices. Externalizing the service section could shift down the curve ss', so it will make the firm to seek more economy of scale of good-producing. At the early stage of deindustrialisation, many firms in manufacturing separated their service activity, transport, security service, trade, advertising, etc., aiming the cost reduction. As a follower of predecessor, the US and UK, Japan likes to be on the position of early stage of deindustrialisation after the First Oil Crisis. We can often see that these newly born firms grew beyond the parent firms' demand. And we should remember that improvement of external effect through multiplier could be achieved by investment.[9)]

Furthermore, we can examine these changes by using a measure of the extent of spreading of an activity in its own sector. Let us define 'the inside ratio of spreading' as

$$b_{ij}/b_{ij}^{*} \qquad (9)$$

This is the ratio of internal to total multiple coefficient and this ratio shows degree of spreading of production within an industry.[10] Figure 3 illustrates the change of the average column sum of this ratio, $\Sigma b_{ij}/\Sigma b_{ij}^{*}$. If the ratio is larger, there is a greater degree of interdependence within a sector. In UK's sector P, except for the petroleum refining industry, all industries have reduced their ratios. It corresponds to the decline of b_{ij}^{*}. In sector S, four out of six industries increased their ratios (finance and service industries could not).

Figure 3

In contrast, although near half of industries of Japan's sector P reduced their ratios, $\Sigma_i b_{ij}/\Sigma_i b_{ij}^{*}$, electronic machinery, motor vehicle, and precision machinery industry have increased the values of $\Sigma_i b_{ij}^{*}$ themselves. These industries are the new locomotives in the Japanese economy after the first oil crisis. So we can estimate that the rapid technological change in manufacturing sector and a change of interdependence between sector P and sector S have occurred in Japan. These changes have been certainly accompanied by investment behaviour.[11] In sector S of Japan, all six industries increased the in-

side ratio of spreading. It is reflected in the change of the internal multiplier of sector S.

IV. Factors involved in output change

Change of total output in the distinct periods may be partitioned into three categories. One is due to technological change, which appears in changes in a_{ij} and the multipliers, second the changes in final demand, which appears in changes of its size and structure, and finally the cross effect of these changes. The first term may be composed of technological changes in each sector and a residual part of change which results from the change of the inter-sectoral dependence; changes of b_{ij} in the partitioned matrices of **A** and S, and others. Hence, from (2) and (3) we can formulate:

$$\begin{aligned} \Delta \mathbf{X} &= \Delta (\mathbf{I} - \mathbf{A})^{-1}\mathbf{F} + (\mathbf{I} - \mathbf{A})^{-1}\Delta \mathbf{F} + \Delta (\mathbf{I} - \mathbf{A})^{-1}\Delta \mathbf{F} \\ &= \Delta \mathbf{B}^{*}\mathbf{F} + \mathbf{B}^{*}\Delta \mathbf{F} + \Delta \mathbf{B}^{*}\Delta \mathbf{F} \end{aligned} \tag{10}$$

Furthermore, rewriting $\Delta \mathbf{B}^{*}$ in the two sector model by using the equation (8),

$$\begin{aligned} \Delta \mathbf{B}^{*} &= \begin{bmatrix} \Delta \mathbf{B} + \Delta (\mathbf{B}_2\mathbf{M}\mathbf{B}_1) & \Delta (\mathbf{B}_2\mathbf{M}) \\ \Delta (\mathbf{M}\mathbf{B}_1) & \Delta \mathbf{M} \end{bmatrix} \\ &= \begin{bmatrix} \Delta \mathbf{B} & 0 \\ 0 & \Delta \mathbf{T} \end{bmatrix} + \begin{bmatrix} \Delta (\mathbf{B}_2\mathbf{M}\mathbf{B}_1) & \Delta (\mathbf{B}_2\mathbf{M}) \\ \Delta (\mathbf{M}\mathbf{B}_1) & \Delta \mathbf{M} - \Delta \mathbf{T} \end{bmatrix} \end{aligned} \tag{11}$$

In the above equation, the first term extracts the degree of the internal multiplier change, $\Delta \mathbf{B}$ and $\Delta \mathbf{T}$ respectively, apart from the total change of the Leontief inverse coefficients. That is to say, ($\Delta \mathbf{B}$ and $\Delta \mathbf{T}$)$\cdot \mathbf{F}$ shows the separated internal effects of technical change on

outputs of industries, including the effects of substitution of inputs, improvement of technology, and so on, from the change of output coming from inter-sectoral dependencies. The latter captures the effects which one sector has upon the other; the change of the interdependence between sectors P and S.

Figure 4

In Figure 4, we find the comparable set of results from calculating equation (11); $\Delta B \cdot F$, $\Delta T \cdot F$ and the residual terms, respectively.[12] An interesting contrast appears when we compare the UK's and Japan's case. In UK, manufacturing industries decreased their output dependence upon the change of the internal multiplier and sector S did not positively contribute to the output of sector P's industries. In sector S, the finance sector expanded its output largely due to sector P's effect. Transportation and communication, and service industries, both of which reduced their share of output by 1.621 and 1.528 per cent point respectively, decreased their output due to technical change. In the transportation and communication industry, imports as a proportion of inputs declined from 46.706% to 22.410%, but more than 90% of reduction of $\Delta B^* \cdot F$ resulted from the effects of change of the internal multiplier $\Delta T \cdot F$. We can see that the service industry has been faced with the largest decline of $\Delta T \cdot F$ due to sector P's effect.

In contrast, near half of Japanese industries in sector P increased their $\Delta B \cdot F$ largely depending upon the technical change within

the sector. Relatively growing industries, rubber and plastics, motor vehicle, electronic machinery, and precision machinery also increased their internal interdependence to a much greater degree than their influence of S sector change. Except for trade, sector S's industries increased their output according to the increase of the internal multiplier, $\Delta T \cdot F$. Transportation and communication, and service industries have not only increased their output share but also strengthened the technical relationship within the sector. These comparable features are correspond with the previous results.

V. Concluding remarks

The UK economy has undergone a number of significant structural change over the past decades and it is widely accepted that the most important change is the increasing prominence of services relative to manufacturing (excluding the mineral oil processing industries). Should we regard such a relative decline of employment in the manufacturing industry as a result of productivity growth and the strengthening of competitiveness in the world markets? If so, the labour surplus of the manufacturing sector would stimulate a reallocation of resources and most of the labour leaving the manufacturing sector might be absorbed by other expanding sectors as Sargent (1979) insisted. If not so, the economy should be inside of the production opportunity curve and there might be welfare loss.

It is true that the UK has developed a comparative advantage in services; nevertheless the relative expansion of service industries has,

so far, not played a role which was expected by Sargent. According to my results, using Miyazawa's partitioned multiplier model, it is clear not only that the internal multiplier of the goods-producing sector has fallen but also that the external effect of the service sector's activity on improving manufactures has not been significant either.

As Bean(1990) mentioned, the discovery of North Sea oil stimulated the manufacturing production. Nevertheless, according to him, 'Manufacturing output has declined both absolutely and as a share of GDP since 1973, and the real exchange rate has appreciated. .. the two phenomena may be connected. A windfall of foreign exchange (in the form of oil) can be expected to lead to an expansion of the services sector and a decline in manufacturing.'(p.88) My analysis is consistent with Bean's view. Generally speaking, the investment in manufacturing sector seems to be lacking flexibility. It is widely accepted that Japan's high investment ratio has been a necessary factor for successful industrialisation. Japan's industrial policy has stimulated to reinvest for the purpose of converting and modernising Japanese industries, particularly manufacturing. In my view, Mrs. Thatcher's Tory government has been little concerned with reform of UK manufacturing. 'Successive ministers at the DTI have managed to avoid thinking seriously about science and technology policy for a decade. As the trade balance shows, a consequence of this neglect has been a steady decline in UK competitiveness.' (Geroski, 1990) These are interesting characteristics of the process of deindustrialisation in the view which are not present in the case of Japan.

Data

The 1974, 1979, and 1984 *Input-output tables for the United Kingdom* (Central Statistical Office), classified into 96, 100, and 102 groups, and the 1975 and 1985 *Nippon Touitsubunrui Sangyou Renkanhyo (Integrated Classified Input-output Table for Japan)*, classified into 46 groups, published by Ministry of International Trade and Industry, were used. I compiled special 27 sector input-output tables for this study. In doing so, I integrated the different number of industry sectors as carefully as I possibly could. However, unfortunately, it is impossible to compile a completely correspondent table. For instance, Japan's input-output table treats 'not elsewhere transaction' as a dependent sector in the tertiary sector, and this sector includes some residual in the aggregating process. So, in my 27 sector table this transaction is involved in service sector. In Miyazawa's original work, he treated this as a part of good producing sector. I calculated Leontief inverse coefficient and all multipliers in line with Miyazawa's method, however following conclusions are not affected by such treatment at all. For example, regression equations between b_{ij}*s of two types are the following:

1975: $Y = -0.0138 + 1.0086X$, $R^2 = 0.9986$, F-value = 433063.811, n=27

1985: $Y = -0.0063 + 1.0039X$, $R^2 = 0.9998$, F-value = 3127970.610, n=27

Where $Y = b_{ij}$*s in Miyazawa's treatment and $X = b_{ij}$*s in our treatment. And Spearman's coefficient of rank correlations are very close to 1 in both cases. Furthermore, since I could not use the real valued I-O

tables for both countries, so it should be noticed that the values of multipliers may be due to change in sectional relative price.

Finally it must be noted that the UK's treatment of imports is different from Japan's tables. In Japan's I-O table imports are treated as competitive and/or substitutable with domestic products. On the other hand, in the UK's table it is assumed that there is no domestic counterpart of imports. The former treatment is called a competitive import and the latter non-competitive import. I tried to compile the competitive import I-O table of 1984 UK by integrating table 4 and 6. Since some elements are quite slightly differ from the original, the Leontief inverse coefficients are closely correlated between two types. Therefore, they do not materially affect the overall picture. Regression equations of the Leontief coefficients between non-competitive and competitive import systems in 1984 UK is;

$Y = 0.1764 + 0.8951X$, $R^2 = 0.9072$, F-value = 18.5152, n = 27

Y: $B_j^* = \Sigma_i b_{ij}^*$ in the competitive import type

X: $B_j^* = \Sigma_i b_{ij}^*$ in the non-competitive import type

My classification system is shown in the following table:

List of industries

Note

* The author would like to thank Professor K. Cowling and J. Round, University of Warwick, Y. Kobayashi, Hokkaido University, and I. Sakuma, Senshyu University for their valuable comments. The author is fully responsible for errors and opinions.

1) As Bazen and Thirlwall insisted, the definition of 'deindustrialisation' is cause-free. I use the term deindustrialisation referring to a trend of contraction of the manufacturing sector. For the definition of deindustrialisation, see Cairncross (1979) and Bazen and Thirlwall (1989).

2) Also the manufacturing share of gross domestic product has fallen from 34.10 per cent in 1969 to 22.62 per cent in 1985. 'Over this period activity shifted towards services, with private services rising from 38 per cent to 48 per cent of GDP. Inevitably, concern has been expressed about the contraction in manufacturing industry reflected in deindustrialisation and its possible adverse effects upon the economy's investment and export' (Curwen, p.267)

3) See Sargent(1979) Table 5-2 and 5-3.

4) In this paper, I want to present an explanation of not what is the cause of deindustrialisation, but what has happen in the process of deindustrialisation in th UK comparing to Japan. In order to compare the two countries', the period after the First Oil Crisis was chosen.

5) The industry's shares of total output and gross added value are closely correlated. I am concerned with the side of production not in-

come, so in the following analysis, I use the total output share as a measure of a particular industry's relative position.

6) Round (1989) consider the framework on which Miyazawa's method is based in the investigation of inter-regional analysis. And in Payatt and Round (1979), the alternative manner of decomposition of the multiplier effects is explored, where the original multiplier composed of three components; internal multiplier, external multiplier, and cross effects multiplier. However, I chose a simpler treatment to calculate the multiplier effects.

7) In the following analysis, six industries compose sector S; printing and publishing, wholesale and retail trade, finance and insurance, transportation and communication, service, and public administration. The reason why I include the printing and publishing industry in sector S is that its value of products is recognised not by the physical material itself but by the informations printed on it.

8) Stout (1979) has already mentioned that 'the UK has combined declining production growth and increasing import dependence' and it is 'quite different in the UK from that in Germany and France'(p.172).

9) Of course, although the advance in productivity and quality of products are accompanied by increasing specialisation it is not a sufficient condition for the development of economies. See also note 11.

10) So the value of $(1 - b_{ij}/b_{ij}^*)$ means the input ratio which based on the other industries' demand originally induced by its own activity. Professor J. Round kindly suggested these expression.

11) Cowling (1986) pointed out 'the longer term impact of the retard-

ing of domestic investment' on the domestic productivity growth and 'a process of cumulative causation' (p.29). In addition, the surplus of the North Sea oil could be reinvested directly in domestic productive capital. 'Rather, the evidence seems to suggest that firms are discouraged from investing projects that might be profitable abroad because of their low expected rate of return. .. the bodies responsible for allocating government funds for industry seems to have been prone to capture by interest groups and the funds themselves channeled towards declining industries.'(Bean, p.87)

Figures report the trend of net investment in three classified manufacturing sectors (not including the service sectors): basic material industries, processing and assembly industries, and consumer-related industries. The reader can easily see the bigger change in the trend of investment in Japan's manufacturing compared with the UK's.

Figures of net investment

12) Tables show the results of calculating equation (11).

Tables of equation (11)

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Table 1 - a

Leontief inverse coefficient and output share: UK

	Σ i b ij*			output share		
	a	b	b - a	c	d	d - c
	1974	1984		1974	1984	
Agric	2.3053	2.2232	-0.0821	3.275%	2.764%	-0.511
Mining	1.7843	1.3226	-0.4617	1.462%	4.547%	3.086
Foods	2.2874	2.3334	0.0459	6.974%	6.206%	-0.768
Textiles	1.9457	1.6609	-0.2848	3.201%	1.816%	-1.385
Tim & Fur	1.8576	1.8439	-0.0137	1.312%	0.970%	-0.342
Paper	1.7710	1.7371	-0.0339	1.553%	1.135%	-0.418
Printing	1.7558	1.6931	-0.0626	4.215%	3.578%	-0.637
Chemical	2.0922	1.8508	-0.2415	2.925%	2.722%	-0.203
Petroleum	1.2558	1.8972	0.6414	1.753%	1.449%	-0.303
Rubber	1.8925	1.7578	-0.1347	1.344%	1.370%	0.026
Stone	1.9381	1.8605	-0.0776	2.346%	1.330%	-1.015
Steel	2.2595	2.0806	-0.1790	1.593%	0.900%	-0.694
Nonfer met	1.8867	1.6799	-0.2069	3.232%	2.156%	-1.076
Metal	2.0243	1.9039	-0.1203	4.413%	3.440%	-0.974
Machin	2.0045	1.8530	-0.1515	2.785%	2.762%	-0.023
Elec mach	1.8705	1.7109	-0.1596	2.516%	1.811%	-0.705
Mot veh	2.1409	1.8458	-0.2951	1.617%	1.528%	-0.089
Trsp eqpt	1.7848	1.6914	-0.0934	0.431%	0.388%	-0.043
Prec inst	1.8058	1.7332	-0.0726	0.453%	0.386%	-0.067
Oth mfg	1.9185	1.6957	-0.2228	8.916%	8.016%	-0.900
Construc	1.9382	2.0800	0.1418	2.617%	3.739%	1.122
Utilities	2.0364	1.8163	-0.2201	1.466%	1.667%	0.201
Trade	1.5177	1.7661	0.2484	10.110%	10.319%	0.209
Finance	1.6808	1.5476	-0.1332	5.446%	11.353%	5.907
Trs & comm	1.3614	1.5935	0.2321	7.796%	6.175%	-1.621
Service	1.7602	1.5486	-0.2116	6.666%	5.148%	-1.518
Pub ad	1.0000	1.0000	0.0000	9.582%	12.325%	2.744
Average	1.8473	1.7677	-0.0796			
Total	49.8759	47.7269	-2.1491	100%	100%	

Table 1 - b

Leontief inverse coefficient and output share: Japan

	Σ i b ij*			output share		
	a	b	b - a	c	d	d - c
	1975	1985	Δ B j	1975	1985	
Agric	1.6670	1.7449	0.0779	4.1158%	2.6452%	-1.4706
Mining	1.7171	1.7896	0.0725	0.4668%	0.2870%	-0.1798
Foods	2.1935	2.1402	-0.0534	6.3547%	5.5491%	-0.8056
Textiles	2.3756	2.3123	-0.0632	2.7810%	2.0040%	-0.7770
Tim & Fur	2.1624	2.1339	-0.0285	1.6614%	1.0305%	-0.6308
Paper	2.5639	2.4361	-0.1278	1.4620%	1.2549%	-0.2070
Chemical	2.3124	2.2820	-0.0304	3.4764%	3.4087%	-0.0676
Petroleum	1.3960	1.3780	-0.0180	2.9718%	2.3976%	-0.5742
Rubber	2.1784	2.2032	0.0248	1.2607%	1.6014%	0.3407
Stone	1.8536	1.8607	0.0072	1.5084%	1.2754%	-0.2330
Steel	2.9228	2.8396	-0.0832	5.9605%	4.0715%	-1.8890
Nonfer met	2.0749	2.0366	-0.0383	1.0808%	0.9384%	-0.1425
Metal	2.1707	2.2257	0.0550	1.8875%	1.7273%	-0.1603
Machin	2.3068	2.2146	-0.0922	3.1892%	3.4435%	0.2543
Elec mach	2.1870	2.2318	0.0448	3.0165%	5.5722%	2.5556
Mot veh	2.4824	2.7840	0.3016	3.1928%	4.3212%	1.1285
Trsp eqpt	2.2760	2.2698	-0.0062	1.2408%	0.7978%	-0.4430
Prec inst	1.9596	2.0197	0.0600	0.4858%	0.5875%	0.1018
Oth mfg	2.1828	2.1412	-0.0416	0.8567%	0.7890%	-0.0677
Construc	2.0473	2.0494	0.0021	10.1951%	8.3501%	-1.8450
Utilities	1.5742	1.5027	-0.0714	2.0515%	3.0534%	1.0019
Printing	2.0820	2.0029	-0.0790	1.1613%	1.2292%	0.0680
Trade	1.4226	1.5018	0.0792	9.2820%	9.1147%	-0.1673
Finance	1.2923	1.2942	0.0018	7.7575%	8.9223%	1.1648
Trs & comm	1.5995	1.5938	-0.0056	4.9599%	5.3246%	0.3647
Service	1.8133	1.7467	-0.0666	14.9728%	17.7609%	2.7881
Pub ad	1.4492	1.5163	0.0671	2.6504%	2.5426%	-0.1078
Average	2.0097	2.0093	-0.0004			
Total	54.2632	54.2518	-0.0114	100%	100%	

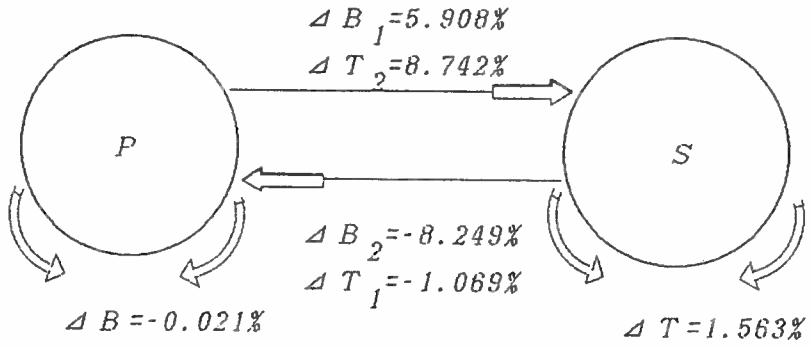
Table 2

Summary table of two-sector analysis

	UK 1974	1984	Change
Sum of Bj*(=Σ Σ bij*)	49.8759	47.7269	-4.309%
Average of Bj*	1.8473	1.7677	
B = (I − A) ^-1	34.4739	31.5470	-8.490%
B 1=S 1 (I − A) ^-1	4.0469	4.3594	7.722%
B 2= (I − A) ^-1A 1	1.0516	0.9897	-5.880%
T = (I − S) ^-1	7.4791	7.6334	2.063%
T 1=A 1 (I − S) ^-1	0.8402	0.8003	-4.744%
T 2= (I − S) ^-1S 1	3.0911	3.9605	28.127%
M = (I — T 2B 2) ^-1T	7.6800	7.8526	2.247%
B 2M	1.3959	1.2963	-7.136%
M B 1	5.2980	6.0060	13.262%
	Japan 1975	1985	Change
Sum of Bj*(=Σ Σ bij*)	54.2632	54.2518	-0.021%
Average of Bj*	2.0097	2.0093	
B = (I − A) ^-1	36.5406	36.0396	-1.371%
B 1=S 1 (I − A) ^-1	5.1341	5.4374	5.908%
B 2= (I − A) ^-1A 1	1.3505	1.2391	-8.249%
T = (I − S) ^-1	7.5245	7.6421	1.563%
T 1=A 1 (I − S) ^-1	0.9919	0.9813	-1.069%
T 2= (I − S) ^-1S 1	3.847	4.1833	8.742%
M = (I — T 2B 2) ^-1T	7.8538	7.9731	1.519%
B 2M	1.2121	1.2391	2.228%
M B 1	6.6008	7.1587	8.452%

Figure 1. Change of multipliers.

a. Change of multiplier: Japan
1975 → 1985



b. Change of multiplier: UK
1974 → 1984

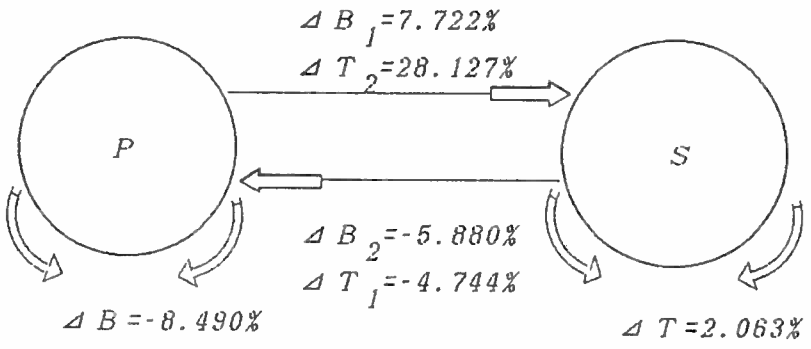
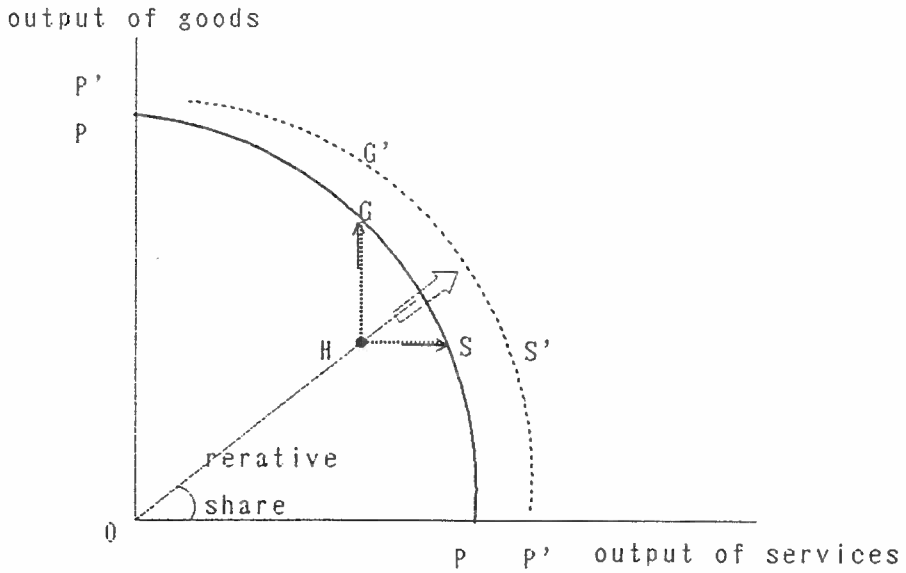


Figure 2 - a



HG: shift by the service sector's external effects

HS: shift by the good-producing sector's external effects

Figure 2 - b

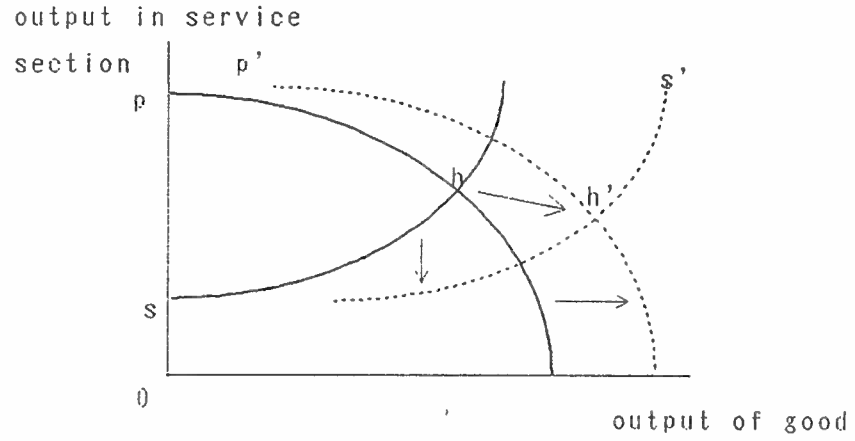
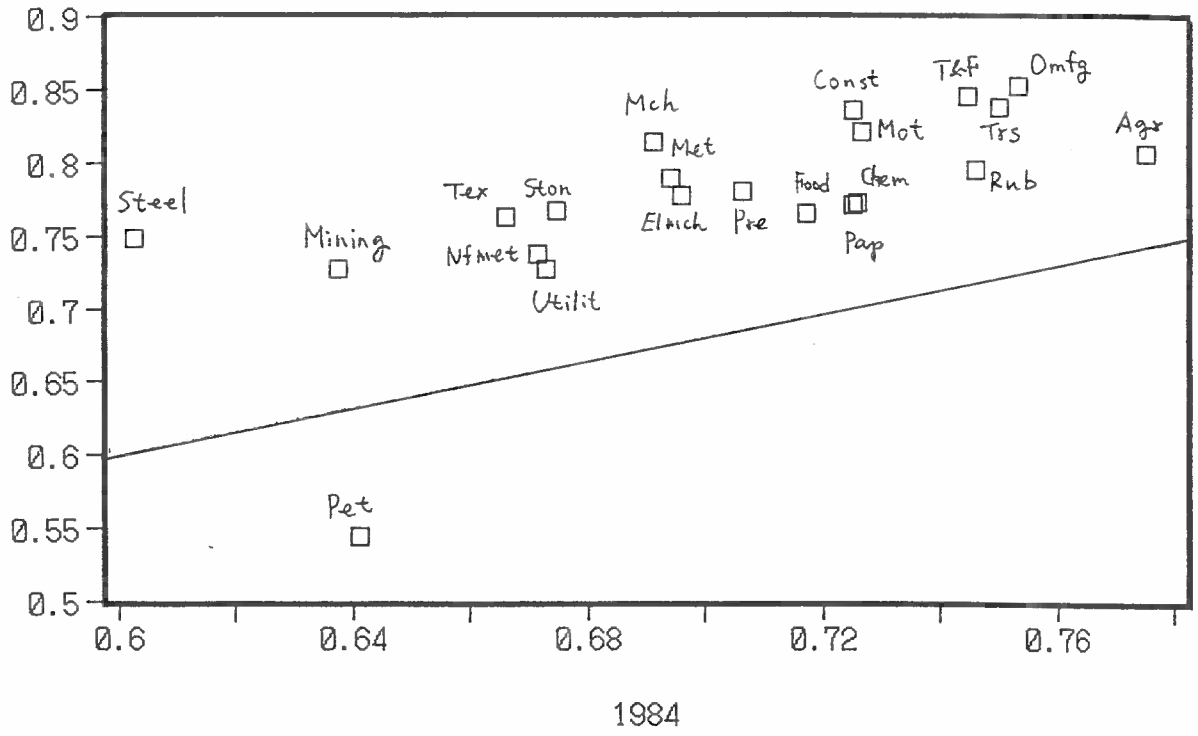


Figure 3. Change of internal spreading effects.

a. Change of Bij/Bij* in UK Sector P



b. Change of Bij/Bij* in UK Service Sector

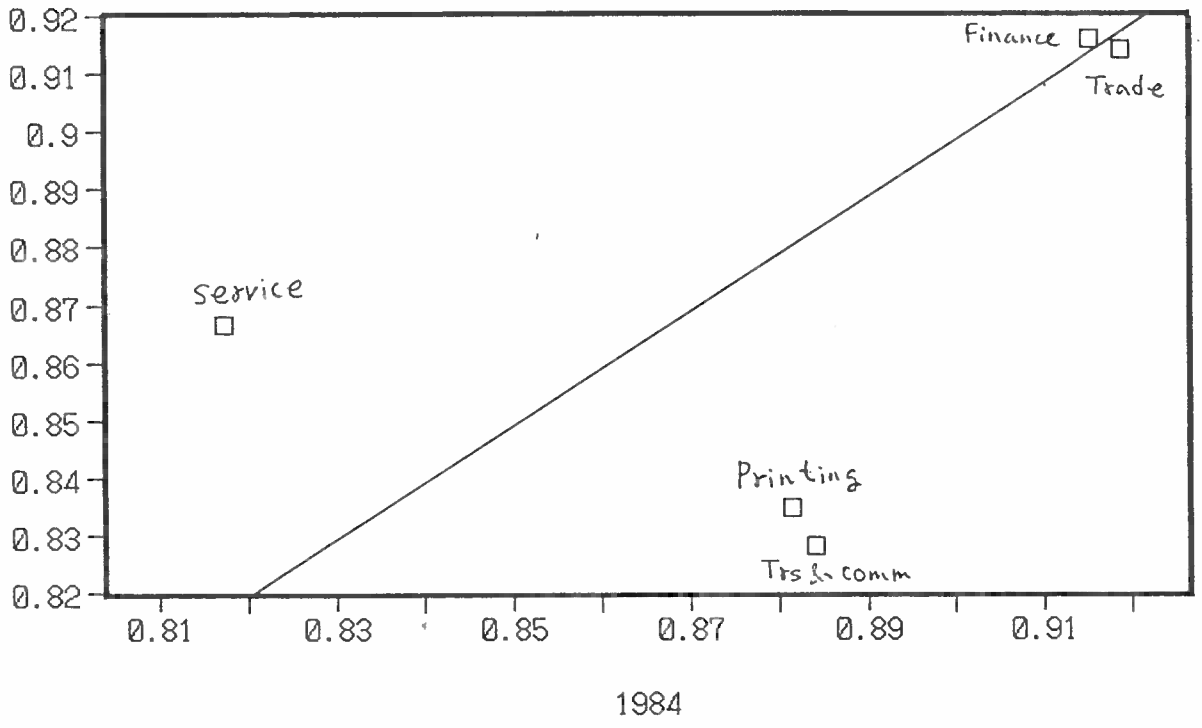
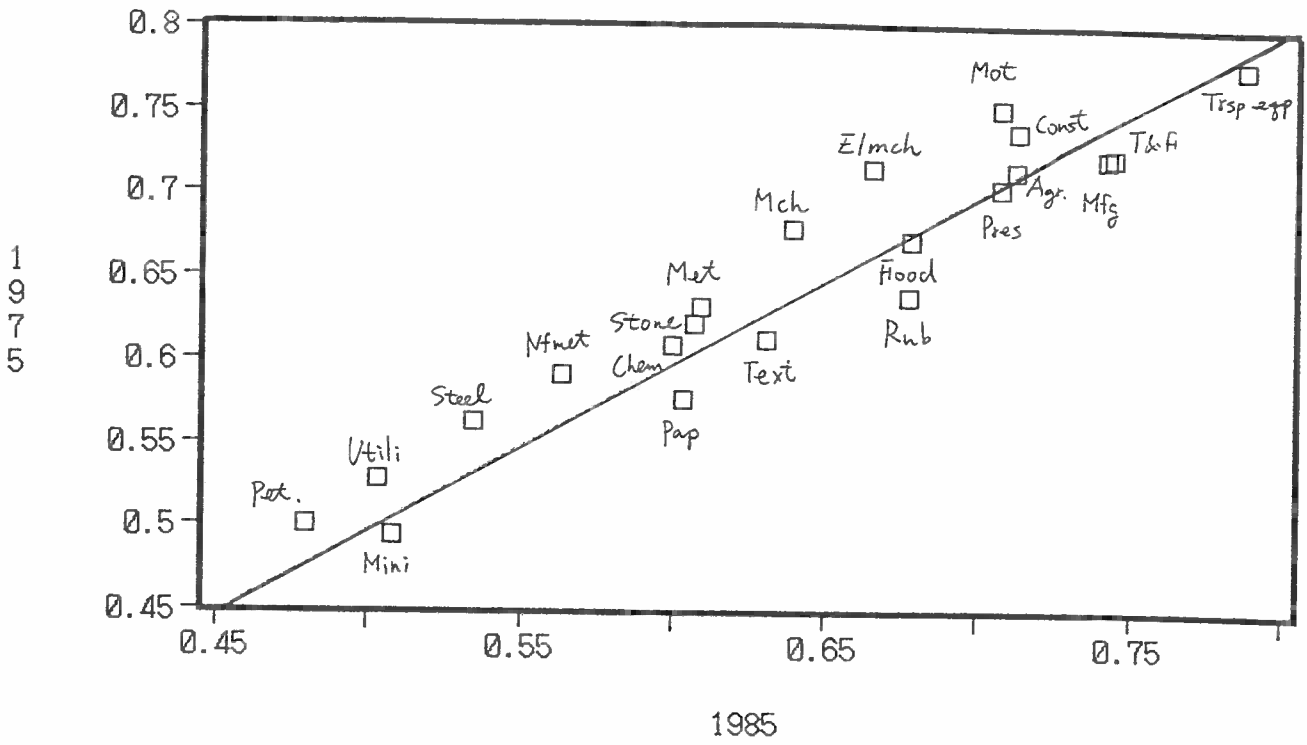


Figure 3. Change of internal spreading effects.

c. Change of Bij/Bij* in Japan

P sector



d. Change of Bij/Bij* in Japan

S sector

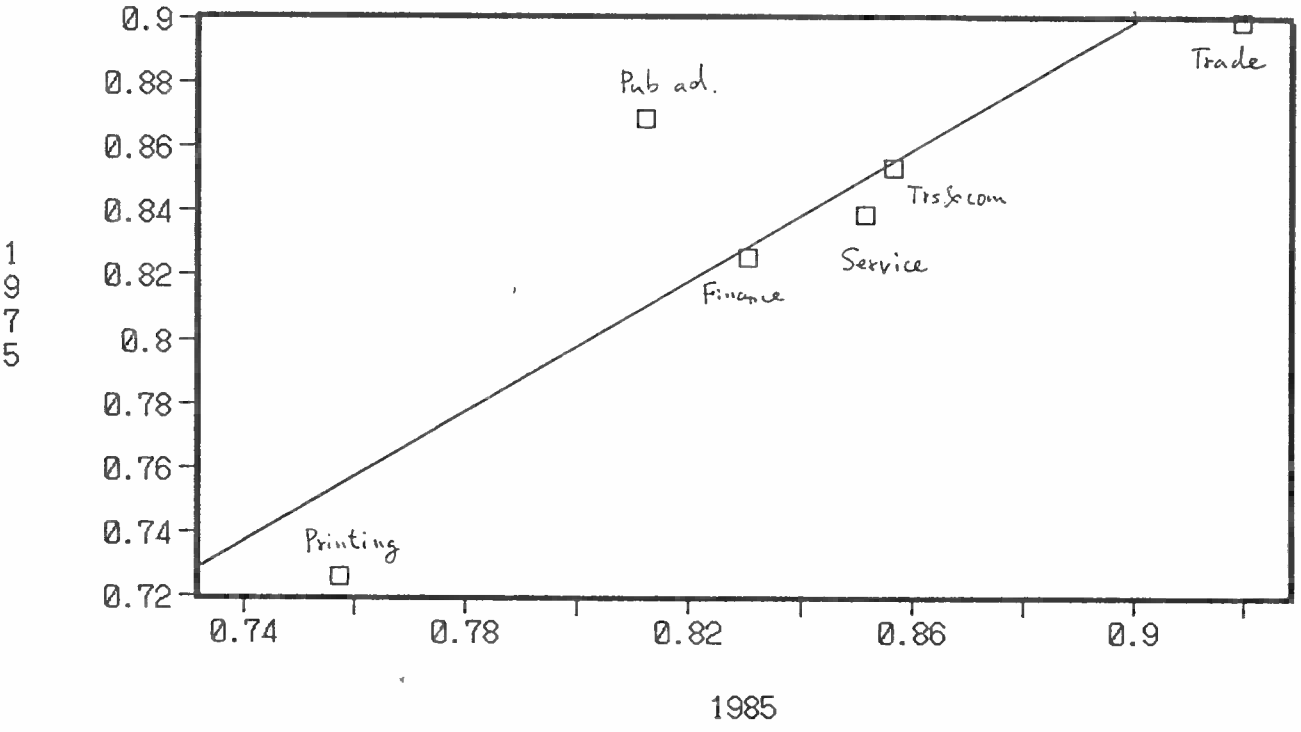


Figure 4. Internal effects of technical change and the interdepence between sectors.

a. Effect of multiplier change on output

UK: 1974-1984

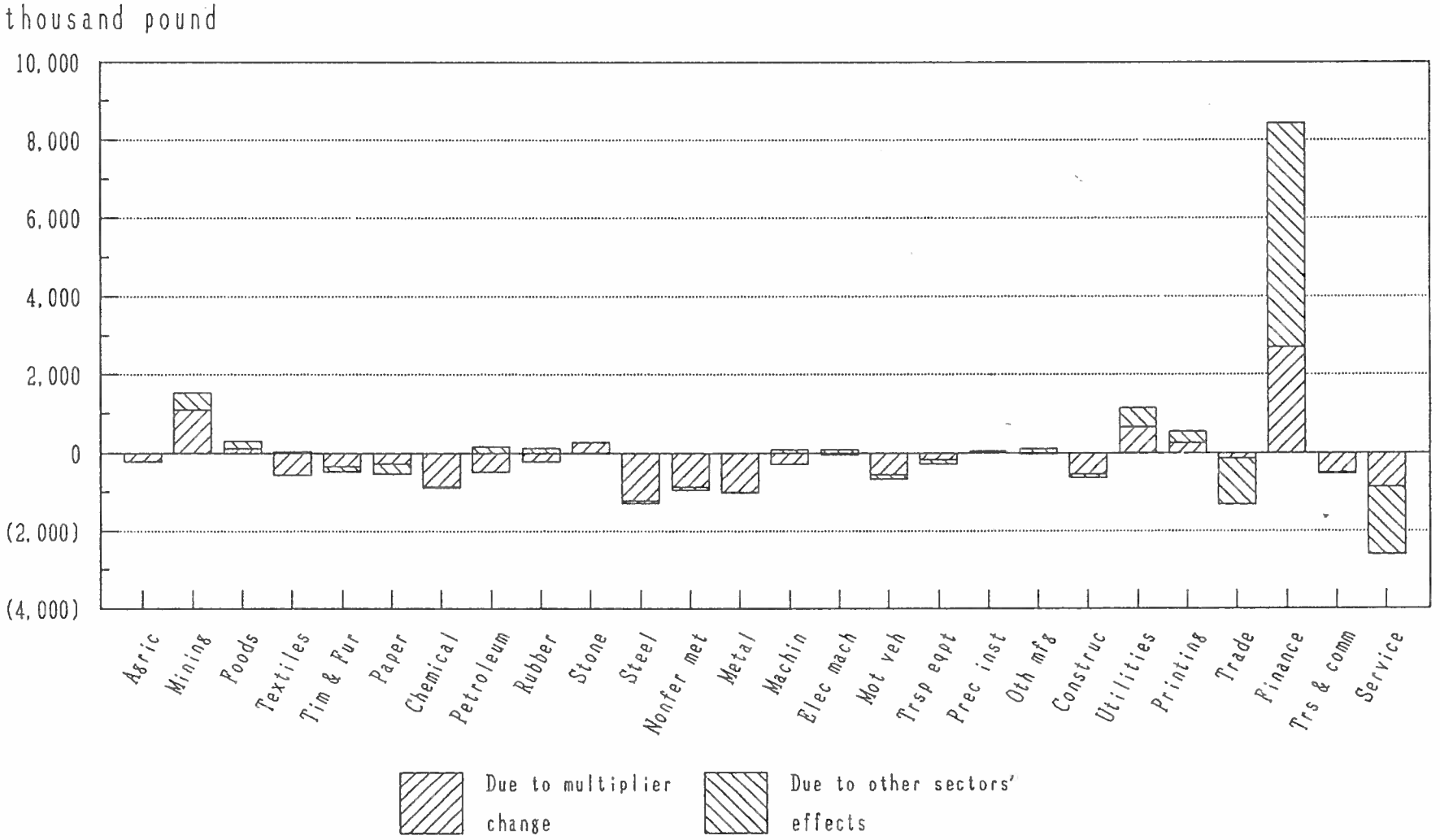
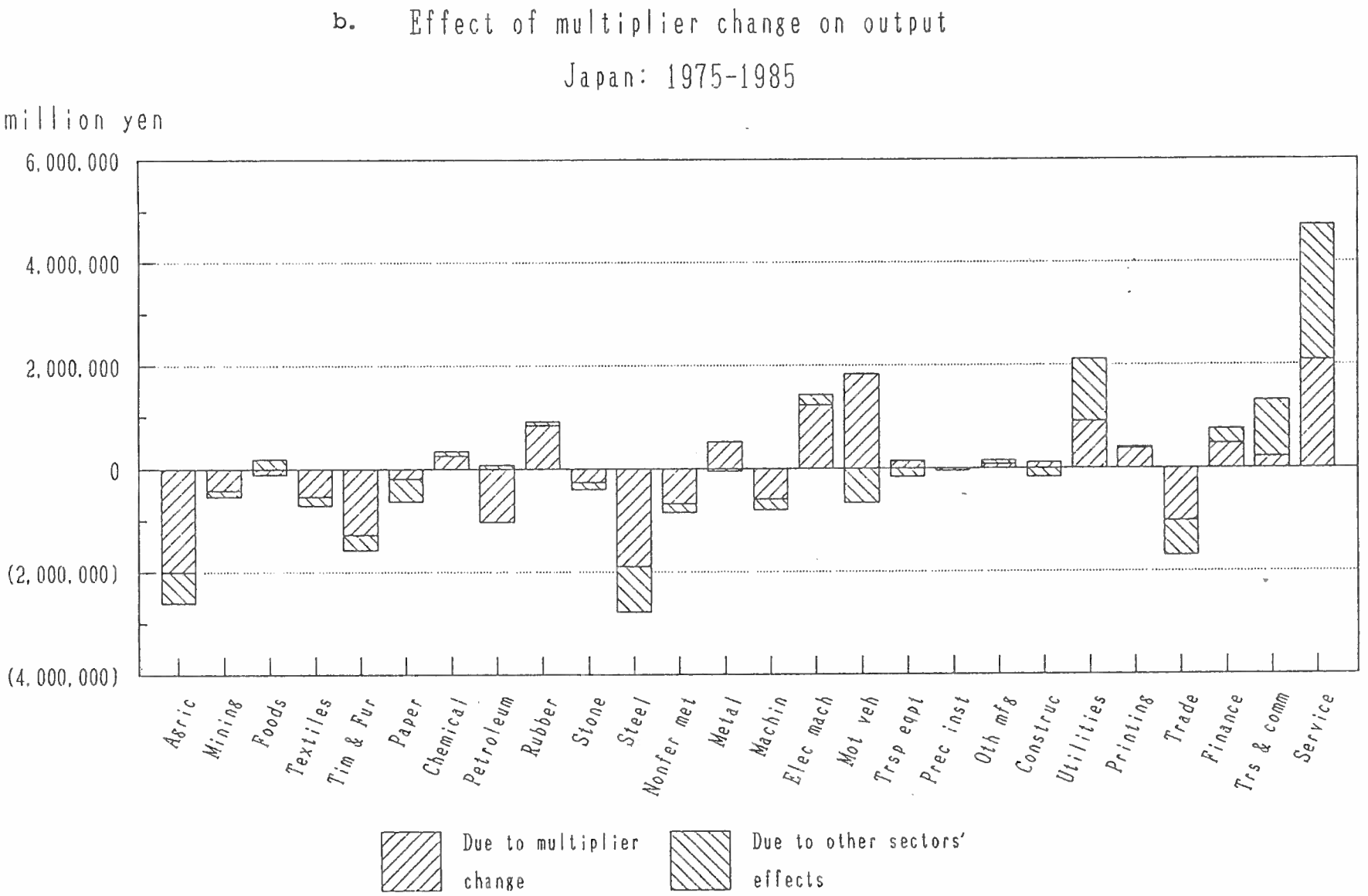


Figure 4. Internal effects of technical change and the interdependence between sectors.



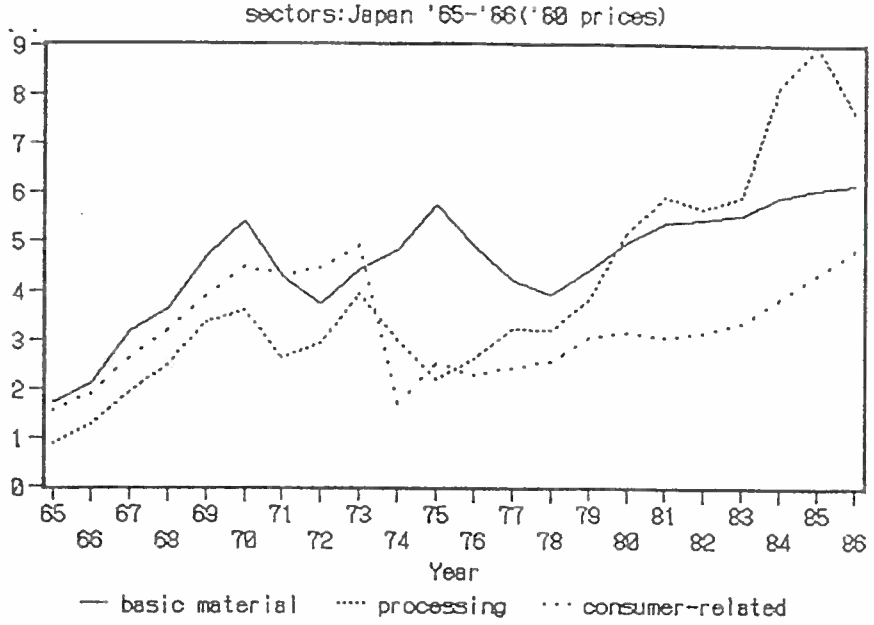
List of Industries

	Industry	Abbreviation (1)	(2)
1	Agriculture, Forestry & Fisheries	Agric	Agr
2	Mining	Mining	Min
3	Food & kindred Products	Foods	Food
4	Textile Products	Textiles	Tex
5	Timber, Wood Products and Furniture	Tim & Fur	T&F
6	Paper & Allied Products	Paper	Pap
7	Printing & Publishing	Printing	Prin
8	Chemical	Chemical	Chem
9	Petroleum Refinery & Coal Products	Petroleum	Pet
10	Rubber, Leather & Plastic Products	Rubber	Rub
11	Stone, Clay, & Glass	Stone	Sto
12	Iron & Steel	Steel	Steel
13	Non-ferrous Metals	Nonfer met	Nfmet
14	Metal Products	Metal	Met
15	Machinery	Machin	Mch
16	Electric Machinery	Elec mach	Elmch
17	Motor Vehicles & Equipment	Mot veh	Mot
18	Transportation Equipment (except motor)	Trsp eqpt	Trs
19	Precision Instruments	Prec inst	Prec
20	Other Manufacturing	Oth mfg	Omfg
21	Construction	Construc	Cons
22	Electric Utility, Gass Supply & Water Supply	Utilities	Util
23	Wholesale & Retail Trade	Trade	Trad
24	Finance & Insurance	Finance	Fin
25	Transportation & Communication	Trs & comm	T&com
26	Service	Service	Serv
27	Public Administration	Pub ad	Pub

Figure of note 11. Investment behaviour divided into three industries.

1,000billion yen

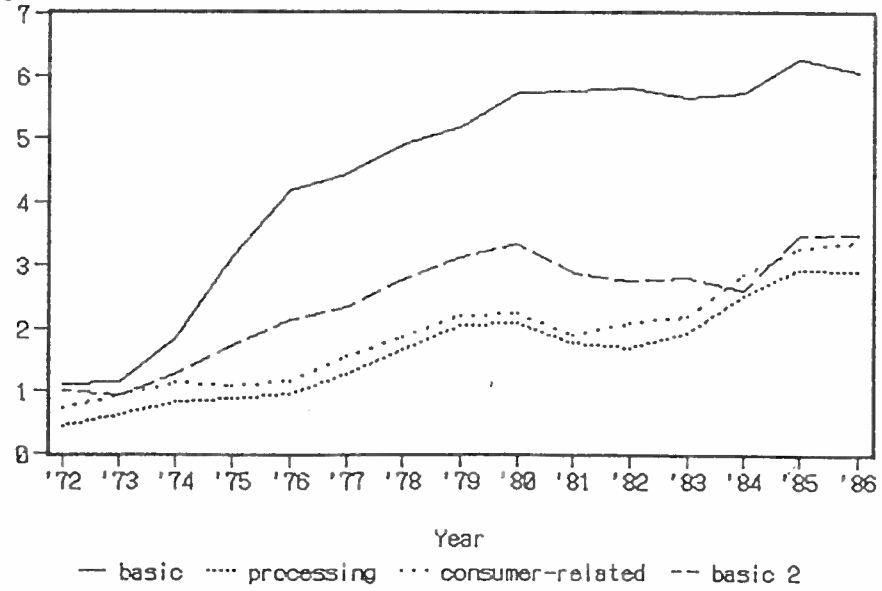
a. Net investment in three industrial sectors:Japan '65-'86('80 prices)



Source) Tushosangyo Tokei Nenkan, yearly. (Tushosangyo Chosakenkyukai)

Thousand pound

b. Gross domestic fixed capital formation in three industrial sectors :UK '72-'86



Note) 'basic 2' is the graph of basic material industry which excludes Extraction of mineral oil and natural gus industry.
Source) The CSO Blue Book, yearly.

Table of note 12.

a. The UK
Effects of internal multiplier change on outputs
UK Thousand Pound

	ΔB*F(74) a	(ΔB,ΔT)F b	Residual a-b	Change b/a
Agric	-226.7	-215.8	-10.8	95.21%
Mining	1536.8	1097.1	439.6	71.39%
Foods	305.9	114.1	191.8	37.31%
Textiles	-532.3	-569.8	37.6	107.06%
Tim & Fur	-480.0	-347.6	-132.4	72.41%
Paper	-537.3	-283.5	-253.8	52.76%
Chemical	-897.4	-860.1	-37.3	95.84%
Petroleum	-334.0	-490.5	156.5	146.87%
Rubber	-107.8	-224.4	116.6	208.22%
Stone	237.1	267.1	-30.1	112.68%
Steel	-1292.0	-1226.2	-65.8	94.91%
Nonfer met	-953.8	-874.0	-79.8	91.64%
Metal	-1027.6	-1008.2	-19.4	98.11%
Machin	-206.1	-288.3	82.2	139.90%
Elec mach	14.4	-62.0	76.3	-430.32%
Mot veh	-669.5	-563.9	-105.6	84.23%
Trsp eqpt	-295.1	-184.5	-110.6	62.52%
Prec inst	47.4	26.4	21.0	55.60%
Oth mfg	68.9	-33.3	102.2	-48.37%
Construc	-639.1	-546.4	-92.7	85.50%
Utilities	1139.4	643.5	495.9	56.48%
Total in P	-4848.8	-5630.3	781.5	116.12%
Printing	532.1	240.6	291.4	45.23%
Trade	-1326.2	-147.8	-1178.4	11.14%
Finance	8425.1	2698.0	5727.1	32.02%
Trs & comm	-546.7	-501.4	-45.3	91.72%
Service	-2623.0	-876.2	-1746.8	33.40%
Pub ad	0.0	0.0	0.0	0.00%
Total in S	4461.2	1413.3	3048.0	31.68%
Total	-5236.4	-9847.4	3829.5	188.06%

Table of note 12.
b. Japan

Effect of multiplier change Million Yen

	⊿B*F(75) a	(⊿B,⊿T)F b	Residual a-b	Change b/a
Agric	-2610233	-2003544	-606688	76.76%
Mining	-537824	-420106	-117718	78.11%
Foods	75215	-108564	183780	-144.34%
Textiles	-717264	-535843	-181421	74.71%
Tim & Fur	-1577500	-1280769	-296731	81.19%
Paper	-632531	-190371	-442160	30.10%
Chemical	338222	247411	90811	73.15%
Petroleum	-957340	-1033508	76168	107.96%
Rubber	906199	833106	73093	91.93%
Stone	-405229	-262414	-142815	64.76%
Steel	-2786893	-1901849	-885044	68.24%
Nonfer met	-848783	-680002	-168780	80.12%
Metal	459250	514430	-55179	112.02%
Machin	-801526	-590057	-211469	73.62%
Elec mach	1419040	1218168	200872	85.84%
Mot veh	1162248	1828062	-665815	157.29%
Trsp eqpt	-28142	138493	-166635	-492.12%
Prec inst	-54258	-57574	3315	106.11%
Oth mfg	140980	70930	70050	50.31%
Construc	-72537	104348	-176886	-143.85%
Utilities	2111242	898828	1212414	42.57%
Total	-5417663	-3210825	-2206838	59.27%
Printing	399472	370367	29105	92.71%
Trade	-1698202	-1026177	-672025	60.43%
Finance	745141	461898	283242	61.99%
Trs & comm	1299328	206406	1092922	15.89%
Service	4718326	2085000	2633326	44.19%
Pub ad	-101747	-85292	-16455	83.83%
Total	5362317	2012202	3350115	37.52%
Sum	-55346	-1198623	1143278	2165.71%