"Service Economy" in Japan*

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I. Introduction

It has been argued for quite some time that Japanese economy is undergoing structural changes brought about by a growth of the service sector after the first oil crisis, which is commonly termed as "service economy". Researches on this subject to date, however, have failed to provide a satisfactory indicator for the growth of the service sector and have often been a mere description of individual changes, with a sociocultural and historical bias.

In this paper, therefore, we deal mainly with the economic aspect of these changes, although we also make certain sociocultural and historical considerations. Specifically, in our analysis of the "service economy", we focus on cyclical business fluctuations, employment and finance, all of which are the main concerns of economic policy making. We try to be empirical, using the simplest economic theories. As the basis for such a macroeconomic analysis, we need to have a clear understanding of the nature of the changes in the economy. Thus, we look into the consumption structure of the household sector and the intermediate input structure of the corporate sector.

We define "the growth of the service economy" as "an increase in the share of the tertiary sector in the total economic activity (primarily, nominal production) of the nation". The sector upon which our analysis is centered is, of course, a

* I am grateful to Professor Masahiro Kuroda of Keio University for his invaluable advice, especially on estimation methodology. Likewise, I learned much from and must thank Professors Ryuichiro Tachi, Masao Baba, Kotaro Tsujimura, Kenichi Miyazawa, Keiichiro Obi, Tsuneo Iida and Shoichi Royama.

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narrowly-defined, private service sector within the tertiary sector.[1,2]

In Chapter II, we review the present condition of "service economy". Then we set forth the reasons behind the advent of the "service economy" in the cases of household and corporate sectors in Chapters III and IV, respectively. We see that the changes in income structure of the household sector represented by the ratio of the housewife's income to total income, and the "habit persistence effect" of consumption, both contributed to the increase in service expenditures. Similarly, we see that growing substitution between intermediate service input and labor inputs of the corporate sector as well as the bias of technological innovations have direct and indirect influences on the share of the service inputs in the total intermediate inputs. Based on the above findings, we analyze the repercussions of the growth of the service sector on production, employment and financial movements using the Input-Output Tables[3] in Chapters V and VI. Here we argue that while the growth of

1. Nominal production figures (value-added plus intermediate input) are used for the following reasons. First, the value-added figures reflect well the economic activity of national economy. However, because they do not represent the total value of transactions, the economic sense of comparing them with prices and financial activities is ambiguous. It is necessary to get rid of such ambiguity by using the sum of value-added and intermediate input (total domestic production). Second, there is a difficulty in measuring the contribution of qualitative improvement to the changes in service prices, which may make it less meaningful to estimate real service output, real productivity and real rate of growth for the service sector in the same way as we do for the manufacturing sector.
However, since the comparison of productivity between the service sector and manufacturing sector is an important point of interest, we will calculate and analyze real service output using existing deflators as a first approximation.

2. In the tertiary sector (including the government sector), such industries as wholesale, electricity and transportation are closely linked to the manufacturing sector. As such, if we use tertiary sector as an indicator, we might overestimate the "service economy". On the other hand, if the industries are narrowed down to private service sectors (services for individuals, firms, and the general public), stressing they are relatively independent of the manufacturing sector and their rates of growth are higher than other industries, their shares in the overall economy may be too small to draw any definite conclusions regarding the "service economy". Thus in our paper, we focus on the broadly-defined service sector, the tertiary sector, while paying considerable attention to the narrowly-defined private service sector by making explicit reference to developments in this sector when necessary.

3. The main framework that we use in this paper is that of the Input-Output Tables. Specifically, we use "Analysis of Movements of Postwar Economic Structure in Japan Using the Input-Output Tables"(1960-75, International Trade and Industry Statistics Association) and "Input-Output Tables for 1980 preliminary" (Government Administration Agency). For further breakdown of industries, we use "1965-70-75 Joint Input-Output Tables" (Government Administration Agency) for the period before 1975, and "1980 Extended Input-Output Tables" (MITI) for 1980.
Incidentally, restaurant services are classified to the narrowly-defined service sector in the

the service sector contributes to stabilization of production and employment, the shortening of the average employment period, due in part to the vulnerability of the service sector to seasonal disturbances, and low labor productivity, suppresses per capita income growth. In addition, the growth of the "service economy" influences money supply and the private sector's financial activities. We show that this influence works to increase the effectiveness of monetary policy by reducing uncertainty in national income determination. In Chapter VII, we conclude the above discussions.

II. The Growing Role of Services in the Japanese Economy

Table 1 shows the growth of the services in the Japanese economy in terms of value of domestic production calculated from the Input-Output Tables. The share of nominal production of the service sector, in both the broad and narrow definitions (given in the note 2), has shown a constant upward trend since 1965. In 1980, the share of the tertiary sector (broadly-defined service sector) was 43.7%, and that of the narrowly-defined service sector, 12.7%.

We next look at the changes in domestic service production during every ten-year periods from 1960 to 1980, decomposing them into changes in intermediate inputs and final demand. In terms of the latter, in 1980, the broadly-defined service sector rose roughly to 50% of total final demand whereas the figure was around 40% in 1960 and 1970. Even when the narrow definition is used, the share rose to 18.5% in 1980 from 12.6% and 14.8% in 1960 and 1970 respectively. It is evident that during the ten years since 1970, the service sector grew spectacularly. The rise in the share of services in the final demand structure can be attributed to two mutually reinforcing reasons: (i) The consumption expenditure, a dominant component of the final demand, is becoming increasingly service-oriented (share of tertiary sector production in total consumption, from 66.2% in 1970 to 74.9% in 1980); (ii) The relatively stable growth of consumption, in contrast to the dip in investment caused by a slowdown of economic growth, enlarged the share of consumption in final demand (from 55.6% in 1970 to 61.0% in 1980).

On the other hand, the share of intermediate input supplied by the tertiary sector rose from 27.9% of the total input value in 1970 to 34.3% in 1980. Although the corresponding figure for the narrowly-defined service sector still remains at only 6%, it has doubled over the last ten years showing the expansionary trend of the sector. Further, along with the increase in the production and the mechanization of

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Input-Output Tables, while some other statistics classify them to the retail sectors. In order to maintain comparability, we reclassify the latter statistics in accordance with the method of the Input-Output Tables.

the tertiary sector, transactions within the sector and intermediate demand of the tertiary sector for the output of the primary as well as secondary sectors saw a huge growth. Table 2 shows that the demand which is directly related to the tertiary sector accounts for more than 50% (and more than 10% for the narrowly-defined service sector) of total intermediate demand.

Table 1 Share of Nominal Gross Domestic Production by Industries

(share, %)

	1955	1960	1965	1970	1975	1980
Primary sector*	12.0	8.2	6.6	4.4	4.0	2.9
Secondary sector**	52.3	60.7	58.2	59.9	55.0	53.4
Manufacturing	44.9	51.4	48.2	49.3	44.0	43.0
Tertiary sector	35.6	31.1	35.2	35.8	41.0	43.7
Services	10.8	7.2	8.7	9.2	11.2	12.7
Wholesale & Retail	8.0	6.7	8.1	8.8	9.2	9.2
Finance, Insurance & Real Estate	4.0	4.9	6.2	6.4	8.2	7.6
Public accomodation	1.9	2.1	2.2	2.0	2.8	2.4

Notes: 1. Compiled from Input-Output Tables.
2. Production for Wholesale & Retail is given by commercial margin.
* Agriculture, Forestry & Fishing.
** Manufacturing, Construction & Mining.

Table 2 Share of the Tertiary Sector-Related Demand in Intermediate Demand

(%, ( ): share of narrowly-defined service sector)

	1960	1970	1980
Demand toward service sector (broad difinition)	23.2 (2.0)	27.9 (3.0)	34.3 (5.9)
Demand from service sector toward non-service sector	10.6 (3.1)	10.6 (3.8)	19.1 (5.9)
Total	33.8 (5.1)	38.5 (6.8)	53.4 (11.8)

Note: Compiled from the Input-Output Tables.

Similarly, the growing predominance of the service sector in overall production can be observed in terms of total working population, outstanding debts, capital stock, etc. As regards the total working population and outstanding debts, the tertiary sector's share reached 55% in 1980 (45% in 1970), and has still continued to rise thereafter. Also, as regards the capital stock, while investment of the manufacturing sector stagnated after 1975, that of the tertiary sector kept steady growth, so that the share of the latter in the total investment is now almost 40%.

Thus, it is evident that influence of "service economy" is not limited to the flow variables of the economy, such as final and intermediate demand, but is spreading out to stock variables such as factors of production. This development of "service economy" is a result of natural evolution of the economic structure, the process of which was accelerated by the first oil crisis. This process, coupled with a later decline in the rate of economic growth and innovations in electronics technology introduced to cope with the decline, has been the main factor behind the structural change in the Japanese economy. From this point of view, the beginning of "service economy" in Japan may be set around 1975 with its rapid development thereafter.

Growth of the service sector is not unique to Japan. As the degree of economic matureness measured by per capita income increases, we observe in most developed countries that: (i) the share of service production in total production increases reflecting a progress of the division of labor; and (ii) the ratio of white-collar workers to total workforce rises[4] (see Figure 1 page 68).

III. Changes in the Demand Structure of the Household Sector

1. The Growing Weight of Services in the Structure of Consumption

We have seen that the growth of service expenditures in the final demand structure is due to: (i) increase in the weight of consumption expenditures, composed mainly of service outlays, in the final demand; and (ii) increase in the weight of service expenditures in each category of final demand, especially in consumption. In what follows, we single out the household consumption, whose share in the total consumption is quite large, and see the impact of "service economy" on its composition.

Table 3 shows figures for various components of household consumption based on GNP statistics. We can see that the weight of service expenditures has been rising

4. The international comparison in Figure 1 is made with no regard to differences in the stage of economic development. If we estimate the trend line only for developed countries, the result may well be different from the one shown in the figure. See Baba (1983) for a suggestive analysis on this point.

Table 3 Changes in the Structure of Service Demand

(1) Household Consumption in Nominal Terms (GNP-base)

(share, %)

	1970	1973	1976	1979	1982
Durables	6.2	6.7	5.7	5.7	4.9
Semi-durables	14.2	15.7	14.1	12.8	11.5
Non-durables	37.2	34.1	36.1	32.6	32.7
Services	42.4	43.5	44.1	48.9	50.9

(2) Household Consumption in Real Terms (GNP-base)

(share, %)

	1970	1973	1976	1979	1982
Durables	5.1	6.5	6.1	6.9	6.7
Semi-durables	14.6	15.3	14.6	13.6	12.6
Non-durables	37.7	35.6	36.2	34.3	33.4
Services	42.5	42.6	43.1	45.3	47.2

Note: Rate of annual change of deflator of consumption (1972-82) are:

(%)

Durables	Semi-durables	Non-durables	Services	Total
3.8	7.4	8.3	8.5	8.1

(3) Expenditure Items in Real Terms

(share, %)

	1963	1967	1972	1977	1982	(Memo) Average annual price increase, 1972-82
Durables	2.2	2.7	4.7	5.5	6.0	3.5
Clothing & Footwear	8.5	8.4	8.4	7.8	6.8	8.4
Food	33.4	32.1	28.7	26.3	24.6	8.4
Other expenditures	11.2	11.7	11.7	12.8	13.0	9.6
Service expenditures	44.7	45.1	46.5	47.6	49.5	9.7
Discretionary services	25.7	27.5	30.7	31.5	32.8	9.5
Service necessities	18.9	17.6	15.8	16.2	16.7	10.0

Notes: 1. Compiled from the Annual Report on the Family Income and Expenditure Survey.
2. Discretionary services include education, leisure, tutorial services, restaurant, etc.
Service necessities include housing rental, health care, school fees, etc.

(4) Main Service Demand in Final Demand (Nominal)

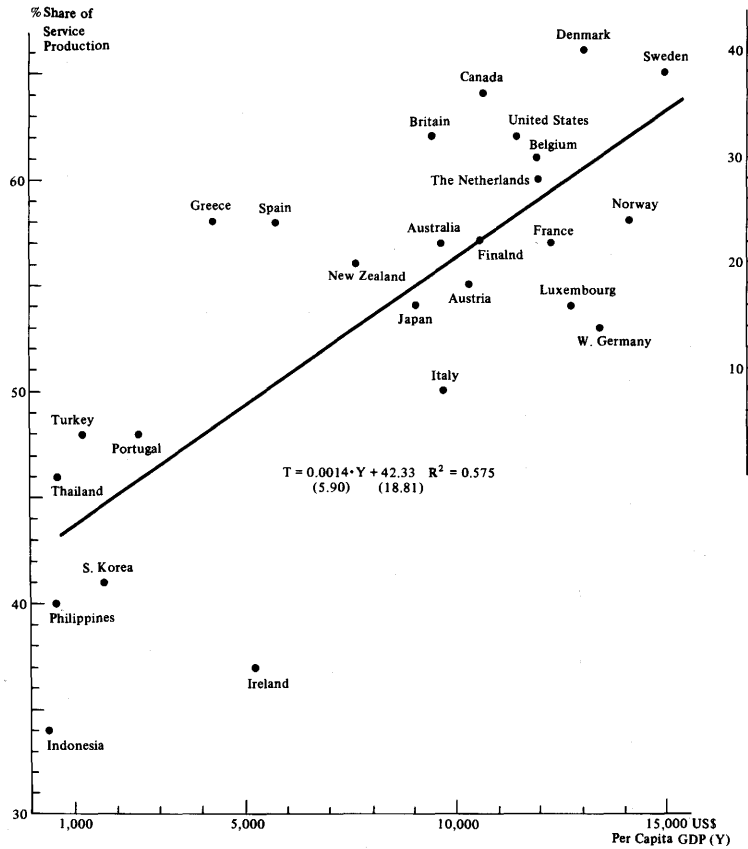
(share, %)

	1970	1975	1980
Education	18.4	19.6	23.4
Health, Social insurance	24.6	28.1	27.3
Restaurant services (Bars & Night clubs excluded)	15.9	17.4	18.4
Leisure services	15.4	12.0	11.0
Daily service necessities	7.6	5.3	4.2
Hotel & other lodgings	7.4	6.0	5.7
(Memo) Ratio of service expenditures to total final demand	14.8	17.3	18.5

Notes: 1. Compiled from Input-Output Tables.
2. Leisure services include cinema, theater, playground, night club, other personal leisure services.
Daily service necessities include other personal services excluding above (except Hotel & other lodgings).

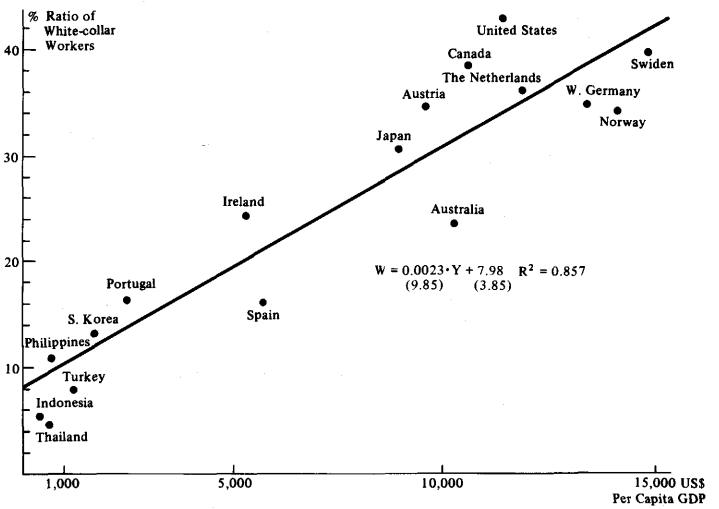
Figure 1 Relation Between Growth of the Service Sector and Per Capita GDP (International comparison)

(1) Relation between Share of Service Production and Per Capita GDP

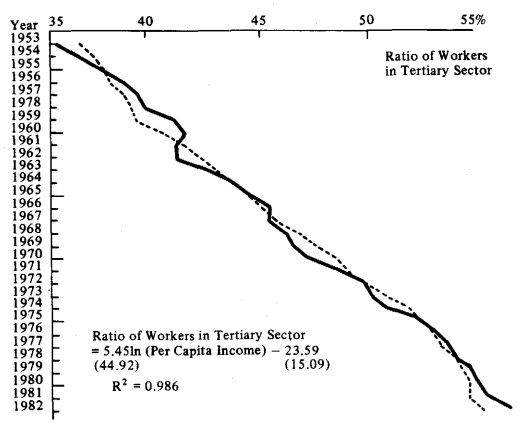


Notes: 1. (1) and (2) are extracted mainly from "Year Book of Labour Statistics" ILO, 1981. Countries included those of OECD and South East Asia.
2. Strictly speaking, difference must be taken into consideration concerning development stages of the various countries.

(2) Relation between Per Capita GDP and Ratio of White-collar Workers to Total Workforce



(Memo) Relation between Per Capita Income and Ratio of Workers in Tertiary Sector in Japan



remarkably in both real and nominal terms. If we take a closer look at each component in real terms using the Annual Report on the Family Income and Expenditure Survey, we find that the shares of clothing & footwear and food, which may be classified as necessities, are declining while those of discretionary service expenditures, mainly education and restaurant services, are growing. Meanwhile, other necessity items such as housing rental and health care services remain roughly constant (all these observations are also valid in nominal term). To confirm these observations derived from microdata of the Family Survey, we refer to the Input-Output Tables compiled every five years. Items on the Tables having remarkably increased are education (broadly-defined to include cultural expenditure in general) and restaurant services, and these increases correspond to the increase in expenditures on discretionary services in the Family Survey. On the other hand, according to the I-O Tables, the share of expenditures on entertainment services is somewhat declining so that apparently this item has not played an important role in the growth of "service economy".

A rapid increase in the share of discretionary services and a relative constancy in that of service necessities are attributable to the following changes in consumer behavior: (i) increase in demand for education and cultural service induced by higher per capita income (consumption of these items tends to produce a "habit persistence effect" on service expenditures); (ii) changes in lifestyle, such as more frequent use of restaurant services, caused by a reduced family size and an increase in the number of families with both husband and wife working; and (iii) influence of increased stock of durables (influence of increased leisure time of housewives spared by wide use of electric appliances).

Judging from a significant increase in restaurant outlays, we may conclude that (ii) above has exerted a dominant impact. Let us take a closer look at this point. First, a reduction in family size tends to increase income per family member, which in turn may raise expenditures on cultural activities and entertainment, while a decline in the number of children may work to reduce such items as educational expenses. Therefore, it is not clear whether this contributes on balance to the growth of "service economy". On the other hand, the growing number of working wives has facilitated growth of the service sector as seen in the example of increased restaurant expenditures. When we analyze the ratio of working wives (roughly equal to the ratio of co-working households), we should take into account the laws[5] defined by

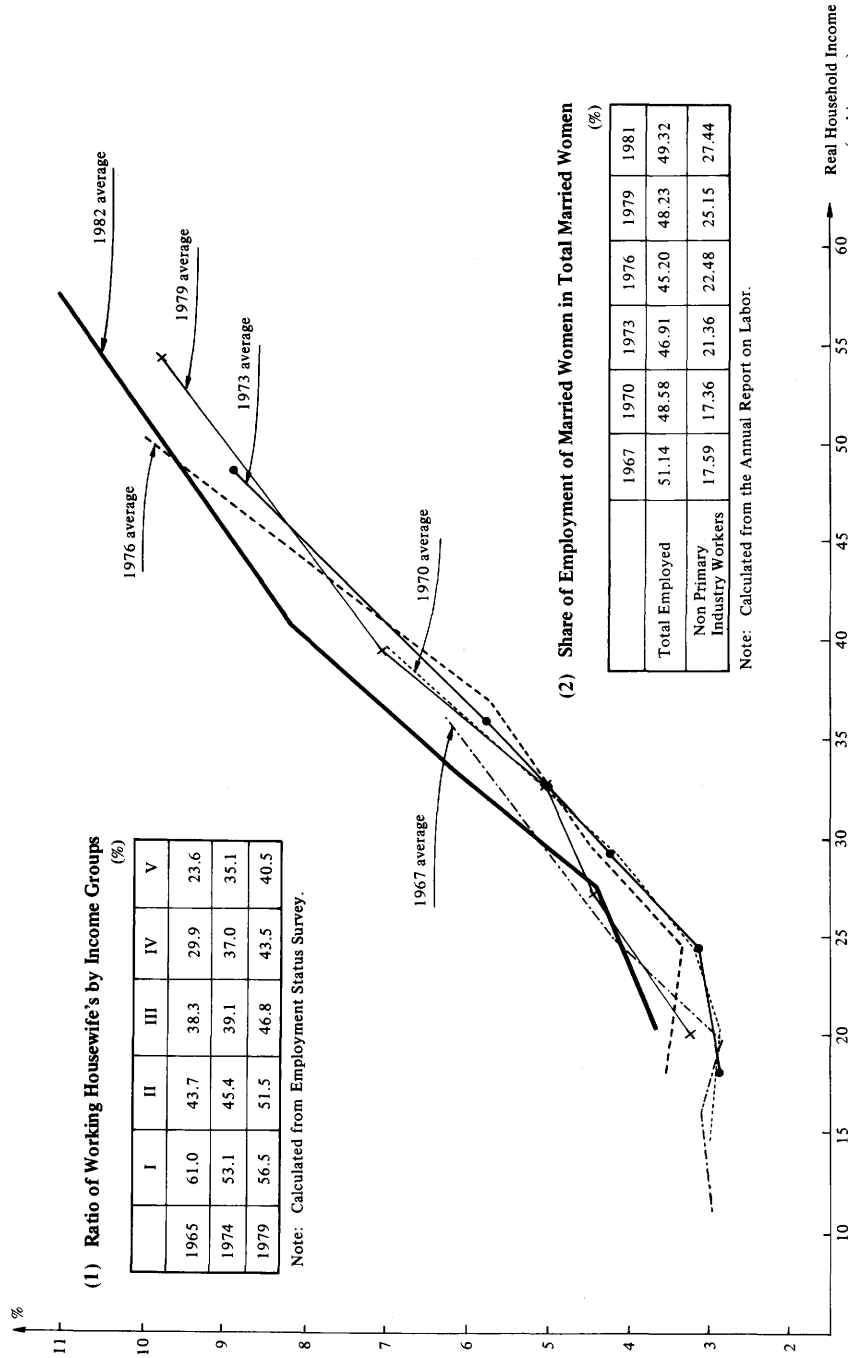
5. The Douglas-Arisawa's laws are observations made on the labor supply measured in terms of the number of workers. They state that an increase (decrease) in the wage rate decreases (increases) the number of working members in the family if that wage rate is for the householder (first law), and increases (decreases) the number if the rate is for the non-householder (second law).

Douglas-Arisawa (especially the first and second ones), concerning the income level of the householder and the wage rate of the wife offered in the labor market. We investigate the ratios of working housewives of different household income groups using the Employment Status Survey. The result that the ratio of working wives is lower for a higher income groups is consistent with the first law. However, a recent increase in the ratio of working wives in families of the high income groups indicates a weakening of this relation (see Figure 2(1)). As for the correlation between the working wife's wage rate and the ratio of working wives, no clear conclusion can be drawn. Yet, according to the Annual Report on the Family Income and Expenditure Survey, the share of the wife's income is larger in higher income groups, and such relation has been observed since around 1965. From this statistical evidence and the weakening of the first law by Douglas-Arisawa, we may presume that wage rates tend to be higher for wives of higher income households, which in turn increases income level and purchasing power of households, especially those of wealthy households. These statistical observations suggest that the traditional role of the wife's income as a supplement to the household income has become relatively less important, and that the increased ratio of working wives is better explained by a reduced burden of child-bearing, brought about by low birth rates, and a higher educational background, both of which encouraged them to participate in professional and social activities, or by their pursuit for an even higher standard of living. Therefore, household income increased by the wife's earnings is much more likely to be spent on discretionary services, such as restaurant and cultural services, rather than on service necessities, and to increase the total service expenditures. In the next section, we formulate and estimate the consumer's utility function focusing on the ratio of income earned by the housewife, and, using this, analyze the increase of service expenditure of households.

2. Analysis Using the Utility Index Function

In the theory of consumption, the household is assumed to maximize the level of utility derived from consumption of goods and services under a budget constraint. The amount of each item consumed by the household depends not only on the level of income (budget constraint) and relative prices of goods and services, but also the shape of the utility index function specific to the household. Among a number of ways for specifying this utility index function, we use a linear expenditure system of Bernoulli-Laplace type, which was also used in Stone (1958) and Tsujimura-Kuroda (1974). The advantage of this system is that it has a relatively easy functional form and that the influence of shift parameters can be easily handled without introducing rigorous substitutional and complementary relationships into formulation.

Figure 2 Share of the Housewife's Monthly Income



(1) Ratio of Working Housewife's by Income Groups (%)

	I	II	III	IV	V
1965	61.0	43.7	38.3	29.9	23.6
1974	53.1	45.4	39.1	37.0	35.1
1979	56.5	51.5	46.8	43.5	40.5

Note: Calculated from Employment Status Survey.

(2) Share of Employment of Married Women in Total Married Women (%)

	1967	1970	1973	1976	1979	1981
Total Employed	51.14	48.58	46.91	45.20	48.23	49.32
Non Primary Industry Workers	17.59	17.36	21.36	22.48	25.15	27.44

Note: Calculated from the Annual Report on Labor.

Note: Calculated from the Annual Report on the Family Income and Expenditure Survey. (1980 basis)

The Bernoulli-Laplace specification is given as:

$$U = \prod_{i=1}^{n} (a_i + q_i)^{\alpha_i} \quad , \quad i = 1 \cdots n \tag{1}$$

where U is total utility, q_i is real expenditure on item i, and a_i and α_i are preference parameters, respectively.[6]

The marginal utility of the i-th item derived from this utility index function becomes infinity when the level of consumption of this item is equal to $-a_i$. Hence, a_i is the minimum necessary expenditure level of the i-th item. At the same time, by explicitly incorporating a_i in this form, we can take into consideration a possibility of changes in the state of preferences. Such changes in the state of preferences include, for example, the effects of past experience of consuming a particular item, which may further increase consumption of that item ("habit persistence effect"), or may rather curtail its consumption ("stock adjustment effect"). It is also possible that shifts of the utility index function arise from the change in the number of family members, or the change in income structure resulting in a transition of a consumption structure of households. For example, Tsujimura-Kuroda (1974) specified a_i by introducing the "habit persistence" potential (h) and the average number of family members (m):

$$a_i = a_{oi} + b_i m + c_i h_i \ . \tag{2}$$

a_{oi} is the necessary minimum expenditure and h_i is the cumulative value of expenditures in the previous periods.

Although the downward trend of the number of family members has almost come to a halt, the change in income structure caused by an increase in the housewife's income share in total household income has been going on after 1975 on which we are focusing in this paper (see Table 4).

6. Using this equation, the marginal utility is given as:

$$U_j = \frac{\partial u}{\partial q_j} = \alpha_j (a_j + q_j)^{\alpha_j - 1} \cdot \prod_{i \neq j} (a_i + q_j)^{\alpha_i} = \alpha_j \frac{U}{(a_j + q_j)} = \lambda p_j \ .$$

The last equality is based on the assumption of equality of marginal utility. λ is the marginal utility of income and p_j, the price of the j-th item. Normalizing $\sum \hat{\alpha}_i$ equal to unity (where $\hat{\alpha}_i = \frac{\alpha_i}{\sum \alpha_i}$), we get the following linear expenditure schedules:

$$\begin{cases} E_1 = \hat{\alpha}_1 \cdot E - (1 - \hat{\alpha}_1) a_1 \cdot p_1 + \hat{\alpha}_1 (a_2 p_2 + \cdots + a_n p_n) \\ \vdots \\ E_n = \hat{\alpha}_n \cdot E - (1 - \hat{\alpha}_n) a_n \cdot p_n + \hat{\alpha}_n (a_1 \cdot p_1 + \cdots + a_{n-1} \cdot p_{n-1}) \ . \end{cases}$$

Table 4 Housewife's Income Share and Number of Family Members*

	1963	1972	1982
Housewife's income share in total income (%)	3.84	4.92	7.57
Number of family members	4.30	3.93	3.78

Note: Compiled from the Annual Report on the Family Income and Expenditure Survey.

We regard this change as one of the main factors inducing a transition of the utility index function and changes in the consumption demand structure.

For this reason, we use the housewife's income share in the total income (denoted by w) as a shifting factor of a preference parameter (a_i), together with the "habit persistence effect" (h_i) which has been incorporated into some previous models, and exclude the number of family members (m) which has also been used in previous works. That is to say, our equation has a following form:

$$a_i = a_{oi} + b_i w + c_i h_i \quad .^{7} \tag{3}$$

The above equation is estimated using the three-stage least squares method, by employing 1963-82 as a sample period for the following six components of consumption expenditures; durables, clothing & footwear, food (excluding restaurant services), other non-durables, discretionary services (including entertainment, restaurant and tutorial services) and service necessities (including electricity, gas, rentals and education services). The data are compiled from the Family Income and Expenditure Survey, and are on annual average basis. The results of estimation are shown in Appendix 1 and 2. We use the estimated preference parameters, shown in Table 5, to study the effect of "service economy" on household consumption. First, we consider the "habit persistence effect". Since the sign of c_i is negative for all expenditure items, we can assume a positive "habit persistence effect". In other words, as the habit potential increases, the marginal utility curve ($U_i = \alpha_i U/(a_i + q_i) = \alpha_i U/(a_{oi} + b_i w + c_i h_i + q_i)$: see footnote 6) shifts to the right, raising the consumption. This effect is relatively prominent in the cases of durables and services in general. In the former case, however, while accumulation of durables may suppress additional purchase of the goods of the same kind ("stock adjustment

7. We have also estimated a function using the number of family members and the "habit persistence effect" as preference parameters (i.e., Equation (2)) instead of the housewife's income share. This equation, however, does not show a good fit and for some items the marginal utility is negative. Since the utility index function depends not only on consumption of goods and services, but also on time for leisure, estimation of Equation (2) which disregards this leisure factor may produce a biased result. In that sense, we may interpret the housewife's income share in Equation (3) as a shift parameter representing the changes in leisure time.

Table 5 Estimation Results of the Consumption Function

(1) Preference Parameter for Each Consumption Item

(figures in brackets are t-values)

	α_i	a_{oi}	b_i	c_i
Durables	(4.8) 0.163397	(0.8) - 5,119.2	(1.1) 1,863.1	(2.3) -0.071060
Clothing & Footwear	(10.6) 0.112998	(0.01) - 104.1	(0.5) - 831.6	(0.6) -0.009227
Food	(11.2) 0.173840	(2.9) -31,111.9	(0.3) - 639.5	(1.4) -0.009572
Discretionary services	(13.8) 0.433275	(0.5) 15,940.8	(0.5) -3,276.6	(2.7) -0.039348
Service necessities	(2.4) 0.047094	(4.3) -26,664.2	(0.9) 1,286.1	(3.4) -0.030427
Other non-durables	(2.9) 0.069397	(0.6) - 4,668.8	(1.0) -1,491.7	(2.1) 0.025116

(2) Estimates of Asympototic Value of Consumption

	1963	1967	1972	1977	1982
Durables	-2,034.9	-1,826.3	- 242.2	598.2	4,117.6
Clothing & Footwear	3,297.6	4,197.8	5,441.2	7,777.6	9,239.8
Food	33,567.4	35,768.9	38,735.5	42,669.9	45,926.6
Discretionary services	-3,358.8	5,313.1	18,871.9	39,762.6	58,215.7
Service necessities	21,725.7	24,523.4	28,593.8	31,602.1	36,164.5
Other non-durables	10,397.0	13,018.6	16,706.5	22,784.3	27,834.2

effect"), judging from these estimation results, "habit persistence effect" dominates "stock adjustment effect" and the total effect is to increase the amount of purchase of durables.

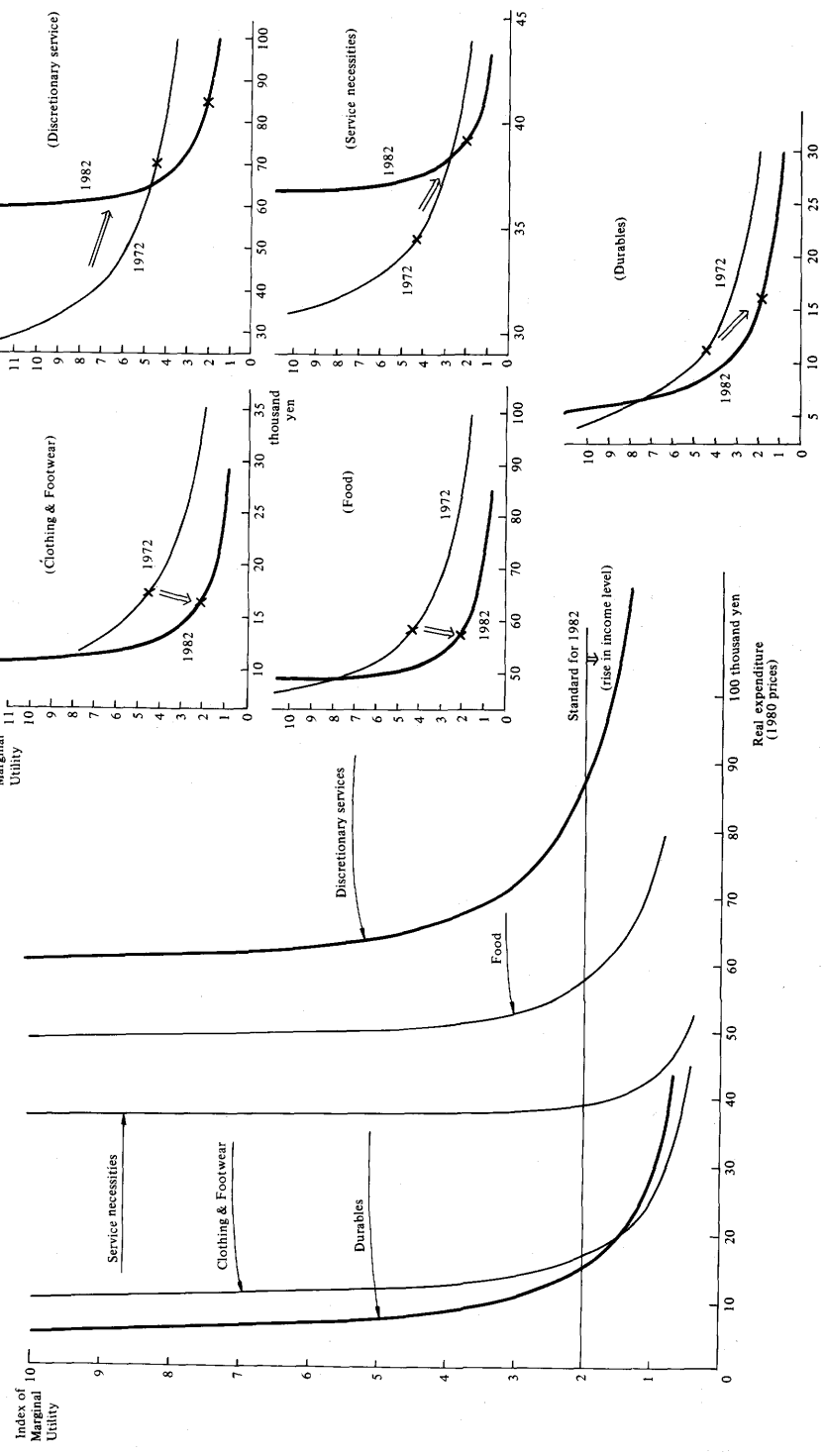
Second, we examine the effect of a change in the housewife's income share (b_i) in total household income. Our result shows that a rise in this share shifts marginal utility curves to the right for items such as discretionary services, clothing, footwear food, and increases the amounts of consumption of these items. This effect is most salient in discretionary services.[8]

Third, apart from the preference parameter, we examine the changes in minimum consumption. Minimum consumption, that is, the position of the asymptote of the marginal utility curve, is indicated by a_i. Using the estimated results, we can calculate a time series of a_i for each item. It is found that the minimum consumption levels for basic necessities, such as clothing & footwear, food and service necessities, have been positive since 1963 and the magnitude of their shifts is relatively small. On the other hand, for discretionary services and consumer durables, minimum consumption levels in 1963 were negative or barely positive indicating that the degree of necessity is small for these items. With a rise in income over the years, however, the minimum consumption of those two items, especially that of discretionary services, has grown quite rapidly. It should be noted that a rise in the housewife's income share and the "habit persistence effect" significantly contributed to this tendency.

With these results in mind, we calculate and depict in Figure 3(1) the marginal utility curves for individual items based on the 1982 income level (we omit the item "other non-durables" for simplicity). The vertical axis represents the level of marginal utility. Figures on the axis are chosen for convenience of measurement, and their absolute value has no economic meaning. The horizontal axis gives the amount purchased (expressed in 1980 price). The line drawn parallel to the horizontal axis at 2 shows the level of marginal utility (divided by the price of individual item in 1982), and the intersection of this line with the marginal utility curve gives the amount of consumption which equalizes the marginal utility of expenditure on various items, which is an equilibrium allocation of consumption expenditure or equilibrium consumption structure. In this framework, marginal utility falls as income level rises

8. In light of the fact that in higher income group the household belongs to, the higher the ratio of the wife's income is to the total household income, it is possible that b, which we assume to be determined by the household income structure independently from the level of income, is in actuality influenced by the latter. For example, in the high income group with a high share of the wife's earnings, increase in total income may not lead to an increased spending on service necessities or consumer durables (because of the past accumulation of durable goods). These factors may bias our estimation result. We need further considerations on this point in future, including estimation of utility index functions separately for individual income classes.

Figure 3 Position and Shift of the Marginal Utility Curve



and the equilibrium level of consumption increases as the marginal utility curve moves rightward.

The slope of the marginal utility function of each item depends on the parameters a_i and α_i. As Figure 3(1) shows, marginal utility curves of clothing & footwear and service necessities, both of which are highly necessary, have a steeper gradient indicating a rapidly diminishing marginal utility. This means that the increments in expenditures on these items are small when the income level rises. On the other hand, such items as discretionary services and consumer durables, which are less necessary component of consumption, have less steep gradient indicating that the consumption of these items rises with the increase in income.

Since the marginal utility scale on the vertical axis is normalized with respect to the prices of expenditure items, it embodies the effect of changes in relative prices over time. Furthermore, in view of the fact that the utility index function shifts in accordance with the "habit persistence effect" and changes in household income structure, consumption may increase over time even when marginal utility is rapidly declining.

Taking these possibilities into consideration, we illustrate in Figure 3(2) the marginal utility curves for 1972 and 1982, and see how they shifted during the period. When we compare the levels of marginal utilities, we find that the equilibrium level in 1982 is lower than the 1972 level. On the other hand, it is evident that the asymptote of the utility curve moved to the right for all items. The magnitude of shift is larger for services in general and consumer durables, while it is smaller for clothing & footwear and food. As a result, purchases of clothing & footwear and food in 1982 decreased slightly compared with their corresponding levels in 1972, while purchases of discretionary services and durables rose markedly and also those of service necessities rose slightly. Apparently, despite the relatively large increases in the prices of discretionary services and service necessities during the period, the increase of the housewife's income share (which has a positive effect on discretionary services) and the "habit persistence effect" (on discretionary services and service necessities) shifted the marginal utility curve to the right inducing higher consumption levels of these items. As for clothing & footwear and food, although the parameter a_i had the effect of shifting the curve to the right, its influence was small and was seemingly offset by the leftward shift due to price increases. As for durables, since the price increase was small, the "habit persistence effect" had a dominant influence and brought about an increase in consumption. In summary, changes in the preference parameters and in relative prices were reflected in the consumption expenditure structure, and resulted in an increase in demand for services, and for discretionary services in particular.

Next, apart from the concept of marginal utility we estimate the magnitude of changes in consumption of each item with respect to the changes in the housewife's

income share (w) and the cumulative value of past expenditures (h_i) using the parameters obtained by the estimation (Equations (4) and (5), see Table 6).

$$\frac{\partial q_i}{\partial w} = \frac{1}{p_i}\left(-b_i p_i + \alpha_i \sum b_j \cdot p_j\right) \quad \text{Change with respect to housewife's income share} \tag{4}$$

$$\frac{\partial q_i}{\partial h_i} = c_i\left(\alpha_i - 1\right) \quad \text{Change with respect to habit persistence effect.} \tag{5}$$

Table 6 Changes in Consumption with Respect to Housewife's Income Share and Habit Persistence Effect

	Yr.	Durables	Clothing & Footwear	Food	Discretionary services	Service necessities	Other non-durables
Change with respect to housewife's income share	1978	-2,290.6	513.0	161.0	2046.9	-1421.0	1275.5
	79	-2,310.9	510.8	143.2	2032.0	-1420.7	1272.2
	80	-2,367.6	482.3	102.6	1938.6	-1431.4	1277.2
	81	-2,395.4	471.2	91.8	1909.1	-1435.4	1273.9
	82	-2,421.0	465.1	74.1	1896.0	-1436.1	1270.4
Change with respect to habit persistence effect		0.05944	0.00818	0.00790	0.02229	0.02899	0.02337

Changes in the housewife's income share most strongly influence consumption of discretionary services in positive direction. This influence exceeds its negative one on service necessities, therefore the changes in the household income structure represented by the housewife's income share have the effect of raising the weight of service expenditures in total consumption expenditures. Meanwhile, the "habit persistence effect" has its strongest influence on durables spendings. However, its influences on discretionary services and service necessities are also large and much stronger than those on clothing & footwear and food; as a whole the "habit persistence effect" tends to be stronger on services than on goods.

Thus, should the upward trend in the share of the housewife's income and the "habit persistence effect" continue, the share of service expenditures in total consumption, especially that of discretionary services, would continue to rise. Furthermore, so long as the weight of consumption in total final demand does not fall substantially — whether or not it does fall is difficult to forecast, depending on the future rates of economic growth — the share of service demand in total final demand will also continue to rise.

IV. Changes in the Input Structure of the Corporate Sector

1. The Growth of Service Inputs in Intermediate Inputs

The changes in the corporate firms' input structure can best be elucidated by looking into the composition of intermediate inputs in the I-O Tables over time. In Chapter II, we have seen the increase in weight of service-related inputs in intermediate inputs. In the following, we view the same phenomenon for a change in the cost structure as a whole — this is equivalent to a change in the price structure — including factor costs such as wages. Table 7(1) shows the input cost structure of domestic products since 1960. The total input is classified as: (i) non-service intermediate input cost (input from the primary and secondary sectors); (ii) intermediate service input cost (input from the tertiary sector); (iii) wage payments (employees' income); (iv) capital cost (profit plus depreciation) and (v) others (indirect tax, etc.). The table clearly shows that the share of inputs supplied by the tertiary sector, particularly by the narrowly-defined service sector, has been rising. It also shows that capital cost has fallen while wage payments have been on the rise. We should note that growth of "service economy" took place amid these changes in various costs.

Table 7(2) gives individual items of rapidly increasing, narrowly-defined intermediate service inputs. We find that: (i) the share of information & research services, such as research, survey, data processing, computing, and lease services of computers and their attachments, have been increasing remarkably; (ii) the share of building and construction and of legal, financial and accounting services have increased compared with their levels in 1965 and 1970, although they somewhat declined after 1975; and (iii) the share of lease services has risen since 1975. In contrast, the share of advertising services, which was quite large in 1965, has dropped drastically. Thus, an overall growth of the service sector accompanies changes in the weights of individual service sectors.

In the I-O Tables, almost all of machine repair and maintenance services, whose weight in total intermediate inputs is approximately 5% in 1980, are classified as "machinery". If, however, these items are properly classified as services (including the cost of machinery parts), the share of the narrowly-defined service sector will exceed 10% of total intermediate input.

While the above analysis of "service economy" focuses on intersectoral market transactions, we should not overlook an expansion of service transactions within individual sectors, especially the movements in wage payments to white-collar workers. As a measure of service inputs within each sector, we employ the value of wages paid to workers engaged in administrative, technical and managerial, and other office works. Applying this measure to the manufacturing sector, we find that

Table 7 Change in Intermediate Service Inputs

(1) Input Cost Structure of Domestic Products

(share, %)

	1960	1965	1970	1975	1980
Non-service intermediate input cost (Primary & secondary sectors)	43.6	38.9	38.7	35.9	36.3
Intermediate service input cost (Tertiary sector)	13.0	14.7	14.8	16.5	18.9
Narrowly-defined services	1.1	1.6	1.6	2.0	3.3
Wage payment	17.2	20.2	19.7	24.9	23.4
Capital cost	20.7	21.0	22.6	18.5	17.3
Others	5.5	5.3	4.3	4.2	4.1

(3) Increase in Service Inputs in the Manufacturing Sector

(share, %)

	1960	1970	1975	1980	Processing
Share of input from tertiary sector	16.8	17.0	18.5	22.3	24.1
Narrowly-defined services	1.8	1.8	2.1	3.2	5.2
Corrected share of input from tertiary sector (Note 4)	21.5	23.0	26.0	28.9	33.2
Corrected share of input from narrowly-defined service sector	7.3	9.0	11.1	11.5	16.6
(Memo) Share of total wage payments paid out to white-collar workers	30.4	39.3	43.1	43.6	45.2

(2) Individual Items of Intermediate Service Inputs

(share, %)

	1965	1970	1975	1980
Information & Research	4.0	9.9	11.4	14.3
Building, Legal, Finance & Accounting, Land services	10.8	31.8	43.2	36.3
Lease services	1.4	5.9	4.7	5.5
Advertising	43.5	33.3	22.3	20.1
Public accomodation	28.1	15.4	15.6	14.0
Share of service in intermediate input (A)	3.0	3.0	3.9	5.9
Share of mechanical repair in intermediate input (B)	2.5	2.3	2.4	4.5
A + B	5.5	5.4	6.2	10.4

Notes: 1. (1) is compiled from Input-Output Tables. Wage payment corresponds to Employee's Income; Capital cost is defined as current profit plus depreciation allowance; Others are indirect tax, etc.

2. (2) is compiled from Input-Output Tables. The items are defined as follows:
   Information & Research: research, survey & data processing & computing, information services, computer leasing.
   Lease services: leasing except computer.
   Public accomodation: broadcasting, education, health & social insurance, other public services.

3. (3) is compiled from Input-Output Tables and Report on Wage Structure Survey.

4. Corrected share of input from tertiary (narrowly-defined service) sector is:

$$\frac{\text{Input of tertiary (narrowly defined service) sector + Wages paid to white-collar workers}}{\text{Intermediate input + Wages paid to white-collar workers}}$$

5. Processing sector includes metal & machinery.

wage payments of such kind have been more than 40% of total wage since 1975, indicating that the "service economy" is also growing in the sphere of the value-added structure. Further, if we classify such wage cost as an intermediate service input and add it to the broadly-defined intermediate service input, service-related input accounts for almost 30% of total intermediate inputs (more than 10% even if we use narrow definition of intermediate service inputs, see Table 7(3)). It should be noted that the service inputs in broad definition reaches to one third (and 15% in narrow definition) of total intermediate inputs in machinery and metal sectors, in which the weight of the workers engaged in research and development is presumably high. While the growth of "service economy" within each sector tends to suppress market transactions of services, such adverse effect is not strong enough, and the "service economy" based on the market transactions is also growing rapidly as we have already seen.

The fundamental reasons for the growth of service inputs in the corporate intermediate input structure are as follows: (i) the expansion of economy has given rise to a general trend of service specialization (a switch from self-sufficiency of service supply within the sector to the purchase of specialized services from outside of the sector); (ii) in the process of diversification of consumers' taste and a decline in the rate of economic growth, urgent needs emerged to reinforce information services and research and development capacities by means of, for example, purchases of various software-related services. Furthermore, the following facts also contributed, directly or indirectly, to the increase in the share of service-related input in total intermediate input: (iii) increased demand for leasing various kinds of industrial machines, which reflects the corporate attitude against investment risk in time of slowdown of economic growth; (iv) demand for repair and maintenance services generated by the progress of mechanization and computerization.

Next, we look into the interdependence between goods and service sectors using the inverse matrix obtained from the I-O Tables (Table 8, categorized into eight sectors, in 1975 price). We note that: (i) although the production of manufacturing industries has the largest "inducement effect" (that is the ratio of products generated by final demand to corresponding final demand) on other industries' production levels, this effect of service industries is getting quite large in recent years and especially that of the narrowly-defined service sector has filled the gap to a great extent between light manufacturing and processing sectors; (ii) while the "inducement effect" of manufacturing industries on themselves has remained roughly constant or slightly decreased, the effect of light manufacturing industry on service industries, has grown remarkably; and (iii) the "inducement" effect of the service sector on itself and on the manufacturing industries has also seen a significant increase.

Therefore, as the growth of "service economy" changes the intermediate input

Table 8 Changes in the Interdependence of Each Sector

(Inverse Matrix, in real terms)

	year	Construction & Mining	Light Manufacturing	Heavy Manufacturing	Processing	Tertiary Sectors (excluding services)	Services
Construction & Mining	1970	1.10442	0.04816	0.25567	0.07822	0.04829	0.03242
	1980	1.06606	0.04221	0.23474	0.04937	0.04879	0.03706
Light Manufacturing	1970	0.21086	1.41549	0.12582	0.13933	0.05274	0.18034
	1980	0.17442	1.36883	0.10864	0.11443	0.06774	0.23838
Heavy Manufacturing (Materials)	1970	0.40375	0.24757	1.74560	0.46781	0.11381	0.13827
	1980	0.33757	0.24332	1.74194	0.31685	0.13571	0.17810
Processing	1970	0.22086	0.05414	0.09623	1.40895	0.06310	0.03586
	1980	0.23741	0.07526	0.10663	1.41247	0.08863	0.05442
Tertiary Sectors (excluding services)	1970	0.25287	0.22227	0.27371	0.26629	1.17813	0.16225
	1980	0.28719	0.27555	0.29916	0.21963	1.23883	0.24942
Services	1970	0.04225	0.03529	0.03739	0.04364	0.03440	1.04998
	1980	0.06838	0.04747	0.05706	0.05777	0.05596	1.08331
Total (Including primary industry & those not specified)	1970	2.33386	2.38097	2.63778	2.49079	1.53390	1.71228
	1980	2.23909	2.30982	2.62392	2.23402	1.68049	1.91570

Notes: 1. Compiled from Input-Output Tables.

2. Divided into 8 industries; the figures were obtained by using the formula $(I-(I-\bar{M})A)^{-1}$, where I is unit matrix, $\bar{M}$ is import coefficient matrix, and A is input coefficient matrix. The division of industry is referred to footnote in Table 11.

structure, the "inducement effect" of each sector also undergoes changes. And the latter changes take the form of strengthening the interdependent relationship between the goods and the service sectors by increasing both the service input of the goods sector and the non-service (goods) inputs of the service sector, rather than taking the form of independent growth of production of the service sector reflecting increases in final demand.

2. Analysis Using the Transcendental Logarithmic Function

In this section, we formulate and estimate the price function explicitly incorporating the input share of each production factor. We shed light on "service economy" by studying the reasons for changes in the input share. We define the cost structure of the corporate by the input shares, or equivalently, distribution ratios, of various factor inputs including intermediate inputs. The change of these share is induced by the relative prices of factor inputs, degrees of substitution determined by technology, and biases of technological progress, etc. Taking these influences into consideration, we divide factor inputs into the following four categories; (i) non-service intermediate inputs (inputs from primary and secondary industries, or M); (ii) intermediate service inputs (inputs from tertiary industry, or S); (iii) capital (K); and (iv) labor (L). We formulate the transcendental-logarithmic function of output (Q) price, incorporating the above four variables and the time trend variable (T) which represents technological progress.[9]

9. We specify the trans-log price function as follows:

$$Q = g_i(P_M, P_S, P_K, P_L, T).$$

Q is the output price of the industry, P_M the price of input produced by the primary and secondary sectors (M), P_S the price of input produced by the tertiary sector (S), P_K the capital (K) price, P_L the labor (L) price, T the time trend. Transforming the above into logarithmic form and expanding it by Taylor series, we get:

$$\ln Q = \alpha_0 + \sum_j \alpha_j \ln P_j + \frac{1}{2}\sum_k \sum_j \ln P_k \ln P_j + \alpha_T \cdot T + \sum_j B_{jT} \ln P_j \cdot T + \frac{1}{2}\beta_{TT} \cdot T^2 \quad (j = M, S, K, L).$$

From this we obtain:

$$\frac{\partial \ln Q}{\partial \ln P_j} = \frac{P_j}{Q} \cdot \frac{\partial Q}{\partial P_j} = \frac{P_j}{Q} \cdot \frac{Y_j}{X} = W_j \quad (j = M, S, K, L).$$

We estimate the function for major fifteen industries on annual average basis filtering out short-term disturbances such as fluctuations of expectations.[10] Furthermore, taking into consideration of structural changes of economy, we estimate separately the high growth period (1960-72) and the period after the first oil crisis (1970-79), the latter period including three years (1970-72) before the crisis to secure sufficient degrees of freedom. Estimation involves twenty parameters, i.e., α_i, β_{ij}, β_{iT}, β_T, α_{TT} (i,j = M, S, K, L) for each sector. We apply the three-stage least squares method in the TSP program.[11] The results are given in Appendix 3 to 6. We find that the estimation has a good fit, except for the parameter of technological progress (W_T), not only during the former sample period, but also during the latter sample period when factor price changes were large. Therefore, we use these results and analyze the estimated values of parameters focusing on those in the latter sample period.

First of all, we look at the value of β_{ij} as a measure of substitution between factors of production. β_{ij} is, by definition, equal to $\partial W_i / \partial \ln P_j$. If $\beta_{ij}>0$, it indicates that as the price of factor j rises, the input share of factor i rises, hence these

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Given that the marginal production conditions are satisfied, the partial derivative of the output price with respect to the input price is equal to its input share (W_j) (where X is the quantity produced, and Y_j the quantity of j-th input).

Let W_j be the distribution ratio (input share) of the production factor j.

Then, $W_M + W_S + W_K + W_L = 1$, and $\partial W_j / \partial \ln P_i = \beta_{ji}$ represents the rate of change in the input share of factor j through factor substitution when the price of factor i changes. As for technological progress, $-\partial \ln Q / \partial T = W_T$ represents the change in the price over time (the rate of technological progress), while $\partial W_j / \partial T = \beta_{jT}$ shows the influence of technological progress on the input share of factor j (bias of technological progress). Finally, $\partial W_T / \partial T = \beta_{TT}$ gives the change in the rate (or speed) of technological progress.

10. The data used here are from the Input-Output Tables. Factor prices (P_M, P_S, P_K, P_L) are discrete divisia indices, which are used with the permission of Professor Kuroda of Keio University. Details of data computation for labor and capital prices are shown in Kuroda (1982) and Imamura (1983).

11. In order for the trans-log price function to be consistent with the equilibrium conditions under perfect competition, it must satisfy the following conditions: (i) symmetry ($\beta_{ij} = \beta_{ji}$, $\beta_{iT} = \beta_{Ti}$ for i,j = M, S, K, L); (ii) homogeneity ($\Sigma \alpha_i = 1$, $\Sigma \beta_{ij} = 0$, $\Sigma \beta_{it} = 0$); (iii) monotonicity ($\alpha_i > 0$); (iv) convexity sufficient for profit maximization (cost minimization, negative semi-definite Hessian matrix). In actual estimation, we impose the restrictions (i) — (iii) on coefficients in advance, and to meet the symmetry condition (i), we drop the equation for L and estimate the remaining four equations simultaneously. This method does not guarantee the satisfaction of the profit maximization condition (iv), so that we introduce an additional restriction on β_{ij} (the strongest restriction on β_{ij}'s which sets them all equal to zero gives the Cobb-Douglas function).

factors are substitutes.[12]

We then take out the β_{Si} or β_{Sj} which represents the relationship between the services and other factors of production, and compare its value during and after the rapid growth period (Figure 4). For the latter period after the first oil crisis, β_{MS}, which represents substitution between services and non-service intermediate inputs, declined in light manufacturing and other sectors. β_{SK}, representing substitution between services and capital, increased in steel, chemicals, and machiney sectors, while it decreased in food and ceramics sectors, so that its value for the whole economy remained more or less constant. Meanwhile, the value of β_{SL} increased in most industries, such as steel, metal and machinery, indicating that an overall substitution between services and labor in the economy was strengthened during this period (in textiles, paper & pulp, chemicals, and some other sectors, an increase in wage rates, which used to be a factor suppressing the share of service input, is now neutral to the service input share). This fact, coupled with a relatively high increase in wage rates, contributed to a large shift in factor inputs from labor to services and to the growth of intermediate service inputs. On the other hand, despite the fact that the rates of increase in non-service intermediate input prices were not so high as those of service prices, the weaker substitution between these factors prevented service demand from declining.

Next, we look at the own elasticity, β_{ii}. In most industries, the absolute values of β_{ii} is lower during the period after the first oil crisis than during the rapid growth period. This means that the decrease in service input resulting from the increase in service prices was not so large as it had been before. Consequently, the input share did not decline as much. The same is true of the own elasticity of labor. A rise in wage rate induced a smaller decrease than it did before. On the other hand, the absolute value of the own elasticity of capital became larger while that of non-service intermediate input did not show significant changes on the whole.

The above analysis of factor substitution indicates that the substitution between services and other factors of production had a stronger influence on the increase of the services' of input share and contributed to "service economy".

Figure 5 shows the bias of technological progress(β_{MT}, β_{ST}, β_{KT}, β_{LT}) for each factor of production. Technological bias, defined as $\partial W_i / \partial T$, shows the effect

12. In fact, β_{ij} represents not the elasticity of substitution, but the change in the share of input value. Allen's partial elasticity gives a general form of elasticity of substitution. The following equations show the relationship between the two.

$$\sigma_{ij} = \beta_{ij} / W_i \cdot W_j + 1 \qquad (i \neq j,\ i,\ j = M, S, K, L)$$

$$\sigma_{ii} = \beta_{ii} / W_i^2 - 1 / W_i + 1 \qquad (i = M, S, K, L)$$

of technological progress on the input share of each production factor. The technological progress is either share-augmenting (when $\beta_{iT}>0$), share-neutral (when $\beta_{iT}=0$), or share-reducing (when $\beta_{iT}<0$).

In the period of rapid economic growth, the technological bias for labor and capital was share-augmenting in almost all industries (β_{LT}, $\beta_{KT}>0$) while those for non-service inputs was, again in almost all industries, share-reducing ($\beta_{MT}<0$). Meanwhile, the bias for service-related input was share-augmenting in manufacturing sectors ($\beta_{ST}>0$) and share-reducing in the tertiary sector ($\beta_{ST}<0$). However, during the period after the oil crisis, we find that the bias for intermediate service inputs changed its direction and became share-augmenting in the majority of the industries (twelve out of fifteen industries). Also, those for labor remained to be share-augmenting. In contrast, those for capital become share-reducing in almost all sectors. As to non-service intermediate inputs, the bias was share-augmenting in light manufacturing and materials sectors and share-reducing in all other sectors.

Judging from the bias of technological progress represented by the changes in the input shares, it is apparent that the number of sectors whose share of intermediate service input increased by the technological progress after the first oil crisis grew remarkably. This resulted from the changes in the production structure of the corporate sector, such as higher needs for research and information-related services.

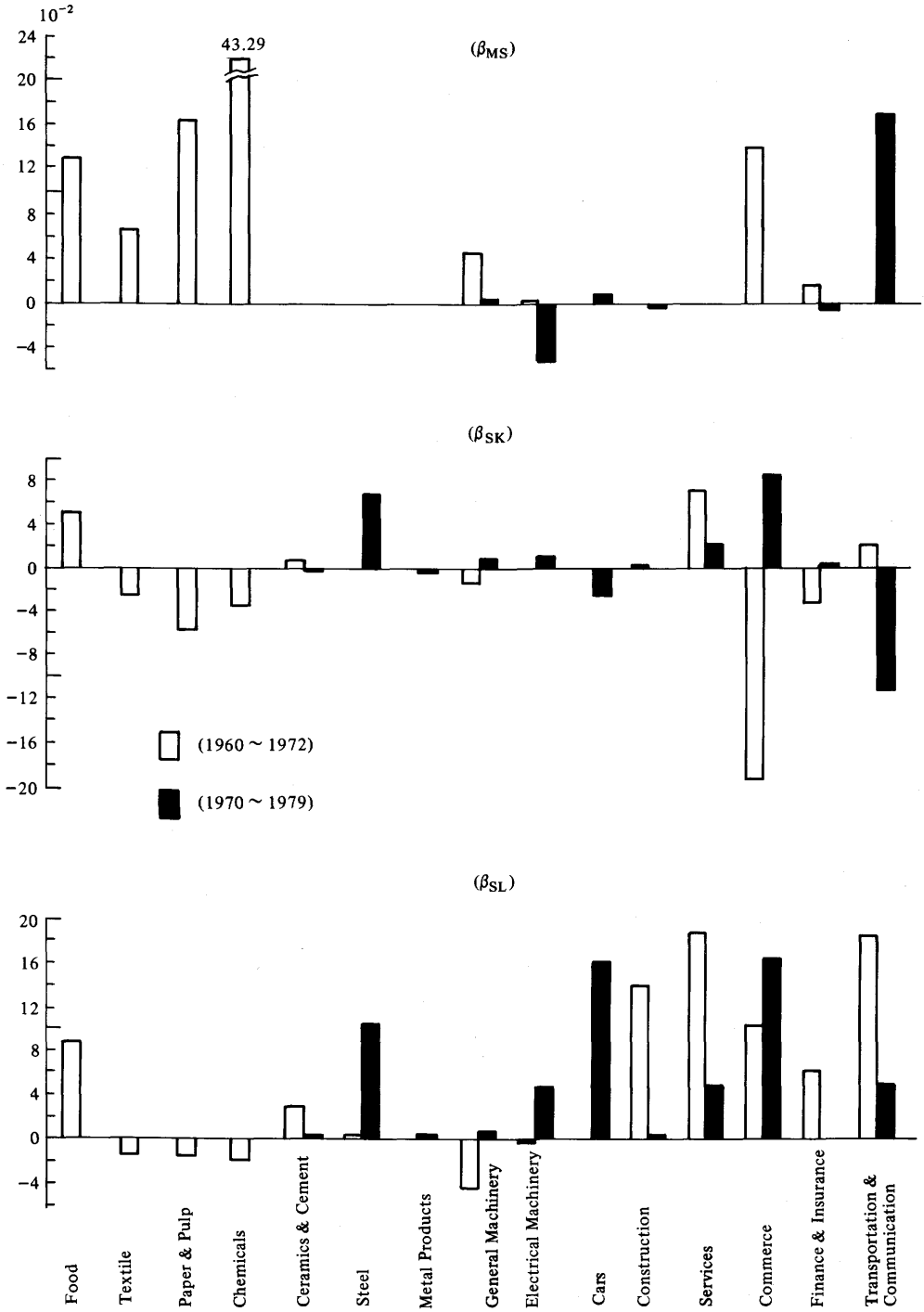
In summary, we find the following three points through the estimation results for substitution and the bias of technological progress obtained from the trans-log price function: (i) During the period after the first oil crisis, substitution was strengthened between services and other production factors, especially that between services and labor because of the high rate of price (wage) increase, which had an effect of raising the share of service inputs; (ii) As for the own elasticity of service inputs, a decrease in the amount of service input brought about by a price increase is getting smaller, so that its negative effect is less severe than before; (iii) Increasing number of sectors having a positive bias of technological progress for services. As stated above, growing specialization and greater needs for research and information services, etc., explain much of these phenomena. All these serve to augment the share of service inputs, thus promoting the growth of the "service economy".

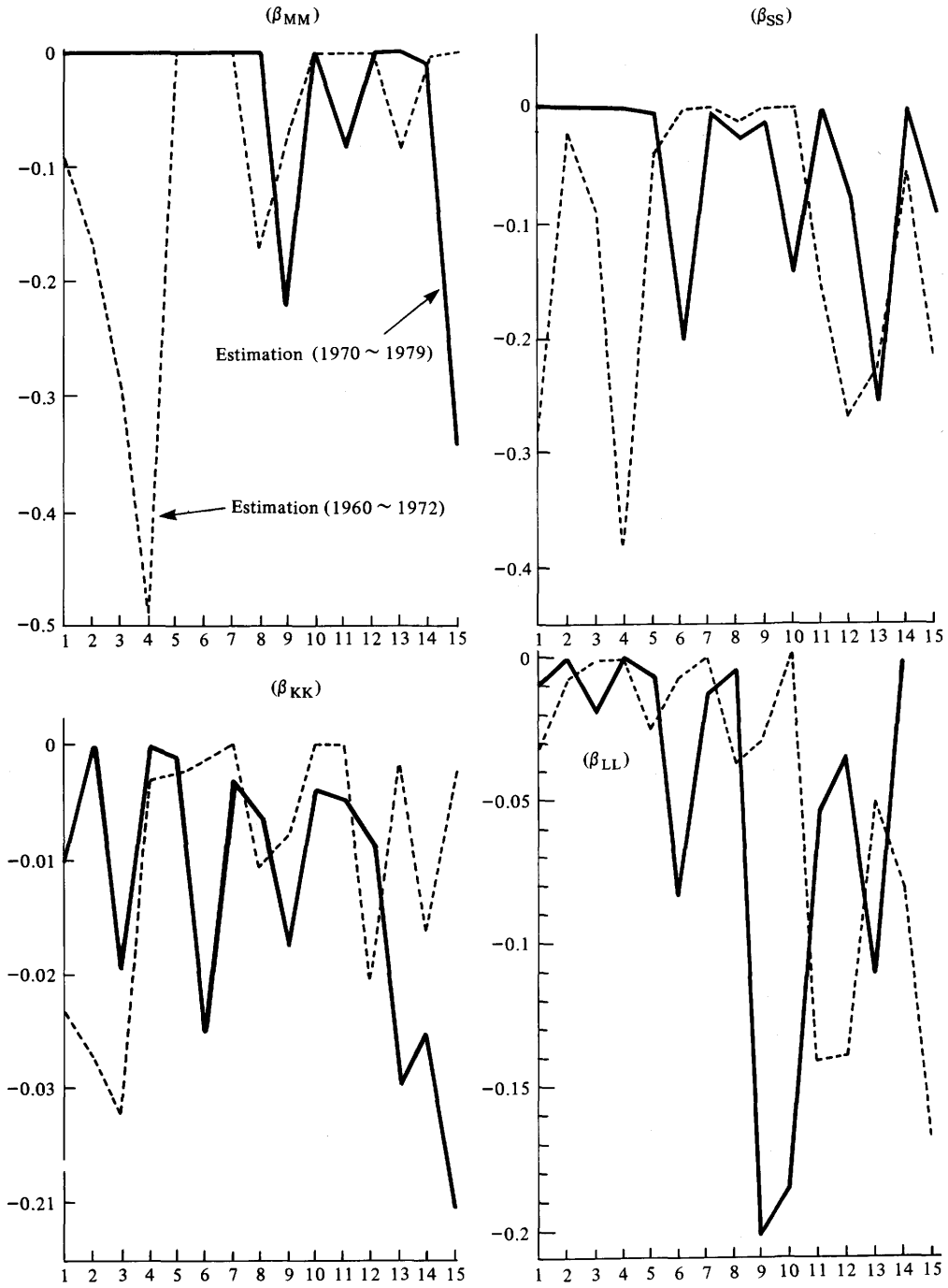
V. The Growth of the Service Sector and Cyclical Economic Fluctuations

1. The "Service Economy" and Its Influence on Production

In this section, we analyze the influence of the growth of the service sector on

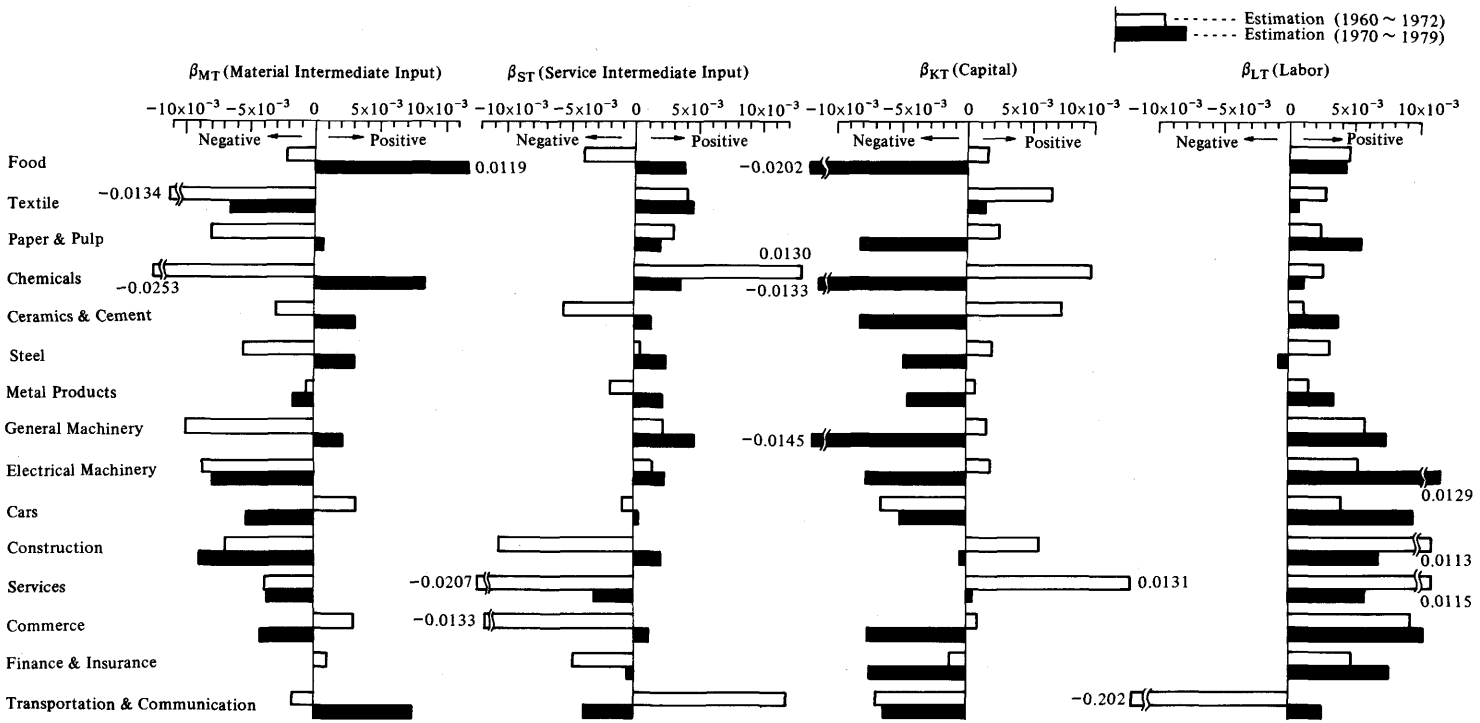
Figure 4 Comparison in Elasticity of Share of Factor Production





1. Food 2. Textile 3. Paper & Pulp 4. Chemicals 5. Ceramics & Cement 6. Steel 7. Metal Products 8. General Machinery 9. Electrical Machinery 10. Cars 11. Construction 12. Services 13. Commerce 14. Finance & Insurance 15. Transportation & Communication

Figure 5 Technological Bias (Influence on the Share of Input of Production Factors)



Note 1. Compiled from Appendix 5 & 6.

2. $\beta_{iT} = \frac{\partial W_i}{\partial T}$

production, employment and cyclical fluctuations in general. First, we point out the characteristics of the firms of the narrowly-defined service sector which stand in contrast with those of the manufacturing firms:

(i) Firms having capital less than ten million yen have a large share in terms of not only in number of firms, but also in sales and number of employees (in 1981, number of firms 87% cf. manufacturing 80%, sales 38% cf. 12%, number of employees 54% cf. 29%).

(ii) Sales of firms in the service sector are far smaller than those of the manufacturing firms of the comparable capital size; that is a small business scale characterizes the service sector.

(iii) Per capita wage rate is 80% for the manufacturing worker. However, there is only a negligible difference in per capita wages between service and manufacturing firms of the same business scale. Therefore, the lower wage rate of the service sector as a whole is a result of a large share of smaller firms. All the above characteristics of service industry can be explained by geographical and time constraints on service production, inability to adjust production by means of inventory stock adjustment, and small and diversified household demand, a major part of service demand.

However, these characteristics of service production, namely daily and seasonal fluctuations in production, do not mean that service production enlarges the amplitude of deseasonalized business cycles. On the contrary, if we measure economic activities on annual basis to eliminate seasonal factors, we find that the expansion of the service sector has a stabilizing effect on the economy. In what follows, we examine this effect using data free from the influence of short-term fluctuations in service demand.

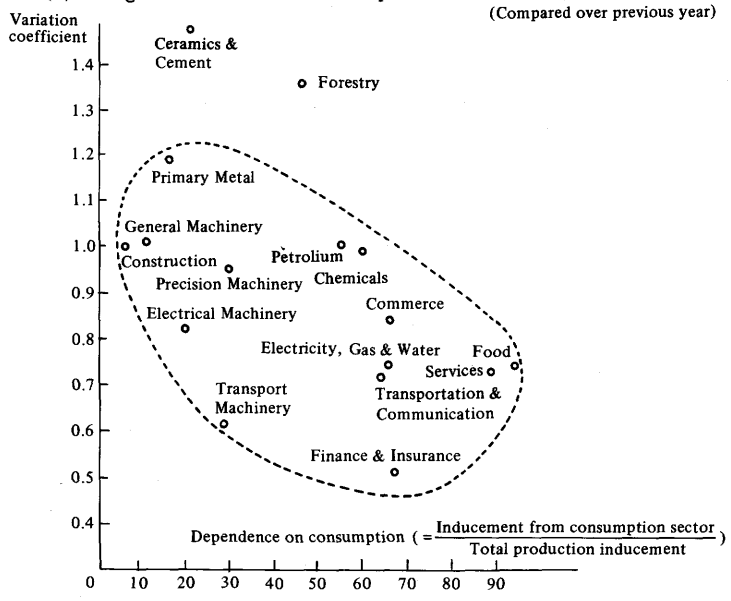
The "service economy" and its influence on production and employment can effectively be studied by using the Input-Output Tables. We use for illustration the equation $X = (I-A)^{-1} \cdot F$, which excludes exports for simplicity (X: domestic production vector; I: unit matrix; A: input coefficient matrix; F: final demand matrix). The growth of "service economy" in the domestic production is affected by: (i) changes in the technological, "production inducement" relations in the corporate sector, represented by $(I-A)^{-1}$; and (ii) changes in final demand, such as consumption expenditure of the household sector, represented by F. For an analysis of economic fluctuations over a relatively short period of about a year, the technological production structure (i), can be taken as a constant. Hence, economic fluctuations, especially changes in production levels, are mainly determined by changes in final demand (ii).

Table 9 gives the variation coefficients for the growth rate of various items of real output based on SNA (over the previous year. Data for 1966-69 are estimated figures). Except for commerce (which includes, as a major component, wholesale

Table 9 Stability of Service Production

(1) Change in Real Production and Dependence on Consumption

(Compared over previous year)



(2) Variation Coefficient by Real GNP Components

(Compared over previous year)

	GNP	Private consump-tion	Public consump-tion	Public capital formation	Private capital formation	Export etc.
1966 ~ 1982	0.597	0.613	0.262	1.309	1.240	0.669
1970 ~ 1982	0.607	0.688	0.275	1.573	1.699	0.736
1975 ~ 1982	0.220	0.580	0.269	1.548	0.714	0.808

(3) Variation Coefficient by Consumption Item (Compared over previous year)

1. Based on Real GNP

	Services	Non durables	Semi durables	Durables	Total consump-tion	(Memo) Manufac-turing
Apr. ~ June, 1971 to Jan. ~ Mar., 1982	(5.3) 0.537	(0.8) 0.806	(2.1) 2.089	(6.7) 1.635	(4.3) 0.759	(4.1) 1.809

2. Based on the Family Income and Expenditure Survey

	Discretionary service	Service neces-sities	Food	Clothing & Footwear	Durables	Other non durables
1964 ~ 1982	(3.8) 0.828	(1.8) 1.307	(0.8) 2.293	(1.3) 2.559	(8.5) 1.008	(3.3) 1.303

Notes: 1. (1) is based on SNA computation. Variation coefficient is computed for 1966~1981 (1966~1969 is extrapolation). Consumption Dependence coefficient is based on 1980's Input-output Table.

2. Variation coefficient = $\frac{\text{Standard Deviation}}{\text{Mean}}$

3. Items in (3) 2 is referred to Table 3. Growth rate over previous year is given in bracket.

sector having a close relationship with the manufacturing sector), the tertiary sector, especially the service sector, has had a smaller variation coefficient compared with the manufacturing sector (see Table 9(l)).

This can be attributed to the following reasons: (i) In the tertiary sector, especially in the narrowly-defined service sector, the ratio of consumption to total demand (that is, a proportion of increased production of the tertiary sector induced by an increase in consumption) is approximately 0.6, which is three times as high as that of the manufacturing sector; (ii) The variation coefficient for consumption is more stable than those of other items such as investment, reflecting the "habit persistence effect" etc., as we have seen in Chapter III (see Table 9 (2)).

We next examine individual items of GNP statistics to see the stability of consumption. The growth rate of service expenditures is higher and more stable than that of non-service (goods) expenditures. As we have seen in Chapter III, if we break down the service outlays, discretionary services (education, restaurant services, etc.) show a higher and more stable increase than service necessities (electricity, gas & water and medical expenses). The high growth and stability of service outlays described above are due to the fact that during the estimation period (mainly after 1965), the upward trend of service expenditures has strengthened itself, and also to the fact that even in time of slower economic growth, the increasing share of the housewife's income has had a positive effect on service outlays, with relatively mild curtailment of service expenditure. As to why the variation coefficient of discretionary services is much smaller than that of durables, the following points may be important: (i) Since the expenditure unit of discretionary services is more flexible, it is easier to average out the level of spending over time; (ii) discretionary services do not have such replacement cycles as consumer durables do. Overall, the stability of service production is attributed to the stability of service consumption based on the "habit persistence effect," especially that of discretionary service consumption whose share in total service production is rising.

To analyze the long-run relationship between cyclical fluctuations and "service economy" from a long- and medium-term point of view, it is important to consider changes in the "production inducement." structure. As we have seen in Chapter IV, the growth of the "service economy" generates a greater cross-sectoral demand between the service sector and non-service sector, thus strengthening the cross-sectoral "production inducement effect." On the other hand, in terms of "production inducement effect" within each sector, "service economy" has expanded within the service sector, while it has remained roughly constant within the non-service sector, though its value is still relatively large. As a result, difference in the "production inducement effect" among various sectors is getting smaller (Table 8). This means that although the total amount of induced production depends on the relative weights of final demand components such as consumption and investment,

this kind of weights has come to have less effect on the total amount of induced output. We may conclude, therefore, that through the increased weight of production which is directly or indirectly related to services, the growth of the "service economy" tends to dampen fluctuations in production even in the long- and medium-terms.

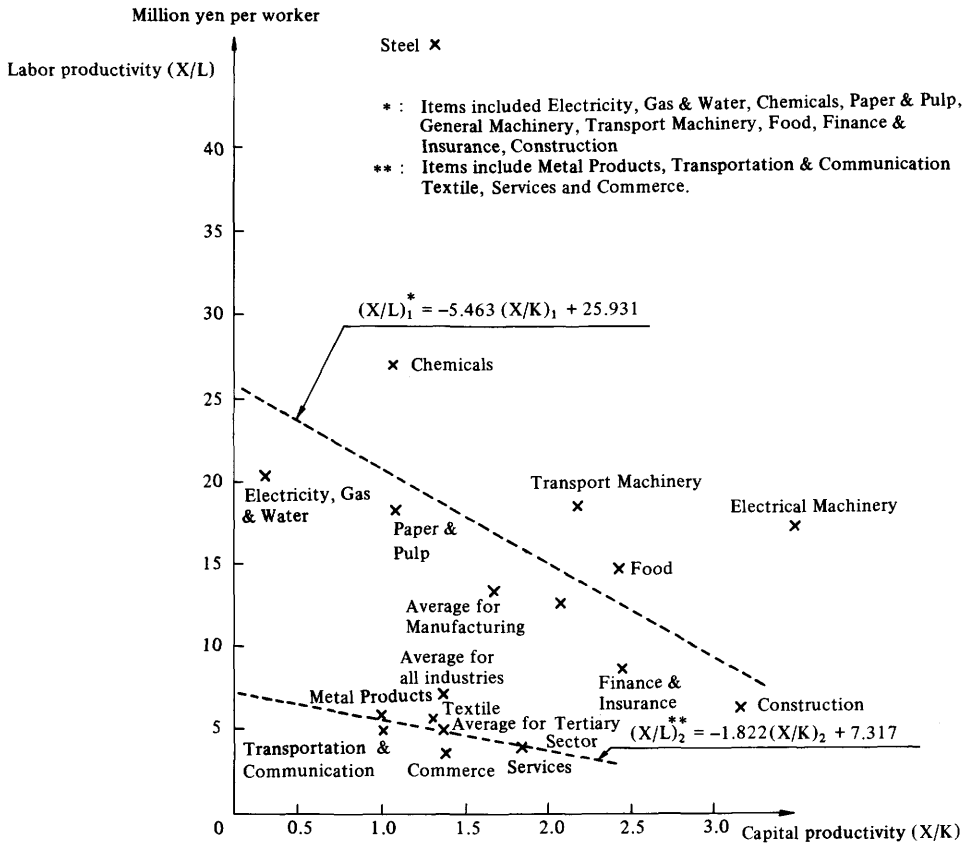
We next look at the effect of the growth of the service sector on capital formation in the long run. It is noted that the capital coefficients (capital stock / production) of the tertiary sector has been rising in recent years. It has been argued that the capital coefficient for the tertiary sector, calculated on the basis of the value-added figures (capital stock / GDP), is far smaller than that of the manufacturing sector, hence the growth of "service economy" has an adverse effect on investment. Nevertheless, since 1975, the gap between the coefficients of the two sectors has narrowed considerably. And if we calculate the coefficient (capital stock/output), the level of the tertiary sector has already roughly equalled to that of the manufacturing sector by 1980 (see Figure 6). A closer look at capital coeffients of various industries which are based on production figures in 1981 reveals that, that of the tertiary sector (excluding electricity, gas & water) is lower than those of metals and chemicals, but much higher than those of machinery and food. The fact that the capital coefficient gap is narrowing is explained by changes taking place in both sectors. First, in manufacturing sector, capital coefficient has remained almost constant for the following reasons: (i) The weight of material sector (such as chemicals, steel, etc.) whose capital coefficients are large has fallen, while that of machinery with smaller capital coefficients has increased; (ii) investment on pollution control devices has leveled out; (iii) firms have made an attempt to raise investment efficiency to adjust to the low rate of economic growth after the first oil crisis. On the other hand, in the tertiary sector (excluding electricity, gas & water), the capital coefficient has had an upward trend reflecting the process of mechanization in this sector, and also a shift on the part of the manufacturing sector to substitute the purchase of lease services (computers, industrial machines, etc.) for investment, which shifted the burden of investment from the manufacturing sector to the service sector.

2. The "Service Economy" and its Influence on Employment

In this section, we examine the influence of the "service economy" on employment. Because of daily and seasonal fluctuations inherent to the production of services, employment is subject to a large fluctuation. This fact is typically shown by the fact that the share of regular workers is only two-thirds of the total workers in the service sector (cf. average of manufacturing and processing sector — 84%), and correspondingly, the share of workers with daily or temporary contracts is quite

Figure 6 Productivity and Capital Coefficient of by Sectors

(1) Productivity (1981)



Note: X: Real production, L: Employed workers, K: Gross capital stock (All GNP based, 1975 basis)

(2) Capital Coefficients

(Production value based, ( ): GDP based)

	1965	1970	1973	1976	1979	1981
All Sectors	0.528	(0.881) 0.490	(1.235) 0.545	(1.471) 0.668	(1.496) 0.684	(1.534) 0.735
Manufacturing	0.487	(1.568) 0.446	(1.659) 0.497	(1.897) 0.604	(1.723) 0.585	(1.637) 0.607
(Chemicals, Primary Metal) Material	0.714	(3.088) 0.593	(2.841) 0.648	(3.255) 0.800	(2.735) 0.778	(2.840) 0.844
(Metal, Machinery) Processing	0.482	(1.155) 0.394	(1.202) 0.421	(1.357) 0.526	(1.135) 0.472	(1.011) 0.454
Tertiary Sector (excluding Electricity, Gas & Water)	0.448	(0.618) 0.395	(0.676) 0.441	(0.816) 0.528	(0.871) 0.555	(0.921) 0.601
Services	0.222	(0.398) 0.222	(0.543) 0.282	(0.760) 0.389	(0.927) 0.445	(1.127) 0.544

Note: Compiled from SNA statistics. (1965 data are extrapolated.)

large, and this tendency is further reinforced in recent years. According to the Employment Status Survey, average duration of employment is shorter, and the ratio of female labor higher, in the service sector than in the manufacturing sector. This is one of the causes of increase in the ratio of working wives stated earlier. These characteristics of employment in the service sector, coupled with the fact that their business scale is small, has suppressed the wage level of the sector. With these characteristics of employment in the service sector in mind, we analyze the longer-run employment fluctuations by eliminating daily and seasonal disturbances.

Table 10 Employment Period and Share of Female Workers (1982)

(%)

	Employment Period			Share of Female Workers		
	1 Yr.	2-4 Yrs.	5-6 Yrs.	Total employed	employees	(wives /females)
Services	4.1	23.3	10.5	51.4	49.7	30.3
Manufacturing	3.8	20.0	8.8	38.9	34.6	28.5
Non-Agricultural (average)	3.9	20.9	9.4	38.3	35.3	24.8

Note: Compiled from Employment Status Survey.

Using the framework of the Input-Output Tables, we factorize short-term fluctuations of employment into: (i) changes in final demand and (ii) changes in labor productivity. As we have already analyzed the former factor, we concentrate on the analysis of the latter.[13]

We use the ratio of real domestic product (based on SNA) in individual sectors to the sectoral total employment as a measure of labor productivity. A comparison of this measure across industries in 1981 shows that labor productivity in the tertiary sector, especially that in the narrowly-defined service sector, transportation & communication, and commerce (whose output is taken as the value of its commercial margin), is considerably lower in comparison to that in paper & pulp, food, and

13. $$L = \underset{(ii)}{\ell}\,\underbrace{(I-A)^{-1}}\cdot\underset{(i)}{F}$$

L: Number of employees
ℓ: Labor coefficient (matrix with the inverse of labor productivity as its diagonal elements)
F: Final demand
A: Input coefficient matrix
I: Unit matrix

general machinery industries, not to mention such capital-intensive industries as steel and chemicals. We observe that the tertiary sector, as well as textile sector, is very labor-intensive (see Figure 6). We also find that the following significant changes have taken place since the first oil crisis (see Figure 7): (i) Although the growth rate has somewhat slowed down, labor productivity in the manufacturing sector continued to grow, while that in the tertiary sector stagnated since 1975; (ii) the stagnating tendency of labor productivity is most conspicuous in the narrowly-defined service sector whose weight is large in the tertiary sector, and in commerce; (iii) in the manufacturing sector, the growth of labor productivity in material sectors such as chemicals and steel decelerated owing to sluggish production, while that in processing sectors such as electrical machinery and transport equipment has been accelerating.[14]

We attribute the widening of differentials among the growth rates of labor productivity across industries to the following facts: (i) demand for the product of the processing sectors has remained strong even after 1975 owing to an expansion of export demand, which made it possible for these industries to carry out labor-saving investment. This, in turn, may have contributed to an upgrading of the labor quality; (ii) material industries, on the other hand, have not been succesful in reducing excess labor produced by a long spell of unfavorable demand conditions, which stifled a growth of labor productivity; (iii) in the tertiary sector, in addition to the unique characteristics of service production (small business scale, large seasonal disturbances, etc.) which tend to lower labor productivity in the sector, an increase in demand for services due to the growth of the "service economy" after 1975 and the resultant absorption by the sector of cheap labor force, most of which was female, part-time workers, have further reduced the labor productivity level.[15] Detailed comparisons of the major industry groups within the service sector show that labor productivity in the corporate services sector is the highest (though only 40% of the average of manufacturing industries), and has continued to rise since 1975. In contrast, that of the personal service sector, accounting for almost 50% of total production and the number of employees in the service sector, has been only 60% of the productivity in the corporate service sector, and its growth rate has been lower.

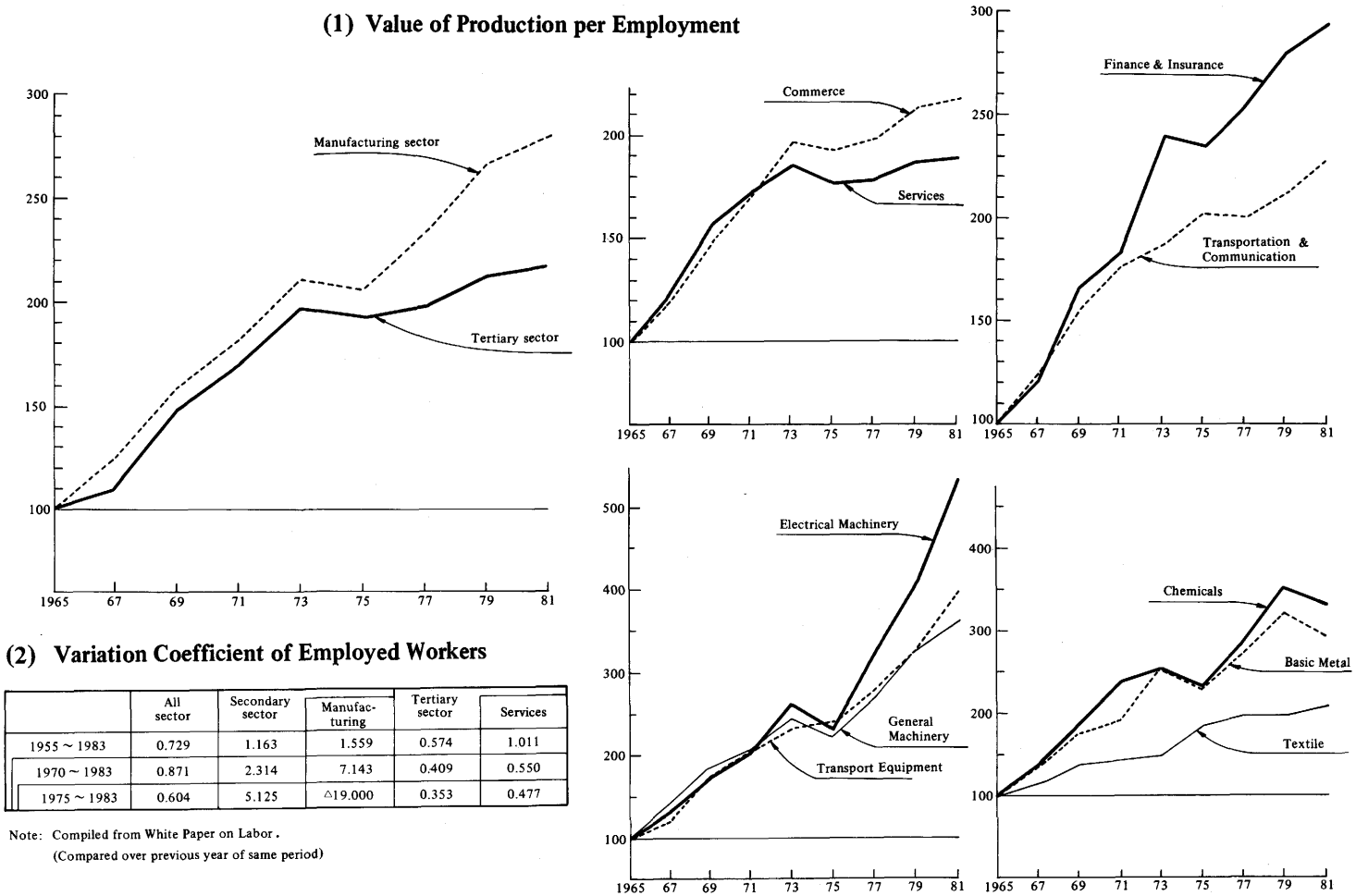
Based on these observations regarding the movements in labor productivity, we

14. Labor productivity is measured without consideration to labor quality and working hours. However, even if these are accounted for as in Imamura (1983), little difference is detectable and the same result is obtained that the productivity in service-related industries is very low.

15. From Figure 4, we observe that the negative price elasticity of the share of labor input decreased significantly after the first oil crisis. This indicates that the negative effect of wage increase on employment is weakening.

Figure 7 Labor Productivity (1965 = 100)

(1) Value of Production per Employment



(2) Variation Coefficient of Employed Workers

	All sector	Secondary sector	Manufac-turing	Tertiary sector	Services
1955 ~ 1983	0.729	1.163	1.559	0.574	1.011
1970 ~ 1983	0.871	2.314	7.143	0.409	0.550
1975 ~ 1983	0.604	5.125	△19.000	0.353	0.477

Note: Compiled from White Paper on Labor.
(Compared over previous year of same period)

analyze the influence of the "service economy" on employment. Using the Labor Force Survey, we first look at the short-term fluctuations of employment in various sectors (rate of changes over the previous year). We find that in recent years very large fluctuations have been observed in the manufacturing sectors. In contrast, the tertiary sectors have shown quite stable growth in employment, and their stability is even more strengthening recently. This can be traced to the smaller fluctuation in service production, as we have seen previously using the Input-Output Tables. The overall employment level has become less and less volatile since 1975, which may be attributable to an increase of the weight of service production.

However, in light of the fact that the share of full-time, permanent employees is lower in the service sector, stability of the total employment in the sector does not mean a longer period of labor contract signed by individual workers. It should be noted that the period is rather shorter in the service sector, as is typically shown by its absorption of housewives as part-time labor force, and in that sense, an increased weight of the service sector has a destabilizing effect on job security of individual workers and tends to suppress their wage level.

Next, we consider the effect of the "service economy" on fluctuations of employment in the long- and medium-term. Table 11 gives the causes of employment changes obtained from Input-Output Tables which consists of twenty-eight sectors. We find from this table that: (i) although an expansion of employment induced by a rise in final demand has recovered since 1975, its level is still one half of the level in the latter half of 1960s, indicating that a decline in the growth rate has a negative effect on employment; (ii) changes in production structure since 1975 have had a positive effect on employment, suggesting that the service-oriented production structure increases employment through a strong "production inducement effect" of the service sector (see Table 8); and (iii) a remarkable improvement of labor productivity in the manufacturing sector, especially in the processing industry, now has come to offset more of employment expansion brought about by a rise in final demand (47% in 1965-70 to 58% in 1970-75, to 70% in 1975-80).

In summary, the growth of the service sector tends to stabilize a deseasonalized production level and smooth out fluctuations in employment. Moreover, an increase in the share of services in production structure and final demand structure tends to encourage the growth of employment, directly or indirectly. The tendency toward the "service economy" is facilitated by an increased supply of female labor force. The high proportion of workers with short-term contracts (that is, temporary and part-time workers) in the service sector increases job opportunities and the number of workers, while the same fact may destabilize employment by making the contract period of each employee shorter. This is likely to suppress the wage level compared with the case where permanent employment is dominant. Hence, the impact of the growth of the "sevice economy" on employment is to create more jobs at the expense

Table 11 Causes of Employment Changes

(thousand workers)

	Increase in number of workers 1965-70	(Memo) Temporary and daily wage workers	Increase in number of workers 1970-75	(Memo) Temporary and daily wage workers	Increase in number of workers 1975-80	(Memo) Temporary and daily wage workers
Total increase in workers	+ 4,200	+ 300	+ 2,810	+ 630	+ 1,570	+ 1,000
Increaxe of final demand (A)	+22,650	+ 1,930	+ 7,110	+ 640	+10,560	+ 870
Increase of final demand (A')	+22,080	+ 2,070	+ 6,660	+ 610	+11,340	+ 1,150
Structural change of final demand	+ 570	− 140	+ 450	+ 30	− 780	− 280
Structural change in production (B)	+ 120	− 20	− 1,340	− 150	+ 3,320	+ 280
Change in employment coefficient (productivity increase) (C)	−10,290 (47)	− 930	− 3,840 (58)	+ 80	− 7,890 (70)	− 50

Notes: 1. Computed from a 28-industry division abstracted from Input-Output Tables.
All in real terms (1980 deflator is Projection).
The industries are Agriculture, Forestry & Fishing, Mining, Construction, Manufacturing (15 industries including Food, Textile, Wood & Wood Products, Paper & Pulp, Chemicals, Petroleum, Ceramics & Cement, Steel, Non-Ferrous Products, Metals, Machinery, Electrical machinery, Cars, Other transport machinery, Precision machinery and other manufactures), Tertiary Sectors (9 sectors including Transportation & Communication, Electricity & Gas & Water, Commerce, Finance & Insurance, Real Estate, Office services, Personal services, Other services, Public accomodation), Packaging & Other unspecified.

2. $L = \underbrace{\ell}_{\text{corresponds to C}} \cdot \underbrace{(I-(I-\bar{M})A)^{-1}}_{\text{corresponds to B}} \cdot \underbrace{((I-M)F_D+F_E)}_{\text{corresponds to A}}$, where L : vector for total employment
ℓ : diagonal matrix with employment coefficient on the main diagonal
I : unit matrix
$\bar{M}$: import coefficient matrix
A : input coefficient matrix
F_D : total domestic demand vector
F_E : export vector

3. Figures in brackets show the amount by which the effect of increased final demand is offset by productivity increases.
i.e., C / A '

4. Interaction effects of A , B , C are ignored.

of wage rate.

Meanwhile, as regards the relation between labor productivity and per capita income, the expansion of the "service economy" retards the growth of overall labor productivity by increasing the share of less productive sector (in terms of output value), which may be regarded as a kind of work sharing process. A slower growth of labor productivity tends to hamper the growth of per capita real income (value-added productivity), which is an important measure of national welfare level (however, the direction of changes in value-added ratio caused by the "service economy" remains ambiguous). Though it is difficult to reach a definite conclusion at this stage, it is highly probable that the "service economy" increases total employment in the economy while stagnating the growth of per capita income level.

VI. The Growth of the "Service Economy" and Financial Activities

1. Changes in Financial Indicators and Their Background

Changes in the real economy caused by the growth of the service sector gives a profound impact on financial activities, especially loans and money supply. It is evident that this process is also influenced by changes in the structures of household consumption and intermediate inputs of the corporate firms which we have analyzed in Chapters III and IV. In this section, we assume that the household's financial behavior is given, and concentrate on the corporate finance from financial institutions on which the growth of the "service economy" presumably has a direct and strong impact. Table 12(1)[16] gives a breakdown of loans of 1970 and 1982 to individual industries by the major financial institutions including city banks, "sogo" banks, "shinkin" banks and government-affiliated financial institutions. We find that the share of the loans to the manufacturing sector dropped from 45% to 33% and that of the tertiary sector showed a remarkable increase from 48% to 58% (and the narrowly-defined service sector in particular came to account for more than 10% of the total outstanding loans). This tendency is confirmed by the statistics on new loans for equipment funds collected by the Bank of Japan, which indicate that the two-thirds of new loans are granted to the tertiary sector reflecting a rise in the weight of service-related investment as we have seen in Chapter V. It also indicates that the narrowly-defined service sector has increased its share to more than 20% of the total new loans, which is almost twice as much as its share ten years ago

16. The total value of loans shown in the Sectoral Outstanding Loans Statistics is approximately 97% of the outstanding borrowing of the corporate firm sector in the Money Flow Statistics in 1982.

Table 12 Changes in Sources and Employment of Funds

(1) Total Balance of Outstanding Loans

(share, %)

	Loans from all financial institutions		All Banks (bank accounts)		Capital Funds for Equipment (New loans)		Total Deposit Balance	
	End of 1970 → 1982		End of 1970 → 1982		1971 ~ 1972 ↓ 1981 ~ 1982		End of 1971 → End of 1981	
All Sectors (Share of Banks)	100.0 → 100.0		100.0 → 100.0 (64.1) (63.2)		100.0 → 100.0		100.0 → 100.0	
Manufacturing Sector	45.2	33.3	47.1	35.4	38.2	24.6	44.3	36.9
Tertiary Sector	47.6	58.0	46.0	57.0	53.4	67.2	45.0	49.5
Services	6.6	10.5	5.3	9.2	13.3	22.1	3.3	6.4
Commerce	27.0	26.1	29.9	28.2	15.7	15.9	32.3	32.2
Real Estate	4.5	7.8	4.0	6.9	8.3	10.0	38.8	5.6
Transportation & Communication	5.6	4.9	4.2	4.0	9.7	8.7	4.8	4.6
Electricity, Gas & Water	2.1	4.1	1.5	3.2	6.5	10.5	0.8	0.8
Finance & Insurance	1.8	4.6	1.3	5.4	–		–	

Notes: 1. In (1) loans from all financial institutions include all banks (including trust accounts), Sogo banks, Shinkin Banks, Export-Import Bank of Japan, The Japan Development Bank, The Shoko Bank and The Small Business Finance Corporation.
New loans for capital equipment is from survey of Bank of Japan, deposit balance is from Annual Statistics of Corporate Firms.
Loans to restaurants were included in the service industry.
2. (2) is compiled from Annual Statistics of Corporate Firms. Processing industry includes metal products, general machinery, electrical machinery, transport equipments and precision machinery.
3. Physical Asset Investment + Financial Investment, etc. + Increased liquidity = Borrowings + Internal finance, etc. = Total employment or borrowing in (3)
Internal finance includes capital, reserves and depreciation.
Total balance excludes depreciation.
Borrowing includes loans and bonds.

(2) Share of Balance of Borrowings & Deposits in Transactions

(%)

	Borrowings + debentures / Transactions		Total deposit balance / Transactions	
	1970CY	1980CY	1970FY	1980FY
All Sectors	32.0	28.5	9.8	8.6
Manufacturing Sector	41.8	32.5	12.5	9.8
Processing	41.4	25.1	13.4	9.6
Tertiary Sector	26.3	27.0	7.7	7.3
Services	40.0	45.0	13.1	13.2
Commerce	20.4	17.5	7.4	6.0
Transportation, & Communication	60.1	46.5	12.7	10.7
Electlicity, Gas & Water	129.6	108.7	8.5	4.9

(3) Share of Borrowing in Total Fund Raising and Debenture (flow base)

(share, %)

	1967~ 1971	1972~ 1976	1977~ 1981	1981 Total balance
All Sectors	51.3	50.6	40.7	63.5
Manufacturing Sector	46.8	43.2	27.7	56.3
Processing	43.7	33.8	18.5	44.5
Tertiary Sector	58.6	57.9	51.7	71.4
Services	44.5	47.1	48.5	67.9

(meanwhile, the weight of the manufacturing sector has declined from 38% to 25% because of sluggish investment). Money supply to the corporate sector (cash and deposits held by the firms) changed more gradually than loans according to the Annual Statistics of Incorporated Enterprises. Yet, we clearly observe a fall in the share of the manufacturing, and a rise in that of the tertiary sector (especially the narrowly-defined service sector) in terms of money supply, as well.

It is effective to use the framework of the Input-Output Tables for the analysis of financial aspects of the "service economy", as it is for the analysis of its real aspects. That is, changes in financial indicators such as loan balances and money supply arise from changes in the following factors: (i) final demand; (ii) the technological "production inducement" structure; and (iii) amount of monetary aggregates (such as loans) per unit of production (transactions). (i) and (ii) above are measured in nominal terms, but their movements are more or less the same as their counterparts in real terms as we have already seen in Chapter V. By contrast, (iii) is affected by changes in both real and monetary aspects of the economy. We look into this factor in more detail by referring to Table 12(2). The ratio of borrowings (debts and bonds) to transactions in the manufacturing sector (especially processing sectors) has decreased considerably, while that of the tertiary sector has increased, though slightly, over the past ten years. Especially, in the narrowly-defined service sector, the level of the ratio exceeds the corresponding level in the manufacturing sector. On the other hand, the liquidity ratio (bank deposits / transactions) of the manufacturing sector has fallen noticeably, while the ratio in the tertiary sector has declined only slightly. The ratio of the tertiary sector has remained constant and its level is fairly larger than that of the manufacturing.

On a flow basis (as contrasted to a stock basis), the share of borrowing in the total demand for funds has declined significantly in the manufacturing sector since 1975. Especially in the processing industries, the ratio of external finance became less than 20% on the flow basis, and also less than 50% on the stock (or outstanding borrowing) basis, thus the degree of dependency on borrowing was reduced considerably. In the tertiary sector, in contrast, the weight of borrowing was relatively high on both flow and stock bases, and its decline after 1975 has been marginal (the weight of external finance on the stock basis still exceeds 70%). In particular, the weight of borrowing in the service industry began to rise gradually since 1975 (see Table 12(3)). The higher degree of dependency on external finance of the service-related industries means that a boom in their business (production) and investment activities tends to give rise to a higher demand for bank loans and other sources of funds.

The difference in the ratios of outside finance between the secondary and tertiary sectors is attributable to the difference in the ratio of long-term borrowing. Namely, the ratio of long-term debts to total transactions is higher in the tertiary

sector (except for commerce which has a low capital-labor ratio, etc) reflecting the increased capital investment made in the tertiary sector as seen in Chapter V. The latter includes not only a large-scale investment by the electricity industry, but also purchases of machinery by the leasing industry which replace the demand for loans of the manufacturing sector. On the other hand, the ratio of short-term funds to total transactions is slightly lower in the tertiary sector than in the manufacturing sector. Among the manufacturing industries, the material industry has a high short-term borrowing ratio, while the level of the ratio in the processing industry is more or less the same as that in the tertiary sector (see Table 13).

On the basis of these statistics, we may conclude that the growth of the "service economy" in final demand, especially the increased weight of services in personal consumption, tends to increase the ratio of external finance, and stimulates financial activities measured in terms of loans.

Table 13 Ratio of Borrowings to Sales (Fiscal Yr. 1980)

(%)

	Total	Long-Term (including bonds)	Short-Term
Manufacturing Sector	32.5	13.5	19.1
(processing only)	(25.1)	(10.5)	(14.6)
		(45.6% in cost of excluding commerce)	
Tertiary Sector	27.0	12.9	14.1
(services only)	(45.0)	(28.0)	(17.0)

Note: See notes of Table 12.

2. Financial Activities and the Growth of "Service Economy"

With the movements of the external finance ratio described above in mind, we examine in this section the impact of the growth of "service economy" on loans and money supply. Using the I-O Tables, we factorize the increase in loans and money supply of the corporate sector for the periods 1965-70, 1970-75, and 1975-80 (see Table 14).[17]

17. It should be noted that the framework based on the Input-Output Tables (i) assumes independence between the ratio of outstanding borrowing (or money supply) to total sales and final demand, (ii) cannot differentiate transactions demand and fixed capital formation demand for loans, and (iii) cannot distinguish between deposits (money supply) held voluntarily and compensating balances. All these factors are contained together in the ratios of sales and financial indicators. We carry out our analysis in the following disregarding this problem.

First, we analyze the determinants of loan demand. Table 14 shows that the expansion of final demand (corresponding to most part of item (A)) had the largest impact on the growth of loans, but the effect of curtailing of borrowings (corresponding to item (C)), especially in the manufacturing sector, refecting the recent stance of more cost conscious management, became fairly large offsetting approximately one-fourth of the expansionary effect of final demand growth during the 1975-80 period.

The effect of changes in the final demand structure (part of item (A)) and production structure (item (B)), which had been roughly nil from 1965 through 1975, became prominent during the 1975-80 period inducing a loan increase of 22 trillion yen which accounted for about 40% of total loan increase. As we have seen in Chapters IV and V, this huge increase was brought about by an enlarged "production inducement effect" of the service-related sectors (whose dependency on borrowing is high), and also by an increase in the weight of service demand in total final demand. As to the effect on the broadly-defined service sector (the tertiary sector), we find that out of the total increase in borrowing of 62 trillion yen in 1975-80, this sector was responsible for 42 trillion yen.[18] We also find that while the incremental of borrowing of this sector explained by changes in the demand structure and production structure increased significantly to 14 trillion yen (cf. 22 trillion yen for the whole economy), a negative effect of a decline in the borrowing ratio is relatively small and is only -5 trillion yen (cf. -20 trillion yen for the whole economy). Thus, the sector has come to

18. The influence of the tertiary sector can be examined using the following matrix where m (see footnote of Table 14) is the matrix of twenty-eight industries.

$$m = \begin{bmatrix} m_1 & & & & 0 \\ & m_2 & & & \\ & & \ddots & & \\ & & & m_k & \\ & & & & m_{k+1} \\ 0 & & & & & \ddots & \\ & & & & & & m_{28} \end{bmatrix} \begin{matrix} \} \text{ non-service sector} \\ \\ \} \text{ service sector} \end{matrix}$$

The effect of changes in m can be analyzed by setting $m_1, m_2, \ldots, m_K = 0$ such that:

$$m' = \begin{bmatrix} 0 & & & & 0 \\ & \ddots & & & \\ & & 0 & & \\ & & & m_{k+1} & \\ & & & & \ddots \\ 0 & & & & & m_{28} \end{bmatrix} .$$

The same method is applicable to other items. However, the total is calculated by simply adding A, B and C in the table disregarding the effect of cross terms. Furthermore, we do not consider the positive effect which the expansion of the service sector has on intermediate input from the goods sector, which we have seen in Chapter IV. Therefore, it is likely that we are underestimating the total amount.

Table 14 Effects of Changes in Industrial Structure on Financial Activities

(Increase in trillion yen)

	Effects on loans (from all banks)						Effects on the corporate sector's money supply					
	1965~1970 Amount increased	Effect on service industry	1970~1975 Amount increased	Effect on service industry	1975~1980 Amount increased	Effect on service industry	1965~1970 Amount increased	Effect on service industry	1970~1975 Amount increased	Effect on service industry	1975~1980 Amount increased	Effect on service industry
Growth of total loans (money supply)	+30.2	+13.4	+66.7	+29.9	+61.5	+40.7	+13.4	+ 5.5	+29.0	+13.1	+26.4	+16.4
Effect of final demand structure (A)	+36.9	+14.1	+59.5	+28.4	+86.7	+39.8	+11.8	+ 4.4	+23.8	+12.1	+34.8	+15.5
Expansion of final demand	+34.6	+13.3	+60.6	+24.4	+76.3	+32.6	+11.2	+ 4.4	+23.4	+ 9.8	+31.4	+13.7
Change in final demand structure	+ 2.3	+ 0.8	− 1.1	+ 4.0	+10.4	+ 7.2	+ 0.6	0	+ 0.4	+ 2.3	+ 3.4	+ 1.8
Effect of production structure (B)	− 0.3	+ 0.4	− 1.2	+ 0.8	+11.9	+ 6.3	0	+ 0.2	− 0.6	+ 0.1	+ 4.5	+ 2.2
Effect of change in composition of borrowing (money supply) (C)	− 3.0	− 1.1	+ 5.4	+ 0.7	−19.9	− 5.4	+ 0.5	+ 0.5	+ 3.6	+ 0.9	− 6.7	− 1.3

Notes: 1. Compiled from Input-Output Tables (28 industries), Annual Economic Statistics Report (Loans) and Annual Statistics of Corporate Firms. (Money Supply).

$$L = \underbrace{m}_{\text{corresponds to C}} \cdot \underbrace{(I-(I-\bar{M})A)^{-1}}_{\text{corresponds to B}} \cdot \underbrace{((I-\bar{M})F_D + F_E)}_{\text{corresponds to A}}$$

L : Loan matrix
I : Unit matrix
$\bar{M}$: Import coefficient matrix
A : Input coefficient matrix
F_D : Total domestic demand vector
F_E : Export vector

m : Diagonal matrix with borrowing (money supply) ratio on main diagonal

$$\left[\frac{\text{Borrowing}}{\text{Domestic production}} < \frac{\text{Corporate sector money supply}}{\text{Domestic production}}\right]$$

2. For A, B, C, interaction effects are ignored.
3. Service Industry means the broadly-defined service sector, (i.e., the tertiary sector). Increased input from the non-service sectors resulting from the expansion of the service sector is excluded. Therefore, since the total is computed as A + B + C, this underestimates the total effect.

play a larger role as an expansionary factor of financial activities.[19]

These conclusions can also be applied roughly to the effect on money held by the corporate sector. That is, the expansion of final demand was the key factor behind the increase in the money supply, but about 20% of this effect has been offset by the fall of Marshallian k (total money supply divided by production) in the manufacturing sector since 1975. Changes in demand and production structures accounted for 8 trillion yen, or 30%, of the total money supply increase (26 trillion yen). On the other hand, the share of the tertiary sector increased to 16 trillion yen, or 60% of the total (cf. slightly more than 40% in 1970-75). It is clear that this increase was brought about for the most part by the changes in the final demand and production structures.

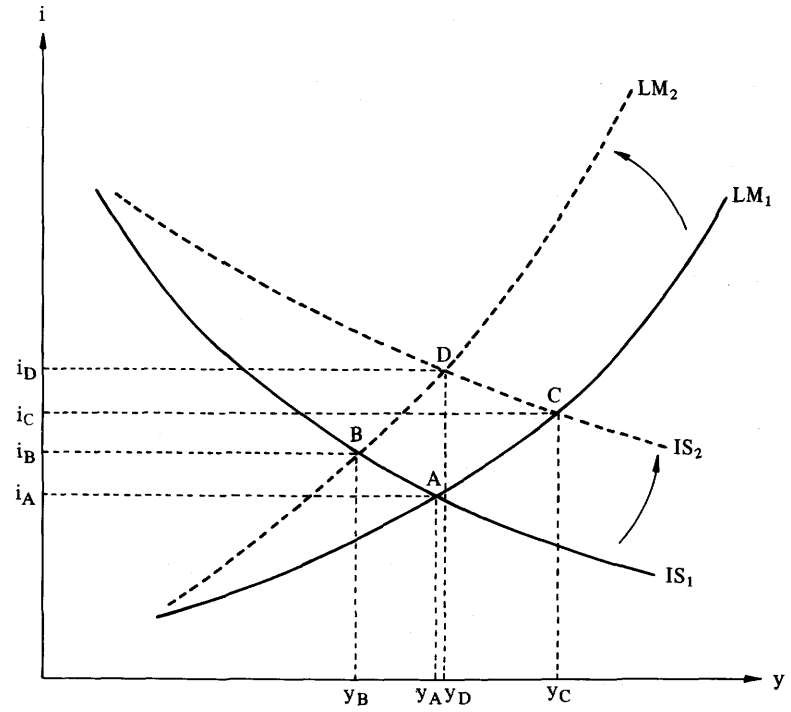
As is clear from the above analysis based on Table 14, the influence of the broadly-defined service sector (tertiary sector) has expanded to 60-70% of the whole economy. As long as the "service economy" keeps growing with the "production inducement effect" of the service sector increasing at its present pace, it is likely that financial activities will become more and more active in future.

Given the stimulative effect of the "service economy" on financial activities, we need to be careful in interpreting financial indicators. We have seen that the growth of "service economy" increases the transactions demand for money and loans. This means that even when Marshallian k for individual sectors stays constant, changes in the industrial structure in favor of the service sector may increase the average k which tends to tighten the money markets (of course, if a decline in k in the manufacturing sector continues, it will have a countervailing effect).

We next apply a simple IS-LM framework to our analysis of the effect of the "service economy" on monetary policy (see Figure 8). First, we assume that the interest rate elasticity of money held for transactions purposes is smaller than that of money held for liquidity purposes. Under this assumption, if the demand for money held for transactions purposes increases (due, for example, to the growth of the service sector whose dependency on external funds is high), it reduces the overall elasticity of money demand and the LM curve becomes steeper. If the money supply

19. The growth of "service economy" has a positive impact on financial activities in spite of the fact that the "production inducement effect" is generally larger in the manufacturing sector. This is because the difference in the "production inducement effect" between various industries is not very large (which is confirmed by the figures in real terms in Table 12(2), and the difference is presumably even smaller in nominal terms), and also because the "production inducement effect" of the tertiary sector has expanded over time while that of the manufacturing sector has been more or less the same. Therefore, to be more precise, we should say that if the rise in the "production inducement effect" of the service sector continues at the present rate, the growth of "service economy" will have a positive impact on financial activities.

Figure 8 Shift of the LM and IS Curves



Notes: i : Real interest rate
y: Real income

is held constant at this time, the interest rate will rise and the equilibrium point will shift from A to B reducing the level of national income. In this case, the rate of changes in income level with respect to changes in money supply (i.e., elasticity of equilibrium income with respect to money supply) will become smaller. At the same time, however, because of the increased weight of transactions demand in total demand for money, the influence of the IS curve (its position and shape) on the determination of income level also becomes smaller, so that uncertainty regarding the effect of monetary policy on income determination may decrease.[20]

Second, the growth of "service economy" increases the weight of small- and

20. We analyze the effectiveness of monetary policy in terms of changes in real income caused by changes in money supply (for simplicity, we assume that the price level is held constant). The growth of "service economy" is treated as changes in the interest rate elasticity of investment and the income elasticity of money demand, so that the point of our interest is the effect of these changes on real income determination. Our model consists of the following three equations.

(1) $I(r) = S(y)$ Equilibrium in goods market
(2) $M/P = \ell(r) + \alpha_1 y$ Equilibrium in money market
(3) $I(r) = I_0 - \alpha_2 r$ Investment function

where I: Investment,
S: Savings,
r: Real interest rate,
y: Real income,
M: Money stock,
α_1: Income elasticity of money demand,
α_2: Interest rate elasticity of investment demand.

From (1) and (3) we get:
(1)' $S'(y) > 0 \quad \ell'(r) < 0 \quad \alpha_1, \alpha_2 > 0$.
From (1)' and (2) we get:

$$\begin{pmatrix} S' & \alpha_2 \\ \alpha_1 & \ell' \end{pmatrix} \begin{pmatrix} dy \\ dr \end{pmatrix} = \begin{pmatrix} dI_0 - r\,d\alpha_2 \\ \frac{1}{P} dM - y\,d\alpha_1 \end{pmatrix}$$

$$\Delta = \begin{vmatrix} S' & \alpha_2 \\ \alpha_1 & \ell' \end{vmatrix} = S'\ell' - \alpha_1\alpha_2 < 0$$

$$dy = \frac{1}{\Delta} \begin{vmatrix} (dI_0 - r\,d\alpha_2)\,\alpha_2 \\ (\frac{1}{P} dM - y\,d\alpha_1)\,\ell' \end{vmatrix}$$

$$= \frac{1}{\Delta} \{ \ell'(dI_0 - r\,d\alpha_2) - \alpha_2 (\frac{1}{P} dM - y\,d\alpha_1) \}.$$

That is $\dfrac{dy}{dM} = -\dfrac{1}{\Delta}\dfrac{\alpha_2}{\bar{P}} > 0$.

Differentiating this with respect to α_1 and α_2 gives:

$$\frac{d}{d\alpha_1}\left(\frac{dy}{dM}\right) = \frac{d}{d\alpha_1}\left(-\frac{\alpha_2}{\bar{P}(S'\ell' - \alpha_1\alpha_2)}\right)$$

$$= \frac{\alpha_2}{\bar{P}} \frac{-\alpha_2}{(S'\ell' - \alpha_1\alpha_2)^2} < 0$$

$$\frac{d}{d\alpha_2}\left(\frac{dy}{dM}\right) = \frac{d}{d\alpha_2}\left(-\frac{\alpha_2}{\bar{P}(S'\ell' - \alpha_1\alpha_2)}\right)$$

$$= -\frac{(S'\ell' - \alpha_1\alpha_2) - \alpha_2(-\alpha_1)}{\bar{P}(S'\ell' - \alpha_1\alpha_2)^2} = \frac{-S'\ell'}{\bar{P}(S'\ell' - \alpha_1\alpha_2)^2} > 0.$$

Therefore, we find that in general a rise in α_1 (income elasticity of money demand) weakens the effectiveness of monetary policy (measured in terms of the amount of increase in real income brought about by a unit of increase in money supply), and a rise in α_2 (interest rate elasticity of investment) strengthens the effectiveness of monetary policy.

medium-sized firms. Typically, these firms depend heavily on external borrowing and the share of the independent component of their investment is small compared with large, capital-intensive firms whose investment is, for the most part, independent, replacement investment. Therefore, the growth of "service economy" tends to flatten the IS curve, which again increases the potential of monetary policy to determine national income level (in this case, combined effects of movements in the LM and IS curves shift the equilibrium point to D. The relative position of A and D depends on the magnitude of movements in both curves). All in all, this diagramatical exposition shows that the growth of "service economy" is favorable to the conduct of monetary policy in that the former reduces uncertainty regarding the effect of the latter.

VII. Conclusion

The main conclusions drawn from our discussion on the growth of the "service economy" and its implications are as follows.

(1) The growth of the "service economy" in Japan is typically shown in the increase in the weight of service outlays in the household's consumption expenditures and the firm's intermediate inputs, and also in the increase in the direct and indirect impacts of changes in service outlays on overall economic activities. The phenomenon is not unique to Japan, but has been observed in most developed countries as per capita income rises. However, a closer look reveals that, this phenomenon has various causes besides the income level.

   (a) In the household sector, the following factors encouraged the expansion of service expenditure: (i) the higher interest in cultural and educational activities induced by a rise in income level; (ii) the increase in the participation in labor force of housewives, especially those higher income groups, which had an effect of raising the level of expenditures on restaurant services and cultural activities; (iii) "habit persistence effect" (that is, the "ratchet" effect of past spending behavior). These factors, (ii) and (iii) in particular, will continue to exert a positive impact on service consumption in the future.

   (b) In the corporate sector, increased substitution between services and labor and technological progress augmenting the input share of services turned the intermediate input structure more service-oriented (in other words, they increased the share of services in the cost structure of firms). This was a result of specialization and demand for information services and research and development activities, which has grown in importance since 1975.

(2) Besides its impact on the household and corporate sectors, the growth of the "service economy" affects in the following ways cyclical fluctuation of production,

employment, and financial activities which are the main concern of economic policy making.

(a) The growth of the service sector smoothes out economic fluctuations because: (i) owing to the fact that the growth of service demand has been brought about by an increased share of services in consumption demand whose level is relatively stable compared with other items of final demand, the value of service production is also stable, so that the increased weight of the service sector tends to dampen a short-run fluctuation of economic activities (though the inability to hold inventory stock amplifies seasonal and daily disturbances); (ii) the growth of the service sector reduces the gap of the "production inducement effect" between the goods and service industries, hence the production disturbance caused by a shift in final demand becomes smaller.

(b) It has been argued that the expansion of "service economy" has a negative effect on capital formation and hence on the rate of economic growth. This argument is based on the fact that the capital coefficient in the tertiary industry is lower, and the "production inducement effect" of investment smaller, than in the manufacturing sector. However, with the progress of mechanization, such differences between these sectors are disappearing, as a result, the negative impact induced by the growth of the service sector is getting smaller.

(3) The growth of the "service economy" influences employment in the following ways: (i) It reduces fluctuations of employment as a whole by smoothing out the production level; (ii) the low labor productivity in the sector creates more job opportunities; (iii) on the other hand, short-term labor contract reflecting the seasonal fluctuations of production and the low labor productivity is likely to suppress the increase in per capita income level.

(4) The impact of "service economy" is also found in financial activities. The share of loan to and money held by the service sector has increased remarkably. This is partly a reflection of the growth of real "service economy". However, according to the data collected so far, it is also a result of higher dependency of the service sector on outside finance and of a larger "production inducement effect" of the service sector, both of which have stimulated the financial intermediation from the "ultimate lender" to the "ultimate borrower".

(5) The implication for monetary policies of the "service economy" are as follows: (i) The interest elasticity of the LM curve declines as the transactions demand for money, whose interest elasticity is presumably smaller relative to demand for money as an asset, increases; (ii) because of a higher weight of small- and medium-sized firms in the service sector and their higher dependency on borrowing, the interest elasticity of investment for the whole economy tends to

rise and the slope of the IS curve becomes less steep; (iii) as a result of these two effects, monetary policy remains to be effective as long as the uncertainty concerning its effect in the determination of income becomes smaller.

(6) Finally, along with the growth of "service economy", it will be necessary to give greater attention to the service sectors in forecasting economic fluctuations. Therefore, it is an urgent task to obtain more detailed and precise information on current activities of the service sector, and for that purpose, to prepare and expand various kinds of statistics.

Appendix 1 Consumption Function by Item

(1963 ~ 1982)

(Durables)

$$
\begin{aligned}
P_1 \cdot Q_1 = {} & 0.163397 \cdot E \\
& + 4{,}282.7 \cdot P_1 - 17.0 \cdot P_2 - 5{,}083.6 \cdot P_3 + 2{,}604.7 \cdot P_4 - 4{,}356.8 \cdot P_5 - 762.9 \cdot P_6 \\
& + (-1{,}558.7 \cdot P_1 - 135.9 \cdot P_2 - 104.5 \cdot P_3 - 535.4 \cdot P_4 + 210.1 \cdot P_5 - 243.7 \cdot P_6) \cdot w \\
& + (0.059449 \cdot P_1H_1 - 0.001508 \cdot P_2H_2 - 0.001564 \cdot P_3H_3 - 0.006429 \cdot P_4H_4 - 0.004972 \cdot P_5H_5 - 0.004104 \cdot P_6H_6)
\end{aligned}
$$

(Clothing & Footwear)

$$
\begin{aligned}
P_2 \cdot Q_2 = {} & 0.112998 \cdot E \\
& - 578.5 \cdot P_1 + 92.3 \cdot P_2 - 3{,}515.6 \cdot P_3 + 1{,}801.3 \cdot P_4 - 3{,}013.0 \cdot P_5 - 527.6 \cdot P_6 \\
& + (210.5 \cdot P_1 + 737.6 \cdot P_2 - 72.3 \cdot P_3 - 370.2 \cdot P_4 + 145.3 \cdot P_5 - 168.6 \cdot P_6) \cdot w \\
& + (-0.008030 \cdot P_1H_1 + 0.008184 \cdot P_2H_2 - 0.001082 \cdot P_3H_3 - 0.004446 \cdot P_4H_4 - 0.003438 \cdot P_5H_5 - 0.002838 \cdot P_6H_6)
\end{aligned}
$$

(Food)

$$
\begin{aligned}
P_3 \cdot Q_3 = {} & 0.173840 \cdot E \\
& - 889.9 \cdot P_1 - 18.1 \cdot P_2 + 25{,}703.4 \cdot P_3 + 2{,}771.1 \cdot P_4 - 4{,}635.3 \cdot P_5 - 81.6 \cdot P_6 \\
& + (323.9 \cdot P_1 - 144.6 \cdot P_2 + 528.3 \cdot P_3 - 569.6 \cdot P_4 + 223.6 \cdot P_5 - 259.3 \cdot P_6) \cdot w \\
& + (-0.012353 \cdot P_1H_1 - 0.001604 \cdot P_2H_2 + 0.007908 \cdot P_3H_3 - 0.006840 \cdot P_4H_4 - 0.005289 \cdot P_5H_5 - 0.004366 \cdot P_6H_6)
\end{aligned}
$$

(Discretionary services)

$$
\begin{aligned}
P_4 \cdot Q_4 = {} & 0.433275 \cdot E \\
& - 2{,}118.0 \cdot P_1 - 45.1 \cdot P_2 - 13{,}480.0 \cdot P_3 - 9{,}034.0 \cdot P_4 - 11{,}552.9 \cdot P_5 - 2{,}022.8 \cdot P_6 \\
& + (807.2 \cdot P_1 - 360.3 \cdot P_2 - 277.1 \cdot P_3 + 1{,}856.9 \cdot P_4 + 557.2 \cdot P_5 - 646.3 \cdot P_6) \cdot w \\
& + (-0.030789 \cdot P_1H_1 - 0.003998 \cdot P_2H_2 - 0.004147 \cdot P_3H_3 + 0.022299 \cdot P_4H_4 - 0.013183 \cdot P_5H_5 - 0.010882 \cdot P_6H_6)
\end{aligned}
$$

(Service necessities)

$$
\begin{aligned}
P_5 \cdot Q_5 = {} & 0.047094 \cdot E \\
& - 241.1 \cdot P_1 - 4.9 \cdot P_2 - 1{,}465.2 \cdot P_3 + 750.7 \cdot P_4 + 25{,}408.5 \cdot P_5 - 219.9 \cdot P_6 \\
& + (87.7 \cdot P_1 - 39.2 \cdot P_2 - 30.1 \cdot P_3 - 154.3 \cdot P_4 - 1{,}225.5 \cdot P_5 - 70.3 \cdot P_6) \cdot w \\
& + (-0.003346 \cdot P_1H_1 - 0.000435 \cdot P_2H_2 - 0.000451 \cdot P_3H_3 - 0.001853 \cdot P_4H_4 + 0.028994 \cdot P_5H_5 - 0.001183 \cdot P_6H_6)
\end{aligned}
$$

(Other non-durables)

$$
\begin{aligned}
P_6 \cdot Q_6 = {} & 0.069397 \cdot E \\
& - 355.3 \cdot P_1 - 7.2 \cdot P_2 - 2{,}159.1 \cdot P_3 + 1{,}106.2 \cdot P_4 - 1{,}850.4 \cdot P_5 + 4{,}344.7 \cdot P_6 \\
& + (129.3 \cdot P_1 - 57.7 \cdot P_2 - 44.4 \cdot P_3 - 227.4 \cdot P_4 + 89.3 \cdot P_5 + 1{,}388.2 \cdot P_6) \cdot w \\
& + (-0.004931 \cdot P_1H_1 - 0.000640 \cdot P_2H_2 - 0.000664 \cdot P_3H_3 - 0.002731 \cdot P_4H_4 - 0.002112 \cdot P_5H_5 + 0.023373 \cdot P_6H_6)
\end{aligned}
$$

Appendix 2 Closeness of Fit of the Consumption Functions

	Durables		Clothing & Footwear		Food	
	(Actual value)	(Predicted value)	(Actual value)	(Predicted value)	(Actual value)	(Predicted value)
1963	2,689.0	2,625.6	4,104.1	3,877.8	13,973.8	14,274.1
1964	2,813.9	3,219.8	4,271.4	4,227.5	15,227.0	15,175.1
1965	2,840.0	2,759.5	4,451.2	4,520.3	16,588.7	16,539.5
1966	3,147.0	3,370.5	4,665.2	4,762.7	17,430.3	17,384.6
1967	3,714.9	3,992.4	5,041.5	5,164.0	18,788.0	18,629.1
1968	4,638.0	4,234.2	5,537.7	5,758.4	20,128.7	20,222.0
1969	5,701.0	5,008.5	6,166.2	6,293.4	21,615.6	21,835.3
1970	6,520.4	6,683.1	6,810.3	6,983.7	24,127.1	24,222.7
1971	7,846.9	7,094.9	7,626.8	7,798.0	25,967.4	25,977.0
1972	7,851.6	8,124.7	8,393.2	8,334.7	27,623.9	27,267.6
1973	9,383.4	8,977.1	10,463.5	10,295.5	31,490.6	31,526.9
1974	10,428.8	10,226.9	12,229.0	12,195.5	39,248.9	39,322.7
1975	11,635.9	11,415.8	13,634.3	13,805.4	44,499.4	44,794.3
1976	11,697.6	12,834.1	14,777.0	14,229.5	48,318.5	47,970.1
1977	12,843.8	12,725.0	15,291.6	15,191.1	51,273.9	51,199.7
1978	13,214.2	12,751.8	15,420.3	15,536.9	52,760.0	52,716.5
1979	14,166.2	15,142.7	16,139.3	16,141.7	53,960.2	54,415.6
1980	14,309.0	14,911.4	16,600.8	16,601.4	57,484.2	57,018.2
1981	15,693.1	15,226.4	17,027.5	16,918.7	59,655.1	59,558.8
1982	16,159.9	15,591.3	17,521.6	17,782.1	60,908.8	61,182.1
	(R^2)	(Theil's U)	(R^2)	(Theil's U)	(R^2)	(Theil's U)
	0.9876	0.02568	0.9987	0.00802	0.9998	0.00295

	Discretionary services		Service necessities		Other non-durables	
	(Actual value)	(Predicted value)	(Actual value)	(Predicted value)	(Actual value)	(Predicted value)
1963	10,209.8	10,240.3	4,991.1	5,764.9	5,165.3	4,350.4
1964	11,654.9	11,682.4	6,801.6	6,481.4	4,777.2	4,759.8
1965	12,737.8	12,895.2	7,705.5	7,251.0	5,034.0	5,391.5
1966	14,431.6	14,084.4	8,279.6	8,191.7	5,626.9	5,786.7
1967	16,142.1	15,916.0	8,924.5	8,832.0	6,175.0	6,252.7
1968	18,212.5	18,502.3	9,897.0	9,629.0	7,077.8	7,145.9
1969	20,592.8	21,002.2	10,633.3	10,463.5	7,893.8	7,999.6
1970	24,285.4	23,954.3	11,794.2	11,895.9	9,057.3	8,854.9
1971	27,031.9	27,472.5	12,974.7	12,813.2	9,820.0	10,112.1
1972	30,417.0	30,291.2	14,098.8	14,429.9	10,955.8	10,892.3
1973	36,448.9	37,202.6	16,117.2	15,864.9	13,110.5	13,146.9
1974	44,886.3	44,731.4	19,025.7	18,892.3	16,396.6	16,846.5
1975	53,752.9	53,976.2	23,023.2	22,300.2	19,500.0	19,753.7
1976	58,808.8	58,219.4	25,878.2	26,073.1	21,181.0	21,334.9
1977	65,673.8	66,250.3	29,497.9	29,004.3	23,358.9	23,569.4
1978	70,488.7	70,489.9	31,219.6	32,144.8	25,122.7	24,585.7
1979	76,776.9	75,450.3	33,529.2	35,579.6	27,922.8	25,764.7
1980	82,027.1	81,152.2	37,664.6	37,973.1	30,007.8	30,437.2
1981	85,756.4	86,384.4	41,498.9	40,410.6	31,630.3	32,762.2
1982	92,944.4	93,693.9	43,380.7	42,706.1	35,194.9	35,154.8
	(R^2)	(Theil's U)	(R^2)	(Theil's U)	(R^2)	(Theil's U)
	0.9996	0.00520	0.9970	0.01431	0.9977	0.01670

Appendix 3 Estimation of the Trans-Log Function (1)

(Coefficient of correlation, 1960 ~ 1972.
( ) Theil's inconsistency coefficient)

	Intermediate Input (non-service industries)	Intermediate Input (service industries)	Capital	Labor	Technological Progress
Food	0.9505 (0.0062)	0.3878 (0.0257)	0.1665 (0.0227)	0.9681 (0.0158)	0.2417 (0.4819)
Textiles (Secondary products like clothing excluded)	0.9700 (0.0058)	0.7858 (0.0184)	0.8648 (0.0246)	0.6051 (0.0399)	0.2302 (0.4480)
Paper & Pulp	0.8007 (0.0085)	0.6843 (0.0138)	0.0886 (0.0303)	0.8377 (0.0257)	0.3085 (0.4974)
Chemicals	0.9243 (0.0132)	0.5652 (0.0179)	0.9408 (0.0298)	0.7835) (0.0271)	0.3926 (0.3988)
Ceramics & Cement	0.7894 (0.0097)	0.9637 (0.0067)	0.9345 (0.0292)	0.7372 (0.0117)	0.5578 (0.4518)
Steel	0.9532 (0.0046)	0.7561 (0.0357)	0.6769 (0.0473)	0.3534 (0.6497)	0.3630 (0.4747)
Metal Products	0.1163 (0.0137)	0.7062 (0.0279)	0.3285 (0.0217)	0.2556 (0.0683)	0.3539 (0.5063)
General Machinery	0.5056 (0.0107)	0.6092 (0.0132)	0.4248 (0.0464)	0.7811 (0.0308)	0.4329 (0.4498)
Electrical Machinery	0.7753 (0.0096)	0.7442 (0.0129)	0.4137 (0.0254)	0.7507 (0.0232)	0.4581 (0.4502)
Cars	0.7628 (0.0200)	0.4020 (0.0196)	0.9555 (0.0532)	0.9105 (0.0289)	0.4194 (0.3225)
Construction	0.8917 (0.0135)	0.7274 (0.0228)	0.6684 (0.0921)	0.4309 (0.0415)	0.2963 (0.6391)
Services	0.6282 (0.0313)	0.8483 (0.0380)	0.7911 (0.0435)	0.4918 (0.0391)	0.1934 (0.6860)
Commerce	0.8213 (0.0181)	0.9294 (0.0155)	0.4358 (0.0205)	0.9169 (0.0151)	0.4201 (0.6308)
Finance & Insurance	0.7261 (0.0164)	0.8030 (0.0126)	0.0070 (0.0185)	0.0492 (0.0192)	0.6265 (0.4797)
Transportation & Communication	0.4377 (0.0380)	0.4484 (0.0188)	0.8451 (0.0371)	0.9348 (0.0155)	0.2069 (0.7349)

Appendix 4 Estimation of the Trans-Log Function (2)

(Coefficient of correlation, 1970 ~ 1979.
( ) Theil's inconsistency coefficient)

	Intermediate Input (non-service industries)	Intermediate Input (service industries)	Capital	Labor	Technological Progress
Food	0.6995 (0.0334)	0.7862 (0.0311)	0.7212 (0.1035)	0.6519 (0.0296)	0.7630 (0.3059)
Textiles (Secondary products like clothing excluded)	0.8335 (0.0113)	0.8706 (0.0240)	0.2833 (0.0327)	0.4239 (0.0178)	0.0253 (0.7920)
Paper & Pulp	0.1990 (0.0100)	0.4522 (0.0363)	0.7889 (0.0398)	0.6608 (0.0340)	0.2815 (0.7770)
Chemicals	0.8093 (0.0626)	0.6023 (0.0569)	0.9588 (0.1970)	0.5651 (0.0350)	0.1549 (0.6699)
Ceramics & Cement	0.1916 (0.0479)	0.3000 (0.0296)	0.5923 (0.0990)	0.8448 (0.0164)	0.3611 (0.8486)
Steel	0.3521 (0.0170)	0.3431 (0.0623)	0.2700 (0.0782)	0.8408 (0.0299)	0.1908 (0.8713)
Metal Products	0.3499 (0.0099)	0.6274 (0.0386)	0.5201 (0.0427)	0.4568 (0.0725)	0.0985 (0.7582)
General Machinery	0.3044 (0.0291)	0.7350 (0.0418)	0.9450 (0.0624)	0.9069 (0.0394)	0.4485 (0.7261)
Electrical Machinery	0.0828 (0.0209)	0.4873 (0.0467)	0.8249 (0.0579)	0.7237 (0.0487)	0.3002 (0.5936)
Cars	0.2853 (0.0262)	0.6505 (0.1098)	0.4296 (0.0631)	0.2093 (0.0427)	0.4122 (0.6039)
Construction	0.8422 (0.0152)	0.7939 (0.0129)	0.0477 (0.0274)	0.7524 (0.0304)	0.1806 (0.8196)
Services	0.9560 (0.0059)	0.2295 (0.0129)	0.7811 (0.0319)	0.6544 (0.0396)	0.3930 (0.6477)
Commerce	0.6484 (0.0703)	0.5794 (0.0209)	0.6716 (0.0364)	0.9656 (0.0118)	0.4371 (0.6183)
Finance & Insurance	0.0304 (0.0405)	0.5189 (0.0271)	0.4196 (0.0433)	0.7493 (0.0278)	0.1770 (0.6287)
Transportation & Communication	0.4210 (0.1889)	0.1965 (0.1274)	0.6773 (0.2039)	0.5745 (0.0431)	0.2296 (0.6040)

Appendix 5 Parameters of Each Factor of Production (1)

(1960 ~ 1972, ( ) t value)

	Food	Textiles	Paper & Pulp	Chemicals	Ceramics & Cement	Steel	Metal Products	General Machinery	Electrical Machinery	Cars	Construc-tion	Services	Commerce	Finance & Insurance	Trans-portation & Com-munication
α_M	0.5172 (26.2)	0.7101 (22.8)	0.6708 (34.0)	0.7697 (15.8)	0.4604 (126.0)	0.7508 (76.5)	0.5719 (133.3)	0.6212 (11.5)	0.5907 (18.8)	0.5465 (80.0)	0.5342 (140.5)	0.3096 (57.3)	0.0948 (5.9)	0.0234 (9.0)	0.1692 (54.0)
β_{MM}	−0.0913 (3.5)	−0.1686 (3.5)	−0.2846 (5.1)	−0.4910 (4.5)	0	0	0	−0.1705 (2.8)	−0.0730 (2.1)	0	0	0	−0.0863 (1.6)	−0.0058 (1.6)	0
β_{MS}	0.1335 (5.0)	0.0666 (4.7)	0.1665 (3.6)	0.4329 (4.0)	0	0	0	0.0476 (1.7)	0.0024 (0.2)	0	0	0	0.1405 (2.4)	0.0177 (2.9)	0
β_{MK}	−0.0079 (0.3)	0.0675 (3.2)	0.0959 (5.3)	0.0394 (2.0)	0	0	0	0.0427 (5.0)	0.0243 (1.9)	0	0	0	0.0117 (1.1)	0.0097 (5.0)	0
β_{ML}	−0.0343 (2.0)	0.0345 (1.3)	0.0222 (11.3)	0.0187 (0.6)	0	0	0	0.0802 (2.1)	0.0463 (2.0)	0	0	0	−0.0659 (3.6)	−0.0217 (5.7)	0
β_{MT}	−0.0021 (1.1)	−0.0134 (4.7)	−0.0080 (4.4)	−0.0253 (5.8)	−0.0029 (6.4)	−0.0055 (5.8)	−0.0005 (0.9)	−0.0099 (2.0)	−0.0086 (2.9)	0.0033 (3.8)	−0.0069 (14.5)	−0.0038 (5.6)	0.0031 (2.1)	0.0011 (4.5)	−0.0016 (4.0)
α_S	0.1706 (8.1)	0.0942 (12.4)	0.1123 (9.9)	0.0316 (0.8)	0.2649 (19.3)	0.0830 (8.7)	0.1499 (53.9)	0.1087 (5.1)	0.1501 (10.8)	0.1127 (69.9)	0.2904 (6.0)	0.4291 (12.5)	0.4021 (9.6)	0.2935 (14.6)	0.3144 (6.5)
β_{SS}	−0.2762 (6.8)	−0.0263 (2.7)	−0.0974 (2.4)	−0.3817 (3.3)	−0.0438 (2.6)	−0.0023 (0.3)	0	−0.0133 (1.1)	−0.0001 (0.8)	0	−0.1464 (3.6)	−0.2678 (5.3)	−0.2289 (2.9)	−0.0546 (2.2)	−0.2134 (2.8)
β_{SK}	0.0547 (2.9)	−0.0267 (3.7)	−0.0561 (6.0)	−0.0347 (2.3)	−0.0106 (1.6)	−0.0017 (0.6)	0	−0.0119 (2.4)	−0.0008 (0.2)	0	0.0026 (0.3)	0.0746 (4.4)	−0.1906 (1.4)	−0.0300 (2.7)	0.0241 (1.8)
β_{SL}	0.0880 (4.5)	−0.0136 (1.8)	−0.0130 (1.4)	−0.0165 (0.6)	0.0332 (2.2)	0.0041 (0.3)	0	−0.0224 (1.6)	−0.0015 (0.2)	0	0.1438 (2.6)	0.1932 (3.4)	0.1074 (2.4)	0.0669 (2.1)	0.1893 (2.9)
β_{ST}	−0.0040 (2.0)	0.0042 (5.9)	0.0031 (2.9)	0.0130 (3.9)	−0.0056 (4.6)	0.0004 (0.4)	−0.0019 (5.3)	0.0024 (1.2)	0.0014 (1.2)	−0.0009 (4.3)	−0.0104 (2.4)	−0.0207 (6.7)	−0.0133 (3.5)	−0.0047 (2.4)	0.0120 (2.7)
α_K	0.2516 (13.4)	0.1303 (11.0)	0.1353 (20.4)	0.1159 (12.9)	0.1071 (21.9)	0.1369 (18.9)	0.2190 (42.0)	0.1392 (21.5)	0.1598 (16.3)	0.2503 (56.9)	0.0852 (12.1)	0.1987 (20.7)	0.2757 (40.9)	0.4081 (29.2)	0.2981 (27.8)
β_{KK}	−0.0236 (0.7)	−0.0270 (2.6)	−0.0323 (3.0)	−0.0032 (1.0)	−0.0026 (0.9)	−0.0013 (0.3)	0	−0.0107 (1.9)	−0.0081 (1.0)	0	−0.0001 (0.2)	−0.0208 (1.9)	−0.0016 (0.7)	−0.0165 (1.6)	−0.0027 (1.2)
β_{KL}	−0.0231 (2.0)	−0.0138 (1.3)	−0.0075 (1.2)	−0.0015 (0.5)	−0.0080 (2.0)	0.0031 (0.4)	0	−0.0201 (6.2)	−0.0154 (2.4)	0	−0.0025 (0.3)	−0.0538 (7.2)	0.0089 (1.4)	0.0367 (1.8)	−0.0214 (1.9)
β_{KT}	0.0015 (0.8)	0.0065 (6.0)	0.0025 (4.0)	0.0098 (11.8)	0.0074 (16.2)	0.0020 (2.5)	0.0008 (1.3)	0.0016 (2.1)	0.0019 (2.1)	−0.0064 (11.5)	0.0059 (8.7)	0.0131 (12.2)	0.0009 (1.2)	−0.0011 (0.7)	−0.0067 (5.8)
α_L	0.0607 (5.6)	0.0653 (4.7)	0.0816 (18.5)	0.0828 (6.8)	0.1675 (13.2)	0.2930 (1.5)	0.0591 (13.4)	0.1309 (3.9)	0.0994 (4.1)	0.0905 (23.2)	0.0902 (2.1)	0.0625 (1.7)	0.2273 (7.9)	0.2750 (9.2)	0.2183 (5.1)
β_{LL}	−0.0306 (2.3)	−0.0071 (0.7)	−0.0017 (0.7)	−0.0007 (0.3)	−0.0252 (1.8)	−0.0076 (0.2)	0	−0.0377 (1.6)	−0.0294 (1.6)	0	−0.1413 (2.8)	−0.1394 (2.4)	−0.0504 (1.5)	−0.0819 (1.8)	−0.1679 (2.9)
β_{LT}	0.0046 (4.6)	0.0027 (2.0)	0.0024 (6.0)	0.0025 (2.3)	0.0011 (1.0)	0.0031 (1.8)	0.0015 (2.7)	0.0059 (1.9)	0.0053 (2.4)	0.0040 (8.1)	0.0113 (2.9)	0.0115 (3.5)	0.0093 (3.5)	0.0047 (1.6)	−0.0202 (5.2)
α_T	0.0419 (2.3)	0.0387 (2.5)	0.0554 (2.4)	0.0663 (3.8)	0.0497 (3.4)	0.0941 (2.6)	0.0673 (2.4)	0.0834 (3.0)	0.0813 (3.2)	0.0852 (4.0)	0.0645 (2.0)	0.0346 (1.9)	0.0338 (1.7)	0.0622 (2.5)	0.0389 (0.4)
β_{TT}	−0.0024 (1.1)	−0.0021 (1.1)	−0.0038 (1.3)	−0.0047 (2.1)	−0.0048 (2.6)	−0.0069 (1.5)	−0.0051 (1.4)	−0.0066 (1.9)	−0.0067 (2.1)	−0.0050 (1.8)	−0.0062 (1.5)	−0.0029 (1.3)	−0.0049 (2.0)	−0.0092 (3.0)	−0.0096 (0.9)

Appendix 6 Parameters of Each Factor of Production (2)

(1970 ~ 1979, ( ) t value)

	Food	Textiles	Paper & Pulp	Chemicals	Ceramics & Cement	Steel	Metal Products	General Machinery	Electrical Machinery	Cars	Construc-tion	Services	Commerce	Finance & Insurance	Trans-portation & Com-munication
α_M	0.3345 (47.2)	0.6439 (45.9)	0.5706 (57.0)	0.3995 (14.8)	0.4175 (8.8)	0.6620 (40.5)	0.5721 (6.18)	0.4961 (9.6)	0.5665 (15.5)	0.6552 (40.8)	0.5567 (25.0)	0.3202 (56.0)	0.1620 (8.9)	0.0348 (17.1)	0.1611 (2.8)
β_{MM}	0	0	0	0	0	0	0	−0.0000 (0.0)	−0.2212 (3.3)	−0.0001 (0.1)	−0.0836 (1.5)	0	0	−0.0103 (6.3)	−0.3411 (6.3)
β_{MS}	0	0	0	0	0	0	0	−0.0008 (0.0)	−0.0520 (1.2)	0.0043 (0.2)	−0.0034 (0.2)	0	0	−0.0049 (1.6)	0.1771 (4.5)
β_{MK}	0	0	0	0	0	0	0	−0.0004 (0.0)	0.0621 (2.8)	0.0007 (0.2)	0.0201 (1.1)	0	0	0.0160 (17.5)	0.2674 (4.6)
β_{ML}	0	0	0	0	0	0	0	−0.0004 (0.0)	0.2111 (5.1)	−0.0049 (0.2)	0.0669 (1.2)	0	0	−0.0008 (0.3)	−0.1034 (2.5)
β_{MT}	0.0119 (26.2)	−0.0064 (7.2)	0.0008 (1.3)	0.0085 (4.9)	0.0031 (1.0)	0.0032 (3.0)	−0.0014 (2.4)	0.0023 (0.5)	−0.0078 (2.4)	−0.0052 (4.0)	−0.0088 (4.5)	−0.0035 (9.8)	−0.0041 (3.6)	−0.0000 (0.1)	0.0076 (2.0)
α_S	0.0789 (14.8)	0.0811 (7.3)	0.1159 (11.6)	0.1229 (12.1)	0.1754 (10.8)	0.0571 (5.1)	0.0941 (4.4)	0.0705 (2.6)	0.1232 (5.0)	0.0868 (4.4)	0.1544 (21.2)	0.2351 (18.1)	0.2350 (9.9)	0.2507 (23.2)	0.1790 (4.0)
β_{SS}	0	0	0	0	−0.0029 (0.1)	−0.1993 (7.8)	−0.0043 (0.2)	−0.0245 (0.1)	−0.0122 (0.5)	−0.1436 (2.1)	−0.0001 (0.1)	−0.0776 (3.0)	−0.2552 (6.2)	0.0023 (0.8)	−0.0919 (3.2)
β_{SK}	0	0	0	0	−0.0016 (0.3)	0.0704 (11.0)	−0.0034 (0.4)	0.0126 (0.3)	0.0146 (0.9)	−0.0237 (2.5)	0.0008 (0.2)	0.0255 (5.1)	0.0869 (3.7)	0.0076 (1.4)	−0.1388 (3.7)
β_{SL}	0	0	0	0	0.0045 (0.2)	0.1289 (5.8)	0.0077 (0.2)	0.0111 (0.2)	0.0496 (0.9)	0.1630 (2.9)	0.0027 (0.2)	0.0522 (2.4)	0.1683 (7.0)	−0.0004 (0.3)	0.0537 (2.1)
β_{ST}	0.0039 (11.3)	0.0045 (6.2)	0.0019 (2.9)	0.0037 (5.7)	0.0013 (1.0)	0.0025 (2.9)	0.0023 (1.2)	0.0048 (2.0)	0.0024 (1.2)	0.0005 (0.3)	0.0022 (3.8)	−0.0030 (2.7)	0.0013 (0.7)	−0.0004 (0.6)	−0.0039 (1.3)
α_K	0.5288 (32.2)	0.1804 (29.0)	0.2620 (14.5)	0.3693 (21.8)	0.2752 (9.0)	0.2083 (19.0)	0.2903 (8.5)	0.3311 (10.0)	0.2742 (19.1)	0.2150 (33.0)	0.1518 (18.5)	0.3124 (30.6)	0.3858 (21.9)	0.4886 (30.5)	0.1906 (3.3)
β_{KK}	−0.0098 (2.4)	0	−0.0196 (2.5)	0	−0.0009 (0.2)	−0.0249 (6.9)	−0.0027 (0.3)	−0.0065 (0.6)	−0.0175 (1.7)	−0.0039 (2.0)	−0.0048 (0.7)	−0.0084 (4.4)	−0.0296 (2.4)	−0.0249 (4.1)	−0.2100 (3.6)
β_{KL}	0.0098 (2.4)	0	0.0196 (2.5)	0	0.0024 (0.3)	−0.0455 (9.9)	0.0062 (0.5)	−0.0057 (0.4)	−0.0593 (3.1)	0.0269 (3.3)	−0.0161 (1.1)	−0.0171 (4.0)	−0.0573 (4.8)	0.0013 (0.3)	0.0811 (2.2)
β_{KT}	−0.0202 (17.3)	0.0014 (3.4)	−0.0081 (6.0)	−0.0133 (12.3)	−0.0081 (4.0)	−0.0048 (6.4)	−0.0044 (1.9)	−0.0145 (4.9)	−0.0076 (7.8)	−0.0049 (10.7)	−0.0003 (0.5)	0.0006 (0.9)	−0.0074 (6.2)	−0.0072 (7.0)	−0.0061 (1.6)
α_L	0.0579 (3.8)	0.0946 (11.2)	0.0515 (2.7)	0.1082 (10.7)	0.1320 (6.6)	0.0725 (11.6)	0.0434 (1.5)	0.1023 (4.0)	0.0361 (1.1)	0.0429 (2.9)	0.1371 (6.6)	0.1323 (9.4)	0.2172 (16.7)	0.2259 (15.8)	0.4693 (11.6)
β_{LL}	−0.0098 (2.4)	0	−0.0196 (2.5)	0	−0.0070 (0.3)	−0.0833 (4.5)	−0.0139 (0.4)	−0.0050 (0.2)	−0.2014 (3.3)	−0.1850 (4.3)	−0.0535 (1.0)	−0.0351 (2.0)	−0.1110 (6.0)	−0.0001 (0.1)	−0.0314 (1.5)
β_{LT}	0.0044 (4.0)	0.0006 (1.2)	0.0055 (3.8)	0.0011 (1.6)	0.0037 (2.2)	−0.0009 (2.0)	0.0035 (1.5)	0.0074 (3.6)	0.0129 (4.4)	0.0096 (8.0)	0.0069 (3.7)	0.0059 (5.6)	0.0103 (8.9)	0.0076 (8.3)	0.0024 (0.9)
α_T	−0.1187 (1.9)	0.0205 (0.1)	−0.0612 (0.6)	0.0530 (0.8)	0.0302 (0.5)	0.0197 (0.2)	0.0698 (0.5)	0.0399 (0.5)	0.0182 (0.2)	0.1333 (1.6)	0.0314 (0.5)	0.1271 (1.3)	−0.0750 (1.2)	−0.0053 (0.0)	0.0043 (0.7)
β_{TT}	0.0089 (2.3)	−0.0006 (0.1)	0.0040 (0.6)	−0.0030 (0.7)	−0.0022 (0.6)	−0.0010 (0.2)	−0.0033 (0.4)	−0.0025 (0.5)	−0.0002 (0.0)	−0.0080 (1.5)	−0.0024 (0.6)	−0.0088 (1.4)	0.0048 (1.2)	−0.0020 (0.2)	−0.0040 (1.0)

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