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THE RESEARCH INSTITUTE FOR
ECONOMICS AND BUSINESS ADMINISTRATION
KOBE UNIVERSITY

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CONTENTS

THE CHANGE IN REGIONAL CHARACTERISTICS OF INDUSTRIES IN JAPAN

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I Introduction

The necessity of re-examining the "National Regional Development Plan" begun in 1962, and due to be completed in 1970, has been gradually noticed because of apparent gaps between the political aims and the actual change. The government authorities in Japan, having admitted the situation, started their examination in the spring of 1965 and set forth the interim report in 1966 and the final report in 1967. This year they are trying to publish the "New National Regional Development Plan", due to be completed in 1985 on the basis of these two reports. The writer's concern in this article is not in the contents of these plans, but in how the problem of industrial location, which has a considerable bearing on the problem, is treated, and in what kinds of problems are found in them.

The reports mentioned above pointed out the tendency of industrial location — dividing the industries into two main types — "foot-tight" and "foot-loose."

The industries called "foot-tight" here are to a considerable extent limited by local conditions. These industries include lumber and wood products, paper, pulp, pottery etc. which are the raw material-oriented industries, and petroleum refining, chemicals, steels, ship building which are located in coastal areas. They are mainly located in the three central industrial districts in Japan, but are located in other local districts as well.

"Foot-loose" type industries, or the other hand, are generally taken to be the high value-added industries which are rather free in location, including electric machinery, precision engineering and other higher processed engineering industries (so-called growth industries). In the case of Japan, in addition, their tendency to concentrate strongly in the three central industrial districts is a distinctive feature.

The final report concludes that foot-loose type industries, which have shown extreme concentration until the present, ought to be literally foot-loose, and to contribute to the development of local districts, admitting the notable roles foot-tight industries will play from now on in the development of local districts.

Having divided Japanese main industries into foot-tight and foot-loose types, the writer, in this article, intends to focus on the following point: the extreme concentration of the foot-loose type, contrary to its name, is a remarkable tendency compared with the actual conditions in western countries.

The writer's concern in this area originated from his previous study on the regional characteristics of Japanese industries with British and American ones, based on the study of Professor P. S. Florence who had grasped the characteristics of industrial locations in U.S. and Britain by the concept of regional concentration. (P.S. Florence "The Logic of British and American Industries" 1953). The writer has previously published a comparative study between Japanese and British, American industries, focusing on their relation to the business features of industrial location in Japan using the 1951–52 data, using the method of Professor Florence (M. Beika "Spatial Characteristics of Industries Relating to their Business Features" The Kobe Economic & Business Review 2, 1954). In this article, the writer is going to investigate the change in Japanese industries on the basis of 1956 and 1966 data. The main point of investigation will be the characteristic change of foot-loose type industries during these ten years.

II Study on Change using Florence's method

Professor P.S. Florence, a well-known scholar in the studies of industrial organization and business structure, still working actively in his old age, has a great influence in Britain on the study of location theory as well. Recently he has caught the attention of Japanese scholars in this field. In this chapter, the writer intends to study the regional concentration and management conditions in Japan by types, and refer to the problems related to regional concentration, the concept of which prompted this study, as the premise to the main subject.

The term, regional concentration, used here means the comparison between the regional (prefectural in our case) distribution rate of the workers in a certain industry and that of the total number of workers in all industries. And its coefficient is obtained by deducting the former from the latter for each prefecture, and summing up all the plus and minus deviations of the distribution rates of workers in a certain industry compared with the distribution rates of workers in all industries. That means the nearer the distribution of a certain industry is to that of all industries, the nearer the coefficient is to zero. The more the distribution differs, the nearer the coefficient is to 100 per cent. However, whereas Florence used occupied persons as norms, the writer has used the total number of industrial workers instead. The writer has adopted Professor Florence's method of portraying the characteristics of each industry by classifying them in

terms of number of workers, admitting the considerable connection between the features of regional concentration and the business features of each industry.

In addition, the writer has supplemented the data on the actual concentration of each industry in three leading prefectures, fearing that, while such a coefficient of localization somehow indicates the extent of concentration of industries relatively on the one hand, it might make the overall concentration unclear on the other.

In conclusion, Professor Florence, relating the coefficient of localization to plant size, grasped the logic of industries inductively when he compared British and American industries and found the points of similarity between them. But it is the writer's finding that the Japanese condition forms a considerable contrast with British and American conditions, as regards foot-loose type industries, following the terms used before.

No small change can be found between the data of 1956 and the data of 1966.

III The regional concentration in 1956 and plant size

Combining the data gained from the "1956 Census of Japanese Manufactures" and the some indexes noted above, the writer completed Table 1. The writer only suggests his conclusive viewpoint here because of space limitations. Seven types were devised by the writer in connection with industrial location and business features in Japan, and they were put together in Table 1, for want of space in classifying all industries by types.

Combining each item in the Table and considering the actual conditions of each industry, the writer devised seven types as follows:

Type 1. Industries which are closely related each other and are concentrated chiefly in a few central industrial districts

They include large, medium and small plants, for which regional concentration is a prerequisite demand. One distinctive feature of this type is the heavy concentration in the three central industrial districts, especially in the Keihin area. Machine industry, electric machinery etc. — all of them are higher processed engineering industries and are typical examples of the foot-loose type.

Type 2. Industries consisting mainly of large plants located both in the central industrial districts and other local industrial areas

They are big plants which are located not only in the central industrial districts but in other local industrial areas, depending upon the local conditions such as ports, transportation, water, electricity, special raw materials, etc. Some typical examples are iron and steel, shipbuilding, chemical fertilizer. Pulp,

Table 1. Coefficient of Localization and Size of Plant in 1956

	Similar Type	Group of Industry	Coefficient of Localization	3 Leading Prefectures				Percentage of Workers by Size of Plant (No. of workers)				
				Percentage	I	II	III	-49	50-99	100-499	500-999	1000……
1	⑤	Pottery	72	80	Aichi	Gifu	Mie	47.4	13.2	27.1	4.6	7.7
2	①	Surveying instruments	70	85	Tokyo	—	—	30.9	69.1			
3	⑤	Lacquer ware	68	59	Ishikawa	Kagawa	Fukushima	73.8	26.2		—	—
4	⑤	Natural resin and wood chemical products	64	52	Kagoshima	Hyogo	Miyazaki	85.2	14.8		—	—
5	①	Optical instruments and lenses	61	81	Tokyo	Nagano	Saitama	36.8	11.6		51.6	
6	④	Silk reeling plants	61	41	Nagano	Gunma	Yamanashi	19.9	6.4	71.5	2.2	—
7	①	Watches and clocks	61	84	Tokyo	Aichi	Nagano	19.2	10.2	23.0		47.6
8	①	Musical instruments	60	82	Shizuoka	Tokyo	Aichi	26.4		73.6		
9	④	Clay refractories	59	53	Okayama	Hyogo	Aichi	13.1	11.9	51.5	23.5	
10	①	Electric measuring instrument	57	74	Tokyo	Hiroshima	Nagano	26.4	17.7	25.7	30.2	
11	②	Shipbuilding	54	50	Hyogo	Hiroshima	Kanagawa	9.7	3.6	12.5		74.2
12	①	Medical instruments	53	70	Tokyo	Kyoto	Saitama	69.4	30.6		—	—
13	⑥	Pens and pencils	51	75	Tokyo	Osaka	Kanagawa	47.6	7.0	45.4		
14	①	Electric bulbs	50	79	Tokyo	Osaka	Kanagawa	38.4	12.5		49.1	
15	①	Communication equipment	50	78	Tokyo	Kanagawa	Osaka	20.1	11.4	25.2	14.8	28.5
16	④	Ropes and nettings	49	49	Hokkaido	Aichi	Mie	34.0	11.6	36.4	18.0	
17	③	Drugs and medicines	48	63	Tokyo	Osaka	Toyama	27.3	12.9	35.3	13.8	10.7
18	①	Bicycles, rearcars	48	82	Osaka	Tokyo	Aichi	21.2		78.8		—
19	④	Paper mills	46	39	Shizuoka	Hokkaido	Tokyo	19.4	10.7	28.9	20.1	20.9
20	②	Chemical fertilizers	45	30	Niigata	Fukuoka	Toyama	1.4	0.7	11.6	8.7	77.6
21	⑦	Sea food products	44	32	Shizuoka	Hokkaido	Chiba	64.9	11.4	22.0	1.7	—
22	③	Oils and Paints	44	74	Tokyo	Osaka	Hyogo	33.0	14.3	32.5	20.2	—
23	②	Railroad equipment	44	50	Osaka	Aichi	Hyogo	9.3	4.8	11.1	7.1	67.7
24	①	Rollingmills, except smelting and steel works	43	64	Osaka	Tokyo	Hyogo	25.2	16.9	40.0	17.9	

25	⑧	Sugar	43	52	Hokkaido	Tokyo	Osaka	15.1	2.3	63.5	19.1	—
26	⑥	Paper products	42	71	Osaka	Tokyo	Aichi	59.8	12.2		28.0	
27	①	Textile machinery	42	57	Aichi	Osaka	Hyogo	32.6	12.4	27.1	8.1	19.8
28	①	Household electric appliances	42	45	Ibaragi	Osaka	Tokyo	16.1	9.4	17.3	23.0	34.2
29	④	Canned fruits and vegetables	42	30	Shizuoka	Tokyo	Aichi	42.3	18.8	38.9	—	—
30	④	Industrial inorganic chemicals	41	30	Yamaguchi	Kagawa	Osaka	23.2	12.8	37.1	8.7	18.2
31	①	Motor vehicles	41	57	Tokyo	Aichi	Kanagawa	23.5	10.0	25.0	6.4	35.1
32	⑧	Animal and vegetable oil and fats	40	36	Hyogo	Kanagawa	Fukuoka	30.2	6.8		63.0	
33	①	Metal working machinery	40	52	Tokyo	Osaka	Kanagawa	45.4	13.4	26.0	15.2	
34	①	Tincans	39	63	Tokyo	Osaka	Hyogo	35.0	19.6	45.4		—
35	⑥	Dyeing and finishing textiles	39	48	Aichi	Osaka	Kyoto	45.5	13.1	31.0	10.4	
36	⑤	Woven fabric mills	38	37	Aichi	Osaka	Fukui	59.5	16.0	20.9	3.7	
37	①	Heating apparatus	38	52	Tokyo	Osaka	Saitama	44.8	18.3	23.3	13.6	
38	⑥	Toys and sporting goods	37	59	Tokyo	Aichi	Osaka	62.8		37.3		—
39	⑦	Structural clay products	37	29	Aichi	Hyogo	Fukuoka	88.7	7.5	3.8	—	—
40	⑧	Rubber products	37	50	Hyogo	Tokyo	Fukuoka	12.7	9.4	38.9	16.1	22.9
41	⑥	Metal stamping	37	71	Tokyo	Osaka	Aichi	73.9	15.1	8.0	3.3	—
42	⑧	Glass	36	60	Tokyo	Osaka	Kanagawa	30.0	20.6	25.7	13.5	10.2
43	④	Agricultural machinery	36	22	Niigata	Osaka	Okayama	40.2	16.5	32.7	10.6	—
44	②	Yarn and thread mills	36	45	Aichi	Osaka	Gifu	12.4	4.3	20.6	28.7	34.0
45	⑥	Paper coating	35	56	Tokyo	Osaka	Aichi	62.5	19.9	30.9		—
46	①	Rolling of non-ferrous metals	35	61	Tokyo	Osaka	Aichi	49.2	16.2	31.1	17.4	16.2
47	⑤	Table ware and cutlery	35	55	Osaka	Niigata	Tokyo	19.1	16.4	15.7		—
48	⑥	Miscellaneous metal products	34	62	Tokyo	Osaka	Aichi	67.9	17.9	24.4	—	—
49	⑥	Fabricated wire products	34	62	Osaka	Tokyo	Kyoto	57.7	17.3	12.8	—	—
50	①	Office machines	34	60	Osaka	Tokyo	Aichi	69.9	13.4	31.1	16.9	
51	①	Measuring instruments	33	56	Tokyo	Osaka	Aichi	38.6	17.6	31.6	8.9	—
52	⑦	Flour and grain mills products	33	23	Hokkaido	Aichi	Shizuoka	41.9	11.7	19.9	—	—
53	①	Electric wire and cable	33	54	Tokyo	Kanagawa	Osaka	68.4	6.4	34.4		45.4

54	②	Iron and steel	33	41	Hyogo	Fukuoka	Osaka	13.8	8.0	18.1	8.6	45.5
55	①	Steel forgings and castings	32	42	Tokyo	Aichi	Osaka	19.8	12.5	33.7		25.7
56	③	Industrial organic chemicals	32	46	Fukuoka	Osaka	Tokyo	28.1	5.7	34.8	21.4	25.3
57	⑥	Knitting mills	32	49	Osaka	Tokyo	Aichi	68.2	13.1	16.1	2.6	—
58	①	Electrical generating and distributing apparatus	32	46	Tokyo	Osaka	Aichi	24.1	10.0	17.1	11.5	37.3
59	①	General industry machinery	32	54	Tokyo	Osaka	Kanagawa	34.8	17.1	28.1	5.9	14.1
60	⑦	Seasonings	31	23	Chiba	Aichi	Hyogo	62.0	10.5	13.6	13.9	
61	⑦	Sawmills and Planing mills	31	21	Hokkaido	Shizuoka	Aichi	82.8	10.2	5.8	1.2	
62	⑥	Miscellaneous machinery	30	46	Osaka	Tokyo	Kanagawa	40.9	12.5	25.6	6.5	14.5
63	⑥	Bolts and nuts	30	64	Tokyo	Osaka	Aichi	73.9	13.8	12.3		—
64	⑥	Iron castings	29	48	Osaka	Saitama	Aichi	55.4	15.8	16.4	12.4	—
65	⑥	Non-ferrous foundries	29	54	Tokyo	Osaka	Aichi	64.3	19.0	16.7		—
66	⑦	Concrete products	28	21	Tokyo	Tochigi	Fukuoka	16.8	15.3	22.9		—
67	⑦	Beverage industries	28	19	Hyogo	Fukuoka	Hiroshima	58.0	7.9	28.6	4.7	
68	①	Fabricated structural metal products	27	56	Tokyo	Osaka	Kanagawa	48.6	14.7	31.4	5.3	
69	⑦	Meat and dairy products	27	34	Hokkaido	Tokyo	Osaka	48.8	21.6	29.6	—	—
70	①	Boilers and turbines	24	41	Osaka	Tokyo	Hyogo	29.5	9.6	23.4	10.8	26.7
71	⑥	Printing	23	49	Tokyo	Osaka	Aichi	63.0	16.9	13.9	6.2	
72	⑥	Paper containers	23	53	Tokyo	Osaka	Aichi	63.7	14.9	21.4		—
73	⑥	Special industry machinery	22	49	Tokyo	Osaka	Shizuoka	60.8	17.3	21.9		—
74	⑥	Furniture	16	34	Tokyo	Osaka	Aichi	80.3	10.6	9.1	—	—
75	⑥	Bakery and confectionery products	12	36	Tokyo	Osaka	Aichi	68.0	11.4	15.7	1.6	3.3

(The writer calculated by the data of 1956 Census of Japanese Manufactures)

chemical fibers, petroleum and cement, which are not listed in the Table for want of data, also belong to this type. They are typical examples of foot-tight type industries.

Type 3. Medium size plants which are market-oriented

Many of them are industries in which medium size plants form the majority. As business enterprises, they are fairly big in scale and show medium regional concentration. This is the type in which several industries are located in their own market centers, dividing the whole domestic market into three or four parts. Drugs and medicines, sugar, and beverage (not in the Table) typify this group.

Type 4. Medium size plants which orient local markets and local raw materials

They are almost similar to Type 3 size and in regional concentration, but one difference is that most of those plants are centered not on general central markets but on dispersed local markets in some cases, or on local raw materials in others.

Type 5. Localized industries

They are formed by the concentration of medium or small industries of the same group. They are dispersed all over the country and are typical examples of cases where location depends largely on external economies. The coefficient of localization ranks middle or high and the actual regional concentration is high as well. Pottery, lacquer ware, woven fabric mills are typical examples.

Type 6. Small plants which orient the central markets

Small and petty industries form the majority and they are concentrated in the Keihin, Hanshin and Chukyo districts. Though the actual regional concentration is rather high, the coefficient of localization ranks middle or low. They fairly resemble in the distribution of the whole industries in general. The names of the groups are given in the Table.

Type 7. Small size plants depending on local raw materials

Most of them are small or petty industries which have a low coefficient of localization. One difference from Type 6 is that they orient local raw materials and some of them orient dispersed local markets as well. Remarkably low concentration in leading prefectures is a characteristic of this type.

These are the distinctive types, which the writer has devised on the basis of the 1956 census, revising Florence's method in consideration of practical conditions in Japan.

IV Comparative study of regional concentration between the 1956 and 1966 data

In order that the picture may be clear, it will be necessary to make a detailed analysis of the industrial scene. Using the minute classification per prefecture given in the "1966 Establishment Census of Japan", the writer proceeds with the study focusing on the change in these ten years.

But in the 1966 census, twice as many groups are noted, and also several new industries are added due to the rapid development of industrial structures. The writer proceeds with his study on the change during this decade by looking at both the coefficient of localization in 1966 and that of 1956 as shown in Table II.

In this Table, 146 groups of industries are shown according to the relative orders of coefficient of localization in the 1966 census and 75 groups in the 1956 census. The writer classifies them into three ranks and surveys the changes in ranks and orders — for example, the type which changed its rank from top to middle, the type which changed its order which is almost the same as changing the rank, the type which changed its rank from middle to bottom, or the change in the opposite direction, and the slight change in order, etc.

(1) Those which have a slight upward change in rank (from bottom to middle)

	Order in the coef. of localization in 1956 → in 1966	Concentration in 3 leading prefectures	Type
Sawmills and planing mills	$\frac{61}{75} \rightarrow \frac{63}{146}$	21% → 20%	⑦
Electric wire and rope	$\frac{53}{75} \rightarrow \frac{85}{146}$	54% → 56%	①
Steel, forgings and castings	$\frac{55}{75} \rightarrow \frac{94}{146}$	42% → 43%	①
Boilers and turbines	$\frac{70}{75} \rightarrow \frac{96}{146}$	41% → 36%	①

(2) Those which show a downward change in rank and order (Type 1)

(a) Downward change in the top rank

Surveying instruments	$\frac{2}{75} \rightarrow \frac{34}{146}$	85% → 78%
Optical instruments and lenses	$\frac{5}{75} \rightarrow \frac{24}{146}$	81% → 73%
Watches and clocks	$\frac{7}{75} \rightarrow \frac{35}{146}$	84% → 62%

Table 2. Coefficient of Localization in 1966

1966	1956	Group of Industry	Coefficient of Localization	3 Leading Prefectures			
				Percentage	1	2	3
1		Cut tobacco	97	100	Tokushima	Niigata	
2		Small arms	81	99	Tokyo	Kanagawa	Shizuoka
3		Cigars	74	40	Chiba	Yamaguchi	Tottori
4		Leather gloves	72	79	Kagawa	Hyogo	Tokyo
5		Rubber scrap products	71	71	Mie	Kagoshima	Akita
6	1	Pottery	71	72	Aichi	Gifu	Saga
7		Pulp mills	66	28	Yamaguchi	Miyagi	Toyama
8		Iron smelting with blast furnaces	64	58	Fukuoka	Kanagawa	Hyogo
9	8	Musical instruments	62	76	Shizuoka	Tokyo	Nagano
10		Rubber foot wear	62	50	Fukuoka	Hyogo	Hiroshima
11		Ophthalmic goods	62	85	Fukui	Osaka	Tokyo
12		Applied electronic equipment	62	85	Tokyo	Kanagawa	Nara
13		Chemical fibres	62	33	Aichi	Ehime	Miyazaki
14		Physical and chemical instruments	61	90	Kyoto	Tokyo	Osaka
15	3	Lacquer ware	61	39	Fukushima	Ishikawa	Wakayama
16		Publishing	60	88	Tokyo	Osaka	Aichi
17		Reclaimed rubber	60	47	Aomori	Hyogo	Okayama
18		Iron smelting not with blast furnaces	59	44	Niigata	Toyama	Yamagata
19	9	Clay refractories	58	54	Okayama	Aichi	Gifu
20		Leather tanning and finishing	57	75	Tokyo	Hyogo	Wakayama
21	6	Silk reeling plants	57	35	Nagano	Gunma	Fukushima
22		Electron tubes and semi-conductor devices	57	59	Kanagawa	Hyogo	Chiba
23		Petroleum refining	56	51	Kanagawa	Tokyo	Yamaguchi
24	5	Optical instruments and lenses	56	73	Tokyo	Nagano	Saitama
25		Other textile goods	55	39	Fukui	Ishikawa	Kyoto
26		Wooden foot wear	55	36	Hiroshima	Shizuoka	Ibaragi

27		Industrial leather products materials	54	66	Osaka	Hyogo	Tokyo
28		Miscellaneous leather products	54	82	Tokyo	Osaka	Saitama
29		Book-binding and printed matters worked	54	84	Tokyo	Osaka	Kyoto
30	10	Electric measuring instruments	53	67	Tokyo	Kanagawa	Nagano
31		Aircraft	53	82	Tokyo	Aichi	Kanagawa
32		Cement	53	49	Fukuoka	Yamaguchi	Tokyo
33		Other petroleum products	53	67	Hyogo	Osaka	Tokyo
34	2	Surveying instruments	52	78	Tokyo	Kanagawa	Osaka
35	7	Watches and clocks	51	62	Tokyo	Nagano	Saitama
36		Fur goods	51	54	Tokyo	Osaka	Hokkaido
37		Precious metal products	51	61	Tokyo	Yamanashi	Hyogo
38		Coated steel	50	68	Osaka	Yamaguchi	Tokyo
39	21	Sea food products	49	30	Hokkaido	Shizuoka	Miyagi
40		Service industries for printing trade	49	79	Tokyo	Osaka	Aichi
41	11	Shipbuilding	48	42	Hiroshima	Hyogo	Kanagawa
42	16	Ropes and nettings	48	40	Aichi	Mie	Hokkaido
43		Coal products	48	54	Fukuoka	Tokyo	Hyogo
44	4	Natural resin and wood chemical products	48	50	Tokyo	Hyogo	Hiroshima
45		Leather foot wear	46	65	Tokyo	Osaka	Nara
46	25	Sugar	46	50	Tokyo	Hokkaido	Kanagawa
47		Industrial leather products	46	76	Osaka	Tokyo	Shizuoka
48		Carbon and graphite products	46	34	Kanagawa	Nagano	Toyama
49		Primary smelting and refining of non-ferrous metals	45	37	Ehime	Tokyo	Shizuoka
50		Luggage	45	77	Tokyo	Osaka	Hyogo
51	14	Electric bulbs	45	61	Tokyo	Kanagawa	Osaka
52	13	Pens and pencils	44	67	Tokyo	Osaka	Kanagawa
53	20	Chemical fertilizers	44	37	Ehime	Tokyo	Yamaguchi
54	24	Rolling mills, except smelting and steel works	44	65	Osaka	Hyogo	Tokyo
55	36	Woven fabric mills	44	37	Aichi	Kyoto	Osaka
56		Lubricating oils and greases	43	69	Osaka	Tokyo	Kanagawa

57		Miscellaneous non-ferrous metal products	43	49	Osaka	Tokyo	Kyoto
58	18	Bicycles, rearcars	43	67	Osaka	Tokyo	Shizuoka
59	15	Communication equipment	43	64	Tokyo	Kanagawa	Osaka
60		Handbags	43	64	Tokyo	Osaka	Saitama
61	19	Paper mills	42	44	Shizuoka	Hokkaido	Tokyo
62		Costume related products	42	58	Tokyo	Osaka	Toyama
63	61	Saw mills and planing mills	42	20	Hokkaido	Shizuoka	Akita
64	44	Yarn and thread mills	42	48	Aichi	Osaka	Gifu
65	27	Textile machinery	41	46	Aichi	Osaka	Ishikawa
66	12	Medical instruments	41	57	Tokyo	Osaka	Kyoto
67		Cigarettes	41	24	Tokyo	Osaka	Hiroshima
68	26	Paper products	40	63	Tokyo	Osaka	Aichi
69	35	Dyeing and finishing textiles	40	50	Aichi	Kyoto	Osaka
70	23	Railroad equipment	40	50	Osaka	Hyogo	Tokyo
71	29	Canned fruits and vegetables	39	24	Yamagata	Hokkaido	Tokyo
72	31	Motor vehicles	39	55	Aichi	Kanagawa	Tokyo
73	17	Drugs and medicines	39	60	Tokyo	Osaka	Saitama
74	22	Oils and Paints	38	67	Tokyo	Osaka	Hyogo
75		Miscellaneous electrical machinery	38	60	Osaka	Tokyo	Kanagawa
76		Tyres and tubes	38	50	Tokyo	Hyogo	Osaka
77		Reclaiming of waste petroleum oils	38	44	Tokyo	Yamaguchi	Fukuoka
78		Religious furniture	38	39	Aichi	Tokyo	Tokushima
79	28	Household electric appliances	38	52	Osaka	Tokyo	Ibaragi
80		Tyre reclaiming plants	38	46	Tokyo	Aichi	Niigata
81	39	Structural clay products	38	36	Aichi	Hyogo	Saitama
82		Steel works	38	58	Hyogo	Aichi	Tokyo
83		Hats	37	68	Tokyo	Osaka	Hyogo
84		Abrasive products	37	40	Aichi	Tokyo	Hiroshima
85	53	Electric wire and cable	36	56	Tokyo	Osaka	Kanagawa
86	46	Rolling of non-ferrous metals	36	53	Osaka	Tokyo	Tochigi

87	43	Agricultural machinery	36	26	Osaka	Okayama	Shimane
88		Secondary smelting of non-ferrous metals	35	59	Tokyo	Osaka	Toyama
89		Plywood products	35	43	Aichi	Hokkaido	Osaka
90	42	Glass	35	59	Tokyo	Osaka	Kanagawa
91		Industrial rubber products	34	55	Tokyo	Aichi	Hyogo
92	50	Office machines	33	57	Tokyo	Osaka	Aichi
93	47	Table ware and cutlery	33	53	Osaka	Tokyo	Niigata
94	55	Steel forgings and castings	33	43	Osaka	Saitama	Aichi
95		Miscellaneous iron and steel	33	61	Osaka	Tokyo	Aichi
96	70	Boilers and turbins	33	36	Hyogo	Tokyo	Osaka
97		Miscellaneous rubber products	33	53	Tokyo	Kanagawa	Osaka
98	51	Measuring instruments	31	52	Tokyo	Osaka	Kanagawa
99		Miscellaneous chemical products	31	60	Tokyo	Osaka	Kanagawa
100	49	Fabricated wire products	31	60	Osaka	Tokyo	Hyogo
101	30	Industrial inorganic chemicals	31	33	Tokyo	Niigata	Osaka
102		Miscellaneous apparel	31	41	Tokyo	Osaka	Kyoto
103		Newspapers	31	58	Tokyo	Osaka	Aichi
104	64	Iron castings	30	43	Osaka	Saitama	Aichi
105	56	Industrial organic chemicals	30	39	Tokyo	Osaka	Kanagawa
106		Outwear	30	42	Tokyo	Osaka	Okayama
107	57	Knitting mills	30	36	Osaka	Tokyo	Aichi
108		Underwear	29	39	Osaka	Tokyo	Aichi
109		Construction and mining machinery	28	40	Tokyo	Kanagawa	Ishikawa
110	48	Miscellaneous metal products	28	59	Tokyo	Osaka	Aichi
111	37	Heating apparatus	28	54	Tokyo	Osaka	Aichi
112	66	Concrete products	28	19	Hokkaido	Tokyo	Fukuoka
113	38	Toys and sporting goods	28	45	Tokyo	Aichi	Saitama
114		Miscellaneous textile mills	28	41	Osaka	Aichi	Tokyo
115		Sliding doors	27	24	Tokyo	Hokkaido	Wakayama
116	67	Beverage industries	27	19	Hyogo	Osaka	Fukuoka

117	60	Seasonings	26	24	Tokyo	Chiba	Aichi
118	65	Non-ferrous foundries	26	43	Tokyo	Osaka	Saitama
119	52	Flour and grain mills products	26	23	Aichi	Kanagawa	Hyogo
120		Paper products	26	37	Tokyo	Osaka	Shizuoka
121	32	Animal and vegetable oil and fats	26	37	Tokyo	Kanagawa	Hyogo
122	45	Paper coating	25	40	Osaka	Tokyo	Saitama
123	34	Tin cans	25	51	Tokyo	Osaka	Kanagawa
124		Miscellaneous stone and clay products	25	25	Tokyo	Aichi	Osaka
125	63	Bolts and nuts	25	59	Osaka	Tokyo	Aichi
126	58	Electrical generating and distributing apparatus	25	52	Osaka	Tokyo	Ibaragi
127	41	Metal stamping	24	55	Tokyo	Osaka	Aichi
128		Miscellaneous transporting equipment	24	46	Osaka	Tokyo	Aichi
129		Paving materials	24	39	Tokyo	Kanagawa	Osaka
130	62	Miscellaneous machinery	24	45	Osaka	Tokyo	Kanagawa
131	59	General industry machinery	24	50	Tokyo	Osaka	Aichi
132		Miscellaneous food products	24	23	Shizuoka	Tokyo	Aichi
133	71	Printing	23	52	Tokyo	Osaka	Aichi
134		Miscellaneous fabricated textile products	23	39	Osaka	Tokyo	Hyogo
135	73	Special industry machinery	22	48	Tokyo	Osaka	Aichi
136		Fabricated plastic products	22	48	Tokyo	Osaka	Aichi
137		Miscellaneous industries	21	32	Tokyo	Osaka	Hyogo
138	33	Metal working machinery	20	44	Tokyo	Osaka	Aichi
139		Miscellaneous wood products	20	26	Aichi	Tokyo	Sizuoka
140	69	Metal and dairy products	19	30	Tokyo	Hokkaido	Osaka
141		Miscellaneous furniture	19	43	Tokyo	Osaka	Aichi
142	74	Furniture	19	34	Tokyo	Aichi	Osaka
143		Wooden containers	18	24	Osaka	Tokyo	Aichi
144	68	Fabricated structural metal products	18	42	Tokyo	Osaka	Kanagawa
145	75	Bakery and confectionery products	14	30	Tokyo	Osaka	Aichi
146	72	Paper containers	13	44	Tokyo	Osaka	Aichi

(1966 Establishment Census of Japan)

Electric measuring instruments	$\frac{10}{75} \rightarrow \frac{30}{146}$	74% → 67%	

(b) Downward change from top to middle

Medical instruments	$\frac{12}{75} \rightarrow \frac{66}{146}$	70% → 57%	
Electric bulbs	$\frac{14}{75} \rightarrow \frac{51}{146}$	79% → 61%	
Communication equipment	$\frac{15}{75} \rightarrow \frac{59}{146}$	78% → 64%	
Bicycles, rearcars	$\frac{18}{75} \rightarrow \frac{58}{146}$	82% → 67%	

(c) Downward change in the middle rank

Household electric appliances	$\frac{28}{75} \rightarrow \frac{79}{146}$	45% → 52%	

(d) Downward change from middle to bottom

Heating apparatus	$\frac{37}{75} \rightarrow \frac{111}{146}$	52% → 54%	
Tin cans	$\frac{34}{75} \rightarrow \frac{123}{146}$	63% → 51%	
Metal working machinery	$\frac{33}{75} \rightarrow \frac{138}{146}$	52% → 44%	

(Other types)

(a) Downward change in the top rank or change from top to middle

			(Type)
Ship building	$\frac{11}{75} \rightarrow \frac{41}{146}$	50% → 42%	②
Chemical fertilizers	$\frac{20}{75} \rightarrow \frac{53}{146}$	30% → 37%	②
Railroad equipment	$\frac{23}{75} \rightarrow \frac{70}{146}$	50% → 50%	②
Drugs and medicines	$\frac{17}{75} \rightarrow \frac{73}{146}$	63% → 60%	③
Oils and paints	$\frac{22}{75} \rightarrow \frac{74}{146}$	74% → 67%	③
Ropes and nettings	$\frac{16}{75} \rightarrow \frac{42}{146}$	49% → 40%	④
Paper mills	$\frac{19}{75} \rightarrow \frac{61}{146}$	39% → 44%	④

Natural resin and wood chemical products $\frac{16}{75} \rightarrow \frac{44}{146}$ 52%→50% ⑤

Pens and pencils $\frac{13}{75} \rightarrow \frac{52}{146}$ 75%→67% ⑥

(b) Downward change from middle to bottom

Animal and vegetable fats $\frac{32}{75} \rightarrow \frac{121}{146}$ 36%→37% ③

Industrial inorganic chemicals $\frac{30}{75} \rightarrow \frac{101}{146}$ 30%→33% ④

Toys and sporting goods $\frac{38}{75} \rightarrow \frac{113}{146}$ 59%→45% ⑥

Paper coating $\frac{45}{75} \rightarrow \frac{122}{146}$ 56%→40% ⑥

Metal stamping $\frac{41}{72} \rightarrow \frac{127}{146}$ 71%→55% ⑥

(3) Little change in relative orders

In those 72 industries which are comparable, except for 4 industries which showed an upward change and 26 of downward change as stated above, there seems to be little change in the 42 industries left.

As a whole, we can see that a few industries moved upward in order and a considerable number of them moved downward. One characteristic change is that there are some industries which have moved to the top rank mainly by dint of the minute classification in the 1966 census, and some have moved into the top rank owing to the technological development during this decade. The writer will examine the relation between the coefficient of localization and business features by types in the next chapter.

V Change of regional characteristics by types

The writer's concern in this article lies in the field of regional development and industrial location in Japan and particularly the central theme is the change of high concentration of foot-loose type industries in Japan. The writer, therefore, will begin the investigation in this chapter by focusing on Type 1 (foot-loose type) and will then refer to other types.

(1) Change in Type 1 (foot-loose type)

Tentatively the writer assigns 25 industries out of 75 which were in the 1956 census to Type 1. The writer is not quite sure if all 25 fit into this type,

but they seem to have similar tendencies. The change in the 25 industries during this decade, as indicated in the above chapter, can be summarized as follows:

(1) Downward change in the top rank in the coefficient of localization 4 industries
Downward change from the top to the middle rank 4 〃
Downward change in the middle rank 1 〃
Downward change from the middle to the bottom rank 3 〃
(2) Upward change from the bottom to the middle rank 3 〃
2 industries out of 10 in the top rank
(3) Little change in orders 4 〃 〃 8 〃 middle 〃
3 〃 〃 7 〃 bottom 〃

To summarize the findings, we can recognize several changes, for instance, a considerable number of foot-loose type industries which had relatively high coefficients of localization before have moved downward to the middle rank, and there have been little changes in the industries which were in the middle or bottom ranks, and a few of them have moved upward from the bottom to the middle rank.

We must pay attention to the fact that such industries as applied electronic equipment, physical and chemical instruments, electron tubes and semi-conductor devices which were not seen in the 1956 census and are thought to Type 1, have appeared in the very high orders in the coefficient of localization.

In the more detailed analysis, we come to the conclusion that the same phenomenon as the rapid expansion of population and industries from urban to suburban areas and the relative decrease of them in the central districts as a result can be seen in Type 1, foot-loose type industries as well.

In other words, the conclusion will be that foot-loose type industries in Japan are still maintaining their concentric character, and the urbanization of suburban areas in terms of population and industries is making the concentration more or less low.

(2) Change in Type 2 (foot-tight type)

In the second type, foot-tight type industries, that is, those which are located both in the central and local districts, out of the three industries which have moved more or less downward in the coefficient of localization, only chemical fertilizer has changed its local condition owing to the technological development during these years and no distinctive change has been seen in others.

That means that the second type industries are still influential in local districts.

(3) Change in other types

Among other types, some leading industries which have moved downward in the coefficient of localization are drugs and medicines, oils and paints, animal and vegetable oils and fats (Type 3), and ropes and nettings, papermills, industrial inorganic chemicals (Type 4).

(a) Type 3 and Type 4

These types in general have shown a considerable trend, but their characteristics in the local condition have changed little within this change.

(b) Type 5 (localized industries)

Type 5, so-called localized industries, has shown little change in the regional concentration. Therefore these industries are still maintaining relatively high regional concentration. Rather, by dint of minute classification in 1966, more industries are picked up distinctly as localized industries, and also many of them rank in the top group. We can assume that this trend is the only result of the fact that the industries which originally had high regional concentration, have classified their characteristics owing to the minute classification in 1966.

(c) Type 6 and Type 7

Type 6 and Type 7 industries in which middle, small and petty industries form the majority, have changed little, except a few of them, as most of them originally occupied low orders in the coefficient of localization.

VI Characteristic changes in the decade

The scale of Japanese industrial activities taken up here through ten years from 1956 to 1966 grew nearly four times as large in production and shipment, and the number of industrial workers on which this article is based almost doubled. The extent of concentration of the workers to the main prefectures shows such a change as indicated in the following table.

Table 3. Change of percentage in 5 prefectures

	No. of workers	
	1956	1966
Total of all prefectures	5,506,000	11,336,000
Tokyo	15.0%	16.3%
Kanagawa	4.7	6.0
Aichi	9.4	8.5
Osaka	11.5	11.0
Hyogo	6.1	5.3
Total	46.7	47.1

("Census of Manufactures, 1956" and "1966 Establishment Census of Japan)

(Source) "Census of Manufactures, 1956" and "1966 Establishment Census of Japan"

Thus we have examined the features of regional concentration according to the enlargement of the Japanese industrial scale.

Now we can summarize the characteristic changes as follows:

(1) A considerable number of changes has occurred in order in the top and middle ranks.

(2) New type industries which occupied heavy positions in the 1966 census, such as electronic industries of the foot-loose type (Type 1) and chemical products of the foot-tight type (Type 2), so-called growing industries, rank relatively high in the coefficient of localization. Type 1 new industries out of them are located mainly in the central industrial districts and Type 2 new industries are located both in the central and local districts. Their typical characteristics have shown little change compared with before.

(3) In contrast with them, quite a lot of Type 1 and Type 2 industries taken up in the 1956 census have moved downward in order in the coefficient of localization. Type 1 has shown fairly wide permeant development in the central industrial districts especially in and around the suburbs of the capital. Type 2 industries, with a few exceptions, have moved a little lower in the coefficient of localization without showing any distinctive change in characteristics.

(4) There seems to have been little change in other types in this decade in local characteristics.

So far we have surveyed the characteristic changes in industrial location in this decade. Today when the regional development policy is under re-examination, it is necessary to proceed with our consideration on the basis of understanding the features of industrial location as a propelling power of regional development. From the public stand point of policy-maker, one should consider well, once at least, the logic of the actual situations of industrial locations, and from the stand point of private business, one also should examine to a large extent what sort of relation will be made between the present trend of location being formed by private business itself and the future regional problems our country will necessarily face.

FUNCTIONS OF SCREEN ACCOUNTS

Nobuko NosÉ

1. Introduction

In the early 1960's the advantages claimed for the screen account, originated in the French national accounting system were known only by a few social accountants.[1] After that it has come to be felt that a new grand design for integrating many branchs of social accounts should be introduced and the traditional system of national accounting such as SNA has to be substituted for the system of accounts based on the grand design. It is also felt that a new type of account for recording transaction in detail and for rerouting the transaction flow from one branch to another is required as a key device in the new system. The interest in the screen account has been growing and its applications have been tried by leading social accountants.

In this article we intend to analyse the specific functions of the screen account with aids of matrix notation and of account forms proper.

2. The Characters and Functions of the Screen Account

There are three basic characters of the screen account which has been utilized by the French system:

i The screen account, an account for transaction categories, i.e. commodity, factor service and transfer, is linked with the transactor account. Every transaction is recorded first in the screen account as a sub-account of the transactor account and we are able to read the operation in detail of any transactor in the accounting period, otherwise we can not have any information in detail.

ii In any system with screen accounts, direct relationships between sectors are broken down because the screen account is set between transactor accounts as a screen in the system and the transaction flows between transactor accounts (or sector accounts) can be closed only via screen accounts as shown in table 1.

The first quadrant of table 1 where rows and columns of screen accounts intersect together is as empty as the fourth quadrant where rows and columns of transactor accounts intersect, while it is remarkable that transaction flows are

(1) P. Ady and M. Courcier, Systems of National Accounts in Africa, (OEEC, Paris, 1960). G. Stuvel, Systems of Social Accounts, (Clarendon Press, Oxford, 1965).

Table 1. The transaction flows in the system with transactor accounts and screen accounts

dr / cr	Commodity 1	Commodity 2	Sector 1	Sector 2	Resources transacted
Commodity 1			t^1_{+1}	t^1_{+2}	t^1
Commodity 2			t^2_{+1}	t^2_{+2}	t^2
Sector 1	t^1_{-1}	t^2_{-1}			
Sector 2	t^1_{-2}	t^2_{-2}			
Use of resources	$t^{1\prime}$	$t^{2\prime}$			

Table 2. The macro-accounting system with screen accounts

	dr / cr		Screen account				Transactor account							Total
							Production a/c		Income a/c		Capital a/c		Consolidated a/c	
			Goods & services	Factor services	Transfer	Claim	Sector 1	Sector 2	Sector 1	Sector 2	Sector 1	Sector 2	R.O.W.	
Screen account	Goods & services						52	15	168	41		4	49	329
	Factor services						202	31					9	242
	Transfer								15	9				24
	Claim										1		3	4
Transactor account	Production a/c	Sector 1	232								4	18		254
		Sector 2	46											46
	Income a/c	Sector 1		188										188
		Sector 2		50	20									70
	Capital a/c	Sector 1							5					5
		Sector 2				2				20				22
	Consolidated a/c	R.O.W.	51	4	4	4								61
Total			329	242	24	4	254	46	188	70	5	22	61	1, 256

concentrated on the second quadrant and the third quadrant respectively.

iii The accounting system with screen accounts can be extended and elaborated for analyzing an economy as a whole. This system is written in a matrix form as is shown in table 2.

The functions of the screen account, derived from these characters above mentioned are as follows:

A. Function of serving as a means of showing transaction structure by transaction categories.

There are some convenient ways which are applicable to show the transaction flow in detail when we are not contented with aggregative information available from aggregative systems of accounts like OEEC/UN system and when we wish to get more disaggregative information of the transaction structure for building the disaggregative model. They are i to deconsolidate of sector accounts, ii to show individual items in supplementary tables of aggregative accounts, iii to adopt the semi-articulated system, and iv to adopt the system with screen accounts. The last one (iv) is a more operational and consistent method than the others because they have more demerits, that is, the adoption of i, which is the best method from the theoretical point of view, is difficult and infeasible from the statistical point of view because by deconsolidation of sector accounts the cells in the matrix concerned increase enormously in numbers and accordingly the informations to give contents in the cells required also grow larger in numbers; ways ii and iii are more feasible than i, but they have another obstacle, that is, we fail to observe constituent transactions in the state of response of entries of them and their counter-entries because the individual items of transaction are not connected with its counterpart but are connected only with the aggregates in these systems. This is a common demerit of the systems of ii and iii. The system with screen accounts has greater virtue than all the others as it can provide disaggregative informations by transaction categories which are recorded on the screen accounts as sub-accounts of the transactor account. In this system it is not necessary to deconsolidate transactor accounts further. Instead of doing this, screen accounts are built in the system to show transactors' operations by transaction categories. The transaction flow is able to be analyzed in double view — aggregative and disaggregative, and the network of the transaction flow in an economy can be maintained without loose ends because both accounts — transactor accounts and screen accounts — are linked together and any transactor account is linked with each other through screen accounts.

The system with screen accounts is, therefore, a comprehensive system for excluding obstacles in observing the constituent elements in the transaction flow without loose ends. This function of screen accounts was discovered and has been utilized by the French system.

B. Function of serving as an operational system for articulating the transaction flow. To get a fully articulated system where all transaction flows are recorded on 'to whom from whom' basis, is beyond our present statistical ability, because on the part of the payable flow it is difficult to ascertain the sector of destination

and on the part of the receivable flow it is also difficult to do the sector of origin. For this reason we must abandon the ideal way and are obliged to take a more operational way as a substitute. As the operational way we have alternative system: the semi-articulated system and the system with screen accounts. The former is limited because it can articulate only the aggregates of transaction flow but it fails to articulate the constituent elements of the aggregates in the system. On the contrary, in the system with screen accounts, the whole transaction flow — not only the aggregative flow but also the elements of the transaction flow in detail — can be closed because the screen accounts serve as record keepers for the items of the transaction flow which can not find their counter-entry whithin the system. The screen account performs this function as if in the market where every transaction flow from the sectors of origin and of destination is met and the *ex post* equality of supply and demand is attainable in either case where the entry or its counter-entry is identifiable or not in the numerous transactor accounts. Moreover, from the record of market one can estimate the amounts of the transaction flows that came to the market.

The screen account is, called 'market account', by its attribute of market proper i.e. intermediating sectors of origin to sectors of destination and keeping records of transactions.

Transaction flow, composed of individual transactions as constituent elements are thus able to be closed by this accounting device even when entries of transactions in one transactor account cannot find the counter-entries in another, that is, even when there are many loose ends in the system. This function was discovered by Dr. Stuvel.

C. Function of serving as a substitute for disaggregating the sector account.

This function, derived as a corollary from the above A and B, has double merits: i the function of serving for elaborating and decomposing the transaction flow of the transactor instead of deconsolidating the sector account, and ii the function to serving for disaggregating the aggregates into separate accounts according to the many operations performed by a transactor in the accounting period.

As for ii the screen account is serving in the French system where the business sector is limited not *on the establishment basis* but on *the institutional basis*. And in SAM for the Cambridge model, they combined the screen accounts and the industry accounts instead of decomposing industries by the commodities which they produce. The screen account of the commodity is called commodity account, and we shall specify it in later.

As for ii, it serves for the system in which the transactors' operations are

various and are required to be analyzed by number of transaction categories. The typical example is the system of flow of funds accounts where it is required to represent the flow of funds from the viewpoint of the 'who owes what to whom' basis. In the system of flow of funds analysts intend to observe the transaction flow by three dimensions, i.e. transactor, his counterpart, and the categories of financial claims which ascertain the transactors' portfolio selection. Hence, the screen accounts are applicable as useful accounting devices in this flow of funds accounting and we shall refer to this problem later it again.

D. Function of serving as a channel of many macro-accounting systems.

i. Functions of classifying and converting the transaction flow in the input-output accounting.

They are the main functions of the commodity account.

Table 3. Commodity flow in the system with dual classification of production account

cr / dr	Commodity 1	Commodity 2	Industry 1	Industry 2	Institutional sectors	The other all accounts consolidated	Total
Commodity 1			$\boldsymbol{T}_{11}{}^{1}$	$\boldsymbol{T}_{12}{}^{1}$	$T_{1C}{}^{1}$	$T_{1R}{}^{1}$	t^{1}
Commodity 2			$\boldsymbol{T}_{21}{}^{2}$	$\boldsymbol{T}_{22}{}^{2}$	$T_{2C}{}^{2}$	$T_{2R}{}^{2}$	t^{2}
Industry 1	$T_{11}{}^{1}$	$T_{12}{}^{2}$					t_1
Industry 2	$T_{21}{}^{1}$	$T_{22}{}^{2}$					t_2
Institutional sectors						T_{CR}	t_C
The other all accounts consolidated			T_{R1}	T_{R2}	T_{RC}	T_{RR}	t_R
Total	$t^{1\prime}$	$t^{2\prime}$	$t_1{}'$	$t_2{}'$	t'_C	t'_R	

As for the classifying function, we will get table 3 first, of production accounts into the commodity accounts and the industry accounts, by deconsolidating. The four entries $\begin{pmatrix} \boldsymbol{T}_{11}^{1} & \boldsymbol{T}_{21}^{2} \\ \boldsymbol{T}_{12}^{1} & \boldsymbol{T}_{22}^{2} \end{pmatrix}$ in the upper middle in the table, are elements of $T^{1.2}$ of the symbolic SAM i.e. Absorption Matrix and the four entries $\begin{pmatrix} T_{11}^{1} & T_{12}^{2} \\ T_{21}^{1} & T_{22}^{2} \end{pmatrix}$ in the left hand side in the table, are elements of $T^{2.1}$ i.e. Make Matrix $\boldsymbol{T}$ shows a group of commodities and T shows a group of products produced in industries respectively.

The products of one industry are not homogeneous because the products

(2) G. Stuvel, Systems of Social Accounts, ibid.

of any establishment which is an accounting unit of an industry in input-output accounting are composed not only of its principal product but also subsidiary products which should be classified as principal products of the other industries.

The usefulness of table 3 is as follows: it works as serviciable to be an acid test by which one can examine whether an industry's input-output coefficients are more reliable than commodity-input-output coefficients, that is to say, whether the assumption of industry technology should be favored or the assumption of commodity technology should be. This is because the table shows that there is one to one correspondence between the products of industries and the commodities if and when the elements of T^1_{21} and T^2_{12}, the elements which exist away from the leading diagonal of $T^{2.1}$, are almost all zero but that there is no one to one correspondence between then if and where the elements are considerably big, that is, when the share of any commodity spreads over industries. As it will be easily understood, the former case is fit for the industry technology assumption while the latter is for the commodity technology assumption. In the latter case, $T^{1.2}$ i.e. $\begin{pmatrix} \boldsymbol{T}^1_{12} & \boldsymbol{T}^1_{12} \\ \boldsymbol{T}^2_{21} & \boldsymbol{T}^2_{22} \end{pmatrix}$ is required for estimating exact input-output coefficients matrix.

Thus the commodity account is a useful accounting device for analyzing the input-output structure of economy and for showing commodity flow from the industry, where commodities are actually produced either as principal products or as subsidiary ones, to the sector of destination where the commodities are actually utilized.

As for the converting function of the commodity account, it serves for the system integrated by the input-output accounts and the other social accounts. The transaction flows of commodities on the input-output tables are classified by industry i.e. on industry basis. It should be remarked that the same transaction flows are classified according to the government purposes *when* they are recorded in the government account, but that they are classified according to the order of the private consumers' purposes like a consumer's shopping list *when* they are recorded in the private consumers' account. There is no one to one correspondence between the items classified in the production accounts of industries and the items of the expenditure classified in the accounts of general government or of the account of consumer's sector. Then is required, a common accounting device for connecting the same transactions classified on different basis with each other and the commodity account is called to serve for this purpose. By using the commodity account as a common sub-account of many systems with multiple classifications, the flows of government expenditure and of private consumers' consumption classified on their respective basis are reclassi-

Tabe 4. Conversion of the government expenditure into the commodity groups.

4 A Government income and outlay a/c

Defence	1,611	Income	4,189
Health, education & child care	1,548		
Other	1,030		
	4,189		4, 189

4 B Government expenditure reclassified by commodities and other

Screen accounts	Defence	Health, education, child care	Other
Commodity 1	74	46	41
Commodity 2	637	62	98
Commodity 3	28	147	39
Commodity 4	23	266	67
Net indirect tax	10	20	14
The other all accounts consolidated	839	1, 007	771
Total	1,611	1,548	1,030

4 C Classification converter matrix (government expenditure)

	Defence	Health, education, child care	Other
Commodity 1	0. 05	0. 03	0. 04
Commodity 2	0. 40	0. 04	0. 10
Commodity 3	0. 02	0. 09	0. 04
Commodity 4	0. 01	0. 17	0. 07
Net indirect tax	0. 01	0. 01	0. 01
The other all accounts consolidated	0. 52	0. 65	0. 75

fied and converted into the categories on the industry basis by every item as table 4 and 5 show respectively.

Table 4A shows the government expenditure classified for government purposes and table 4B shows the account resulting from the conversion of 4A into commodity account on the industry basis. Only after routing through the commodity account, it is possible to estimate the exact effect of the expenditure flow of the government on the industries. And table 4C, the matrix of classification converters derived from tables 4A and 4B can be applicable to reclassify the government expenditure. As the coefficients in table 4C are stable in the

Table 5. Conversion of the private consumers' expenditure into the commodity groups

5 A. Consumers' income and outlay a/c

Food, drink, tobacco	**7,041**	Current income	**16,429**
Clothing & household	**4,918**		
Other	**4,470**		
	16,429		16, 429

5 B. Consumers' expenditure reclassified by commodities and other

Screen accounts	Food, drink, tobacco	Clothing & household	Other
Commodity 1	0	647	94
Commodity 2	0	373	88
Commodity 3	4, 046	1, 363	381
Commodity 4	1, 478	878	2, 569
Net indirect tax	1, 221	353	372
The other all accounts consolidated	296	1, 294	966
Total	**7,041**	**4,918**	**4,470**

5 C. Classification converter matrix (consumers' expenditure)

	Food, drink, tabacco	Clothing & household	Other
Commodity 1	0	0. 13	0. 02
Commodity 2	0	0. 08	0. 02
Commodity 3	0. 57	0. 27	0. 09
Commodity 4	0. 21	0. 18	0. 57
Net indirect tax	0. 17	0. 07	0. 08
The other all accounts consolidated	0. 04	0. 26	0. 22

short run, by using this classification converter matrix, we can immediately get the government's final demand on commodity classified on the industry basis. Table 5 also shows the reclassification of consumers' expenditure into the demand for the product on industry basis. This is the table for showing the conversion of the private consumption flow based on the consumer's shopping list into the commodities classified on the industry basis.

This function of classification and conversion is found by Prof. Stone and his followers in 'Social Accounting Matrix' i.e. SAM[3] and is used again in

(3) Cambridge, Department of Applied Economics. A Social Accounting Matrix for

'Proposals for revision of the SNA'.(4) ii. Functions of connecting the real account with the financial account and of connecting the system of flow accounts with balance sheet.

These functions of screen account are specified as those of so-called dummy account.

As for the first function, the dummy account serves to integrate the two types of sub-account of the capital account i.e. the capital expenditure account as a real account and the capital financing account as a financial account. To explain this, let us take the inventory formation as a kind of investment. The inventory formation is a transaction between commodity account i.e. the account of fuels and low materials and capital expenditure account and is recorded on the cells where the row of the commodity account concerned intersects the column of capital expenditure account. Then, the record of the finance for this inventory formation, shown in the capital financing account, does not give any information as to how that purchase for inventory formation by the industry is financed, because there is no one to one correspondence between the elements of industry's capital expenditure account classified on the industry basis and those of business sector's capital financing account classified on the institutional basis. Therefore in order to integrate the two types of sub-accounts based on the different criterion, it is required to have the dummy account which links them up. The items of capital expenditure, i.e. inventory formation and fixed asset formation, are put into the credit side of the dummy account as uses of funds, and the items of the financing flow, i.e. saving, borrowing from the other sectors, and depreciation, are put into as sources of funds.

The dummy account is also used to give a link between value added, a sub-account of the production account recorded on the industry basis, and factor incomes as sub-accounts of income and outlay account of the institutional sector.

As for the second function, the dummy account is introduced for connecting the capital expenditure account with the sector balance sheet. The sector balance sheet is, in the present state, provided only with one type i.e. balance sheet on the institutional basis. It is easy and straight forward to integrate the capital financing account and the sector balance sheet because both of them are on a common institutional basis and there is a definitional relationship which

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1960. N. 2 in A Programme for Growth, 1962. Stone, R. Multiple Classifications in Social Accounting, in 'Mathematics in the Social Sciences and Other Essays', (Champman and Hall, London, 1966).

(4) UN, A System of National Accounts (Proposals for the Revision of the SNA, 1952). E/CN, 3/320, (UN, New York, 1965). UN, Proposals for Revising the SNA, 1952. E/CN, 3/345, (UN, New York, 1966). UN, Proposals for the Revision of the SNA, 1952. E/CN, 3/356, (UN, New York, 1967).

we denote as $A_1 \equiv A_0 + \Delta F + R$ and $L_1 \equiv L_0 + \Delta F + R$ (where A, ΔF, R, and L are asset, increment of asset, item of revaluation, and liability respectively and subscripts 0 and 1 denote the beginning of the accounting period and the end of the period respectively). On the other hand, in order to connect the capital expenditure account with the sector balance sheet, it is necessary first to take a more roundabout way of rerouting the flow of real capital formation into that of capital financing account through the dummy account as above mentioned and then to sum the amount of capital financing, the amount of revaluation, and the amount of capital in the opening sector balance sheet to get the closing sector balance sheet.

The dummy account, which converts the elements of the capital expenditure account classified on the activity basis into the elements of the capital financing account classified on the institutional basis, has a pure property of the screen account. By this dummy account, two different types of accounting system, namely, sub-accounts of the capital account and the systems of flow account and stock account (sector balance sheet) are integrated at every transaction categories.

3. Screen Account in Present and in Future

It is in the Social Accounting Matrix that the screen account has been built to arrange the transaction flow to fit a disaggregative model i.e. the Cambridge model which is composed of various elements such as input-output matrix, capital matrix, consumption function, Cob-Douglous function, and the required rate of growth. The model being far from simple and static macro-model, the informations available from traditional systems of macro-accounts i.e. Blue Book and Yellow Book (The 1954 input-output tables for the United Kingdom) were not suitable and so a new elaborated system of accounts with screen accounts i.e. SAM was introduced.

SAM is a big step toward a comprehensive and integral system of social accounts. After this experience, the 'proposals for revision of SNA' demonstrated a revolutionary system based on the grand design attained the integration of the systems of social accounts and was fit for disaggregative model. In the system, the screen account was used again as a key accounting device. The wider use of the screen account is obviously due to its virtue — its various functions as has been explained.

The screen account in future use. The screen account tends to be adopted wider in social accounting system. There are some reasons to support our assumption: Firstly, there is a tendency to deconsolidate the type of real

account and that type of the financial account move on their basis respectively. On the other hand, it is also aimed to integrate the two types of account deconsolidated or to give a knot for real-financial dichotomy from a viewpoint of a sinthestic dimension. For example we wish to have a statement of capital goods classified by age of capital goods, kind of capital goods and by industry as a user of them, and on the other hand we wish to have a balance sheet classified by size of capital, type of organization of business and the region where the business is located. And we also wish to have a general integrated balance sheet out of two different types of balance sheets i.e. the balance sheets on the industry basis and on the institutional basis. Thus the screen account is required to provide an indispensable channel between the two accounting systems on different basis.

Secondly, the proper nature of screen account for showing the operation of transactor in detail is still useful and this function should be applied wider than now. This is true especially in financial accounting. The financial activity which any institutional sector performs is observable only in the screen account of claim where the financial transactions are recorded by kinds of claim classified by different degree of liquidity and date of maturity, etc. Obviously it is an important merit of the screen account of claim to serve for analyzing how the sector selects his portfolio from among many financial objects and then to serve for getting the matrix of financial expenditure coefficients. The form of accounts which is used by financial accountants is a traditional form of financial accounts. But it can be expected that the present form of accounts will tend to change for a more concise system in matrix form and the system with screen accounts for getting better information.

From all of these considerations we conclude that the screen account is applicable the most useful weapon in many realms of social accounting systems.

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ON MR. STOLERU'S OPTIMAL POLICY FOR ECONOMIC GROWTH

Hikoji KATANO

Introduction

1. Mr. Stoleru [1] has dealt with the problem of optimal investment allocation between capital goods and consumer goods industries in a developing country. Using a new mathematical method (Pontryagin's Maximum Principle),(1) he has achieved the definition of an optimal investment policy.

The purpose of his study is to determine the best way to allocate investment in a developing country where there is severe unemployment. In this case, he means to make precise the words "best way" by specifying the following two goals: (1) to reach full employment as soon as possible in such a way that balanced growth is possible afterward, and (2) to produce a maximum total discounted amount of consumer goods.(2)

The method of his study is to build a simple two sector model with a capital goods sector and a consumer goods sector, in both of which a fixed coefficient of production prevails. Then the optimal investment allocation between the two sectors is obtained by using the Pontryagin's Maximum Principle. The general conclusion is to invest in the capital goods sector at the highest rate during the first phase, and then to shift all investment to the consumer goods sector in the second phase. Finally, the economy expands along the balanced growth path (von Newmann path) during the last stage.

We consider this general conclusion to be the completed version of Mahalanobis [4] — Domar [2] — Dobb [1]'s economic growth theory of developing countries. These economists have suggested only the investment allocation pattern in the first stage mentioned above.(3)

2. In this paper, we examine Mr. Stoleru's employment problem: to reach full employment as soon as possible in such a way that balanced growth is pos-

(1) Cf. L. S. Pontryagin et al. [5].

(2) As a refinement of this criteria, Mr. Stoleru adds the constraint that a minimum level of per capita consumption is fixed each year.

(3) M. Dobb has touched the investment allocation pattern in the second stage. But his consideration is not concerned with the balanced growth path after full employment is achieved.

sible afterward. Our findings are the followings:

(1) Full employment can not always be achieved within a minimum time horizon under the condition that balanced growth is possible afterward.

(2) To reach full employment within a minimum time horizon, appropriate technical choice is needed.

Mr. Stoleru's Growth Model.

3. Mr. Stoleru's growth model is composed of the following relations.

A. Labour Supply: Total labour supply $L(t)$ grows at a constant rate n at the same time the total population grows.

$$(1)\quad L(t)=L(0)\ e^{nt}$$

B. Production Function: The growth model is composed of two sectors, one producing capital goods and the other producing consumer goods. We define the following notations:

	Capital Goods Sector	Consumer Goods Sector
Output	X_1	X_2
Captal	K_1	K_2
Employment	N_1	N_2
Captal-Output ratio	$1/\beta_1$	$1/\beta_2$
Labour-Capital ratio	α_1	α_2

Then we have the following production functions:

$$(2)\quad X_1=\beta_1 K_1\ , \qquad X_2=\beta_2 K_2\ ,$$

$$(3)\quad N_1=\alpha_1 K_1\ , \qquad N_2=\alpha_2 K_2\ .$$

C. Investment: There is no foreign aid, no lag between production of capital goods and investment, no possible shift of existing capital from one sector to the other, no depreciation prevailing in both sectors.[4] Using the general notations $\dot{x}=dx/dt$, we have the equations of capital accumulation:

$$(4)\quad \begin{aligned} &X_1=\dot{K}_1+\dot{K}_2 \\ &\dot{K}_1\geqq 0 \\ &\dot{K}_2\geqq 0 \end{aligned}$$

D. Allocation of Investment: We now introduce a control variable $u(t)$ defined

(4) In the original paper of Mr. Stoleru, depreciation in both sectors have been considered. But, in this paper, we neglect depreciation for the sake of simplicity.

as a ratio of gross investment in the capital goods sector to total gross investment,

$$(5)\quad u=\frac{\dot{K}_1}{\dot{K}_1+\dot{K}_2}$$

E. Balanced Growth: With the above definitions, we have

$$(6)\quad \begin{aligned}\dot{K}_1&=u\beta_1K_1\\ \dot{K}_2&=(1-u)\beta_1K_1\end{aligned}$$

for $0\leq u\leq 1$.

Let us suppose that full employment is achieved after some time T. This can be written as

$$(7)\quad \alpha_1K_1+\alpha_2K_2=L(0)\ e^{nt}$$

for $t\geq T$. So that we have

$$(8)\quad \begin{aligned}\dot{K}_1+\dot{K}_2\ &=\beta_1K_1\\ \alpha_1K_1+\alpha_2K_2&=L(0)\ e^{nt}\end{aligned}\qquad \text{for}\quad t\geq T.$$

This systems has the solution

$$(9)\quad \begin{aligned}K_1(t)&=Ae^{nt}+e^{C(t-T)}[K_1(T)-Ae^{nT}]\\ K_2(t)&=Be^{nt}+e^{C(t-T)}[K_2(T)-Be^{nT}]\end{aligned},\qquad \text{for}\quad t\geq T,$$

where

$$A=\frac{nL(0)}{(\beta_1-n)\alpha_2+n\alpha_1}$$

$$B=\frac{(\beta_1-n)L(0)}{(\beta_1-n)\alpha_2+n\alpha_1}$$

$$C=\frac{\beta_1\alpha_2}{\alpha_2-\alpha_1}$$

A balanced growth is possible only for the specified values of $K_1(T)$ and $K_2(T)$. The balanced growth path, known as the von Neumann maximal steady growth path, is obtained when

$$(10)\quad \begin{aligned}K_1(T)&=Ae^{nT}\\ K_2(T)&=Be^{nT}\end{aligned},$$

and the economy is then expanding at the rate of the growth of population.

After all, Mr. Stoleru restricts his study to the path which reaches the von Neumann path at some time T and then follows it. Therefore, the growth model becomes as follows:

1) Before full employment ($t \leq T$),

(i) equations

$$\dot{K}_1 = u\beta_1 K_1$$
$$\dot{K}_2 = (1-u)\beta_1 K_1$$

where $K_1(0)$ and $K_2(0)$ are given,

(ii) conditions on the control variable

$$0 \leq u(t) \leq 1 \quad ,$$

(iii) path condition

$$\alpha_1 K_1 + \alpha_2 K_2 < L(0)e^{nt} \qquad \text{for } t < T \quad ,$$

(iv) terminal conditions

$$K_1(T) = Ae^{nT}$$
$$K_2(T) = Be^{nT} \quad .$$

2) After full employment ($t \geq T$)

$$K_1(t) = Ae^{nt}$$
$$K_2(t) = Be^{nt} \quad .$$

Then Mr. Stoleru's employment problem is *to find the policy $u(t)$ which minimizes T.*

Mr. Stoleru's Optimal Policy.

4. The employment problem can be solved by using the Pontryagin's Maximum Principle. The solution is

$$(11) \quad \begin{matrix} u(t)=1 \\ u(t)=0 \end{matrix} \quad \text{for} \quad \begin{matrix} 0 \leq t \leq \tau \\ \tau \leq t \leq T \end{matrix} ,$$

where τ and T are determined by the system

$$K_1(T) = K_1(0)e^{\beta_1 \tau} = Ae^{nT}$$
$$K_2(T) = K_2(0) + K_1(0)e^{\beta_1 \tau}(T-\tau) = Be^{nT}.$$

Thus the optimal investment policy will be to concentrate all invesment to the capital goods sector in the first stage ($0 \leq t \leq \tau$), and then to shift all investment to the consumer goods sector in the second stage ($\tau \leq t \leq T$). And finally, the economy expands along the balanced growth path during the last stage ($t \leq T$).

Growth Frontier

5. Taking the optimal investment policy (11), we can find a growth frontier at time T. The growth frontier is reduced from (11) by eliminating the turning time point τ.

$$(13)\quad \frac{K_2(T)-K_2(0)}{K_1(T)}=T-\log\frac{K_1(T)}{K_1(0)}$$
$$K_1(T)\geq K_1(0)$$
$$K_2(T)\geq K_2(0)$$

This frontier has characteristics to be a concave to the point $S[K_1(0), K_2(0)]$, and to extend in itself at a certain rate toward the north-east direction.

6. Mr. Stoleru's full employment situation is located at the point $F[K_1(T), K_2(T)]$ on Figure 1. This situation $[K_1(T), K_2(T), T]$ is determined by the system (10) and (13). Tangent of the straight line OF is $(\beta_1-n)/n$. Mr. Stoleru's optimal growth path is then illustrated by $S\to R\to F\to E$ on Figure 1.

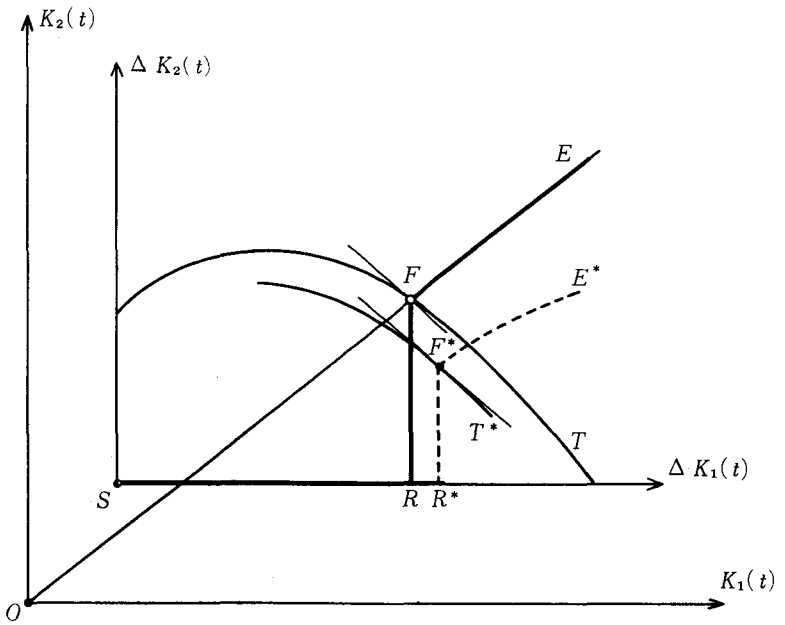


Figure. 1

Full Employment Level

7. By neglecting the condition that balanced growth is possible after full

employment is achieved, we can have a full employment situation which is attained within a minimum time horizon under the given condition. The full employment situation is expressed by the relation (7). We call this relation the full employment level, which expands at a certain rate toward the north-east direction. The full employment within a minimum time horizon is attained at the point whose the growth frontier touches the full employment level. To reach the full employment situation within a minimum time horizon, the rate to expand the growth frontier must be larger than the rate to expand the full employment level. Otherwise, the growth frontier can not come up to the full employment level. Thus the condition that makes it possible to reach full employment within a minimum time horizon is written as

$$(14)\quad \frac{K_2(T)-K_2(0)}{K_1(T)}=1-\frac{\alpha_1}{\alpha_2}$$

Then the full employment situation within a minimum time horizon $[K_1(T^*), K_2(T)^*, T^*]$ is determined by the system (7), (13) and (14).

Balanced growth or Full Employment within a Minimum Time

8. Let us illustrate the full employment situation within a minimum time horizon by the point F^* on Figure 1. Point F does not always identify point F^*. And when the point F is different from the point F^*, time T^* is necessarily less than T. This is verified by the fact that the growth frontier touches the full employment level at the point F^* but the former crosses the latter at the point F.

9. When full employment is attained at the point F^*, a balanced growth can not be expected afterward. Therefore, the growth path that leads to the point F^* is not optimal. Thus it is clear that balanced growth contradicts the term of full employment within a minimum time horizon.

Optimal Choice of Technique

10. In the next stage, we have to consider the optimal choice of technique. If we can expect full employment within a minimum time horizon T^{**} that is less than T^* after any appropriate choice of technique, we call it the optimal choice of technique.

Eliminating $K_1(T)$ and $K_2(T)$ in the system (7), (13) and (14), we have

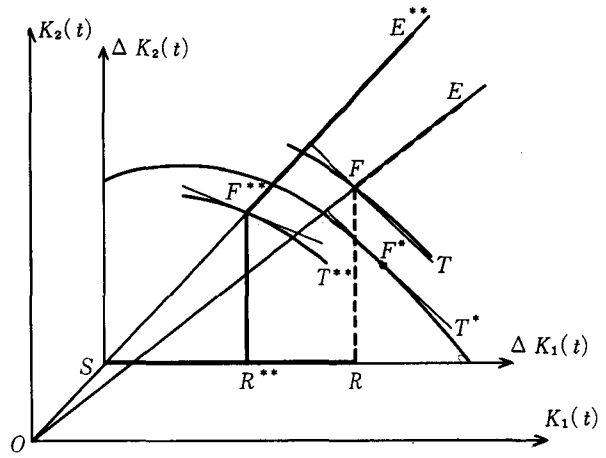
$$(15)\quad L(0)e^{nT}=\alpha_2 K_2(0)+\alpha_2 K_1(0)e^{\beta_1 T-\left(1-\frac{\alpha_1}{\alpha_2}\right)}.$$

So that we have

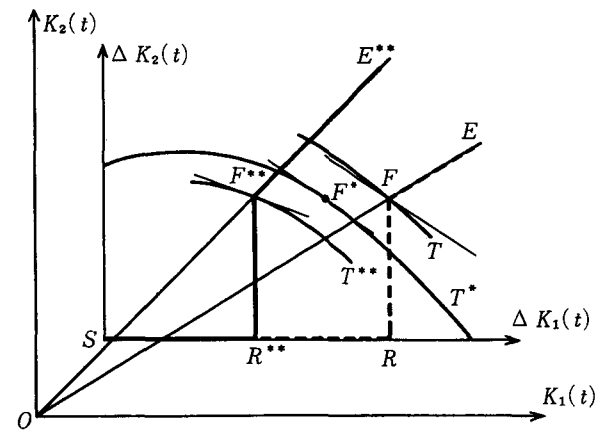
$$(16)\quad \frac{dT}{d\beta_1}<0\,,$$

$$(17)\quad \frac{dT}{d(\alpha_2/\alpha_1)}<0\,.$$

Decreasing the time T required for attaining full employment, the optimal choice of technique is to increase either β_1 or α_2/α_1. The appropriate combination of both of these makes it possible to decrease the time required for attaining full



(a)



(b)

Figure. 2

employment. The optimal situation can be realized at point F^{**}, where the growth frontier touches the full employment level and

$$\frac{K_2(T^{**})}{K_1(T^{**})}=\frac{\beta_1^*-n}{n}.$$

Thus the optimal growth path is illustrated as $S\to R^{**}\to F^{**}\to E^{**}$ on Figure 2. This optimal path can be realized after the optimal choice of technique.

(October, 1968)

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A NOTE ON SHORTER WORKING HOURS FOR SEAMEN

Hiromasa YAMAMOTO

After the introduction of the three-shift system on board of ships, the demand of seamen for shorter working hours has not resulted in the actual reduction of working hours, as demanded by the seamen, but has produced a shorter standard working week accompanied by an increase of overtime earnings. Though seamen of different countries have obtained standard working weeks of different length, all have in common that they work on a fifty-six-hour regular working week. This fact may lead to the opinion that the demands of seamen for shorter working hours in recent years are related only to wage calculation without any relationship to the regulation on actual working hours. However, the writer considers that their demands originate, similar to those of workers on land, from the protest against overwork and the desire for more leisure time. Based on this standpoint the writer will examine the relationship between the problem of shorter working hours and the early retirement of young seamen from the industry, as witnessed in many countries, and to propose ways for retaining seamen in the shipping industry.

I

Workers demand shorter standard working-days or working-weeks as one of their general demands for the improvement of their working conditions. The demands are based on the opinion that long working hours bring fatigue which could lead eventually to diseases and or absence from work. The labour movement of setting up a eight-hour working day was born as a protest against unhealthy long hours of work of ten hours and more. This state of affairs was gradually corrected by the labour movement for shortening working hours and the enforcement of the factory acts regulating hours of work. The change was partly due to the change of employers' attitude who recognized that shorter working days usually resulted in higher productivity of labour and it was not necessarily accompanied by the reduction of the total output.

With increasing income and shortening of working hours, the demands or workers for still shorter hours of work derive from a slightly different viewpoint. They put the stress on getting more leisure time not only for resting but

for their hobbies, studies and shopping, although some of them who are working under severe working conditions continue to demand shorter working hours as a requirement for their health.

Sometimes union leaders demand shorter working hours as a weapon against a decreasing demand for labour when a recession causes unemployment among union members. However, historically speaking working hours have shown a steadily decreasing trend following the pace set by the economic growth and the rise of the income level.

II

In the present time seamen of most countries work at sea on a basis of a fifty-six hour working week with a three shift system according to the provisions in trade agreements or the seamen's acts except in the case of small vessels where the two-shift system is maintained. Though it is not our intention to describe the change of working hours at sea in detail,(1) it is useful to indicate it briefly. At the beginning of this century seamen worked at sea on the two-shift system, and working hours sometimes amounted to seventeen or more hours without any extra overtime payment. Gradually the three-shift system was introduced on ocean-going vessels of various countries, and extended to cover smaller vessels. In 1936 the I.L.O. Maritime Convention adopted a convention according to which the hours of work at sea should not exceed eight in a day nor should they exceed fifty-six hours in a week for the crew on board of ships of 2,000 gross tons and over.(2) Later in 1947 and 1957 the I.L.O. adopted new conventions on hours of work which remedied shortcomings and extended the coverage of the old conventions.(3)

After the introduction of the three-shift system on board of ships, the movement by seamen for shorter hours of work has not resulted in an appreciable reduction of working hours at sea though the standard working week has gradually been shortened. For example, in the United States the National Maritime Union has gained a forty-hour week in 1951.(4) However, men on watch have still to work eight hours in a day and fifty-six hours in a week, although day workers are not required to work on Saturdays and Sundays except for minimum routine duties. All works performed during the hours in excess of

(1) For this purpose, the documents of I.L.O. Maritime Conventions on hours of work and manning are useful.
(2) I.L.O. Convention, No. 57, Hours of Work and Manning (Sea) Convention, 1936.
(3) I.L.O. Convention, No. 93, 1949, I.L.O. Convention, No. 110, 1957.
(4) J.P. Goldberg, Maritime Story, 1958, p. 229.

the standard working week are compensated by overtime payments. In other countries where the standard working week of seamen is forty-eight, forty-four or forty hours, the same practice has, without exception, been adopted. In other words regular hours of work for men on watch are fifty-six hours in a week even if the standard working week is shorter. In short the reduction of the standard working week in the shipping industry has not been accompanied by the reduction of the actual working hours.

The fact that the reduction of the standard working week has not resulted in the reduction of actual hours of work does not necessarily mean that the shipping companies or seamen's unions have made little effort for reducing the total hours of work. On the contrary some shipping companies have made considerable efforts for keeping overtime work at a minimum level in order to reduce overtime payments. Unions have often negotiated with managements in order to reduce excessive overtime work and demanded an increase of manning. Unions have also paid attention to minimizing overtime work at sea on Sundays and holidays.

However, no attempt has emerged either from seamen's unions or employers to reduce the actual standard working day or to change the shift-system on board of ships. Therefore one can say that the demand of seamen for shorter hours of work is fictitious in the sense that it is not intended to affect the actual numbers of working hours in a week.[5] Indeed, the problem of shorter hours of work at sea seems to belong to the system of calculating wages, and to have little relation with the regulation of actual working hours. But to the writer it seems necessary to reconsider whether or not the demands of seamen for shorter hours of work should belong to the system of calculating wages. Understanding of their demands might lead to an appropriate approach and policy for the retaining of seamen in the shipping industry.

III

The demand of seamen for shorter working hours derives, as it is the case of other industrial workers, from the fear that their health may suffer and also from the desire to enjoy more off-duty hours. After the introduction of the eight-hour working day and the three-shift system on board of ships the opposition to long hours of work seems to have become a minor or indirect factor. Improvement of accommodation and working conditions also provide

(5) Sharing this opinion is, for example, the "Final Report of the Court of Inquiry into Certain Matters concerning the Shipping Industry," Feb. 1967, pp. 25–27.

seamen with more protection for their health. Although shipping companies introduced the eight-hour working day in face of the fact that fatigue of seamen caused loss of lives, vessels and cargoes, they are reluctant to shorten hours of work when the probability of marine accidents become fewer. Recently seamen's unions and employers deal with the volume of work load of the whole crew or of each member in relation with the manning scale under the three shift system, and not in relation with shortening the hours of work.

Here it should be pointed out that the shipowners' reluctance for the introduction of shorter working hours is due to the fact that it will result in a considerable increase of costs without bringing an appreciable improvement of labour-productivity. The operation of ships needs constant watchkeeping which is met in case of the three-shift system on a basis of the fifty-six hours a week. In addition, the berthing and sailing of ships cannot be timed in hours of the standard working day and necessitate overtime. Maintenance and repair works are also important factors requiring overtime. Consequently, in order to introduce a working week shorter than fifty-six hours, a considerable increase of the number of crew becomes necessary. In the shipping industry increase of manning means not only the increase of wage costs as in other industries, but also the increase of costs for additional food and accommodation on board. Larger space for accommodation decreases the space for cargo. Therefore, the actual reduction of the standard working week would burden shipowners with large expenses, and they rather choose shorter working weeks nominally and compensate hours of work in excess of the standard working day with overtime payment when unions demand shorter hours of work.

On the other hand, if unions demand shorter working hours for the sake of extra leisure hours, they tend to accept rather readily the shipowners' counterproposal, i.e., overtime compensation, when the overtime allowance rate is high enough, because the working and living conditions at sea are not suitable for enjoying leisure hours, as will be shown below and they give less value to leisure hours at sea than to those on land.

When working at sea seamen are forced to be separated from their families and friends and they cannot enjoy home life. On board the contact with other people is confined to the crew, especially to members of the crew belonging to the same shift. The hierarchy in the crew often hinders friendship between officers and ratings. Hobbies and amusements aboard are also limited. Reading, listening to the radio and talking with companions constitute the main ways for seamen for spending their leisure hours. Only a small number of ships have sporting facilities and movies for the crew. When seamen want to study some special subject, they often encounter difficulties to find correspondence

courses. Owing to the existence of all the conditions in the present working and living circumstances at sea of which some may be removed or relieved and some are inevitable, seamen cannot enjoy fully their leisure hours. Thus, it seems quite natural that they accept willingly more overtime earnings and paid vacation instead of an actual shortening of working hours at sea.

IV

Hereafter we shall examine the relationship between seamen's wages and hours of work under the general tendency of shorter hours of work.

As workers on land obtain shorter hours of work and improvement in real income, which enables them to enjoy their leisure hours in and out of their homes, it seems obvious that seamen tend to want more leisure hours, too and at the same time that they will feel that their working and living conditions at sea are more disadvantageous. Therefore, seamen do not remain in the shipping industry unless they feel that the increase of their wages earnings is high enough to compensate for their disadvantageous working conditions. In fact, in the shipping industry wage rates and overtime rates have shown a steadily increasing trend, and the wage differential between seamen and workers on land has changed favorably for the former.(1) It is expected that in future this tendency becomes even clearer.

By the way, do seamen consider the present wage rates and earnings as being enough compensation for their disadvantageous working conditions? The labour shortage in the shipping industry of many countries can be regarded as a phenomenum due mainly to the dissatisfaction of seamen with regard to their wages and working conditions. In Japan, for example, the number of applicants into Merchant Marine Academies and high schools has shown the decreasing tendency in spite of the growing demand for seamen in Japan. In addition, in the coastwise trade many seamen flow out into other jobs on land and result short supply of seamen.(2) Indeed, as one of the main factors which induces the movement of workers from one job to another, the opportunities of finding jobs should be taken into account in addition to the difference of wages and working conditions. But in the Japanese shipping companies the number of available jobs has increased in recent years and also there is no institutional

(1) H. Yamamoto, "Peculiarities of Maritime Labor", Kobe Economic and Business Review, No. 14, 1967.

(2) Kaiun Hakusho (White Paper on Shipping), 1964, p. 75, 1968, p. 129. In the United Kingdom early retirement of many young seamen, especially of ratings was reported. See, Pearson Report, Final Report, 1967, paras 80–85.

hindrance for young seamen to find jobs in the merchant marine. Therefore we may conclude that the flow out of young seamen from the Japanese shipping industry is due to their dissatisfaction of not being properly rewarded in comparison with their working conditions. Our conclusion shows the urgent necessity of establishing a policy by the Government and the shipping companies for retaining seamen in the industry. The problem of shorter hours of work should also be considered in this context.

V

Seamen are, as has been mentioned, in an unfavorable position on board of ships with regard to enjoying their leisure hours. What can be done for the improvement of their state?

As a first step, the improvement of recreation facilities should be considered as a comparatively easy remedy. Together with the provision of libraries, indoor game facilities and movie films, provisions of sporting facilities are most desirable because in sports seamen are able to spend their leisure time actively in contrast to the passive enjoyment of other amusements. Deck tennis, table tennis and deck golf are some of the sports which can be easily played by every one and can be introduced on board with rather small expenses. Development of new types of sport which are suitable to be played aboard are also desirable. In cooperation with seamen's unions, shipping companies should plan and carry out recreation programs which are adequate to the type of ships and trade routes. As a next step, correspondence courses for seamen should be improved and enlarged in order to give seamen the opportunities for the acquision of higher licenses and studying other subjects. Through such improvements we can expect that in the future seamen will utilize their leisure time at sea better.

Furthermore the adoption of a port relief system is desirable in order to give the crew leisure hours in port if we consider the recent situation that owing to the improvement of loading facilities and a quicker turn round of ships seamen have to spend busier hours in port resulting heavy work load on them. It is also necessary to establish in more ports seamen's clubs where seamen can rest and spend their leisure hours.

However, so long as seamen work at sea, it is impossible for them to enjoy their home life if we neglect the exceptional case in which companies allow wives to accompany their seagoing husbands aboard. The early retirement from the shipping industry of young seamen, especially that of newly married ones seems to be related with this problem. Even if actual shorter hours of work at sea are realized, it will not satisfy the seamen's desire for more enjoyable

leisure hours. Only vacations will afford them the opportunity of enjoying their home life and to have activities which are impossible at sea. Therefore paid vacations and home leave have far more importance for seamen than for workers on land. Although shipping companies and unions conclude minute agreements on vacation, little consideration has been paid to the relationship between the seamen's desire for leisure hours and vacation. If we consider that vacation is the sole and indispensable occasion for seamen to have a home life, vacations should be provided regularly in shorter intervals, and of longer duration.

An increase of vacations will induce the increase of labour costs in various ways. The provision of paid vacations will result in additional wage costs. Even in the case of vacation on leave wage costs for relief crew become necessary. However, in any way the supply price of seamen will rise with their increasing distaste for working conditions at sea, of which the separation from life on land is most keenly felt, and which is beyond the control of the shipping companies. In order to retain seamen in the industry with a minimum increase of labour costs it is necessary for the management to reexamine forms in which the labour costs should be allocated. Whether or not the improvement of new vacation plan is more effective than a similar expense for wage increases or the improvement of several working conditions depends on the level of wage earnings and social customs, and it is difficult to come to a clear conclusion. But it can be expected that the vacation plan tends to become more important for seamen than the increase of wage earnings, because with rising income their desire for more leisure is getting greater than that for additional wages.

In the foregoing discussion, we have not touched on the relation between hours of work and the change of working conditions which has been brought by the technological development in the shipping industry. Today the technological development on board of ships is in a transit period, and physiological and psycological research concerning work load, fatigue and productivity of labour on automated ships remain in a early stage. If the introduction of automation apparatus on board of ships increases the mental fatigue of seamen, then shorter hours of work must be reconsidered from a different view point than that of this article.

OBJECTIVITY REEXAMINED

Isao NAKANO

1

The "objectivity" concept is still regarded as an important criterion for deciding acceptable accounting principles and methods and for denoting an essential property of accounting informations.(1) However, opinions differ as to the exact meaning of this concept and as to the concrete requirements for achievement of "objectivity". In other words, no precise and uniform definition of this term has been established.

In this paper various views (or definitions) of the "objectivity" concept will be examined, their mutual relationships probed, and further, possible ways to settle existing and misleading interpretations of this concept will be suggested.

2

Five different views on the meaning of "objectivity" will be shown and examined here.

(1) The definition of "objectivity" as "possibility of substantiation".

The proponent of this definition is Professor H.A. Arnet. Though not explained by him, the word "substantiate" means "insure the accuracy of — by the weight of evidence" according to Kohler's "Dictionary for Accountants".(2) Perhaps with such an interpretation of the word in mind, Professor Arnet asserts "any data which are considered useful are objective to accountants, provided they are substantiated or capable of being substantiated by an independent party".(3) Thus, his suggestion is that objectivity of a given datum or information exists when it is supported by any valid evidence. Then, when is

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(1) "Objectivity — of accounting measurements is usually regarded as an important criterion for choosing among measurement methods." (Yuji Ijiri and Robert K. Jaedicke, Reliability and Objectivity of Accounting Measurements, The Accounting Review, July 1966, p. 475).

(2) Eric L. Kohler, A Dictionary for Accountants, 3rd ed., Englewood Cliffs, N.J. 1963, p. 486.

(3) Harold E. Arnet, What Does "Objectivity" Mean to Accountants?, the Journal of Accountancy, May 1961, (republished in: Readings in Accounting Theory, edited by Paul Garner and Kenneth B. Berg, Boston 1966, p. 188 — in this paper quotation will be made from this book alone).

meant by "evidence"? On this point he says, "This type of evidence may range all the way from supplier's invoices and mathematical formulas, to data derived from the use of index numbers and fair market values."(4)

This "objectivity" concept is characteristic in that it has been "inferred from the practices and assertions of accountants".(5) In other words, it is claimed that "if the term 'objective' is to be valid at all, it should be applicable to any and all items that the accountant reflects in the accounts and financial statements",(6) and from this view-point this "objectivity" concept has been developed as that attribute which can (or should) be shared by all items in the financial accounting. In this sense this definition tends to justify the accounting system as it is.

(2) The definition of "objectivity" as "consensus among different measurers" or "repeatability".

According to Professor C.H. Stanley, one meaning of "objectivity" is the "agreement in the results of experiments made by different experimenters"(7) and this sense of objectivity is attained, "when it is possible for different experimenters to perform the same operation with reasonable agreement in their results. 'Repeatability', then, is the test for determining the presence of this kind of objectivity."(8) Also Professor W.B. Meigs and Professor Ch. E. Johnson say, "if a measurement is objective, 10 competent investigators who make the same measurement will come up with substantially identical results."(9) Professor Y. Ijiri adopts this concept of objectivity, defining it as "the consensus among a given group of observers or measurers."(10)

Strictly speaking, however, the phrase "consensus among different measurers" or "repeatability" seems to be open to the following two interpretations.

(2a) One interpretation would be that the hypothetical measurers should be able to reach the same results when they follow the same judgements and use the same accounting methods as were actually adopted by the firm. (For example, if a firm has valued a certain item of inventory with the periodic average method, the hypothetical measurers are also assumed to use the same inventory

(4) Ibid., p. 188.
(5) Ibid., p. 179.
(6) Ibid., p. 183.
(7) Curtis H. Stanley, Objectivity in Accounting, Ann Arbor, Michigan 1965, pp. 2*d*3.
(8) Ibid., p. 4.
(9) Walter B. Meigs and Charles E. Johnson, Accounting, The basis for business decisions, McGraw-Hill 1967, p. 647.
(10) Yuji Ijiri, The Foundation of Accounting Measurement, Englewood Cliffs, N.J. 1967, pp. 134–135.

method regardless of the presence of other alternative methods such as the specific identification method, the fifo method, the lifo method etc).

(2b) The other interpretation would be that the hypothetical measurers should be able to come to the same measures when the choice of any accounting method from those available within the accounting system is possible regardless of the method actually selected by the firm (except when the principle of consistency forces them to follow the same method as that used by the firm). (For instance, even if a firm has valued a new item of inventory with the periodic average method, the hypothetical measurers are assumed to be free to select any inventory method which appears most appropriate to them).

The proponents of "objectivity" concept as "consensus among different measurers" or "repeatability" have not made clear which of the above-mentioned two kinds of "consensus" or "repeatability" they have had in mind. In this sense, their definition seems to lack exactness.

(3) The definition (or interpretation) of the "objectivity" concept as "measurability with (reasonable) accuracy".

Professor F.W. Windal, considering the term "objective", insists that "objective" is the opposite of "subjective" and therefore, in order for an item to be sufficiently objective for recognition, it must appear substantially the same to all accountants examining it. And "the quality of measurability seems to satisfy to a large extent the demand for objectivity. If an item can be measured with reasonable accuracy, it assumes a large degree of objectivity".(11)

But the exact meaning of the term "measurability with accuracy"(12) is not

(11) Floyd W. Windal, The Accounting Concept of Realization, East Lansing, Michigan 1961, p. 75.

(12) Of course, the concept "measurability" is used by Professor Windal not in the sense of "measurability with perfect accuracy" but in the sense of possibility of measurement within reasonable variation limits, as is indicated by the following quotation: "This factor ("measurability") has a broad connotation: an item is considered to be measurable, if it can be estimated with a reasonable degree of accuracy. The depreciation of fixed assets, for instance, is considered to be measurable even though it is based on an estimate. Likewise, the income on long-term construction contracts is estimated." (Floyd W. Windal, op. cit., p. 75).

In the phrase "measurability with (reasonable) accuracy", what is the exact meaning of "accurate" and how is it different from "precise"? "Accuracy" is generally defined as "the success with which the nearness to a true value is attained", while "precision" relates "to the tendency of tests to give the same value even though the value is inaccurate" (Eric L. Kohler, A Dictionary for Accountants, 3rd ed., Englewood Cliffs, N.J. 1963, p. 20).

Further one might question what the difference between "measurability with (reasonable) accuracy" and "accuracy" is. It seems to me that the latter concept refers to a correspondence of a measurement object with its valid measurement result (or figure), but the former concept means freedom from subjective biases in the measurement process in order for "accuracy" of the measurement result to be approached. In other

clear at all and seems to be open to the following two alternative interpretations. Moreover we cannot tell which of the two interpretations Professor Windal has agreed to.

(3a) One interpretation would be that when several alternative sorts of judgements and accounting methods are available as to measurement of one and the same object within a business accounting system, the possible different measures (by using each judgement and accounting method) would be all "accurate" (so long as calculated correctly in the arithmetical sense) and therefore all these measurements would have the quality of "measurability with accuracy". (For example, when one selects one inventory pricing method from the group composed of the specific identification method, the fifo method, the lifo method, the periodic average method, the moving average method etc., any measurement result calculated correctly by applying any selected inventory method to the total inventory cost — including the beginning inventory cost — of the period would be regarded as "accurate" and therefore with respect to one measurement object one could think of the "measurability with accuracy" by the specific identification method, the fifo method, the lifo method etc.).

(3b) The other interpretation of the phrase "measurability with accuracy" would be that since "accurate" means "the success with which the nearness to a true value is attained"[13], only "one" accurate measure would be possible as to one measurement object within one accounting system (or for one accounting purpose). If this interpretation is adopted, strict logic would lead to the conclusion that when the result of the calculation by one — say the specific identification method — of several alternative accounting methods is the "accurate" measurement, then the result by any other method (ex. the fifo method, the lifo method, the average methods etc.) will have to be regarded as "inaccurate" even though the latter measurement might have been made correctly in the arithmetical sense. In other words, according to this point of view the "measurability with accuracy" would exist only where one accurately measured figure can be given to the measurement object concerned. Therefore, when a free choice of an adequate accounting method from several alternative ones is permitted without any rule or convention to specify which method should be used in a given situation (except the principle of consistency), no logical assurance exists that this kind of "measurability" is perfectly attained in practice.

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words, the former is concerned with a characteristic of the "measurement process" of accounting, but the latter means a "relation between a measurement object and its measured result".

(13) Eric. L. Kohler, A Dictionary for Accountants, op. cit., p. 20. Also see the footnote (12) of this paper.

(4) The definition of "objectivity" as "deductive certainty".

This is the second "objectivity" concept developed by Professor C.H. Stanley besides his first definition of the term as the "consensus among different measurers". According to this view, "objectivity" in the sense of "deductive certainty" may be said to exist when "the relationship between, say, two statements is a matter of deductive logic. — where the implications of a statement are determinable by the application of deductive logic to that statement, all persons acting as logicians will arrive at the same conclusions, assuming that the rules of deductive logic are known and applied correctly. The statements of mathematics, for example, are objective in this sense".(14)

The significance of this concept in the context of business accounting is pointed out by Professor Stanley as follows:

(a) Accounting theories, he says, are (or should be) developed by the consistent application of deductive logic to postulates and definitions which have been established as the starting point. And this way of formation of accounting theories means providing them with the "objectivity" in the sense of "deductive certainty".(15) Therefore, one important role of this "objectivity" concept would seem to lie in that it denotes a desirable feature to be shared by accounting theories as formal systems.

(b) The "objectivity" concept in the sense of "deductive certainty" would indicate, he asserts, a characteristic of the double-entry book-keeping. Namely, he says that this book-keeping system can be developed by the application of the rules of logic and arithmetics to several predefined concepts — in Stanley's explanation four concepts of "time", "entity", "asset" and "liability" — and that in this sense the double-entry book-keeping does possess the "objectivity" as deductive certainty.(16)

Therefore, in Stanley's book this concept of objectivity is regarded as denoting a characteristic of the double-entry book-keeping or of a desirable accounting theory. However, in the context of objectivity as applied to accounting data, he uses the term "objectivity" only in the sense of the "consensus among different measurers" but not of the "deductive certainty". "Objectivity of an accounting system" as deductive certainty will probably be related with the "objectivity of the accounting data" produced by the system, but the exact relationship

(14) Curtis Holt Stanley, Objectivity in Accounting, op. cit., p. 3.
(15) Ibid., p. 17 and p. 106.
(16) Ibid., pp. 20–30.

between the two concepts has not yet been made clear.[17]

(5) The definition of "objectivity" as "freedom from biases against the accounting purposes".

Professor R.J. Chambers and Professor P.E. Fertig, insist that the "objectivity" concept should be defined as the freedom of actual measurement results from biases against the really desired figures on the part of the readers of the financial statements (therefore, against the accounting purposes) rather than as the formal "verifiability," since all the concepts and methods of business accounting should be developed from the view-point of what is desired by the users of the financial statements. "If we are to measure such things as 'financial position' and 'income', and to obtain objective measures of them, it is necessary, at the outset, to define what we mean by these terms".[18] "Only if we know what we are setting out to measure, can we have an idea about the biases which may arise or about the value to which we seek an approximation".[19] And based on this standpoint, "the evidence of the purchase cost of an asset may be highly verifiable evidence, but obviously the statement that this purchase cost is an unbiased (i.e., "objective" in the broader sense of the word) measure of current value is completely unjustified".[20]

Though such a definition of the "objectivity" concept is theoretically very attractive, practical application of this concept would require "a consensus on what we are setting out to measure, i.e., general agreement on the goals of accounting and the objectives of the users of accounting information. This we

(17) Of the possible relationships between the two objectivity concepts one thing is clear: "deductive certainty" as applied to an accounting system cannot always be the sufficient condition for the objectivity of accounting data (in the sense of "possibility of substantiation", "consensus among different measurers" or "measurability with accuracy) to be attained. For instance, the income concept as a difference between the discounted present values of future net cash inflows at the beginning and the end of a period is theoretically very consistent and has deductive certainty, but uncertainty about the future events would deprive the income figure of almost all "objectivity" concerning accounting data. (As to this income concept, refer to the following literature: Ronald S. Edwards, The Nature and Measurement of Income, The Accountant 1938; Sidney S. Alexander, Income Measurement in a Dynamic Economy, The Study Group on Business Income of the American Institute of Accountants, Five Monographs on Business Income, New York 1950, pp. 1–95; G.E. Philips, The Accretion Concept of Income, the Accounting Review, Jan. 1963; David Solomons, Economic and Accounting Concepts of Income, the Accounting Review, July 1951; Palle Hansen, The Accounting Concept of Income, Kopenhagen 1962; Emily Chen Chang, Business Income in Accounting and Economics, the Accounting Review, Oct. 1962).

(18) R.J. Chambers, Measurement and Objectivity in Accounting, the Accounting Review, April 1964, p. 268.

(19) Ibid., p. 268.

(20) Paul E. Fertig, Current Values and Index Numbers: The Problem of Objectivity: in, R. K. Jaedicke, Y. Ijiri and O. Nielsen (ed.), Research in Accounting Measurement, American Accounting Association, p. 142.

seem to lack to a serious degree".[21] For example, there is still no agreement of opinions upon which of the alternative valuation bases such as the historical cost, the adjusted cost (on the basis of a general price index) or the replacement cost is theoretically most proper for accounting purposes. And as the case stands now, no one can tell to what a degree a given accounting data has attained the objectivity in the sense of "absence of biases against the accounting purposes".[22]

3

The above analysis has made it clear that among people with different "objectivity" concepts in mind useless differences of opinion might occur as to the extent of "objectivity" which the present business accounting system will be able to achieve. To illustrate this state of affairs, a person thinking of the "objectivity" concept in the sense of "verifiability (or possibility of substantiation)" (1) would say, "The existing accounting system can attain a sufficient degree of objectivity", while another insisting upon the "objectivity" concept as the "measurability with accuracy (3b)" would probably object that "the extent of currently available objectivity is far from enough". Reexamination of this concept seems necessary for avoidance of such a needless disagreement.

One possible solution would be defining the "objectivity" concept anew clearly, concretely and unanimously. In this case, if the concept is to be given the definition "consensus among different measurers (2)" or "measurability with accuracy (3)" care must be taken to indicate which of the two alternative interpretations (i.e. (2a) or (2b), or (3a) or (3b)) should be followed. Of course, one could conceive some other definition than the above mentioned five possibilities, since those views on objectivity are mere illustrations.

The other, increasingly influential trend is discarding the abstract and metaphysical "objectivity" concept in favor of a more concrete and operational one. For instance, Professor N.M. Bedford has insisted as follows: "The

(21) John W. Wagner, Defining Objectivity in Accounting, the Accounting Review, July 1965, p. 604.

(22) When we compare the "freedom from biases against accounting purposes" with the "measurability with accuracy", the latter concept requires an accurate measurement in accordance with the explicit or implicit accounting principles and procedures in a specific business accounting system as it is, while the former would mean the absence of accounting data from biases against theoretically claimed (valid) accounting purposes regardless of the accounting principles in the existing accounting system. So, the acquisition cost of an asset may completely meet the requirement of "measurability with accuracy" (3b), but whether the data has the characteristic of "freedom from biases against accounting purposes" or not is quite uncertain.

term objectivity has been used to designate certain characteristics which will provide for a standard count of money income by different accountants. The idea is that only things which can be objectively observed by everyone should be counted. This approach seems to have promise, but the use of "objective" may be unfortunate. Unprofitable discussions on whether or not something is objective or subjective have been carried on without regard to the problem objectivity was intended to solve. If an acceptable count is defined as the count that would result if different accountants were to do the counting, it could well be that counting the amount of income would not be such an unsettled issue as it now is".[23] Abandonment of the abstract and disturbing "objectivity" concept is claimed here in support of the concept "agreement (of measures) among measurers (accountants)". Further, the AAA's recent monograph, "A Statement of Basic Accounting Theory" does not include the objectivity concept as a criterion for selecting accounting information, but the content of the concept has found its way in the monograph under the name of "verifiability".[24] Thus, a recent significant trend may be said to lie in discarding the abstract and disturbing concept of "objectivity" in favor of a clearer and more concrete concept, say, "consensus among measurers (repeatability)".

To sum up, a reexamination of the "objectivity" concept should be carried out along either direction.

(23) Norton, M. Bedford, Income Determination Theory: An accounting framework, Reading, Massachusetts 1965, p. 62.

(24) A Statement of Basic Accounting Theory, American Accounting Association 1966, pp. 10–11.

A NOTE ON THE BEHAVIORAL THEORY OF INNOVATION

Hideki YOSHIHARA

I

"The behavioral theory of organizational decision - making," as developed by Chester I. Barnard, Herbert A. Simon, and James G. March, have focused one of its main research interests on the subject of innovation in an organizational context.(1) And a theory of organizational innovation evolved as one of its main subtheories. We shall call this parcel of theory "the behavioral theory of innovation."

In this note we would like to do three things regarding the behavioral theory of innovation, that is, (1) to make clear its basic framework, (2) to add some critical comments upon it, and (3) to make a couple of proposals for solving its shortcomings.

The behavioral concept of innovation might be best described in the following proposition by March and Simon. They said:

> Initiation and innovation are present when change requires the devising and evaluation of new performance programs that have not previously been a part of the organization's repertory and cannot be introduced by a simple application of programmed switching rules.(2)

Under a relatively stable environment an organization carries out its goals and tasks smoothly and efficiently with its performance programs. But, when the environment changes on a large scale, this becomes difficult. For, the existing programs are not effective under the new circumstances. Then, it becomes necessary for the organization to change the existing programs or develop new ones to adapt itself to the new environment. This kind of adaptive behavior is defined as an innovative behavior or simply as an innovation.

On the basis of the previous description, we may summarize the core of

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(1) Chester I. Barnard, *The Functions of the Executive* (Cambridge: Harvard University Press, 1938).
Herbert A. Simon, *Administrative Behavior* (New York: Macmillan Co., 1947, 2nd ed., 1957).
James G. March and Herbert A. Simon, *Organizations* (New York: John Wiley & Sons, Inc., 1960).

(2) James G. March and Herbert A. Simon, *op. cit.*, pp. 174–175.

the behavioral theory of innovation in the following two propositions:

(1) An organization initiates innovative behavior when it fails to satisfy its goals or anticipates such a failure in the immediate future.

(2) The innovative behavior is directed toward devising new performance programs.

We shall examine the behavioral theory of innovation along these two lines in the following sections.

II

Any theory of human behavior has a set of assumptions about human behavior. In the case of the behavioral theory of organizational decision-making a model which is called "the general model of adaptive motivated behavior" is laid for such a set of assumptions. The model is defined by the following propositions:

(1) The lower the satisfaction of the organism, the more search for alternative programs it will undertake.

(2) The more search, the higher the expected value of reward.

(3) The higher the expected value of reward, the higher the satisfaction.

(4) The higher the expected value of reward, the higher the level of aspiration of the organism.

(5) The higher the level of aspiration, the lower the satisfaction.[3]

The model is portrayed in Figure 1.[4]

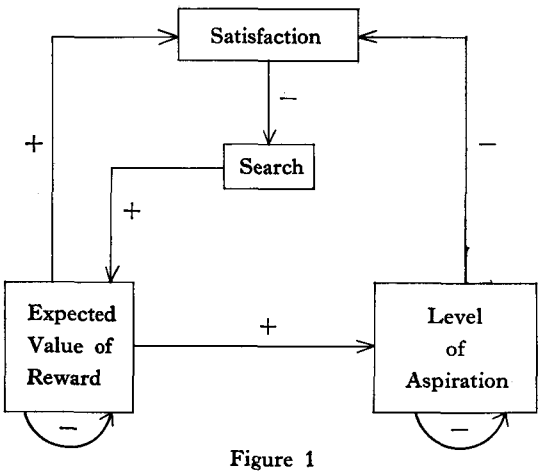

Figure 1

(3) *Ibid.*, p. 48.

(4) *Ibid.*, p. 49, Figure 3.5.

Now, let us pay attention to the first proposition. From it we can derive a relationship of "dissatisfaction →search →a change in programs." And this relationship represents an essence of the behavioral theory of innovation. We may summarize the essential assertions of the theory in the following three propositions:

(1) Dissatisfaction (or a problem) induces search.

(2) Induced search results ordinarily in innovation.

(3) Innovation solves dissatisfaction (or the problem).

These three propositions may be portrayed as in Figure 2 which is a slightly adapted version of Figure 1.

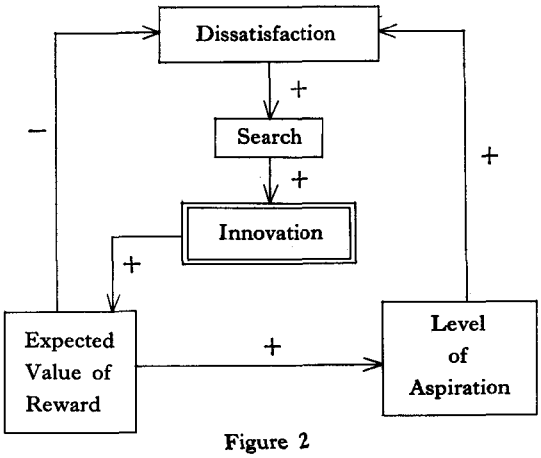

Figure 2

On the basis of the above argument we may well conclude that the behavioral theory of innovation is built upon the adaptive model of human behavior. Cyert and March have applied the term "problem-oriented innovation" to the behavioral concept of innovation that we have just examined.[5] Following their terminology, the behavioral theory of innovation may be said to have been developed as a theory of problem-oriented innovation.

It must be pointed out here that the theory of problem-oriented innovation has difficulty in explaining and predicting some kinds of innovation in organizations. Let us show a couple of examples that evidence this.

A recent study of research spending over a ten-year period in five large

(5) Richard M. Cyert and James G. March, *A Behavioral Theory of the Firm* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963) pp. 278–279.

firms revealed that decreases in research activity followed decreases in sales and/or profits.(6) This empirical evidence appears inconsistent with the theory of problem-oriented innovation. For, the evidence shows that a problem — in the above case, decreases in sales and/or profits — suppresses rather than stimulates an innovative behavior of organization — in the above case, research activity —.

E. Mansfield revealed that it was impossible to confirm empirically the hypothesis that, other things being equal, relatively unsuccessful firms would be quicker than relatively successful firms to begin using a new technique.(7) This evidence also appears to cast a doubt upon the concept of problem-oriented innovation.

Thus, the theory of problem-oriented innovation as it exists has difficulty in explaining and predicting some kinds of organizational innovation.(8)

As a tentative solution to this difficulty, a new concept of slack innovation has been introduced by Cyert and March.(9)

Organizational slack is the difference between the payments required to maintain the organization and the resources obtained from the environment by the organization. In general, success tends to breed slack. One of the main consequences of slack is a muting of problems of resource scarcity. Slack provides a source of funds for innovative projects that would not be approved in the face of scarcity but that have strong subunit support. These are not problem-oriented innovations. For, they are not directly linked to any specific problems. They contribute mostly to subunit goals such as professional status and subunit prestige. These slack innovations are expected to give a rather reasonable explanation to the fact that relatively successful firms (thus firms with substantial slack) are more likely to introduce some kinds of innovation.

But the concept of slack innovation seems to have the following shortcomings. One shortcoming is to be found in the treatment of the motive to innovate. As described above organizations do not have any specific problems to solve. In spite of this, innovative projects are approved and implemented in organizations. Why? Because there are plenty of resources not committed to any going operations or plans at hand, and subunits strongly demand the approve-

(6) Richard M. Cyert and James G. March, "Organizational Factors in the Theory of Oligopoly." *Quarterly Journal of Economics*, vol. LXX, February 1956, p. 52.

(7) Edwin Mansfield, "The Speed of Response of Firms to New Techniques, "*Quarterly Journal of Economics*, vol. 77, No. 2, 1963, pp. 302–305.

(8) Julian Feldman and Herschel E. Kanter, "Organizational Decision Making," James G. March, ed., *Handbook of Organizations* (Chicago: Rand McNally & Company, 1965) pp. 622–623, pp. 633–634.

(9) Richard M. Cyert and James G. March, *op. cit.*, 1963, pp. 278–279.

ment of their innovative projects to raise their status in the organization. Thus, it may be said that in the case of slack innovation the motive to innovate is explained largely in terms of subunit group demands.

We are inclined to think that this treatment of motivation is not satisfactory. Suppose a case in which a certain subunit strongly demands the approvement of its innovative project. It is a large scale one, so its implementation is considered to exert a substantial influence upon the whole organization. In such a case, to be approved it is necessary for the innovative project to find support by other subunits and especially by the top management. These inside supports will likely be given when the project is judged to contribute effectively to the solution of certain problems that the organization has. If so, to explain the motive to innovate in terms of resource affluency and strong subunit group demands can not be a satisfactory one. We hold it is necessary to introduce explicitly the notion of "dissatisfaction (or a problem)" in the treatment of the motive of slack innovation.

Next, we may point out that the theory of slack innovation is not consistent with the basic assumptions of the behavioral theory of organizational decision -making. It is assumed that dissatisfaction or a problem induces organisms to undertake search behavior for new performance programs. Whereas, slack innovation is one which is to be made by relatively successful organisms having no pressing problems. Thus, the concept of slack innovation is not consistent with the model of adaptive behavior underlying the behavioral theory.

From the above argument we have learned that it is necessary to re-develop the behavioral theory of innovation in the direction toward overcoming difficulties or limitations of both the concept of problem-oriented innovation and that of slack innovation within the basic framework of the adaptive model.

Now we would like to present one proposal for the re-development of the behavioral theory of innovation.

We introduce the idea of a hierarchy of motives[10] into the adaptive model of human behavior. When lower motives such as physiological needs are not sufficiently satisfied, human beings concentrate their efforts to the satisfaction of these motives. In such a circumstance higher-order motives such as esteem-needs or lust for power remain unevoked and therefore exert almost no effect upon human behavior. But, once lower motives are sufficiently satisfied, these higher-order motives are evoked and become the main motivational forces for actions.

Then, along the lines suggested we may re-develop the behavioral theory

(10) A. H. Maslow, *Motivation and Personality* (New York: Harper & Brothers, 1954).

of innovation in the following way. We assume that we can distinguish types of innovative behavior. For example, we assume two types. Let one be called "an innovation for survival," and the other "an innovation for growth." The former would be induced when the survival of the organization is in danger. And its function would be to secure its survival. So, in the case of business organizations, it would take such forms as cost-reduction projects, disposal of unprofitable plants, reduction of administrative personnel, and curtailment of research spending. The innovation for survival corresponds roughly to problem-oriented innovations.

On the other hand, the second type of innovation, an innovation for growth, would be induced when the organization has no pressig survival problems, but does not have its motive for growth satisfied yet. And it would take such forms as diversification strategies, increases in research spending, and capital investment for modernizing plants. It is approximately equivalent to slack innovations.

As for organizational slack, it should be treated as a resource for innovation. The more the organizational slack, the easier the implementation of innovation.

III

In the behavioral theory of innovation, as has been mentioned in the first section, a change in performance programs is defined as innovation. This is the second major distinctive point of the theory. In this section we will examine this point.

Generally speaking, organizations take innovative actions to adapt themselves to the changing environment. For example, in the case of business organizations the following actions may be taken; changing standard procedures for price and output decisions, altering inventory control systems, the introduction of new technology, changing the organizational structure and/or the product-market posture.

Now, we may naturally raise the question whether it is possible to cover all these innovations with the behavioral concept of innovation, that is, the concept of a change in programs.

For example, the change of standard procedures for price and output decisions is reasonably considered to be a change in programs. Similarly, the alteration of inventory control systems may suitably be called a change in programs. Then, what about the introduction of new technology or the change of product-market posture? Is it reasonable and meaningful to regard these as a change in programs?

A change in programs should be interpreted as a change in decision rules. This is what March and Simon originally intended to mean. Thus we arrive at the following conclusion. The behavioral concept of innovation developed largely by March and Simon is concerned with only those innovations which represent changes in programs. The other innovations are outside of its domain. This is surely a shortcoming of the theory.

To remedy this shortcoming we must substitute some new concept for a change in programs.

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THE RESEARCH INSTITUTE FOR ECONOMICS AND BUSINESS ADMINISTRATION, KOBE UNIVERSITY

HISTORICAL SKETCH

In 1919, a research organization named the Institute for Commerce was founded in Kobe Higher Commercial School, one of the chief predecessors of Kobe University, with a gift made by F. Kanematsu & Company, a leading mercantile firm in Kobe. The organization was designed to carry on and facilitate integrated research on business and commerce and to formulate and publish the results of these studies and investigations in such form as to make them available to the business community.

With the founding of Kobe University of Commerce, successor of Kobe Higher Commercial School, in 1929, the Institute extended its research activities by adding several divisions. One was the famous Latin-American Library, which soon became the center of research in this field in Japan. A room for statistics equipped with various computing machines was established and began publication of "Juyo Keizai Tokei" monthly and "Sekai Boeki Tokei" annually. A filing room was prepared to deposit press clipping files systematically arranged by topics and dates. Another room was designed to become the center of all possible original records and data having to do with the beginning and progress of Japanese business.

On the campus of Kobe University of Commerce, another organization named the Institute for Business Mechanization was founded in 1941 utilizing business machines donated by the IBM Corporation and others. With Professor Yasutaro Hirai as its head a broad and forward-looking plan for business mechanization in Japan was developed.

In 1944, Kobe University of Commerce changed its name to Kobe University of Economics. After the war, however, the University was consolidated with three other colleges in Hyogo Prefecture to become Kobe University. With this development, the two Institutes were also amalgamated into the Research Institute for Economics and Business Administration, Kobe University. At present, the Institute, with its seventeen full-time professional staff members, carries on studies and investigations in international economy, business administration, and business mechanization in Japan.

LOCATION AND BUILDINGS

The Research Institute for Economics and Business Administration is located on the campus of Kobe University, Rokko, Kobe. It is a three-storied building named the Kanematsu Kinenkan and has a floor space of about 2,900 square meters, which includes a president's room, forty-one offices, six rooms used as a library, a room for statistics, three conference rooms, etc. Adjoining is a one-story building recently built to install business machines.

ORGANIZATION

Under the directorship of the president, the Institute operates with two research groups, each has five sections respectively. Each research group and its sections are as follows:

A Group of International Economy

(1) International Trade
(2) Economy of Latin-America
(3) Maritime Economy
(4) International Finance
(5) International Law of Economy

B Group of Business Administration

(1) Business Administration and Business Mechanization
(2) Accounting
(3) International Management
(4) Business Statistics
(5) International Labor Problems

Besides the regular work of the Institute organized in this manner, research committees may be created to carry on any special work requiring the joint study of academic and business circles. At present, there are three committees, that is, the Finance Committee, Latin-America Committee, and International Economy Committee.

For convenience and greater efficiency in carrying out its research activities, the Institute has a general office which is responsible for, 1) the collection and preservation of a comprehensive collection of books, periodicals, pamphlets, and original records and data of finance, trade, commerce, industry and business generally; 2) the classification, cataloguing, indexing, arranging, annotation and

compilation of these research materials; and 3) the formulation and publication of the results of the investigations and studies accomplished by the professional staff members of the Institute.

As an affiliated institute, the Documentation Center for Business Analysis has been recently established. It is the first systematic information facility in the field of business administration in Japan that has been recognized and authorized by the Ministry of Education. The purpose is to collect and to make intensive control of all kinds of materials on business administration and to make them available to scholars, universities, governments, and business world with the aid of modern documentation techniques.