Title	The interdependency between economic growth and relative income shares
Sub Title	
Author	Suzuki, Ryoichi
Publisher	
Publication year	1971
Jtitle	Keio business review Vol.10, (1971.) ,p.1- 23
JaLC DOI	
Abstract	
Notes	
Genre	Journal Article
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=AA00260481-19710000-03919613

THE INTERDEPENDENCY BETWEEN ECONOMIC GROWTH AND RELATIVE INCOME SHARES

by

Ryōichi Suzuki

1

It may be said that a most unique economic theory that has made its rise after World War II is the theory of economic growth. While the dynamic theory of prewar days devoted itself to cycle analysis, took for its main theme departure from depression, and hence discussed from this viewpoint the effects of public investment on money flows, the new growth economics focuses on trend analysis setting its task on the removal of secular stagnation. It has originated from the effective-demand doctrine of Keynes's fashion yet is not a simple successor to the Keynesian theory in that it raises the problem of the effect of capital accumulation on the productive capacity. In particular the argument that saving governs the rate of economic growth involves even a possibility of moving on a path inverse to Keynes. When at first Harrod and Domar advocated the growth theory the effective-demand doctrine provided the principal axis for its development, but the weight of this doctrine has lessened since the neo-classicists' interpretations were put forth. By Harrod-Domar on account of the assumption of fixed capital coefficient the growth rate is equal between income and capital. By the neo-classicists' interpretation this comes to the neglect of substitution between capital and labor. (This criticism leads to the problem of discrepancy between a growth rate in the actual and one satisfactory to business.) In R. Solow's *Capital Theory and Rate of Return* a production function was brought in, labor-capital substitution was accepted, and a transition was intended from the unsteady growth theory of Harrod-Hamberg type to a theory of steady growth. In so far as the Cobb-Douglas function is used, however, no attempts are born to introduce positively changes in the propensity to consume arising from changes in the relative income shares or income distribution because in this function the ratio between shares is constant. In Pitchford's *Growth and Elasticity of Factor Substitution* was discussed the possibility of the existence of stable equilibrium by the medium of the CES production function, yet no positive analysis was exercised on the effects of changes in the propensity to consume due to changes in the relative shares. To combine the production with the growth theory is true a progress in itself, but the interpretations of neo-classicists give us an impression that they have misread the validity of the effective-demand doctrine being too much constrained by their intention to construe the growth theory, which primarily should be understood as a series of moving equilibrium, within the bounds of the equilibrium theory. Even on the changes in saving ratio, which should make the axis of growth theory, active analysis has been lacking. This idea of saving-rate changes is found in Duesenberry's *Business Cycle and Economic Growth* but not in Solow, Swan or Pitchford. The CES function has a merit, which the Douglas function does not, that it can positively explain changes in the relative shares. If, as Klein has done it, consumption is specified as a linear function of wage income W and non-wage income π, in accompany with changes in the ratio between W and π, whose coefficients are not identical, consumption will change even on the same level of national income. So long as a rate of growth free from inflationary gap is presupposed, investment must be financed solely by saving and hence a change in the propensity to save (which may have arisen out of a change in the relative shares in macro-terms) will so much alter investment activities and further demands for labor because of the capital-labor substitution. This will again cause a change in the growth rate itself of the ensuing period. Only with such a cycle in view a complete system can be spoken of.

On admitting changes in saving a next-step problem is that saving has different patterns which may be differently affected by changes in W and π. A change in the relative shares will alter not only the aggregate saving ratio but also the patternal composition of saving. And since the industrial composition of investment varies between financial sources—e.g. bank deposit, life insurance, securities, etc.—a change in the patternal structure of saving will result in a change in the structure of industry via investment. Each industry has a particular capital coefficient and accordingly a change in the structure of investment will bring forth a change in the composition of products. This will again affect the ratio between consumption and capital goods, deriving a second cycle. In this paper the writer intends to develop these problems as realistically as possible, utilizing data of the Japanese economy.

2

We shall start with theoretical frames. Define symbols as shown in Table 1. Assuming that a CES production function is postulated we derive equation 1, where presumably in most cases $b<1$. By transforming this we have equation 2, expression of the relative income shares. On the assumption that the growth rates of national income and employment are equal at the initial point of time,

Table 1

Y = national income (nominal)	W = aggregate wage income ($= wL$)
w = wage rate	L = employment
$\bar{L}$ = labor population	π = non-wage income ($= rK$)
r = price of capital	K = capital accumulation
I = investment ($= \dot{K}$)	S = saving

$$\log \frac{Y}{L} = \log a + b \log w \tag{1}$$

$$W/Y = Aw^{1-b} \tag{2}$$

$$\frac{Y_{t+1}}{Y_t} = \frac{L_{t+1}}{L_t} = g+1 \tag{3}$$

$$\frac{w_{t+1}}{w_t} = w(L_{t+1} - \bar{L}_{t+1}) \tag{4}$$

$$\frac{w_{t+1}\bar{L}_{t+1}}{Y_{t+1}} = Aw_{t+1}^{1-b} \tag{5}$$

$$S = s_1 W + s_2 \pi + s_0 \tag{6}$$

$$s = \frac{S}{Y} \tag{7}$$

$$g_t = s\frac{Y}{rK} \cdot \frac{r}{(1-w^{1-b}A)} \tag{8}$$

Consumption-goods sector I

$$L_1 w + rK_1 = C = \alpha_0 + \alpha_1 W + \alpha_2 \pi \tag{9}$$

Capital-goods sector II

$$L_2 w + rK_2 = I = S = s_0 + s_1 W + s_2 \pi \tag{10}$$

If $\frac{K_1}{L_1} < \frac{K_2}{L_2}$ is assumed,

increase in $\frac{W}{\pi}$ → increase in $\frac{C}{S}$ → increase in $\frac{L}{K}$.

Since $L_1 + L_2 = \bar{L}$, w rises.

Writing $\frac{L_1 w}{C} = \varepsilon_1$, $\frac{L_2 w}{I} = \varepsilon_2$, then $\varepsilon_1 > \varepsilon_2$.

Money inflow to consumption-goods sector: $S_1 = s'Y$.

Growth rate of consumption-goods sector:

$$g_1 = \frac{C}{rK_1} s_1 \frac{r}{(1-Aw^{1-b})}. \tag{11}$$

Money inflow to capital-goods sector: $S_2 = s''Y$.

Growth rate of capital-goods sector:

$$g_2 = \frac{I}{rK_2} s_2 \frac{r}{(1-Aw^{1-b})} \tag{12}$$

$$\frac{C}{rK_1} > \frac{I}{rK_2} \cdot \text{ Since } s_1 + s_2 = S,$$

$$g_2 = \frac{1}{rK_2}(s - s_1)\frac{r}{(1-Aw^{b-1})}. \tag{12'}$$

For the prolongation of roundabout production,

$s_2 > s_1 \frac{C}{K_1} \frac{K_2}{I}$ is necessary.

$K_1 + K_2 = I = S_1 + S_2 = S$.

Positing $S_1=\theta S$, (12′) changes as below,

Writing $\frac{K_1}{C}=\beta_1$, $\frac{K_2}{I}=\beta_2$,

The condition for prolonged roundabout production, $g_2>g_1$:

$$\theta<\beta_1/(\beta_1+\beta_2) \tag{13}$$

equation 3 is derived. Equation 4 expresses that the demand-supply position of labor at period $t+1$ causes a change in the wage rate. In case there are unemployed workers the right-hand side of this equation shows a figure of explicit unemployment, but in the case of labor shortage L_{t+1} expresses merely a theoretical value obtained from equation 3, not an actual value. And as regards capital we take that there is no ceiling provided its accumulation continues.

The relative share of labor at period $t+1$ is presented by equation 5. On the other hand, by postulating a Klein-type consumption function as described in the preceding section the saving function is given as equation 6. Where the value of b is below unity a rise in wage rate due to labor shortage in accordance with equation 4 will boost W/π. Since there is a good reason to believe $s_1<s_2$ in equation 6 an increase in W diminishes investment via saving. As to the demonstration effect which accompanies economic growth, we could rightly regard it as implicitly involved in equation 6 because a change of share between W and π implies also a change in income differentials, hence its attendant effect, i.e., increased consumption. Thus the growth rate at period t, g_t, is expressed by equation 8, which tells that (1) the smaller the share of non-wage income, (2) the higher the interest rate, and (3) the higher the wage level, the higher is the growth rate. Or, in another way combining (1) and (2) we could say the lower the capital coefficient, the higher becomes the growth rate.

Next we divide the above analysis into consumption- and capital-goods sectors, I and II. Equations 9 and 10 exhibit this. If the elasticity of labor-capital substitution is below unity, the increase in C is larger than in I. And if we take $L_1w>L_2w$, this will increase W (at least in terms of rate) and the share of consumption goods all the more. If this situation is to be evaded equation 13 is derived as the necessary condition, which will become a government's requirement.

3

Let's proceed to the problem of quantification. For the growth theory the value of b, i.e., elasticity of substitution, is a concept of great importance. For estimating the macro-economic production function by equation 1, the following procedure is conceivable. First as to Y we use figures in the Economic Planning Board's *Kokumin-shotoku Tōkei Nempō* (Annual National Income Report) 1969 ed. For the denominator L we employ employment numbers in the *Rōdō-ryoku Chōsa* (Labour Force Survey). Thus we calculate Y/L. For w we take

Table 2

Year	Y	L	w	Y/L	$\log \frac{Y}{L}$
1958	9423	43050	52.7	21888	4.34025
1959	10750	43350	56.6	24790	4.39428
1960	13009	44360	61.1	29326	4.46731
1961	15414	44980	68.0	34296	4.53491
1962	17215	45560	75.0	37785	4.57852
1963	19981	45950	83.0	43484	4.63829
1964	22580	46550	91.3	48507	4.68583
1965	25041	47300	100.0	52684	4.72165
1966	29249	48270	110.8	60594	4.78240
1967	34593	49200	124.2	70321	4.84702
	(billion yen)	(employees 1,000)	(Index)	(10 yen)	459.9046
					Av. 4.59905

Year	$\log w$		W/Y	
1958	1.7218		52.4%	
1959	1.7528		51.4	
1960	1.7860		49.8	
1961	1.8325		50.0	$\log A+0.143 \log w$
1962	1.8751		53.2	$=\log \frac{wL}{Y}$
1963	1.9191	$b=1.233$	53.5	
1964	1.9605		54.9	0.275 (w index)
1965	2.0000		57.1	
1966	2.0445		56.1	
1967	2.0941		55.0	
	19.0364			
	Av. 1.9036			

wage indices (whole industry, annual, cash pay) by the Labor Ministry. The coverage is not identical between these two data of employment and wages, which shall be ignored here. Table 2 shows these figures, by which b has been computed as 1.233, that is, above unity. This result is not always tenable, since if b exceeds unity the labor's share should decline as wage rate rises yet by the table W/Y (employees' total income divided by national income) follows arising, though zigzag, trend over the ten years covered. So, as another approach, we have found from the relative share by equation 5 as 0.857 as shown in the last part of Table 2, which is not unplausible. (A has been adjusted for place since π is index number.)

The data used for estimating the propensity to consume are presented in Table 3 (figures by national income statistics above). But when these are applied to $C=\alpha_0+\alpha_1 W+\alpha_2 \pi$, α_1 exceeds unity. This results from multicolinearity and as well from the rapid growth of C in the latter part of the period. And

Table 3

Year	C	W	π=Y−W	S
	(billion yen)	(billion yen)	(billion yen)	(billion yen)
1958	7024	4937	4486	1197
1959	7760	5524	5229	1432
1960	8774	6483	6526	1877
1961	10200	7794	7620	2307
1962	11777	9156	8059	2492
1963	13615	10698	9283	2908
1964	15510	12408	10172	3388
1965	17539	14285	10729	3693
1966	19790	16414	12835	4481
1967	22606	19025	15568	5660
				(personal savings)

Table 4. (Savings Trend Survey, 1962)

Quinquesection	W	Ws	Debt	Net Ws
	(100 yen)	(yen)	(yen)	(100 yen)
I	2650	11074	−1176	123
II	4123	12837	−3368	162
III	5197	33897	199	337
IV	1691	44387	−6880	512
V	10677	111320	1367	1099

$Ws = 0.1015\,W - 1508$ yen

Macro: $S = 0.1015\,W + 0.2516\,\pi - 416$ billion yen

again in $S = s_0 + s_1 W + s_2 \pi$, s_1 shows a minus value. So in any way these results are unreasonable to use.

However, that the consumption function (or saving function) is unable to estimate is very unfavorable for our model specification. So we have intended to evade the problem of multicolinearity by combining cross-section and time-series analyses as is often done. For the cross-section data to estimate the saving function we can utilize the *Chochiku-dōkō Chōsa* (Savings Trend Survey) by the Statistics Bureau, Prime Minister's Office. Taking figures of this survey for 1962 (middle year of the experiment period) we contrast net increases in savings (subtracting increases in debts) to annual incomes in order to find the propensity to save. This calculation is possible, however, only with respect to W; it is impossible with π because data about self-employed persons are lacking. Thus by Table 4 the marginal propensity to save for W is 0.1015. By substituting this value into the above-shown time-series data we have got the marginal propensity to save for π as 0.2516. In the national income statistics W and π are not presented as disposable incomes, so if these figures were known the marginal propensities to save would show still higher values.

4

A third problem is the estimation of capital coefficient for both consumer's goods and capital-goods sectors. For the sake of strictness capital amounts by the national wealth survey should be employed but here as the first approach we use the Finance Ministry's *Hōjin-kigyō Tōkei Chōsa Nempō* (Annual Survey on Corporate Businesses), 1966 ed. It should be noticed that since this source does not include personal (non-corporate) businesses the capital coefficients would become larger than in the case of a complete survey, and that since our model employs for K aggregate assets or capital —without distinguishing inventory and equipment investments—the coefficients would again be larger than in the usual way of calculation. As for the whole industry we have taken for the coefficient the reciprocal of the product of capital-rotation rate and value-added rate (PQ denotes sales). In separating consumption and capital goods, however, we have had to estimate Y (value added) by dividing total assets of each industry by the above-mentioned capital coefficient since the actual amounts of value added for industries each are unavailable. We have not included the real estate business into either consumption or capital goods sector because its character is uncertain. And some problematic points may be found in the table such as that shipping is included into capital goods while other transport into consumer's goods, and the paper-pulp manufacture into the consumer's goods sector. Anyhow, thus we have calculated Y's by industries, summed them up for the two sectors, and divided K's (similarly calculated) to find capital coefficients, by which unexpectedly $\beta_1 > \beta_2$. This seems to have been affected by the inclusion of the wholesale-retail trade, which has a high capital coefficient, into the consumption goods industry.

Equation 15 (Table 7) state equilibrium between investment and saving. By introducing this condition, as the factors to define economic growth can be mentioned (1) wage level, (2) rate of wage change, (3) level of interest rate and (4) rate of change in interest rate, and thus the relation becomes apparent that the relative ratio between wages and interest governs the growth rate. Our primary aim was to carry out estimation on equation 4 in order to know the effect of demand-supply gap of labor on economic growth. However, in the labor-shortage economy after 1960 the correlation between unemployment u and dw/w is very low, hence such estimation is difficult. (See the writer, A US-Japan Comparison of Wage-Price Structure, *Keio Business Review*, No. 7) So in order to examine the situations prior to 1960 we have prepared Table 6, in which again no definite correlation can be found. Thus, to our regret the attempt of estimating equation 4 has to be abandoned, and hence it become difficult to grasp exactly the effect upon economic growth of the balance between growth rate of labor demand and that of Supply. (Where the balance I=S is realized and there is no credit creation the growth rate will be substantially low.)

Table 5. (Corporate businesses, 1966)

Industry	Capital Rotation Rate PQ/K	Value a Added Rate Y/PQ	$\frac{K}{Y}$	$\frac{Y}{K}$
Whole industry	1.43 times	16.1%	4.343	
Agriculture-forestry-fishery	1.02	25.5	3.845	
Food processing	1.82	22.9	2.399	
Textile	1.27	19.1	4.123	
Paper-pulp	1.07	20.1	4.650	
Miscelaneous manufact.	1.44	23.1	3.006	
Wholesale-retail	2.42	6,4	6.457	
Real estate	0.29	34.7	9.937	
Transport-communication	0.85	47.8	2.461	
Service	1.04	33.3	2.887	
Mining	0.92	27.0	4.026	0.2484
Coal mining	0.68	36.1	4.074	0.2455
Construction	1.44	20.2	3.438	0.2909
Chemical	0.92	22.1	4.918	0.2033
Ceramics	0.95	26.9	3.913	0.2556
Steel	0.87	23.9	4.809	0.2079
Nonferrous metal	1.17	16.8	5.088	0.1966
Metal products	1.34	27.4	2.724	0.3672
Machinery	0.99	28.8	3.507	0.2851
Electric equipment	1.03	26.5	3.678	0.2719
Transport equipment	1.04	21.5	4.472	0.2236
Shipbuilding	0.61	23.4	7.006	0.1427
Shipping	0.80	42.8	2.921	
Electric power	0.34	39.9	7.371	
Gas	0.81	32.1	3.846	

Industry	K (total assets) (billion yen)	Y (estimate) (billion yen)	
Agriculture-fish forestry	90	145	
Fishery	467		
Wholesale-retail	20285	3142	
Food processing	2315	965	
Textile	2166	525	
Paper-pulp	1225	264	
Miscellanious manufact.	4382	1458	
Transport-communication	2831	1150	
Service	1964	680	
Consumer's goods total	35725	8329	4.289
Mining	828	206	
Coal mining	402	99	
Construction	4065	1825	
Chemical	4622	940	

Ceramic	1367	349	
Steel	3816	793	
Nonferrous metal	1007	198	
Metal products	1288	473	
Machinery	2087	595	
Electric equipment	3124	849	
Transport equipment	3250	525	
Shipbuilding	1817	258	
Shipping	1148	398	
Electric power	3166	430	
Gas	280	73	
Capital goods total	31367	8006	3.918

Table 6

Year	w	$\frac{\Delta w}{w}$	u
1962	—	—	420 ('000 persons)
1963	58.9	—	470
1963	67.9	15.3%	310
1964	72.3	6.5	610
1965	76.1	5.3	570
1966	81.8	7.5	560
1967	85.6	4.7	420
1968	88.2	3.0	530
1969	93.5	6.0	460
1970	100.0	7.0	330
	(Index)		(unemployment)

5

What effects economic growth works on the patterns of saving has a close relation with the prolongation of roundabout production in future. This is because the diversified patterns of saving—bank deposit, life insurance premium, securities, etc.—have a particular structure of investment each. The higher is the growth of saving in those patterns with a larger allocation of investment in industries with a larger capital coefficient, the more active is the prolongation of roundabout production, which again will raise labor productivity as well as wage levels. On the other hand high capital coefficients will make investment activities in such industries more active, boosting the growth rate. From this viewpoint let's try analysis from both micro- and macro-aspects how the patterns of saving in Japan have shown changes.

First from the micro-viewpoint. The basic data of this sort are provided by the *Chochiku Dōkō Chōsa* (Savings Trend Survey) by the Statistics Bureau, Prime Minister's Office. A problem here is whether we should take gross assets

Table 7. (Quantification model)

$$\log \frac{Y}{L} = \bar{1}.4550 + 0.857 \log w \qquad (1a)$$

$$\frac{wL}{Y} = 0.275 w^{0.143} \qquad (2a)$$

$$\frac{\Delta Y_1}{Y_0} = \frac{\Delta L_1}{L_0} = g \qquad (3a)$$

$$\frac{w_{t+1} L_{t+1}}{Y_{t+1}} = 0.275 w_{t+1}^{0.143} \qquad (5a)$$

$$S = 0.1015W + 0.2516\pi - 416 \text{ billion yen} \qquad (6a)$$

$$g_t = 0.22862(0.1051W + 0.2516\pi - 416 \text{ billion yen})/Y(1 - 0.275w^{0.143})$$

$$= 0.22862[(0.2516 - 0.02791w^{0.143})Y - 416 \text{ billion yen}]/Y(1 - 0.275w^{0.143}) \qquad (8a)$$

$$\beta_1 = 4.289, \quad \beta_2 = 3.918$$

Condition for prolongation of roundabout production:

$$\theta < \frac{4.289}{4.289 + 3.918} = 0.523$$

Investment:

$$I = \dot{K} = \frac{1}{r}\left[(1 - Aw^{1-b})\dot{Y} - A(1-b)w^{-b}\dot{w} - \dot{r}K\right] \qquad (14)$$

Condition for investment-saving equilibrium:

$$\left[s_2 - (s_2 - s_1)Aw^b + A(1-b)\frac{w^{-b}}{r}\dot{w}\right]Y - \frac{1}{r}(1 - Aw^{1-b})\dot{Y} + \frac{\dot{r}}{r}K - s_0 = 0 \qquad (15)$$

$$(0.2516 + 0.3918\frac{w^{-0.857}}{r}\dot{w} - 0.027912w^{0.143})Y - \frac{1}{r}(1 - 0.275w^{0.143})\dot{Y}$$

$$+ \frac{\dot{r}}{r}K + 416 \text{ billion yen} = 0 \qquad (15a)$$

or net assets subtracting debts. Since our purpose is to observe the patterns of saving it will do to employ gross assets, not net assets. And it is desirable for us to know the actual state dividing workers' and proprietor-businesses' households because our aim is to examine the effect of changes in the relative shares. But in this survey by the Statistics Bureau workers' households are separately shown, but proprietors' are not; available data are only for total and workers' households. So, though unsatisfying, we have made comparison of saving patterns between the total and the worker's household, π and W. Table 8 exhibits savings for 1968 and 1962 classified by annual income class. In this table the amount of present savings includes bank current deposits but the latter is not shown as a separate item because of the viewpoint of investment. Among the various patterns of saving three items of time deposit D, life insurance premium J and securities holding B account for overwhelmingly large weights, so we shall consider the choice between these three.

First, comparison between total and worker's households for the same annual income. Since the original data involve some dissimilarity of Y's between the two household groups we have made adjustment for this point. That is to say,

Table 8. (Savings by income class)

Section	Annual Income Y	Present Savings S	Time Deposit D	Life Insurance J	Securities B
	(100 yen)	(100 yen)	(100 yen)	(100 yen)	(100 yen)
		Total Household, 1968			
I	4618	4629	1752	1224	660
II	7187	6338	2165	2009	721
III	9080	8088	2760	2233	1139
IV	11717	11557	3627	2698	2439
V	19059	24117	8319	4298	6491
Av.	10332	11611			
		Worker's Household, 1968			
I	5474	3267	1233	990	204
II	7653	5913	1860	1703	943
III	9259	7355	2330	2049	1091
IV	11631	10147	2857	2485	2339
V	17908	18029	5252	3616	5194
Av.	10385	9007			
		Total Household, 1962			
I	2255	1137	331	362	145
II	3744	1951	595	634	277
III	4962	2733	754	883	510
IV	6556	4311	1133	1211	998
V	11648	11653	2867	2188	4420
Av.	5832	4356			
		Worker's Household, 1962			
I	2592	876	253	292	78
II	4061	1765	485	642	247
III	5134	2515	607	887	457
IV	6594	3710	951	1183	944
V	10565	8302	1810	1791	3385
Av.	5789	2631			

assuming that the whole income distribution poses a logarithmic normal distribution, we have taken geometric average of the inocmes of worker's and total households, W and π, multiplied D, J and B of total household by the ratio of this $\sqrt{\pi W}$ to π, and also on W put similar adjustment. Table 9 shows the result. Even after such adjustment, however, no difference of patterns is observable between the two groups, with the total household holding for almost all items a higher value than worker's on account of the higher propensity to save in the former.

Table 9. (Income-adjusted table)

(unit: 100 yen)

Section	Y	D		J		B	
		π	W	π	W	π	W
			1968				
I	5027	1906	1132	1332	882	718	187
II	7417	2234	1802	2073	1650	744	914
III	9166	2785	2307	2253	2029	1149	1080
IV	11674	3612	2868	2687	2495	2429	2348
V	18475	8061	5420	4775	3732	6290	5360
Av.	10352						
			1962				
I	2418	355	236	388	272	155	73
II	3899	619	465	660	616	288	237
III	5047	767	597	898	872	519	449
IV	6573	1136	948	1215	1179	1001	941
V	11093	2749	1901	2098	1881	4239	3554
Av.	5812						

6

Then, what is it about a method to consider the difference of saving patterns by means of contrasting income-class with an equal amount of present savings, taking a standpoint that, in line with the permanent income hypothesis, the total household has higher propensity to save on account of larger fluctuation of income? In the actual, however, since the 2nd income-class of worker's household has a much larger value of savings than the 1st of total household, it is unreasonable to work adjustment of any appreciable scale on incomes. So we have put further adjustment on the income-adjusted data of Table 9 with respect to savings so that the saving amounts of income-class each of the two groups become equal, and on this supposition studied the difference of patterns. This is an unrealistic supposition but may be allowable for the sake of finding the difference of shares among the patterns rather than of levels. Thus we have obtained Table 10, the "savings-adjusted" data for 1968 and 1962. These data should broadly suffice for our purpose yet we have to take into account the demonstration effect about consumption in order to examine the relation between economic growth and saving. So it is necessary to introduce the relative income hypothesis. So we have sought $\sqrt{\pi W}$ about the total income averages of both groups for the two years. The $\sqrt{\pi W}$ for 1968 is 1.781 times as large as that of 1962. Then each figure of savings of 1962 has been multiplied by 1.781. Should the theory of demonstration effect literally apply, the double-adjusted indifference curve for 1962 thus obtained and the indifference curve for 1968 would at least cross each other. How is it in the actual?

First, let's see the choice between bank (time) deposit D and life insurance premium J. Figure 1 exhibits this. Five indifference curves are plotted for the 1st to 5th income-class for the two years respectively. (Numbers denote sections.) In curve A's, i.e., 1968, in the 2nd and 5th sections both D and J are larger for π than for W, representing completementary rather than substitutional relationship. In the 1st, 3rd and 4th sections substitution is observed, where the marginal substitution rate $-dJ/dB$ is almost the same for the 3rd and 4th but substantially large for the 1st suggesting strong preference of insurance.

Next, curve B's (dotted lines) show 1962 values multiplied by 1.781. On the whole the indifference curves of 1962, even multiplied by the conversion rate, lie in the lower-left side of 1968 curves. This seems to contradict what the theory of demonstration effect teaches us, but we can without conflict interpret that savings, not as flows but as stocks, represent the result of accumulation for the six years. Even if the demonstration effect has worked to shift the indifference curves of flows year by year, there should have been time lags in its process of spread, and the cumulative effect of such shift and saving seems to have produced the result that, as in Figure 1, curve B's sit at the lower-left of curve A's respectively. And it is noteworthy that in curve B's there is seen no complementary relationship in contrast with curve A's. In the 5th income-class the marginal substitution rate-dJ/dD is large implying strong preference of insurance. From these observations we could draw three conclusions as follows.

1) In 1962 D and J were completely in a substitutional relation whereas in 1968 there was born a complementary relation, where the propensity to save is stronger in π than in W.

2) In 1962 strong preference of insurance was seen even in the higher class of 4th, whereas in 1968 no section showed such preference except the 1st.

3) Generally speaking where substitution exists W has stronger preference of insurance than π.

Next, we shall consider the choice between securities holding and insurance taking. Figure 2 presents this. By the 1968 data in the 3rd and 4th sections there is no substitutional relation but a complementary relation. It is to be noticed, however, that in the 4th section π has a higher value for both B and J than W while in the 3rd section this relation is reversed. In the 2nd and 5th sections there is recognized substitution, in which π shows stronger preference of insurance in both sections, and the marginal substitution rate is higher in the 2nd than in the 5th. Also in the 1st section substitution is seen but in this class W has stronger preference of insurance. In these points heavier effects of random factors are recognizable than in the case of choice between J and D. Next in the data of 1962, for the 4th and 5th sections a complementary phenomenon is shown while for the 1st, 2nd and 3rd a substitutional relation, where W has stronger insurance preference than π, and the marginal substitution

Table 10. (Savings-adjusted data)

(unit: 100 yen)

Section	S	πD	wD	πJ	wJ	πB	wB
			1968				
I	3890	1472	1469	1028	1179	554	243
II	6122	2091	1925	1941	1763	696	976
III	7713	2633	2444	2130	2149	1087	1144
IV	10478	3290	2920	2447	2540	2212	2390
V	20852	7196	6077	4263	4184	5615	6009
Av.	10226						
			1962				
I	997	290	288	317	332	127	89
II	1856	566	510	603	675	263	260
III	2618	722	632	846	923	489	476
IV	3989	1048	1022	1120	1272	923	1015
V	9835	2420	2145	1847	2122	2730	41012
Av.	3977						
	(Savings-income double adjusted values, 1962)						
I	1776	516	513	565	591	226	159
II	3306	1008	908	1074	1202	468	463
III	4663	1286	1126	1507	1644	871	848
IV	7104	1866	1820	1955	2265	1644	1808
V	17516	4310	3820	3290	3779	6643	7145
Av.	7083						

(Original figures×1.781)

Figure 1. Deposit and Insurance A 1968, B 1962 (converted)

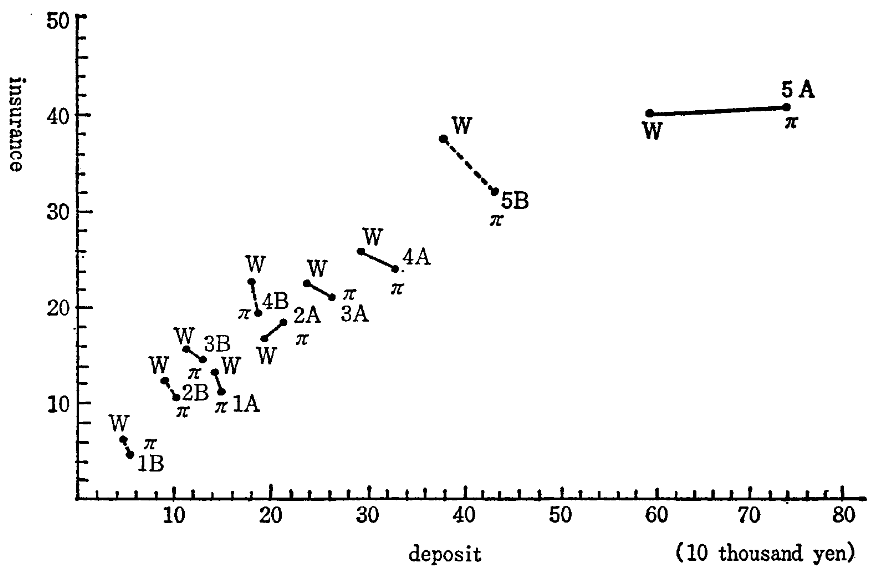


Figure 2. Securities and Insurance A 1968, B 1962 (converted)

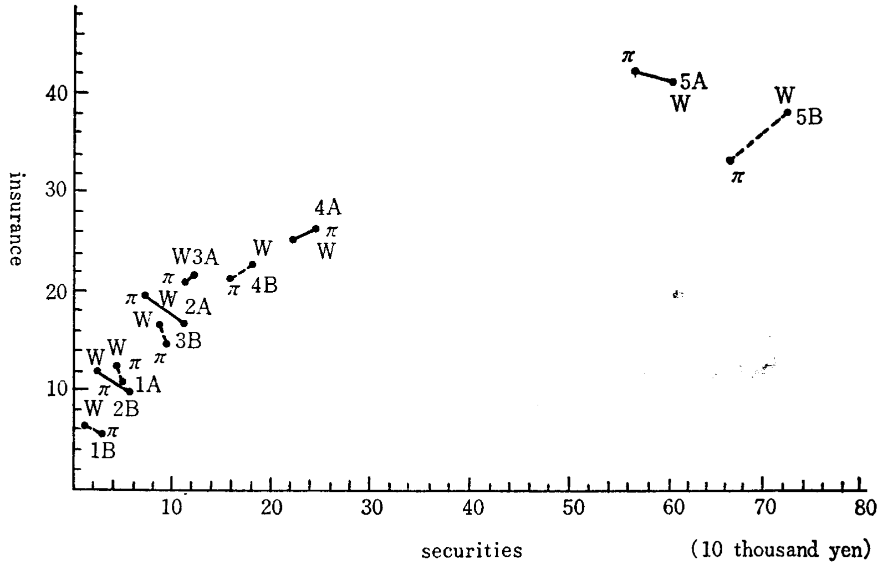
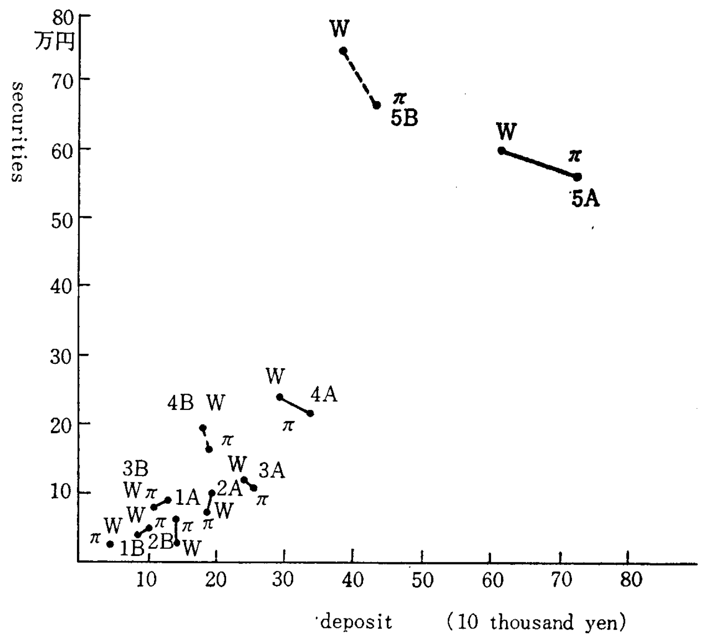


Figure 3. Deposit and Securities A 1968, B 1962 (converted)



rate is highest in the 2nd. Thus the following conclusions.

4) In 1962 in the lower sections clearly emerged a substitutional relation between J and B, and it is possible without doubt to judge that W had stronger insurance preference, whereas in 1968 such relation was disturbed and the choice between the two became less obvious.

5) In order to see the demonstration effect the savings of 1962 have been

multiplied by 1.781. Thus for the 5th section savings of 1968 and 1962 sit on the almost same scale but the scales of the two years become more and more deviated as the class goes down, and the 1st of 1968 and the 2nd of 1962 are close to crossing. This is caused by the fact that the present amounts have been taken similarly with the case of bank deposit. It may be inferred from this that the effect of accumulation is contrariwise larger in the lower income classes. And in the comparison between the two crossing curves preference of insurance is relatively decreased.

Third, the choice between bank deposit and securities holding, shown in Figure 3. In the 1968 data substitution exists as to the 3rd, 4th and 5th income-class. Since, as has been already described, there is no substitutional relation between insurance and securities in the 3rd and 4th sections, we can say in these classes substitution exists between (insurance + securities) and bank deposit. By contrast in the 5th class it is seen between (insurance + deposit) and securities. In any way W has stronger securities preference. For the 1st and 2nd sections it cannot be said that substitution exists between deposit and securities, but isn't it possible to take that some degree of choice exists between (insurance + deposit) and securities? Thus a big difference of behavior seems to lie between the 1st–2nd sections and the 3rd–4th sections. Among the 3rd, 4th and 5th sections there is no large difference of $-dB/dD$.

Next the data of 1962. For the 4th and 5th sections there is seen substitution between B and D, $-dB/dD$ is larger than in 1968. There is no substitution in the 1st, 2nd and 3rd sections. Since between D and J and also between B and J substitutional relations are found as previously mentioned, it may be said that there exists substitution between (D + B) and J, that is, behavior different from in 1968. In the 4th and 5th classes there is recognized the choice between (B + J) and D similarly to the case of 1968. The reason for such a big change of saving behavior seems to lie in a large shift in the present savings.

Thus we could summarize:

6) In so far as the choice between D and J is concerned, the share of J will rise in accompany with the rise in the W's share. The pace of J's increase, however, will be slower than in W's share due to shifts of indifference curves.

7) In the choice between B and J, for the lower sections the share of J will rise with the rise in the share of W, but the change will be still slower than in the case of (6).

8) In the choice between D and J, what can be said about relatively high classes is that the share of B rises with the increase in the share of W, though at a slower pace than the latter.

9) Thus in accompany with rises in the W's share, in the lower income classes J will rise, and in the higher classes B. In terms of amount the latter is larger than the former, but a tendency to increase the B's share is supposed to arise on account of changes in the saving behavior due to changes in income differentials.

7

Is it possible to derive saving functions from savings by patterns as flows? As has been described already, in the derivation of the saving function as aggregate we have made estimation from both the aspects of cross-section and time-series data. We shall again apply this method to the saving function by patterns. Table 11 presents data on annual income, bank deposit, life insurance premium and securities purchase of worker's household, obtained from the *Chochiku Dōkō Chōsa* of 1962. First let's see bank deposit. It is abnormally large in the 1st income-class and abnormally small in the 2nd; only with sections above the 3rd income-deposit correlation can be seen. This state is unsatisfactory to derive the cross-section saving functions. Again in securities purchase the value of the 5th section is strikingly high so that application of least squares method would bring only low fitness. In the end estimation of the cross-section function can have a sense only with insurance premium, the result being shown in Table 11. We have multiplied aggregate national income by this marginal

Table 11. (Worker's savings, 1962)

Section	W	D′	J′	B′
	('000 yen)	(100 yen)	(100 yen)	(100 yen)
I	265	27	64	7
II	412	7	121	32
III	520	102	168	76
IV	669	107	214	77
V	1068	251	298	349

Table 12. (Saving function of life insurance)

Year	J Working Assets of Life Ins. Companies	J′ do, Increments	$s_1 j$W Premium Payment from Labor Income (estimate)
	(100 million yen)	(100 million yen)	(billion yen)
1957	3387		
1958	4458	1071	143
1959	5764	1279	160
1960	7435	1671	188
1961	9426	1991	226
1962	11739	2313	266
1963	14568	2829	310
1964	18009	3441	360
1965	22219	4210	414
1966	27128	4909	476
1967	32780	5652	552

$J' = 0.029W + 6889$ yen

propensity to save (on life insurance), 0.029, in order to estimate premium payment for each year, which is shown as in Table 12. However, this value often exceeds the increment of working assets managed by life insurance companies, which makes it impossible to estimate premium payments from π. Thus we have to abandon derivation of the saving function of insurance as flows by the joint use of cross-section and time-series data.

To investigate the relation between present savings as stocks and income is incompatible with growth economics in its proper sense. But since such functions of saving by patterns as flows are difficult to derive, we shall inquire into the relation between present savings and income (before tax) in order to examine how the shares of savings patterns change with economic growth. First as cross-section data we use the *Chochiku Dōkō Chōsa* to estimate saving functions, the result being:

$D=0.197\,W-20440$ yen (bank time deposit)

$J=0.184\,W-22500$ yen (life insurance)

$B=0.427\,W-149930$ yen (securities)

(for worker's household, 1962; fitness is worse in securities than in other two.)

For securities holding the coefficient of income is very high due to the abnormally high holding in the 5th income-class. We need discount this. By pooling these and time-series data bank deposits have been calculated as are shown in Table 13-A, where dependency on π is much larger than on W. (Time deposits include those owned by corporate persons, but this involves no contradiction since corporate incomes are included in π as reserves.)

As to premium payments Table 13-B gives the product of W's marginal saving rate obtained by cross-section data and W in time-series data. The result, however, shows for all years an amount exceeding the working assets of insurance companies (Table 12), so any reasonable saving function is difficult to derive. This may be due to the too high value of W's marginal saving rate by cross-section data yet it is imaginable that W has made much contribution to the growth of insurance business. It may be said about incentives to taking insurance that persons with a higher "personal value of his own" among total assets are more accessible to insurance, and generally insurance is taken depending on one's subjective probability of death, which is supposed to show a Poisson-Charlier-type distribution, that is, a probability distribution different from the objective probability based on the law of large numbers and used by insurance companies, and hence whether the theorem of Bayes holds or not is questionable.

Derivation of the saving function for securities holding is not easy. As to stocks there lies a problem of evaluation, whether by current prices or face values. By our logic current prices at the time of purchase should be adopted but such statistics are unavailable. The Bank of Japan's *Keizai Tōkei Nempō* (Economic Statistics Annual) presents only data about numbers as shown in Table 13-C; even evaluation by face values is unknown. This renders impossible

Table 13-A

Year	D Deposit	s_1dW	D$-s_1dW$
	(10 billion yen)	(billion yen)	(10 billion yen)
1958	313	973	216
1959	382	1088	273
1960	460	1277	332
1961	535	1535	385
1962	634	1804	450
1963	756	2108	545
1964	874	2444	630
1965	1040	2814	759
1966	1238	3234	915
1967	1431	3748	1056

$D=0.197W+0.780\pi-149.8$ billion yen

Table 13-B

Year	sjW (100 million yen)	J (100 million yen)
1958	9084	4458
1959	10164	5764
1960	11925	7435
1961	14341	9426
1962	16847	11739
1963	19684	14568
1964	22831	18009
1965	26284	22219
1966	30202	27128
1967	35006	32780

Table 13-C

Year	Present Amount of Bonds (billion yen)	Stocks owned by Individuals ('000 share)
1958	1360	13260
1959	1780	15700
1960	2323	19342
1961	3122	26694
1962	3781	32719
1963	4691	36990
1964	5685	41782
1965	7230	41455
1966	9022	42549
1967	10968	42802
	(excl. government bonds)	

our derivation of saving function in macro-terms. Thus it is difficult to go beyond the conclusion obtained in the preceding section.

8

Changes in the saving patterns lead to changes in the investment patterns; changes in the distribution of investment among industries alter the levels of round about production; thus the average level of productivity of value added changes, affecting economic growth. Of course the objects of financing in financial institutions may not be inflexible but drastic changes in their composition within a short period are unconceivable. In this sense the structure of finance is more stable in stock terms than in flow terms, and hence the former

Table 14. (bank loans and payments into stocks)

	Bank Loan		Payment into Stock	
	Amount (billion yen)	Percentage	Amount (100 million yen)	Percentage
1. Agriculture-forestry-fishery	372	1.2	22	1.0
2. Food processing	990	3.1	176	7.0
3. Textile	1831	5.7	51	2.0
4. Paper-pulp	554	1.7		
5. Miscellaneous manufacture	1044	3.3		
6. Wholesale-retail	9910	31.0	332	13.1
7. Real estate	1143	3.6		
8. Transport-communication	1361	4.3	329	13.0
9. Service	1489	4.7		
10. Home loan, etc.	1252	3.9		
A) Comsumer's goods industry total	19976	62.4	910	36.0
11. Mining } 12. Coal mining }	97	0.3	119	4.7
13. Construction	1341	4.2		
14. Chemical	2292	7.2	351	13.9
15. Ceramics	646	2.0	56	2.2
16. Steel	1514	4.7 }		
17. Nonferrous metal	557	1.7 }	141	5.6
18. Metal product	537	1.7 }		
19. Machinery	1209	3.8 }		
20. Electric equipment	1336	4.2 }		
21. Transport equipment	1777	5.6 }	394	15.6
22. Precision instruments	255	0.8 }		
23. Shipbuilding				
24. Shipping				
25. Electric power } 26. Gas }	460	1.4	558	22.1
B) Capital goods industry total	12021	37.6	1619	64.0
Total	(33527) (end-1969)	(31967)	(4217) (1966)	(2529)

is preferable for measuring changes in the levels of round about production. Yet as for stocks data of flows only are available while as to industrial bonds classification by industries is too crude to use for our purpose. So in Table 14 we show financing by the three sources either as present amounts or flows. (In order to keep conformity of industrial classification between banking statistics and corporate business data we include timber & wood product, publishing & printing and rubber manufacture into the miscellaneous group, and oil refinery into the chemical industry.) By this table in life insurance the loans to capital goods industries hold larger shares than in other financial sources, and that

(loans of 20 life insurance companies, end-March 1970)

Industry	Amount (million yen)	Percentage	Increase over Preceding year (million yen)
Chemical	234,733	8.6	61,020
Steel	298,722	11.0	68,592
Nonferrous metal	45,892	1.7	11,288
Metal product	22,087	0.8	4,436
Machinery	76,458	2.8	20,693
Electric equipment	101,847	3.7	31,137
Transport equipment	184,652	6.8	45,468
Precision instruments	10,711	0.4	2,221
Miscellaneous manufacture	45,187	1.7	7,636
Land transport	202,089	7.4	46,295
Shipping	34,020	1.3	6,689
Communication	3,871	0.1	26
Electric power	125,268	4.6	13,115
Gas	7,932	0.3	4,097
Housing public corporation	262,078	9.9	39,733
Miscellaneous	1,060,645	39.0	251,433
Total	2,716,193	100.0	613,850

to those industries with a large capital coefficient. This is partly due to controls by government and partly because its funds for finance are long-term credit which makes it possible to invest fearlessly in industries of high-level round about production.

Thus we can suppose a series of causal relations, that is, increase in labor demand→rise in wage rate→(elasticity of substitution below unity)→increase in labor's income share→increase in the share of insurance taking→prolongation of round about production.

Insofar as we observe by cross-section data, however, it can not always be said that high capital-coefficient industries have high productivity of value added. Figures in Table 15 are adopted from the *Hōjin Kigyō Tōkei Chōsa*, 1966 ed., by which the rank correlation between capital coefficient and value-added productivity is plotted in Figue 4. If the hypothesis "the higher the capital coefficient, the higher the value-added labour productivity" simply holds, the dots showing the ranks of industries would be posited on the line with 45-degree slopes to both axes. However, those actually sitting on this line count only three, i.e., (21) electric power, (11) chemical and (16) machinery. And eight industries lie near to this line, i.e., (18) transport equipment, (10) coal mining, (12) ceramics (electric equipment), (15) metal product, (23) construction, (5) miscellaneous manufacturing and (8) service. The aggregate rank-difference correlation coefficient is a low of 0.443, being disturbed by such industries as:

A) Those with a low capital coefficient and high labour productivity of value

Table 15

Industry	Capital Coefficient		Added-Value Productivity	
	Amount	Rank	Amount (10000 yen)	Rank
1. Total industry	4.343	9	95	14
2. Agriculture-forestry-fishery	3.845	15	108	10
3. Food processing	2.399	24	122	9
4. Textile	4.123	10	59	24
5. Paper-pulp	4.650	7	102	12
6. Miscellaneous manufacture	3.006	19	77	22
7. Wholesale-retail	6.457	3	88	17
8. Transport-communication	2.461	23	85	19
9. Service	2.887	21	67	23
10. Mining	4.026	12	132	6
11. Coal mining	4.074	11	96	13
12. Chemical	4.918	5	142	5
13. Ceramics	3.913	13	89	16
14. Steel	4.809	6	162	4
15. Nonferrous metal	5.088	4	130	7
16. Metal product	2.724	22	79	20
17. Machinery	3.507	17	88	17
18. Electric equipment	3.678	16	90	15
19. Transport equipment	4.472	8	108	10
20. Shipbuilding	7.006	2	123	8
21. Shipping	2.921	20	272	2
22. Electric power	7.371	1	299	1
23. Gas	3.846	14	258	3
24. Construction	3.438	18	78	21

(Source: *Hōjin Kigyō Tōkei Chōsa Nempō*, 1966 ed.)

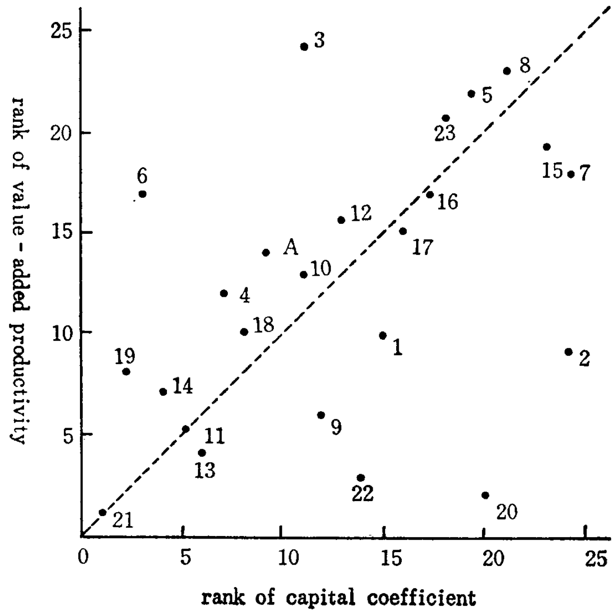
$$\rho=1-\frac{6\times1281}{24\times575}=0.443$$

added—(20) shipping, (2) food processing, (22) gas;

B) Those with a high capital coefficient and low productivity of value added—(3) textile (wholesale-retail).

Of course the corporate business report does not cover all enterprises, with the representation rate being particularly low for the agriculture-forestry-fishery. Yet according to the above-described result of cross-section observation it is difficult to say that prolongation of round about production directly leads to higher productivity of value added. Although it is supposable that in macro-terms structural changes of industry may promote mechanization in the consumer goods industries and raise productivity, this process is not so simple as is intuitively conceivable. Analysis by a more complex model will be necessary. For if the Douglas-type function, whose elasticity of labor-capital substitution

Fig. 4



is unity, is presumed, a rise in capital coefficients, hence in demand for capital, will diminish demand for labor by the same rate, and accordingly productivity of value added will rise.

However, our model employs the CES function, not the Douglas function. So with the elasticity of substitution below unity, the rate of decrease in labor demand accompanying a higher capital coefficient will be smaller than the latter, and the increase in added-value productivity will be smaller than the rise in capital coefficient. The above-said group-B industries have supposedly emerged for this reason. By contrast if the substitution elasticity is over unity, the added-value will rise by a larger rate than will the capital coefficient.

The CES production function presumes constant identity between labor's marginal productivity and wages. This means, in a labor-shortage economy, that wage rises cause upward shifts of the curve of labor's marginal productivity, or else decreases in employment.