THE GROWTH RATE AS A DETERMINANT OF THE SAVING RATIO

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I. *Introduction*

If we accept Keynes' consumption law which states that the saving ratio increases with the increase of income, we would expect countries with high income to have high saving ratios. But as Table 1 shows, Japan's saving ratio is the highest, though she does not have the highest per capita income among the countries listed. This fact casts a doubt on the validity of Keynes' law. In fact, when we draw a scatter diagram, with per capita income on the horizontal axis and the saving ratio on the vertical axis, using international cross-section data, we do not observe a linear relation between the two [23 and 5]. Underdeveloped countries such as Panama, the Barbados, Costa Rica and the Philippines have a negative or low saving ratio, due to their low income. But developed countries such as the United Kingdom and the United States do not have a very high saving ratio. Their ratio is lower

TABLE 1. THE PERSONAL SAVING RATIO FOR SELECTED COUNTRIES IN 1958–64

Country	Saving Ratio (%)	Country	Saving Ratio (%)
Australia	9.3	Honduras	6.1
Austria	8.1	Ireland	8.4
Barbados	−1.8	Jamaica	4.7
Belgium	10.7	Japan	17.5
Canada	7.5	Netherlands	13.1
China (Taiwan)	10.2	New Zealand	9.2
Columbia	7.6	Panama	−7.3
Costa Rica	3.6	The Philippines	3.6
Denmark	10.9	Sweden	11.7
Equador	2.3	Switzerland	10.1
France	7.9	The United Kingdom	4.6
W. Germany	13.4	The United States	5.8
Greece	11.3		

Source: Toshiyuki Mizoguchi, *Personal Savings and Consumption in Postwar Japan* (Kinokuniya Bookstore Co., Ltd., Tokyo, 1970), p. 5.

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than that of countries such as Honduras and Japan where income is less than one half of that of developed countries.

Of course there are objections to this sort of international comparison. We might question the reliability of income and saving data of some countries. Furthermore, the use of foreign exchange rates to convert per capita income into U.S. dollars is not satisfactory. But even if we take these problems into account, the linear relationship between income and the saving ratio (with a positive slope and intercept) does not seem to hold.

In order to retain income as the major determinant of a saving ratio, we might propose a non-linear relation such that the ratio increases up to a certain level and then starts to decrease. This relation would give a better fit to the scatter diagram, but Japan's saving ratio would be considerably above the point predicted by such a relation. This leads us to believe that there are other determinants of the saving ratio.

The other factors which have been discussed in explaining Japan's relatively high personal saving ratio are as follows:

1. The high rate of return on investment [12 and 33]
2. The relative importance of bonus income [14 and 26]
3. The low asset level [33]
4. The high rate of growth [31]
5. The low liquidity level [26]
6. The inadequate social security program [26]
7. The age composition [26]
8. The unequal income distribution [26]

In this paper we shall examine the growth rate as a factor accounting for Japan's high saving ratio.

II. *The Growth Rate and the Saving Ratio*

By using macro-economic data for various countries, Houthakker and Yang have both shown that there is a correlation between growth and saving ratio [12 and 34]. A country with a high growth rate tends to have a high saving ratio. We might be able to explain Japan's high saving ratio by relating it to her high growth. But according to the simple Harrod-Domar model, the higher the saving ratio is, the higher the growth rate. That is, the growth rate is not the cause but the result of a high saving ratio. Thus, the problem of identification enters into the relationship.

There is, however, some evidence to support the contention that growth is one determinant of the saving ratio. Studies of survey data on worker households, where income growth is not as strongly influenced by the saving ratio as in other cases, found that the correlation between the saving ratio and the growth rate [22, 34] is significant. For these families the chain of causation seems to be from the growth rate to the saving ratio, rather than vice versa. Thus, we need to explain how the growth rate influences the saving ratio. For this we offer a distributed lag hypothesis.

III. *A Distributed Lag Model*

A distributed lag model

(1) $$C(T)=\sum_{i=0}^{n} a_i Y(T-i)+c$$

assumes that consumption at time T depends on current as well as all previous income.[1] The effect of income at time T is felt not only on consumption at time T but also on consumption at $T+1$, $T+2,\cdots$. The first coefficient, a_0 measures the contribution of $Y(T)$ to $C(T)$, a_1 the contribution of $Y(T)$ to $C(T+1)$, $\cdots$ extending to time $T+n$ which is sufficiently remote for $Y(T)$ to have no real influence on consumption behavior. The term a_0 measures the proportion of $Y(T)$ consumed at time T and can be therefore called the 'short-term propensity to consume'. On the other hand $\sum a_i$ measures the proportion of $Y(T)$ consumed over time and can be called the 'long-term propensity to consume'.[2]

If a distributed lag model explains consumer behavior, the growth rate influences the saving ratio. If we divide (1) by $Y(T)$, we obtain

(1)′ $$\frac{C(T)}{Y(T)}=\frac{c}{Y(T)}+a_0+a_1\frac{Y(T-1)}{Y(T)}+a_2\frac{Y(T-2)}{Y(T)}+\cdots\cdots+a_n\frac{Y(T-n)}{Y(T)}$$

$$=a_0+\frac{c}{Y(T)}+\sum_{i=0}^{n}a_i\prod_{j=0}^{i}(1+r_j)^{-1},$$

where $$(1+r_j)^{-1}=\frac{Y(T-j-1)}{Y(T-j)}.$$

When the economy is growing at a constant rate r, the consumption-income ratio becomes

$$\frac{C(T)}{Y(T)}=a_0+\frac{c}{Y(T)}+\sum_{i=0}^{n}a_i(1+r)^{-i}.$$

Thus, for a given level of Y, the consumption-income ratio is highest when the growth rate is zero. As the growth rate increases, the consumption-income ratio decreases and approaches $\left(a_0+\frac{c}{Y(T)}\right)$ as an asymptote, as r increases to infinity. As a consequence the saving ratio increases as the growth rate increases. Therefore, even if two countries have the same level of income and the same propensity to consume, the country with a higher growth rate has a higher saving ratio. Therefore, the distributed lag model provides a theoretical bridge between the growth rate and the saving ratio.

There are at least three economic justifications for the distributed lag consumption model. We shall discuss each of these in the remainder of this section.

(a). One justification is to treat the lag model as a 'genuine' distributed lag model. The effect of $Y(T)$ on consumption might be felt on future consumption when a consumer

[1] The distributed lag consumption model was first proposed by M. Friedman in [7].

[2] It is well known that the distributed lag model includes the following models as a special case: a) Keynesian consumption model, $C(T)=aY(T)+c$, *b*) Modigliani's consumption model, $\frac{C(T)}{Y(T)}=a+b\times\left(\frac{Y(T)-Y(0)}{Y(T)}\right)$, where $Y(0)$ is the maximum level of income previous to time T, c) Growth model $\frac{C(T)}{Y(T)}=a+b\left(\frac{Y(T)-Y(T-1)}{Y(T)}\right)$, and d) Duesenberry's model $\frac{C(T)}{Y(T)}=a+b\frac{Y(T)}{Y(0)}$. See [7, 149].

obtains a larger amount of income than he expected and cannot decide its disposition in a short time. This source of lag might be particularly noticeable among Japanese workers, who have obtained large bonuses almost each year in the postwar period. The lag might be also due to planning for future purchases. When a consumer wants to buy a durable whose price is such that he has to save his income for more than one year, we have the second source of lag. To buy a durable the consumer must build up liquid assets until he has enough savings. In this case the excess liquidity might appear to be a variable determining consumption. But the true specification of the consumption behavior is the lag model, and the excess liquidity is merely a superficial phenomenon.

Some types of lag in consumption may be very long. If a consumer saves current income for his children's education, it might not be spent for ten or more years. A longer lag would result when a consumer saves for life after retirement. If he starts to save when he is in his twenties, his consumption after retirement depends on his income of the past thirty to forty years.

Thus far we have not placed any restriction on the sequence of the coefficients, a_0, $a_1, \cdots, a_n$. It seems reasonable to assume that the effect of income at T on consumption at time T' will decrease as T' moves away from T. Furthermore, the sequence of a_i should be positive. We would probably not distort reality to any great extent by adopting a lag scheme which expresses a_i as a function of a few parameters and assumes decay in response over time. There are several lag schemes which satisfy these conditions, but we have chosen to assume that the coefficients decrease exponentially. They constitute a geometric progression whose first term is a_0 and whose common ratio λ lies between 0 and 1:

$$a_i = a_0 \lambda^i, \qquad 0<\lambda<1. \tag{2}$$

If we assume this lag pattern and take n to be infinity, we can write (1) as

$$C(T) = a_0 \sum_{i=0}^{\infty} \lambda^i Y(T-i) + c. \tag{1$'$}$$

The following two hypotheses give rise to (1)$'$

(b) The permanent income hypothesis

Suppose that

$$\begin{aligned} C(T) &= c + kY^P(T) = c + k(\beta W(T)) \\ &= c + k' W(T), \end{aligned} \tag{3}$$

where Y^P is permanent income and W the present value of all future income of a consumer.[3] We can write

$$W(T) = \int_T^{\infty} \exp(-\beta(t-T))\, Y(t)dt, \tag{4}$$

where $Y(t)$ is the income stream accruing to the consumer over a continuous interval, and β is the long-term rate of discount.[4]

There is no data on wealth available which includes both human and nonhuman wealth, much less data on future income streams. One way of computing wealth is to use past income, assuming that $Y(T+1) = Y(T-1)e^{\alpha}$, $Y(T+2) = Y(t-2)e^{2\alpha}, \cdots$, where α is the growth rate of income. This assumption states that to compute the income of $Y(T+n)$, we need to know the income of $Y(T-n)$ and adjust it for the trend factor.[5]

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[3] This is Friedman's permanent income hypothesis when the constant term is zero.
[4] β is considered to be some sort of average of all future discount factors.
[5] The justification for this is given in [8].

To obtain W, we substituted $Y(T+n)=Y(T-n)e^{n\alpha}$ in (4), obtaining

$$W(T)=\int_0^\infty e^{-\beta n}Y(t+n)dn=\int_0^\infty e^{(\alpha-\beta)n}y(T-n)dn \tag{5}$$
$$=\int_{-\infty}^0 e^{(\beta-\alpha)n}Y(T+n)dn=\int_{-\infty}^T e^{(\beta-\alpha)(t-T)}Y(t)dt.$$

If we approximate reality by making $Y(t)$ a step functions, such that it is constant between t and $t+1$, (5) becomes

$$W(T)=\frac{1}{\beta-\alpha}(1-\lambda)\sum_{i=0}^{\infty}\lambda^i Y(T-i), \tag{6}$$

where

$$\lambda=e^{(\alpha-\beta)}.$$

Thus, (3) becomes

$$C(T)=c+a_0\sum_{i=0}^{\infty}\lambda^i Y(T-i),$$

where

$$a_0=k\frac{\beta}{\beta-\alpha}(1-\lambda).$$

(c) The habit-formation hypothesis

The second hypothesis which leads to the distributed lag model with exponentially decreasing coefficients is

$$C(T)=\alpha+\beta Y(T)+\lambda C(T-1). \tag{7}$$

This model assumes that current consumption depends on current income and consumption lagged one period. We could interpret $C(T-1)$ literally as consumption at $T-1$ or as a variable representing past living standards. By either interpretation the distinguishing feature of the model is that it makes current consumption partly dependent on past consumption. The living standards associated with consumption previously enjoyed might become 'impressed' on the consumer and produce an inertial lag in consumer behavior.

About the causes behind this inertia, M.T. Brown wrote:

"Two main theories have been raised in the attempt to reach the causes behind this inertia. One has followed the theories of Modigliani and Duesenberry, and explains the inertia in terms of consumers' memories of past heights or peaks of real income. The second theory followed the approach that past real consumption patterns and levels from consumer habits which persist long enough to slow down the effects of current income changes on current consumption. This theory assumes that the decline of the effect of past habits is continuous over time...... As each new real consumption vector occurrs it becomes the most recent, and hence the strongest habit forming experience; but it, itself, has been influenced by earlier consumption experience and habits. Any level of actual consumption then represents the accumulation of all past experience, and hence a single lag of only one time period seems to be all that is required." [4, 370]

Finally, we need to show that model (7) is identical to model (1)'. But it is a simple matter to show that (7) leads to (1)' by using a lag operator [15].

IV. *Estimation*

Our next task is to estimate the parameters of the distributed lag model. As is well known, the problem which arises in direct estimation by least squares is multicollinearity. That is, if we attempt to regress C_t on Y_t, Y_{t-1}, $\cdots$, Y_{t-n}, we obtain a poor estimate of the par ameters due to the collinear movement of Y. One way to get around this problem is to regress $C(T)$ on $Y(T)$, then on $Y(T)$ and $Y(T-1)$, $\cdots$, by adding one more lagged variable each time until the coefficient of determination after the adjustment of degree of freedom stops increasing. We might stop this process even earlier when the estimated value of the coefficient falls outside the expected range (0-1.0). The result of estimation using Japanese consumption and income data from 1953 to 1967 is shown in equations 5-10 in Table 2.

Equation 7 is the Keynesian consumption function which does not include lagged income. Equation 8 drops the constant term and postulates that the saving ratio has been roughly constant during the sample period. Since the ratio increased during this period, equation 8 gives the worst result among the six equations. By adding lagged income we improved the explanatory power of the equation. But the equation with a constant term performs better than that without it. Equation 5, which includes two lagged values of income, gives the best result. We added one more lagged value of income and estimated the coefficients, but some of their values became negative, so this result is not reported in the table.

There are ways to circumvent direct estimation. One method is to estimate only a few parameters and interpolate or extrapolate the value of the other parameters by using a polynomial equation. Of course, the number of the parameters to be estimated depends on the degree of the polynomial equation to be used. This technique, which we might call the Almon technique, has been successfully employed in investment studies [1], but it has not been applied to the consumption function. We used this method to estimate the parameters, but failed to obtain a reasonable result.

Our failure might be due to the fact that consumption and income have a trend, whereas variables in an investment function might not have a definite trend. But we could also raise the question of whether the Almon technique is as powerful as is generally believed. Rather than going into a technical discussion, we just want to point out that data are often inadequate to discriminate among different lag patterns. That is, we might be asking too much of data if we let it decide an appropriate lag pattern.[6] The Almon technique implies that data can decide a lag pattern, but it is not a valid claim as far as the lag pattern of Japanese consumption is concerned.

Since we did not succeed with the Almon technique, we imposed the condition that the coefficients are positive and decreasing. That is, we assumed that

$$a_0 > a_1 > a_2 > a_3 \cdots > a_n > 0.$$

This should be a reasonable assumption since the effect of income at T on consumption at T' decreases as T' moves away from T. For estimation purposes we have to approximate the sequence. We tried the geometric progression by setting

[6] Grilliches writes "...do not expect the data to give a clear-cut answer about the exact form of the lag. The world is not that benevolent. One should try to get more implications from theory about the correct form of the lag and impose it on the data." [10, 46].

$$a_i = a_0 \lambda^i.$$

Then, by using Koyck's transformation we obtained the equation

$$C(T) = c + a_0 Y(T) + \lambda C(T-1)$$

and estimated the coefficients.[7] The result of estimation is shown in the row for equation 1 in Table 2. Equation 2 has the same independent variables, but it does not have a constant term.

TABLE 2

Equation	Y	Y_{-1}	C_{-1}	Y_{-2}	Constant	$1-\bar{R}^2$ (%)	Durbin-Watson Statistics	Maximum Percentage Deviation	Long-run M.P.C.	Short-run M.P.C.
1	.570		.272		5.89	.11	1.98	1.82	.783	.570
	(.064)		(.0272)							
2	.380		.577			.31	1.38	2.81		
	(.088)		(.114)							
3	.600	−.125	.393		4.81	.11	2.03	1.72	.7838	.600
	(.081)	(.194)	(.210)							
4	.635	−.487	.832			.13	1.82	1.80		
	(.094)	(.136)	(.108)							
5	.584	.082		.121	7.82	.12	1.58	1.82	.787	.584
	(.083)	(.1162)		(.097)						
6	.700	.162		−.033		.80	.35	6.18		
7	.754				9.2	.20	.88	3.56	.754	.754
	(.0089)									
8	.824					1.13	.22	11.50		
	(.0069)									
9	.576	.1997			8.31	.14	1.51	2.50	.776	.574
	(.089)	(.0959)								
10	.635	.202				.82	.26	9.23		

Based on the estimate of the parameters of equation 1, we can evaluate the permanent income justification for the distributed lag model. Since our estimate of γ is .272, we may obtain an estimate of β, the long-term rate of discount per annum, from the equation

$$.272 = e^{(\alpha-\beta)},$$

where α is the average rate of growth of income during the sample period. The growth rate of income in 1953-64 was about 8 per cent on a per capita basis, thus our estimate of β is around 1.40.

This high estimate of the discount rate leads us to question the validity of the permanent income justification for the distributed lag model. The discount rate does not have to coincide with the rate of interest, and the former may be considerably higher than the latter due to imperfections in the financial market or uncertainty. But the annual discount rate

[7] We could assume that the coefficients form an arithmetic progression by setting

$$a_i = a_0 \left(\frac{n-i}{n}\right).$$

We estimated the coefficients by using this assumption, but the result was poor and is not presented here.

of 140 per cent is absurd. Therefore, it would be more reasonable to assume that the distributed lag model is generated either by a planned consumption lag or by habit persistence.

If we contrast equation 1 with equation 7, we find that the former is a better model. But to test whether equation 7 with the first-order Markov process of error terms is really an appropriate model, we computed a regression equation with current income, income lagged one period and consumption lagged one period:[8]

$$C(T)=\alpha+\beta_0 Y(T)+\beta_1 Y(T-1)+\gamma C(T-1)+V(T).$$

The result of estimation is shown in the row of equation 3 in Table 2.

If equation 7 with the first-order Markov process of errors is a correct model,

$$\hat{\beta}_1=-\hat{\beta}_0\hat{\gamma}$$

should hold roughly. But $-\hat{\beta}_0\hat{\gamma}$ is about twice as large as $\hat{\beta}_1$ and thus equation 3 is unlikely to be a derivative of equation 7.

We now have to decide what lag form best represents Japan's postwar consumption behavior. We notice in Table 2 that equation 3 is superior to all other equations in terms of R^2, the Durbin-Watson statistics and the maximum percentage of deviations. Equation 1 has the same explanatory power, but it has a slightly higher maximum percentage deviation and a lower value of the Durbin-Watson statistics than equation 3. Thus, we decided to take equation 3 as the appropriate consumption model.

We now have to transform equation 3 into a distributed lag model in order to reveal the lag pattern. By using a lag operator, we can write equation 3 as

$$C(T)=\alpha+\beta_0 Y(T)+\beta_1 LY(T)+\gamma LC(T), \qquad \text{or}$$

$$(1-\gamma L)C(T)=\alpha+\beta_0 Y(T)+\beta_1 LY(T).$$

By dividing both sides of the equation by $(1-\gamma L)$, we obtain

$$C(T)=\alpha'+\sum a_i Y(T-i),$$

where

$$\begin{aligned} \alpha'&=\frac{\alpha}{1-\gamma} \\ a_0&=\beta_0 \\ a_1&=\beta_0\gamma+\beta_1 \\ a_2&=\beta_0\gamma^2+\beta_1\gamma \\ &\vdots \\ a_i&=\beta_0\gamma^i+\beta_1\gamma^{i-1} \\ &\vdots \end{aligned}$$

The lag pattern constructed from the estimates of β_0, β_1, and γ is shown in Table 3.

We notice in Table 3 that the decrease in a_i is quite fast. About 80 per cent of the contribution of income to consumption is from income in the current year. Income lagged one period has some influence on current consumption, but income before that does not contribute much to current consumption. The average lag is about 0.4 years.

[8] If $C(T)=c+a_0 Y(T)+v(T)$ and
$v(T)=\rho v(T-1)+\mu(T)$,
where $\mu(T)$ satisfies the assumption of the Gauss-Markov theorem, are the correct specification of consumption behavior, we can write

$$C(T)=c+a_0 Y(T)+\rho v(T-1)+\mu(T).$$

But

$$\rho v(T-1)=\rho C(T-1)-\rho c-\rho a_0 Y(T-1).$$

Thus,

$$C(T)=(1-\rho)c+a_0 Y(T)+\rho C(T-1)-\rho a_0 Y(T-1).$$

Therefore, if the model specified above is correct, the coefficient for $Y(T-1)$ must be minus the product of the coefficient for $Y(T)$ and that for $C(T-1)$.

TABLE 3. THE LAG PATTERN IN CONSUMPTION

a_0	.6005	a_5	.0025
a_1	.1111	a_6	.0010
a_2	.0438	a_7	.0003
a_3	.0172	a_8	.0001
a_4	.0068	$\sum a_i$	.7832

In order to contrast Japan's lag pattern in consumption with that of another country, we have chosen the United States. We used postwar data on per capita consumption and income, to estimate the same equations for the United States.[9] The results are shown in Table 4.

TABLE 4. 1950–1965 U.S.A.

Equation	Y	Y_{-1}	C_{-1}	Y_{-2}	Y_{-3}	Constant	$1-\bar{R}^2$	Durbin-Watson Statistics	Maximum Percentage Deviation
1	.927		.036			−77.42	.57	1.63	1.07
	(.094)		(.113)			(40.74)			
2	.974		.062				.63	1.16	1.31
	(.099)		(.110)						
3	.935	−.106	.136			−67.29	.61	1.72	1.06
	(.0997)	(.278)	(.286)						
4	.981	−.305	.262				.65	1.59	1.18
	(.097)	(.243)	(.280)						
5	.94	−.067		.103		−94.14	.68	1.74	1.17
6	.997	−.093		−.122					
7	.946					−52.53	.55	1.58	1.11
	(.01817)					(33.88)			
8	.92						.60	1.32	1.13
	(.0016)								
9	.944	.0143				−75.03	.49	1.58	1.13
	(.095)	(.110)							

One striking result is that the equation with no lag does better than those with lagged income and consumption. The row of equation 3 shows that $\hat{\beta}_1 = -\hat{\beta}_0 \hat{\gamma}$ holds roughly, which indicates that the appropriate model is the Keynesian consumption model with the first-order Markov process of errors. Thus, we conclude that for the United States the contribution of past income to current consumption is non-existent or so insignificant that it cannot be measured.

[9] Per capita personal consumption in 1958 dollars was taken from Table A 26, and per capita disposable income in 1958 dollars from Table A 42 in [32].

V. *Implications*

In this section we shall discuss the contribution of the growth rate to the difference in the saving ratio between the United States and Japan. This would throw some light on the significance of the growth rate in explaining international differences in the saving ratio.

There are two reasons for making Japan's saving ratio higher. The first is her low marginal propensity to consume. Japan's long-run marginal propensity to consume is around .784, whereas that of the United States is over .90. Given the same lag structure and the same growth rate, the country with a lower propensity to consume has a higher saving ratio. We have not attempted to explain the difference in the propensity to consume between the two countries.

But even if the propensity to consume of the two countries were the same, the lag structure and the growth rate would influence the saving ratio. As we pointed out above, we could not detect the existence of a lag in U.S. consumption behavior, whereas a lag is present for Japan. This means that the past growth rate does not have any impact on the saving ratio of the United States. On the other hand the presence of the lag for Japan makes it possible for the growth rate to influence the saving ratio.

Table 5 attempts to measure the percentage contribution of the growth rate to the difference in the saving ratio between the two countries. Column 1 shows the actual difference in the saving ratio (between 1955 and 1965). Column 2 measures the percentage increase of Japan's saving ratio due to the growth rate coupled with the presence of the consumption lag. Column 3 is column 2 divided by column 1 and expressed as a percentage.

TABLE 5. THE PROPORTION OF THE DIFFERENCE IN THE SAVING RATIO BETWEEN JAPAN AND THE U.S. EXPLAINED BY THE GROWTH RATE

	(1) Actual Difference (%)	(2) The Increase Due to the Growth Rate (%)	(3) The Proportion of Difference (1) Explained by (2) (%)
1955	5.48	1.89	34
56	4.05	1.23	30
57	6.37	2.54	40
58	5.45	1.42	26
59	8.46	2.44	29
1960	10.58	3.16	30
61	11.46	4.28	37
62	10.15	2.34	23
63	10.52	2.52	24
64	10.06	2.51	25
65	10.10	2.32	23

We should explain column 2 in more detail. We asked what would have been the Japanese saving ratio if her long-run marginal propensity to consume had coincided with the short-run propensity, or if there had been no lag in the Japanese consumption behavior. This could be measured by writing the equation as

$$C(T)=c+\alpha Y(T),$$

where

$$\alpha=\sum_{i=0}^{n} a_i.$$

By dividing both sides of the equation by $Y(T)$, we computed the hypothetical saving ratio. We attributed the difference between this ratio and the actual ratio to the growth rate working through the lag pattern.

The growth rate is not the only factor accounting for the difference in the saving ratio between the two countries. We must take into account other factors to give a complete explanation. But the growth rate is one of the important factors to be considered. For some years it accounted for more than one third of the difference. In more recent years, however, the growth rate has become less important in accounting for the difference.

VI. *Summary*

A number of factors have been proposed to account for differences in the saving ratio among countries. One of these factors is the growth rate. Based on the positive relation between the growth rate and the saving ratio, it has been argued that the growth rate is an independent variable determining the saving ratio. We postulated a distributed lag consumption model to theoretically justify the growth rate as a determinant of the saving ratio.

Our empirical results show that among the three justifications, the permanent income hypothesis is unlikely to generate the distributed lag model. The estimated value of the parameters gives a discount rate which is too high to be realistic. The lag in consumption is due either to planning or to habit persistence.

In order to find the empirically most satisfactory model we tried various combinations of independent variables. The equation with $Y(T)$, $Y(T-1)$ and $C(T-1)$ as independent variables gave the best result, but the equation with $Y(T)$ and $C(T-1)$ also gave a good result. Since the superiority of the former over the latter equation is slight, we need a longer series of data to discriminate between the two, but judging from available data we concluded the former is the best consumption model for postwar Japan. The implied lag pattern does not have coefficients which decrease exponentially. They decrease fairly quickly, and the average lag is short. This is in contrast to the lag in investment, which has an average lag period of about two years and has coefficients with an inverted V shape.

To illustrate the significance of the growth rate in determining the saving ratio we compared the results for Japan with those for the United States. Although the average lag period is fairly short, Japan's rapid growth produced a few percentage points of difference in the saving ratio. This accounted for more than one third of the difference in the saving ratio for some years. For every year between 1955 and 1965, at least 20 per cent of the difference was due to the growth rate. The lower long-run propensity to consume in Japan is certainly more important in accounting for the difference, but the growth rate is also an important factor to be considered. Some of the various factors given at the end of Section 1 should also help account for Japan's lower propensity to consume, but the task of assessing their relevance has not been undertaken in this paper.

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