A NOTE ON INFLATION AND SAVINGS[1]

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Introduction

Consumer expenditure forms a major component of the Gross National Expenditure and the parameters of consumption function play a crucial role in the mechanism of income determination of macro model. In addition to that recent inability of the economic recovery from the recession can be attributed to the continued hesitancy of consumer expenditure, as reflected in high ratio of personal savings.[2] Income and lagged consumption variable cannot explain this phenomenon sufficiently. Because of the importance of consumption function, progress has been made to incorporate ceteris paribus variables in consumption function.[3]

The sluggishness of consumption expenditure recovery usually explained in terms of role of uncertainty and real asset depreciation. In this note we argue the importance of price expectations and asset effect on consumption expenditure, and discuss the results in relation to previous studies.

Notes

(1) This note depends on the series of paper, T. Fukuchi, K. Ohno and M. Obayashi, "Nihon Keizai no Hendo (1973-75) no Keiryo Bunseki," in Japanese, (An Econometric Analysis of the Fluctuations in Japanese Economy: 1973-75), read at the Annual Meeting of the Association of Japanese Theoretical Economics, Oct. 1977, T. Fukuchi, K. Ohno and M. Obayashi, "Kyoran Bukkaji no Syohisha Kodo no Keiryo Bunseki," in Japanese, (An Econometric Analysis of Consumer Behavior Under Inflation), Mimeo., 1978, and M. Obayashi, "An Econometric Analysis of Japanese Economy – Introduction of Expectations –," (MA thesis presented to the International Christian University, 1978.) The author is indebted to Takao

Fukuchi and Koichi Ohno for their helpful comments and suggestions. The remaining errors or shortcomings are, if any, author's responsibility.

(2) Since consumption plus savings equals disposable income, this identity means that savings can be obtained directly from the consumption function.

(3) The followings are the recent main contributions:
W. H. Branson and A. K. Klevorick, "Money Illusion and the Aggregate Consumption Function," *American Economic Review*, 59, 1969, pp. 832-49.
W. H. Branson and A. K. Klevorick, "Money Illusion and the Aggregate Consumption Function: Reply," *American Economic Review*, 62, 1972, pp. 207-10.
S. W. Burch and D. Werneke, "The Stock of Consumer Durables, Inflation and Personal Saving Decisions," *Review of Economics and Statistics*, 57, 1975, pp. 141-54.
A Cukierman, "Money Illusion and the Aggregate Consumption Function: Comment," *American Economic Review*, 62, 1972, pp. 198-206.
A. Deaton, "Involuntary Saving Through Unanticipated Inflation," *American Economic Review*, 67, 1977, pp. 899-910.
J. W. Freebairn, "Inflation and Stability of the Household Consumption-Saving Function," *Economic Record*, June, 1977, pp. 198-217.
F. T. Juster and P. Wachtel, "Inflation and the Consumer," *Brookings Papers*, 1, 1972a, pp. 71-114.
F. T. Juster and P. Wachtel, "A Note on Inflation and the Saving Rate," *Brookings Papers*, 3, 1972b, pp. 765-78.

I Previous Studies

One of the major source of uncertainty about the consumer reaction concerns about price expectations, which is likely to influence consumer decisions about spending or saving. At this stage, unfortunately, there is no consensus as to the causal mechanism by which inflation influences the consumer decision or as to the magnitude of its effect. On the one hand inflation might be expected to reduce saving ratio, and on the other hand inflation might increase saving ratio. A negative relationship between inflation and saving ratio can be explained by the money illusion effect in the sense of Patinkin, and by the intertemporal commodity substitution. A positive relationship is also at the same time plausible by

the uncertainty effect engendered by inflation and by the real asset depreciation on constant nominal value financial assets due to the price inflation.

In fact there are mainly two contradicting results on this topic, and there are many possible ways which link inflation and savings. In this section some of the major contributions are discussed shortly. One set of results which states positive relationship between inflation and savings are rather dominant.

Juster and Wachtel (1972a)[1] (1972b)[2] focused on the effects of anticipated and unanticipated inflation on savings in the United States and found that their empirical investigation suggests that a fully anticipated inflation will increase consumer expenditure and reduce personal savings. On the other hand a totally unanticipated inflation has the opposite effect. The result support the view that a primary effect of unanticipated inflation is to reduce spending and increase savings, possible explanation is that inflation deepens uncertainty about real income expectations.

Burch and Werneke (1975)[3] concluded that the typical response of American consumer in the period of inflation was to save more for necessities and preserve real balances and thus the wealth variables are important in explaining the variations in the saving ratio. Their conclusion also stress on the existence of the substitution of lower quality goods in inflationary period and relative unimportance of expected price changes.

In case of Australia, Freebairn (1977)[4] estimated various types of consumption function and investigated the cause of high saving ratio of recent Australian economy. He obtained the tentative result that the inflation rate and changes in inflation rate reduce consumption ratio due to the real balance effect and increase in consumer uncertainty.

Deaton (1977)[5] constructed a disequilibrium model of demand which describes the state that imperfect information of prices produce systematic deviation from equilibrium to actual level of consumption when one aggregate individual consumption over different individuals. The main theoretical result of his paper is the following saving ratio function.

$$\frac{S}{Y} = \frac{S^*}{Y^*} + \left\{ \log \frac{Y}{P} - \log \frac{Y^*}{P^*} \right\} - \psi \left\{ \log P - \log P^* \right\},$$

$\psi < 0$,

where S is personal savings, Y disposable income, P price level and variable with asterisk means expected value of each variable. The first term represents equilibrium saving ratio. The second term reflects the fact that all unanticipated real income is saved, and the final term describes the inflation effect on saving ratio. The unanticipated inflation cause the saving ratio rise. The magnitude of the coefficient ψ represents the degree of imperfect price information of the market and negative sign means the downward sloping demand curve. The empirical analysis of this model for the United States and the Britain appeared as when the quarterly rate of inflation is running at 2 percent above the anticipated inflation sightly more than one percent of disposable income is involuntarily saved.

The other set of results which states negative relationship between inflation and personal savings are published in the series of paper by Branson and Klevorick (1969)[6] (1972)[7] and Cukierman (1972)[8]. They estimated "money illusion consumption function". The basic structure of their model without introducing lags is of the form;

$$\log C_t = b_0 + b_1 \log Y_t + b_2 \log W_t + b_3 \log P_t,$$

where all variables are in terms of real and per capita, C is consumption, Y income, W consumer wealth and P is price level. The coefficient b_3 determines the existence of money illusion, if b_3 is significantly different from zero and positive. They concluded that in the short run the price level has independent effect on real consumption due to what commonly called money illusion. This analysis is much similar to Deaton, although perfectly opposite result was obtained.

Notes

(1) Juster and Wachtel, *op. cit.*, pp. 71-114.
(2) Juster and Wachtel, *op. cit.*, pp. 765-78.
(3) Burch and Werneke, *op. cit.*, p. 153.

(4) Freebairn, *op. cit.*, p. 112.
(5) Deaton, *op. cit.*, p. 902.
(6) Branson and Klevorick, *op. cit.*, pp. 832-49.
(7) Branson and Klevorick, *op. cit.*, pp. 207-10.
(8) Cukierman, *op. cit.*, pp. 198-206.

II The Model

The sluggishness of personal consumption recovery is crucial problem in recent recovery from recession of Japanese economy. Attempts have been made in the series of paper by Fukuchi, Ohno and Obayashi (1971)[1] (1978)[2] and Obayashi (1978)[3] to investigate the reaction of Japanese consumer to inflation.

It is clear that the research on the subject should incorporate both price expectations and asset effect. In addition to that it will be more desirable to construct the model in the line of how price expectations and asset influence consumer decision, because previous studies heavily depend on the sign of parameters of additional independent variables in regression. As we will discuss below, we start from rather simple postulate on consumption behavior and obtain the consumption function which satisfies these requirements.

The discussion begins from simple postulate on consumption-savings behavior. It is recognized that the sequential nature of expenditure under imperfect price information means that expected and actual price level can differ not only future but in the present. In the world where the money wage rate cannot fall due to the downward regidity of money wage, the uncertainty about the fall in real income is limited to the price. Thus the price information is sufficient to generate uncertainty about the real income.

First let us assume short run planned consumption expendiutre depends on lagged disposable income deflated by expected price. The lagged disposable income can be justified by the sequential nature of income receipt and spending.[4] We specify the planned consumption expenditure as follows;

$$C^* = \alpha_0 \left[\frac{Yd_{-1}}{P^e} \right]^{\alpha_1} \quad , \quad 0 < \alpha_1 < 1 \ , \tag{1}$$

where C^* is planned consumption expenditure, Yd_{-1} lagged disposable income and P^e is expected price level. On the other hand, the perfect information or equilibrium consumption expenditure can be written as;

$$C' = \alpha_0 \left[\frac{Yd_{-1}}{P} \right]^{\alpha_1} \quad , \tag{2}$$

where C' is equilibrium consumption expenditure and P is actual price level. Employing familiar partial adjustment process, we can obtain the actual consumption expenditure (C) as follows;

$$\log C = \log C^* + \beta \log [C' - C^*], \ 0 < \beta < 1. \tag{3}$$

If price level is perfectly anticipated, then consumption function (3) becomes equilibrium consumption function (2).

Next step is to introduce the asset variable. Assume that consumer try to maintain or adjust toward a certain target level of asset, then the consumption function becomes;

$$\log C = \log C^* + \beta \log [C' - C^*] + \alpha_2 \log [A - A^*], \tag{4}$$
$$0 < \alpha_2 < 1 \ ,$$

where A is actual level of asset and A^* is target level which assumed constant. An advantage of present specification is that we can calculate the following elasticities immediately.

1. Imperfect foresight price elasticity ($d \log P = (1+q)\, d \log P^e$, $0 < q < 1$).

$$\eta_1 = \frac{\partial \log C}{\partial \log P}\bigg|_{d \log P = (1+q)\, d \log P^e} = -\frac{\alpha_1 (1 + \beta q)}{1 + q} < 0.$$

2. Asset elasticity.

$$\eta_2 = \frac{\partial \log C}{\partial \log A} = \alpha_2 > 0.$$

Also it is possible to interpret the equation (3) similar to Deaton, and in

this case our model becomes;[5]

$$\frac{S}{Y} = \frac{S^*}{Y} + \alpha_1\beta \log [P - P^e] \ . \qquad (5)$$

This equation is same to Deaton model without real income anticipation, although the meaning and interpretation of the parameter is quite different.

Substituting equations (1) and (2) into (4), and assuming asset variable be $\sum_0^{-1} S/Yd_{-1}$, we have the following Double Adjustment Consumption function.

$$C = \alpha_0^* \left[\frac{Yd_{-1}}{P^e}\right]^{\alpha_1} \cdot \left[\frac{P^e}{P}\right]^{\alpha_1\beta} \cdot \left[\frac{\sum_0^{-1} S}{Yd_{-1}}\right]^{\alpha_2}, \quad \alpha_0^* = \alpha_0 \left[\frac{\sum_0^{-1} S^*}{Yd_{-1}}\right]^{-\alpha_2}, \qquad (6)$$

where S is personal savings.

Notes

(1) Fukuchi, Ohno and Obayashi, *op. cit.*, pp. 1-6.
(2) Fukuchi, Ohno and Obayashi, *op. cit.*, pp. 1-20.
(3) Obayashi, *op. cit.*, pp. 30-36.
(4) An Alternative justification is also possible when we assume that the expected income is formed by implicit expectations.
(5) Deaton, *op. cit.*, p. 902. He employed following approximation, that is; $S/Y = \log Y - \log C$. Mr. Ohno suggested that the parameter becomes $(1 - \beta)$ when one does not employ this approximation. However the result does not alternate in sign, and also the existence of alternative interpretation can be found in Juster and Wachtel (1972a, p. 88).

III Empirical Analysis and Concluding Remarks

This consumption function (6) is fitted on the Japanese quarterly data from the first quarter of 1970 to the last quarter of 1975, and the expected price series are generated assuming nonlinear regressive expectations due to the lack of appropriate data for expected price.[1] The estimated result appears as follows:

$$C = 735.1 \cdot \left[\frac{YD_{-1}}{P^e}\right]^{\underset{(6.75)}{0.4449}} \cdot \left[\frac{P^e}{P}\right]^{\underset{(1.80)}{0.2375}} \cdot \left[\frac{\sum_0^{-1} S}{Yd_{-1}}\right]^{\underset{(6.80)}{0.3604}},$$

$$\hat{R} = 0.9957,\ \hat{S} = 0.0121,\ DW = 2.68,\ (\text{t-value}).$$

The sign of all parameters are as expected and different from zero significantly at 10 percent level. The result shows good statistical performance and the mean of absolute error rates of total test is 7.75 percent while around 14 percent is obtained in usual income and lagged consumption specifications.[2] Calculating the two elasticities and parameter of equation (5), we have;

$$\eta_1 = -0.4066,\ (q = 0.2262),$$
$$\eta_2 = 0.3604,$$
$$\alpha_1 \beta = 0.2375.$$

The present specification of the model suggests that it is important to incorporate the price expectations and asset variable in consumption function. From estimated equation and the two elasticities, we may conclude that the recent sluggishness of consumption expenditure recovery is due to the mixed effects of price expectations and asset depreciation, the imperfect foresight price elasticity represents that ex post price rise reduce real consumption and the asset elasticity shows asset depreciation due to the price inflation may also reduce real consumption.

The results obtained here are in general consistent with the former set of results in section 1. In our model a totally unanticipated inflation reduce consumption expenditure;

$$\frac{\partial \log C}{\partial \log P} = -\alpha_1 \beta = -0.2375\ .$$

Also if we transform equation (6) to consumption ratio function, then we have;

$$\left.\frac{\partial \log (PC/Yd)}{\partial \log P}\right|_{P=P^e} = 1 - \alpha_1 = 0.5551.$$

Thus fully anticipated inflation reduce saving ratio, these results are consistent with Juster and Wachtel.[3]

The highly significant parameter of asset variable will describe the fact that asset variable is important in explaining consumption expenditure as Burch and Werneke[4] and Freebairn[5] stated. The wealth effect or real balance effect is not negligible.

Reinterpretation of our model to Deaton model shows,[6] although the interpretation and meaning of the parameter are different, the unanticipated inflation causes involuntary savings in both model.

In this note we have argued the importance of ceteris paribus variables in explaining the variations of consumption expenditure.[7] We have also demonstrated that this can be done employing suitable underpinnings. The results suggest that continuing high saving ratio can be attributed to the unanticipated inflation and asset depreciation. It can be said that incorporation of ceteris paribus factors gives us richer understandings of consumer behavior and our results justify the need for further studies in this direction.

(Nov. 21, 1978)

Notes

(1) The technical discussion of the generation of expected price and the estimation method are fully discussed in Fukuchi, Ohno and Obayashi (1978, pp. 5-8) and Obayashi (1978, pp. 30-33).
(2) Fukuchi, Ohno and Obayashi (1978), *op. cit.*, p. 16.
(3) Juster and Wachtel (1972a), *op. cit.*, pp. 87-88 and p. 105. See also Juster and Wachtel (1972a), *op. cit.*, p. 772.
(4) Burch and Werneke, *op. cit.*, p. 153.
(5) Freebairn, *op. cit.*, pp. 208-12.
(6) Deaton, *op. cit.*, p. 902.
(7) Obayashi, *op. cit.* He tried to introduce the price expectations and the production expectations into macro econometric model. These expectations are incorporated in consumption, investment for housing, private fixed investment, inventory investment and money wage function.

インフレーションと貯蓄に関するノート

〈要　約〉

大林　守

本稿の目的は，国民所得決定の重要な要素であるところの個人消費にインフレーションが与える効果の分析，比較研究である。最近の不況からの脱出の遅れは，個人消費の伸び悩み(高貯蓄率)にあることは，たびたび議論されてきた。ここでは，高貯蓄率を，インフレーションの不完全予測と貯蓄の目減りにより説明するモデルを紹介し，他の分析結果との比較を行なった。