The consumption function

Part 2

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The specification of the consumption function under the permanent income hypothesis turns out to be that of the classical statistical "errors in variables" model. The true variables obey an exact functional relationship but they are observed with error. The result is that least squares estimation of the function : $C_P = KY_P$ using the observed variables consumption and income, gives an inconsistent estimate of (k). The observed consumption (c) is given by:

$$C = C_P + C_T = KY_P + C_T$$

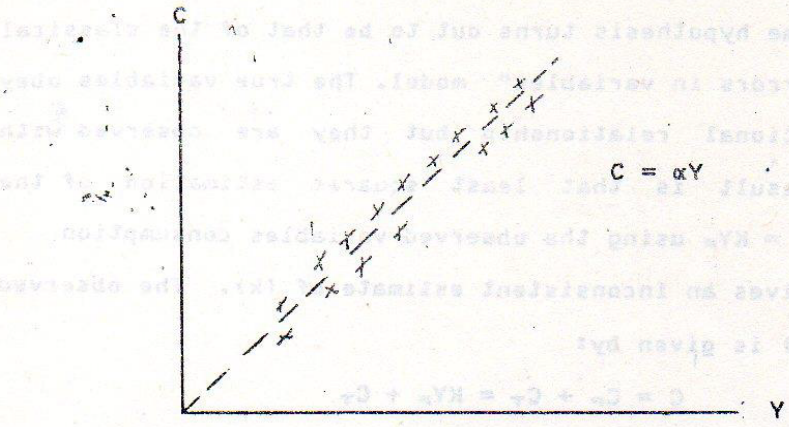
and is related to observed income as follows:

$$C = KY + (C_T - KY_T)$$

This gives a linear relationship between observed variables together with an error term $(C_T - KY_T)$ which is itself a function of the two transitory components and we can see clearly that this equation does not satisfy the assumption of the classical least squares method of estimation, especially the assumption which states that the explanatory variable must be independent of the error term.

2. 4. Implications and tests of PIH for time series analysis.

In the case when (i, w, u) defined above are constant the ratio of $\frac{C_P}{Y_P}$ will maintain the same value over time. If short-time run fluctuations in C and Y are averaged over time, the long-run C/Y will remain constant and will not show any trend.



The long run constancy of the C/Y ratio implies that consumption and income are proportional in the long run and that the long run marginal propensity to consume (MPC) is equal to the average propensity to consume APC[3]. To test this theory empirically and determine whether the regression estimate of (K) is equal to the observed APC, it is necessary to derive empirical approximations for C_p and Y_p. The former is handled simply by substituting C for C_p. Differences in the two are relatively small, because purchases of consumer durables are already excluded from consumption. In any case Friedman argues that on the average C equals C_p. Permanent income is approximated by a weighted average of present and past measured income with the weights declining exponentially. The actual formula given by Friedman is : [4]

$$(Y_p)_T = \beta \int_{-\infty}^{T} e^{(\theta-\alpha)(t-T)} Y_T dt$$

where:

β = An adjustment coefficient between measured and expected income

α = Average annual growth rate

T = Present time period

t = Index of time periods.

Thus with time series data Friedman provided a new interpretation of Brown's equation with the significant difference that the constant term was cancelled. Once one choose to estimate permanent income hypothesis for time series data is distinguishable from other hypothesis and all of them require attention to be paid to the simultaneity problem.

Since the explanatory variables (Y) is related to the error term (Both contains Y_t as mentioned earlier), an instrumental variable (Z) is required. This instrumental variable should be correlated with Y_p but not to the error term $C_t - KY_t$, then the instrumental variable estimate of the MPC will be:

$$b = \frac{\Sigma (C_i - \bar{C})(Z_i - \bar{Z})}{\Sigma (Y_i - \bar{Y})(Z_i - \bar{Z})}$$

if Z is correlated with Y_p and independent of C_T and Y_T then b is a consistent estimate of K

$$\text{Plim } b = \text{Plim } \frac{\Sigma(k(Y_{pi} - \bar{Y}_p) + (C_{Ti} - \bar{C}_T))\ (Z_i - \bar{Z})}{\Sigma ((Y_{pi} - \bar{Y}_p) + (Y_{Ti} - \bar{Y}_T))\ (Z_i - \bar{Z})} = K$$

2.5. The Role of wealth in the consumption function.

In his famous book "A Theory of the Consumption Function", Friedman made a distinction between income derived from labor and income derived from wealth : "All forms of non-human wealth are not equally satisfactory as a reserve for emergencies, this is the reason why certain kinds of non-human wealth, such as so called liquid assets have been singled out for special attention in some empirical studies. But none of the other distinctions betweeen human and non human wealth seem as pervasive and fundamental as the distinction between human and non-human wealth".[7]

But in his empirical works Friedman did not include this distinction between the two forms of income. However, in their paper "The life cycle hypothesis of saving : Aggregate implications and tests" (8), A. Ando and F. Modigliani have proposed a consumption function with such a distinction. They considered the life time resources available to the consumer. Such a formulation is usually known as the "life cycle hypothesis". Under this hypothesis consumer behaviour is formulated in the following way:

$$C_t^T = k_t^T \left[(y_L)_t^T + (N-T)\,(y_L^e)_t^T + W_{t-1}^T \right]$$

where :

t = time indicator

T = present age of individual

N = earning span of individual

k = proportionality factor

y_L = current labour income of individual

w = net worth of individual

$\bar{y}_L$ = Expected future labor income of individual.

In Aggregate form :

$$C_t = \alpha_1 (Y_L)_t + \alpha_2 (\bar{Y}_L)_t + \alpha_3 W_{t-1}$$

where the capital letters shows aggregate of the individual variables.

Ando and Modigliani estimated the above function in a ratio form:

$$\left(\frac{C}{Y_L}\right)_t = \alpha_1 + \alpha_2 \left(\frac{\bar{Y}_L}{Y_L}\right) + \alpha_3 \frac{W_{t-1}}{(Y_L)_t}$$

To examine the implications of this formulation we make the following notes :

Empirically it is true that year to year percentage fluctuations in wealth are much smaller than those in income. In a period of general prosperity, such as the postwar U.S economy, wealth has increased fairly steadily each year. During minor recessions the W/Y_L ratio increases, thus C/Y_L rises. Short run cyclical fluctuations in the C/Y_L ratio are compatible with this function. Furthermore, household net worth continues to rise in recessions as long as personal saving is positive and the value of equities does not decrease ; thus consumption may also increase in absolute terms.

To assess the long-run properties of this function it is necessary to examine the W/Y ratio in terms of the parameters of the equation. Previous functions discussed have not explicitly

contained terms other than consumption and income; The necessary transformations express wealth as function of income alone and thus express W/Y as a constant. We use the identities :

$$S = Y - C$$

$$S = \Delta W$$

Then $C/y = a + b\,(W_{-1}/Y)$ becomes

$$\frac{Y-s}{Y} = a + b\,\frac{W_{-1}}{Y}$$

Or :
$$\frac{Y-W}{Y} = a + b\,\frac{W_{-1}}{Y}$$

Therefore

$$1 - \frac{W}{Y} + \frac{W_{-1}}{Y} = a + b\,\frac{W_{-1}}{Y}$$

Now, Assume that W grows at a constant long-run rate γ, then :

$$W = (1 + \gamma)\,W_{-1}$$

and
$$\left(\frac{1-b}{1+\gamma}\right)\frac{W}{Y} = a + 1 - \frac{W}{Y}$$

Therefore :

$$\frac{W}{Y} = \frac{(1-a)\,(1-\gamma)}{\gamma + b}$$

this function has some interesting implications. If it is assumed that wealth is not growing (that is, $\gamma = 0$), $W_{-1} = W$

and $W/Y = W_{-1}/Y = (1-a)/b$.

Substituting this in the original consumption function, $C/Y = a = bW/Y$, we have :

$$\frac{C}{Y} \quad \frac{b(1-a)}{b} = a + (1-a) = 1$$

Thus by postulating a function in which consumption depends on income and wealth we obtain the result that the long-run marginal propensity to consume, which is equal to the average propensity to consume, is unity for conditions of no growth. Under such conditions consumers would not save any of their income in the long run but would consume it all. Although the no-growth condition does not in itself describe a realistic situation for the postwar U.S. economy, it does focus attention on various aspects of the consumption-savings relationship. Specifically it suggests that personal savings occur only when the savings rate depends on the growth rate of the economy.

2.6. The effect of liquid assets

The question of whether liquid assets are significant in the specification of the consumption function has been open to some interpretation. Although many researchers have found that liquid assets are not significant in consumption function,[9] many others have estimated consumption functions that do contain liquid assets variables [10].

In fact, there seems no particular reason for such dissimilarity because the same national income accounts data are being used in both cases. The distinction must then be made on other levels. First, cross section studies have generally failed to prove any significant effects of liquid assets on consumption as I. Friend and J. Crockett suggest in their paper "A complete set of consumer demand relationships". Second, functions designed to omit the common trend such as ratio functions also do not prove any significant effects of liquids assets as

J.S.Duesenberry shows in : "A simulation of the United States economy in recession".[11] Third, since 1961 the L/Y ratio has risen considerably whereas C/Y ratio has remained unchanged which makes liquid assets less important in more recently estimated functions.

People who agree with the fact that liquid assets rather than total wealth must come into use, give two reasons for this. First, liquid assets can be more reliably measured than wealth and so they may be used as a proxy variable for wealth. Second, liquid assets are the more relevant element of wealth to be included.

Zellner (1965) used aggregate time series data to prove this, he included a real balance effect so that any inbalance in the consumer's liquid assets position affects his consumption behaviour. His results can be summarised as following :

$$C_t = KY^*_t + \alpha\,(L_{t-1} - L^d_t) + \mu_t$$

where : L_{t-1} = Real liquid assets holdings at the start of the period

L^d_t = Desired level of liquid assets

$\alpha > 0$

Y^*_t = Estimated permanent income.

$$Y^*_t = (1-\gamma)\sum_{i=0}^{\alpha}\gamma^i Y_{t-i}$$

$$Ldt = \eta Y^*_t$$

After Kyock transformation:

$C_t = \gamma C_{t-1} + \alpha L_{t-1} - \alpha\gamma L_{t-2} + (K-\alpha\eta)(1-\gamma)Y_t + \mu_t - \gamma\mu_{t-1}$

Finally, the great majority of evidence against the significance of liquid assets in the consumption function confirms that there is very little justification for using liquid assets as a component of wealth in the consumption function so we will exclude this variable from our present investigation.

2.7. The effects of other Determinants

Other factors besides those already discussed above may influence consumption. One of these is the division of personal disposable income between wage income and property income. In general, an individual's short-run MPC is smaller the more variable is his income. The effect of income distribution on aggregate consumption has been measured at least two ways by Klein, who has used these variables in some of his consumption functions. The most straightforward way to measure this effect would be to estimate the function $C_t = aW_t + bP_t + dC_{t-1}$.

However, W and P not only have similar trends but similar turning points too. This makes it very difficult to distinguish statistically between their effects and to measure (a) and (b) accurately. This particular problems can be avoided by rewriting the function as :

$$C_t = a\,(W_t + b/a\,P_t) + dC_{t-1}$$

and estimating b/a independently from cross-section data. This was done in the Klein-Goldberger Model (An econometric model of the United States, 1929-1952), where it was found that b/a=0.74.

Although this method is interesting it does not say whether the cyclical redistribution of income makes significant net addition to the explanation of the consumption function, because b/a is already predetermined by other data. This problem can also be avoided by introducing the ratio of wage to property income as a separate variable in the consumption function and writing it as :

$$C_t = aY_t + b\,(W/P)_t + d\,C_{t-1}$$

This has been done by Klein in one of his quarterly models, in which he divides consumption into durables, non-durables and services. However, the parameter estimate of the W/P term is significantly positive in one equation, significantly negative in another and not significantly different from zero in the third. This does not seem to be a satisfactory result. It is rather doubtful whether the cyclical redistribution of disposable income affects aggregate consumption significantly for the degree of income inequality in the postwar U.S. economy.

Another component can affect the consumption function : the family composition (size and age). These variables have been used mainly in cross-section analysis and are usually considered to be more important in influencing purchases of consumer durables than other consumption. For total consumption it has been found that for a given income, consumption is proportional to the sixth root of the number of members of the family.[12] The high order of non-linearity arises from the fact that the C/Y ratio must remain less than unity in the long run even as the size of the family grows very large. Since larger family units have larger short-run

and long-run MPC's, redistribution of income toward these families would raise aggregate consumption. As a policy matter this is presently accomplished by the use of tax deductions for each member of a family, and a rise in consumption could easily be obtained by increasing these deductions. The reverse argument applies that inflation could be cut by reducing the deductions.

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