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The Relationship between Consumption and Income

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Abstract. Friedman (1957) states that permanent consumption is a function of permanent income in the long-run. Co-integration theory is first used to test whether a long-run equilibrium relation exists between the two variables. The existence of an error-correction form between two variables is necessary and sufficient for them to be cointegrated. We applied for an error-correction form to conform the linear long-run relationship between permanent income and permanent consumption under special conditions and the elasticity of permanent income in logarithms with respect to permanent consumption in logarithms is unity.
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1. Introduction

The magnitudes termed "permanent income" and "permanent consumption" that play such a critical role in the theoretical analysis cannot be observed directly for any individual consumer unit (Friedman, 1957). Permanent income is defined as expected long-term average income. Permanent consumption is proportional to permanent income. Permanent income is a subjective notion of likely medium-run future income. Permanent consumption is a similar notion of consumption. A relation between permanent income and permanent consumption specifies that the ratio between them is independent of the size of permanent income but does depend on other variables, in particular: (1) the rate of interest or sets of rates of interest at which the consumer unit can borrow or lend; (2) the relative importance of property and non-property income (the ratio of non-human wealth to income); and (3) the factors (the portmanteau variable) determining the consumer, unit's tastes and preferences for, consumption versus additions to wealth. Co-integration theory is first used to test whether a long-run equilibrium relation exists between the two variables. Granger & Weiss (1983), and Engle & Granger (1987) have proved a theorem showing that existence of an error-correction form between two variables is necessary and sufficient for them to be cointegrated. An error-correction form is special case of a data-based approach. The work by DHSY [Davidson, Hendry, Srba & Yeo (1978)] is the first important example of this 'data-based' approach to applied econometric work. The DHSY paper is a thorough study of postwar UK quarterly data, concentrating mainly on the dynamic properties and lag structure of the relationship between disposable income and non-durable consumption rather than the economic behavior underlying it. DHSY find that, even when a common sample period of identical non-seasonally adjusted data is used, with identical functional forms and data

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transformations, the three models [those of Hendry (1974), Ball, et al. (1975) and Wall, et al. (1975)] still seem to lead to different conclusions. There are varying lag structures employed in the three studies and different estimating methods and test statistic used. Sims (1972) states that if and only if causality runs one way from current and past value of some list of exogenous variables, then in a regression of endogenous variables on past, current and future value of the exogenous variables, the future values of exogenous variables should have zero coefficient. The objective of this study was to conform the linear long-run relationship between permanent income and permanent consumption.

The rest of the paper is organized as follows: Section 2 reviews the related literature; Section 3 reports the findings; and Section 4 provides the conclusion.

2. Literature Review

According to Hansen (1947), consumption is a function of income in the long as well as the short run. In his opinion, there is an upward secular drift of the consumption function. He concludes, however, that this up ward drift could not occur except as a result of a secular rise of income. The new consumption theorists[1] have produced a theory of the consumption function that unifies the effects of asset holdings and measured income through the concept of normal or permanent income. Cave (1950) concludes that the consumption function varies cyclically, also has certain theoretical

implications relating to Keynesian theory. Brown (1952) states that the consumer theory finally selected is fitted to the observed Canadian data by first building around it a small macro model of the economy followed by simultaneous estimation of parameters. The goodness of fit is studied of first, the individual equations and then of the model treated as a whole. Finally, short-run and long-run multipliers are estimated for the complete model. Friedman (1957) states that permanent consumption is a function of permanent income in the long-run. Farrell (1959) conclude that the hypothesis also has implications for the use of budget studies to throw light on consumption behavior. We have seen that where the Friedman Effect is present and the Normal Income Hypothesis holds, a simple regression analysis will give a biased estimate of the income elasticity of consumption. Heckman (1974) view earnings as resulting from a life cycle labor supply decision. If individuals are free to set their hours of work, and if wage rates change systematically over the life cycle, the path of consumption of market goods will depend on the wage rate at each age unless goods and leisure are independent of each other in utility. Davidson et al. (1978) conclude that it is worth while trying to explain the completes of existing findings; that restrictions derived from economic theories can be valuable in econometric modeling incorrectly implemented to restrict the model but not the data; that seasonal adjustment of data can confuse the selection of an appropriate dynamic specification; that "multicollinearity" is not necessarily resolved by restricting the parameter space rather than by enlarging it, and that econometric relationships can predict accurately over periods in which the behavior of the regressors is sufficiently different that mechanistic time-series methods will fail. Carroll (1996) conclude that many consumers ensure that retirements is taken care of by joining a pension plan, buy a house, and then subject the post-pension-plan, post-mortgage-payment income and consumption streams to buffer-stock saving rules. Buffer-stock savers have a target wealth-to-permanent-income ratio such that, if wealth is below the target, the precautionary saving motive will dominate impatience and the consumer

[1] For example, Morgan (1951), Goldsmith (1951), Boulding (1950).

will save, while if wealth is above the target, impatience will dominate prudence and the consumer will dissave. Hall (1979) have the strong implication that beyond the next few quarters consumption should be treated as an exogenous variable. There is no point in forecasting future income and then relating it to income, since any information available today about future income is already incorporated in today's permanent income. Cutler (2005) finds a stable relationship between consumption, labour income and wealth with plausible long-run estimates of the implied marginal propensity to consume out of income and wealth.

3. Result

The standardization by sample period enables DHSY to 'nest' the three competing hypothesis as special cases of a general hypothesis or estimating equation. This enables them to test, on purely statistical grounds, which provides the best description of the UK relationship between income and consumption. On the basis of standard statistical criteria such as goodness of fit, the best of the three models appears to be that Wall, et al. (1975) which is the form:

$$\Delta \log C_t = a_0 + a_1 \Delta \log Y_t + a_2 \left(\log C_{t-1} - \log Y_{t-1}\right) a_0 > 0.$$

Where:

$\Delta \log C_t$: the quarterly changes in consumption in logarithms form.

$\Delta \log Y_t$: the quarterly changes in income in logarithms form.

This equation has some rather strange economic properties. For example, it implies that even if the level of income were to remain constant indefinitely, in which case

$$\Delta \log Y_t = \Delta \log Y_{t-1} = 0$$

consumption would continue to rise without limit since under such conditions $\Delta \log C_t = a_0 > 0$, which means that this equation has no static equation solution.

This equation implies that the adjustment of consumption to any change in income is completed after just two quarters and, moreover, is apparently independent of any disequilibrium in the previous levels of variables $\log C_t$ and $\log Y_t$. When consumption is 'well above' its equilibrium level relative to income, the increase in

$\log C_t$ accompanying an increase in $\log Y_t$, it can be expected to be much smaller than would have been the case if $\log C_t$ and $\log Y_t$ had previously been well adjusted to each other.

In the steady state (equilibrium relationship between income and consumption):

$$\Delta \log C_t = \Delta \log Y_t = 0$$

If the above condition is substituted into an error-correction model, then:

$$-a_0 = a_2 \log C_t - a_2 \log Y_t$$
$$\Rightarrow -a_0 + a_2 \log Y_t = a_2 \log C_t$$

$$\Rightarrow \frac{-a_0}{a_2} + \log Y_t = \log C_t$$

$$\Rightarrow \log\left[Y_t e^{\frac{-a_0}{a_2}}\right] = \log C_t$$

$$\Rightarrow C_t = Y_t e^{\frac{-a_0}{a_2}}$$

Setting $K = e^{\frac{-a_0}{a_2}}$

We have $C_t^* = K Y_t^*$ (proportional)

Where C_t^* and Y_t^* represent 'equilibrium' values. It is the linear long-run relationship between **C** and **Y** which might represent an underlying relationship between permanent income and permanent consumption. Taking natural logarithms of the above equation.

$$c_t^* = k + y_t^*$$

where lower-case letters denote logarithms. Note that the elasticity of **Y** with respect to **C** is unity.

Now, we try to extend DHSY approach for any two variables case in our paper. In long-run:

$$Y_t = K X_t$$

or in logs:

$$y_t = k + x_t$$

In the short run:

$$y_t = a_0 + a_1 x_t + a_2 x_{t-1} + a_3 y_{t-1}$$

$$y_t - y_{t-1} = a_0 + a_1 x_t + a_2 x_{t-1} + (a_3 - 1) y_{t-1}$$

$$\Delta y_t = a_0 + a_1 x_t + a_1 x_{t-1} - a_1 x_{t-1} + a_2 x_{t-1} + (a_3 - 1) y_{t-1}$$

$$\Delta y_t = a_0 + a_1 (x_t - x_{t-1}) + a_1 x_{t-1} + a_2 x_{t-1} + (a_3 - 1) y_{t-1}$$

$$\Delta y_t = a_0 + a_1 \Delta x_t + a_1 x_{t-1} + a_2 x_{t-1} + (a_3 - 1) y_{t-1}$$

$$\Delta y_t = a_0 + a_1 \Delta x_t + (a_1 + a_2) x_{t-1} + (a_3 - 1) y_{t-1}$$

First restriction $a_1 + a_2 = -(a_3 - 1)$

(to be test) or $a_1 + a_2 + a_3 = 1$

Error-correction form:

$$\Delta y_t = a_0 + a_1 \Delta x_t + (a_3 - 1)(y_{t-1} - x_{t-1})$$

In the steady state: $y_t = y_{t-1}$ and $x_t = x_{t-1}$

$$(1 - a_3) y_t^* = a_0 + (a_1 + a_2) x_t^*$$

$$y_t^* = \frac{a_0}{1 - a_3} + \frac{(a_1 + a_2) x_t^*}{1 - a_3}$$

The unity elasticity implies that $a_1 + a_2 + a_3 = 1$, so it conforms to the postulated long-run relation:

$$y_t^* = k + x_t^*$$

where:

$$k = \frac{a_0}{1 - a_3}$$

$$\frac{a_1 + a_2}{1 - a_3} = \frac{1 - a_3}{1 - a_3} = 1$$

4. Conclusion

Friedman (1957) states that permanent consumption is a function of permanent income in the long-run. The definition of causality proposed by Granger (1969) essentially states that **X** causes **Y**, if the past history of **X** can be utilized to more accurately predict **Y** than only the past history of **Y**. One drawback of the procedure of differencing is that it results in a loss of valuable "long-run information" in the data. The concept of co-integrated series has been suggested to solve this problem. Granger & Weiss (1983), and Engle & Granger (1987) have proved a theorem showing that the existence of an error-correction form between two variables is necessary and sufficient for them to be cointegrated. We applied for an error-correction form to conform the linear long-run relationship between permanent income and permanent consumption under special conditions and the elasticity of permanent income in logarithms with respect to permanent consumption in logarithms is unity.

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