INTRODUCTORY ECONOMETRICS : Exercise 8 (Assessed)

The Consumption Function

In this exercise, which represents your final piece of assessed work, you are invited to conduct your own investigation into the relationship between aggregate disposable income and consumption. This is one of the perennial issues in applied econometrics. Below are series on Real Personal Disposable Income and Real Consumers' Expenditure for the years 1948–1989 which are expressed £million in 1985 prices. The source is *Economic Trends Annual Supplement 1991*, Table 5, p.35.

Year	*Income*	*Consumption*	*Year*	*Income*	*Consumption*
1948	93327.0	92490.0	1969	165582.0	152089.0
1949	95590.0	93968.0	1970	172094.0	156531.0
1950	98470.0	96475.0	1971	174321.0	161582.0
1951	97229.0	95211.0	1972	188992.0	171704.0
1952	99159.0	95247.0	1973	201020.0	180843.0
1953	103843.0	99396.0	1974	199433.0	178216.0
1954	107202.0	103506.0	1975	200419.0	177500.0
1955	112139.0	107870.0	1976	199699.0	178279.0
1956	115088.0	108834.0	1977	195333.0	177483.0
1957	116926.0	111095.0	1978	209844.0	187510.0
1958	118688.0	113770.0	1979	222021.0	195664.0
1959	124753.0	118688.0	1980	225459.0	195825.0
1960	132962.0	123255.0	1981	223988.0	196011.0
1961	138515.0	125986.0	1982	223462.0	197980.0
1962	140017.0	128830.0	1983	229648.0	207106.0
1963	146056.0	134728.0	1984	235200.0	210472.0
1964	152274.0	138868.0	1985	241362.0	217941.0
1965	155438.0	141000.0	1986	252286.0	231670.0
1966	158874.0	143530.0	1987	261301.0	244024.0
1967	161243.0	147058.0	1988	276628.0	261580.0
1968	164064.0	151162.0	1989	291266.0	271707.0

Your are to fit a variety of models to the data and to assess their implications.

A general form for the relationship is given by

$$y(t) = \mu + \sum_{i=0}^{k} \beta_i x(t-i) + \sum_{i=1}^{p} \phi_i y(t-i) + \varepsilon(t), \tag{1}$$

which is described as a regression model with distributed lags and with lagged dependent variables: see Mirer (p. 302). Here μ represents an intercept term which may, on occasion, be set to zero.

Given that the data is trended, ie collinear, only a few parameters can be estimated with any degree of precision. Therefore the values of the integers p and k should not exceed two or three. Nevertheless, there is scope for a variety of models. The scope is enlarged when differences of the data or logarithms of the data of even differences of logarithms are taken.

Early studies of consumption tended to adopt a primitive equation without lagged values, of the sort suggested by comparative-static Keynesian analysis:

$$y(t) = \mu + \beta x(t). \tag{2}$$

You should begin by fitting such a function, and you should record and analyse the various diagnostic statistics which accompany the estimated equation.

Some problems with this function were soon apparent to the pioneer investigators. In the first place, if the equation incorporates a nonzero intercept term of a significant value and if the slope parameter is less that unity, then it is implied that, over time, consumption will be a declining proportion of a rising real income. This was at variance with some of the historical findings.

Another problem with the static consumption function is that it implies that the adjustment of consumption to changes in real income is an instantaneous one, which seems implausible. A more plausible function is one which incorporates a mechanism of partial adjustment. See Mirer (p. 308). A very simple dynamic version of the function might take the form of

$$y(t) = \lambda\big\{\gamma x(t)\big\} + (1-\lambda)y(t-1) + \varepsilon(t), \tag{3}$$

where $\gamma x(t) = y^*(t)$ is the equilibrium level of consumption associated with the income value $x(t)$.

It seems implausible, prima facie, that the disturbance term in the regression should conform to the classical assumptions. You should investigate whether these assumptions can be sustained by examining the value of the Durbin–Watson statistic or of Durbin's h statistic (Mirer, p. 272–274); and, if necessary, you should use the Cochrane–Orcutt procedure (Mirer p. 276) to fit a model with a first-order autoregressive scheme for the disturbances. It is important to note the effect upon the estimated regression parameters of fitting such a scheme.

The next problem to investigate is whether it is plausible to imagine that, in the long run, there is a simple constant of proportionality γ between consumption and income. Various devices may be used to estimate the putative constant. Once might calculate the ratio of consumption to income to see how it varies; and, if this seems reasonable, an average value for the ratio could be calculated. Alternatively, one might estimate the value of γ from the simple regression of $y(t)$ on $x(t)$, or one might calculate the value of γ^{-1} from the regression of $x(t)$ on $y(t)$.

Imagine that a value has been found for γ. Take the value of $y(t-1)$ from both sides of equation (3) to give the equation

$$\nabla y(t) = y(t) - y(t-1) = \lambda\big\{\gamma x(t) - y(t-1)\big\} + \varepsilon(t). \tag{4}$$

Then, if γ were already determined, you might estimate the value of the partial-adjustment parameter λ by a simple regression of $\nabla y(t)$ on the composite variable $\{\gamma x(t) - y(t-1)\}$. In practice, you might wish to investigate the effect of including additional lagged values $\nabla x(t-i)$ and $\nabla y(t-i)$ on the RHS of the equation. Such an equation, estimated via a two-step procedure, should be compared with a corresponding equation in the form of (1) estimated in a single step by OLS; for it is always possible to recast the two-step equation in the form of (1) by merging the parameters and rearranging the result. Thus, for example, equation (4) becomes the equation

$$y(t) = \beta x(t) + \phi y(t-1) + \varepsilon(t). \tag{5}$$