Australian Functions

We have derived the IS-LM curve model of the macro economy under the assumption of no foreign sector and fixed prices. The two curves have been modelled as straight lines, with a small number of parameters. These parameters may not be constant through time, but none the less these parameters have been estimated.

1. Les Johnson's Estimations

1.1 The consumption function

Consider the simple consumption function:

$$C = a + c\,Y$$

Johnson[1] used least squares regression on 44 quarterly observations from 1966 (Q3) to 1977 (Q2) of consumption (C) and real GDP (Y) to derive the following equation (in $ million):

$$C = \underset{(3.16)}{930.54} + \underset{(23.42)}{0.507}\,Y$$

The two t-ratios are shown below their coefficients. Both are greater than 2, especially that for c, the marginal propensity to consume, which indicates significance. The coefficient of determination(r^2)

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1. Interpreting regression results in macroeconomics, Chapter 19, *Australian Macroeconomics*, ed. by J. Veale, G. Walker, T. Murphy, L. Perry, Prentice-Hall of Australia, Sydney, 2nd edition, 1983.

of 0.9272 implies a very good fit: 92.89% of the variation in consumption (C) can be explained by variation in GDP (Y). (The $\bar{r}^2$ is 0.9272.) The Durban-Watson statistic (DW) of 1.618 implies that auto-correlation is probably not a problem.

But quarterly data may be affected by seasons, independently of income. He estimated a new function:

$$C = a + c\,Y + d\,S_2 + e\,S_3 + f\,S_4$$

where S_i is the seasonal dummy variable for Quarter i: they have value 1 in their quarter and value 0 in the other three quarters, so that the estimated consumption functions will be:

$$C = a + c\,Y \qquad \text{(1st Q)}$$

$$C = a + c\,Y + d \qquad \text{(2nd Q)}$$

$$C = a + c\,Y + e \qquad \text{(3rd Q)}$$

$$C = a + c\,Y + f \qquad \text{(4th Q)}$$

So the coefficient of the seasonal dummy S_i is the difference in consumption in Quarter i from the base quarter (the first).

The estimated function is:

$$C = \underset{(2.24)}{356.35} + \underset{(46.61)}{0.553}\,Y + \underset{(5.08)}{321.39}\,S_2 - \underset{(-0.67)}{42.14}\,S_3 - \underset{(-6.51)}{440.45}\,S_4$$

with an r^2 of 0.9835 (an $\bar{r}^2$ of 0.9885) and a DW of 1.743.

This suggests (look at the coefficient of S_4) that consumption in the fourth quarter is on average \$440 million less than the base quarter, but this is Christmas and so contrary to expectations. To overcome this, Johnson models lagged adjustment, in which consumption in any period depends on income in that period and on income in the previous two periods:

$$C = a + c\,Y + d\,S_2 + e\,S_3 + f\,S_4 \\ + g\,Y(t-1) + h\,Y(t-2),$$

where $Y(t-1)$ and $Y(t-2)$ are the income of the last and second last quarters. In this case the estimated marginal propensity to consume (c) must be the sum of coefficients $c+g+h$, since we assume that a change in income will take three quarters to be completely reflected in changed consumption.

The estimated function is given by:

$$C = \underset{(0.04)}{7.60} + \underset{(3.14)}{0.206}\,Y + \underset{(1.55)}{321.00}\,S_2 + \underset{(3.71)}{561.12}\,S_3 + \underset{(3.02)}{674.05}\,S_4 \\ + \underset{(2.63)}{0.155}\,Y(t-1) + \underset{(3.01)}{0.191}\,Y(t-2)$$

The r^2 is 0.9902 (the $\bar{r}^2$ is 0.9885), and the DW is 1.00007.

The coefficient of S_4 is now positive and significant, as expected, and the marginal propensity to consume is estimated at 0.552.

1.2 The demand for money

The demand for money can be written as:

$$\left(\frac{M1}{P}\right)^d = a + h\,Y - f\,r$$

where we allow an intercept (or constant) term a. Using 46 quarterly observations from 1963 (Q3) to 1974 (Q4), real GDP (Y), and the interest rate on three-month local authority bonds (r), Johnson obtains:

$$\left(\frac{M1}{P}\right)^d = \underset{(17.56)}{9.62} + \underset{(1.53)}{0.068}\,Y - \underset{(-4.29)}{10.90}\,r$$

The r^2 is 0.3515 (the $\bar{r}^2$ is 0.3213), and the DW is 0.449. The signs of the coefficients seem correct and the coefficient of r is significant since its t-ratio is greater than 2 in absolute terms. The DW statistic (much less than 1) suggests that autocorrelation is a problem.

Estimate a new, lagged demand function:

$$\left(\frac{M1}{P}\right)^d = a + h\,Y - f\,r + p\,M1(t-1)$$

which says that the demand for money in any period depends on income and interest rate in that period, along with the level of money in the previous period.

The results are:

$$\left(\frac{M1}{P}\right)^d = \underset{(2.73)}{2.161} + \underset{(2.82)}{0.068}\,Y - \underset{(-5.56)}{7.856}\,r + \underset{(10.15)}{0.736}\,M1(t-1)$$

The r^2 is 0.8123 (the $\bar{r}^2$ is 0.7988) and the DW is 2.587. Now all coefficients are significant and of the expected sign, and the r^2 suggests that 81.23% of the variation in the demand for real money balances is explained.

When $M1 = M1(t-1)$, solving for $M1$,

$$(M1/P)^d = 8.1856 + 0.2576\,Y + 29.756\,r$$

which results in the real-income elasticity of demand for money ($M1$) of $0.2576 \times (15.04/9.814)$ = 0.395, (using the mid-point convention with average Y and $M1$ of 15.04 and 9.814, respectively). That is, a 1% increase in real income (Y) results in a 0.4% increase in the demand for real money ($M1/P$). The real-interest elasticity of demand for money is –0.236, given average r of 0.0777.

2. Parkin and Blade's Estimates

2.1 The Australian consumption function

Estimating consumption (C) against real personal disposable income (Y_D), they[2] calculate a marginal propensity to consume (c) of 0.885. Estimating consumption (C) against real GDP (Y), they calculate a marginal propensity to consume (c) of 0.59. What is the difference between the two?

The difference between the two consumption functions arises from the payment of taxes (net of transfers). One dollar of GDP generates 59¢ of consumption, and 41¢ of saving and taxes. One dollar of disposable income generates 89¢ of consumption and 11¢ of saving. These numbers further imply that one dollar of GDP generates 59¢ of consumption (C), 8¢ of saving (S), and 33¢ of net tax revenue (T).

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2. M. Parkin and R. Blade, *Macroeconomics and the Australian Economy*, Sydney: Allen & Unwin, 1990.

2.2 The Australian demand for money

They find a linear relationship between the logarithm of real short-term interest rate (*r*) and the logarithm of the ratio of M1 to nominal GDP (*X*), using annual data between 1960 and 1988. They found an interest-rate elasticity of demand for money of –½:

$$\ln r = -\tfrac{1}{2}(\ln \mathrm{M1} - \ln X) + \text{constant}$$

or

$$\ln \left(\frac{M1}{P}\right)^{d} = a + \ln Y - 2\ln r$$

3. McTaggart, Findlay, and Parkin's Estimates

3.1 The Australian consumption function in 1988

They[3] use data from the ABS Household Expenditure Survey 1988, which records average disposable income and average consumption expenditure for Australian income groups ranging from the lowest decile to the highest. The bottom 50% of Australian households (rows a–e) consumed significantly more than their disposable income in 1988: their average propensity to consume was greater than one. Average propensity to consume falls as income rises, and the highest tenth has an average prpensity to

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3. D. McTaggart, C. Findlay, and M. Parkin, *Macroeconomics*, Addison-Wesley, 1992.

Income decile	Disposable income ($/wk)	Consumption expenditure ($/wk)	Average propensity to consume	Marginal propensity to consume
a lowest	102	215	2.11	
b 2nd	188	255	1.36	0.47
c 3rd	250	308	1.23	0.85
d 4th	321	388	1.21	1.13
e 5th	397	457	1.15	0.91
f 6th	484	499	1.03	0.48
g 7th	586	599	1.02	0.98
h 8th	688	671	0.98	0.71
i 9th	821	779	0.95	0.81
j highest	1258	967	0.77	0.43

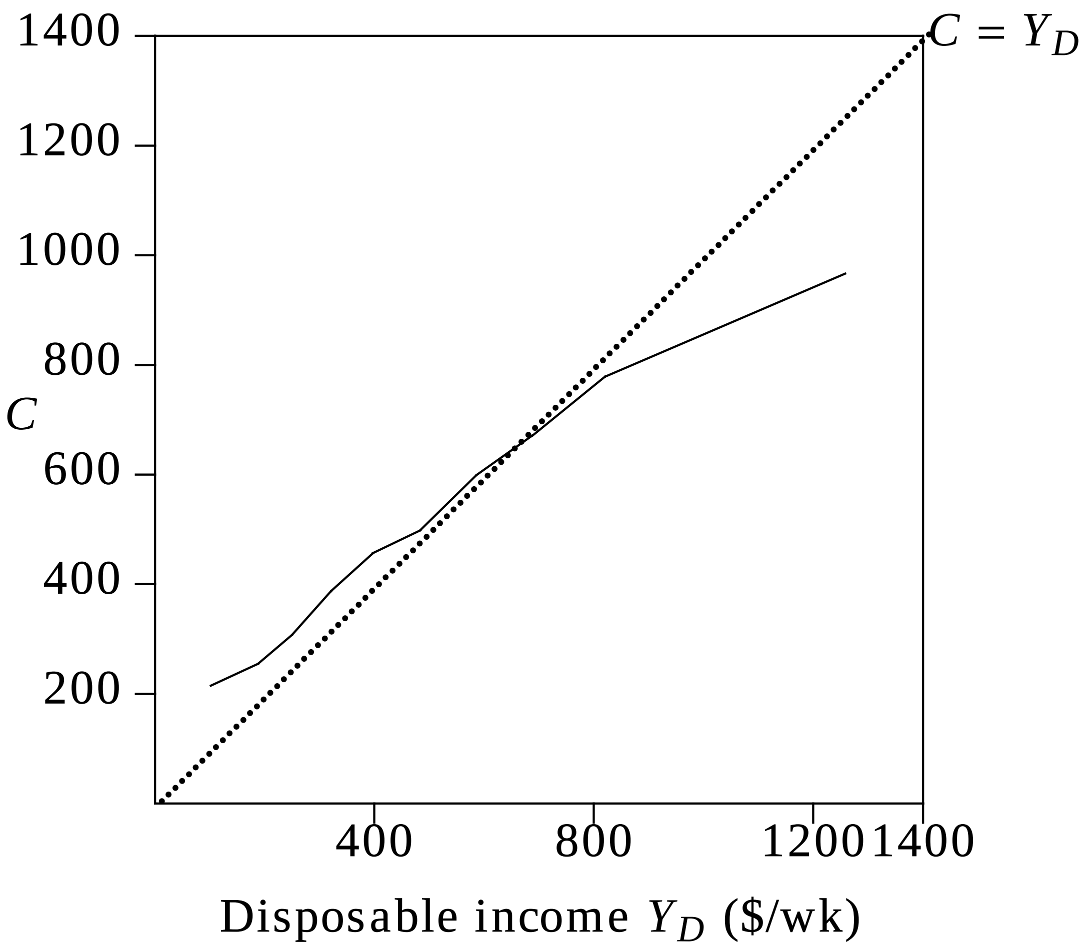
consume of 0.77.

The marginal propensity to consume is

$$\frac{\Delta \text{ consumption expenditure}}{\Delta \text{ disposable income}}.$$

It rises from 0.47 in the lowest tenth as income rises, and then falls: middle-income Australians (row e) spend 90¢ of each additional dollar of disposable income received, while high-income Australians spend less than 45¢ per additional dollar.

The data in the table are plotted below:



Australian Consumption Function in 1988