II

The Demand Side

2

Consumption and savings

2.1 INTRODUCTION

Consumption is important for three main reasons: it is the largest category of spending; the multiplier depends on the marginal propensity to consume; and in recent years the savings ratio has been very unstable.

- ❏ Consumption is the largest category of spending. As shown in figure 2.1, consumption amounted to 66 per cent of GDP in 1989, the next largest category being exports, at 29 per cent. It is thus important to forecasters to be able to predict consumption correctly, for even a small percentage error may involve a large absolute error. For example, suppose that forecasters make an error of 1 per cent in predicting consumption (what might be thought a very small error). This will amount to an error of 0.6 per cent of GDP. This may not seem very much, but it is the difference between a growth rate of, say, 2 per cent (which would be considered low) and 2.6 per cent (a much more reasonable growth rate).

- ❏ The marginal propensity to consume is one of the factors determining the size of the multiplier, which is important for determining the effects of changes in investment and government spending.

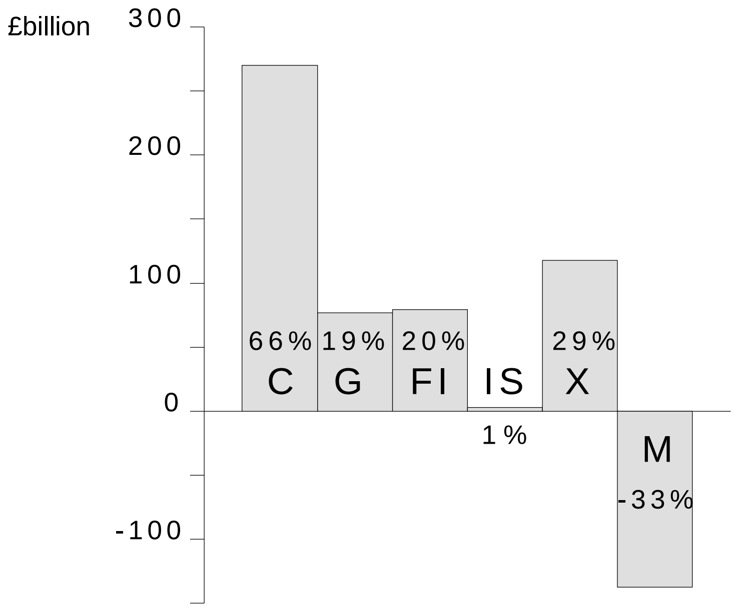

Figure 2.1 Components of GDP at market prices, 1989

Source: Economic Trends. Percentages are shares of GDP.

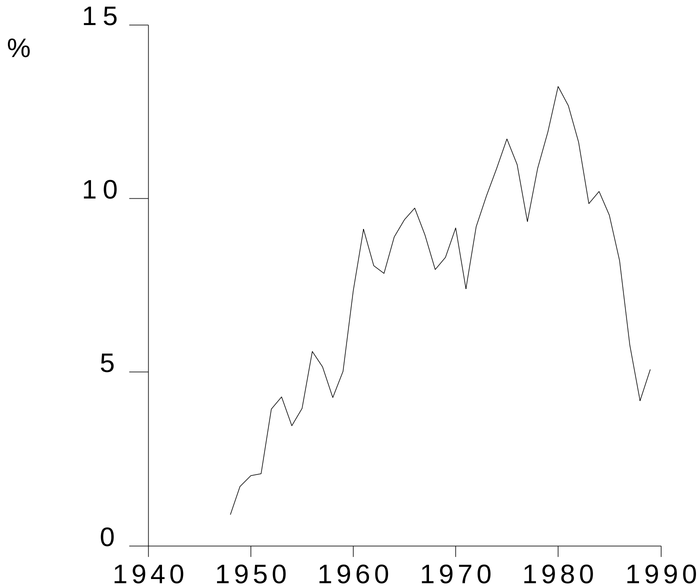

Figure 2.2 The savings ratio, 1948-89

Source: Economic Trends.

- Changes in the savings ratio (the average propensity to save) are shown in figure 2.2. Since 1948 the savings ratio has fluctuated between 1 and 14 per cent, some of the changes being very rapid. During the 1980s, for example, the savings ratio fell from 14 per cent to 4 per cent.

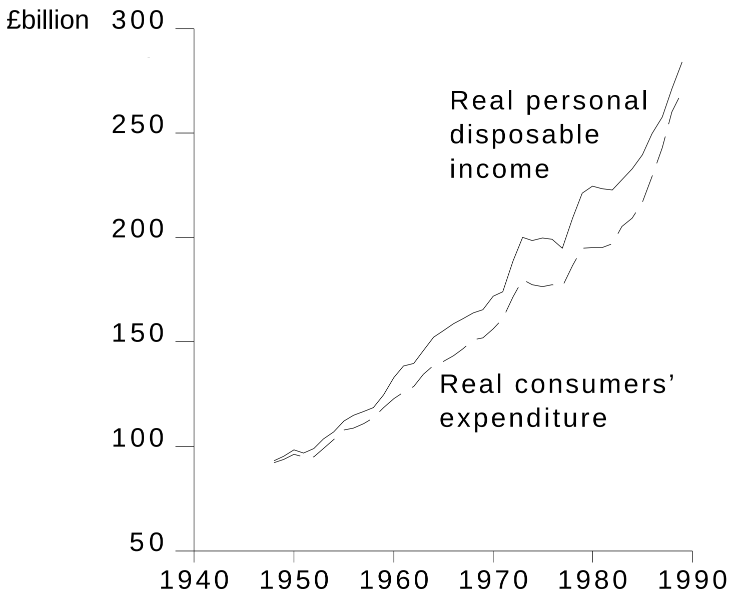

Figure 2.3 Income and consumption, 1948-89

Source: Economic Trends.

Figure 2.3 shows the behaviour of real personal disposable income and real consumers' expenditure. The increase in the saving ratio in the 1970s appears as a widening gap between income and consumption.

2.2 THE 'KEYNESIAN' CONSUMPTION FUNCTION

A simple 'Keynesian' consumption function

The simplest one we could use is a Keynesian consumption function such as:

$$C = A + \beta Y$$

where C is consumption, A is autonomous consumption, Y is income and β is the marginal propensity to consume. If we fit this equation to the data we obtain the following equation:

$$C = 3.65 + 0.89Y.$$

The marginal propensity to consume is 0.89 and autonomous consumption is (just) positive.

Before we can start assuming that the MPC is in fact 0.89, however, we need to decide whether this equation is an acceptable description of what has happened to consumption. There are two ways in which this can be done. One is to use a number of statistical tests to decide whether the equation fits the data properly (some statistics are provided, without discussion, in the appendix). The other is to look at how well the equation predicts consumption. This is done in figure 2.4, where the lines labelled $C = \alpha + \beta Y$ give the values of consumption and the saving ratio predicted by this equation (ignore the lines marked $c = \alpha + \beta y$ for the moment). Figure 2.4(b) suggests that the equation does quite well in predicting consumption but when we turn to the savings ratio in figure 2.4(a) we find that, though it captures the long term rise in the savings ratio it completely fails to explain the fluctuations which took place during the 1970s and 1980s: it predicts neither the sharp rise during the 1970s nor the fall during the 1980s. This is hardly surprising, because with this equation the only thing that can cause the savings ratio to change is changes in income, and for virtually the whole period income was rising. We need to consider other factors if we are to explain the behaviour of the savings ratio.

Before going on to consider other consumption functions, we will make one small change to this simple Keynesian consumption function. This is to use logarithms of consumption and income and to estimate a consumption function of the form

$$c = \alpha + \beta y,$$

where $c = \log(C)$ and $y = \log(Y)$. This implies that the relationship between C and Y is of the form

$$C = AY^{\beta}$$

where $\alpha = \log(A)$. Note that with this log-linear consumption function, β is not the marginal propensity to consume, but the *elasticity* of consumption with respect to income. Though such a consumption function may look less familiar it often makes more sense to assume that it is elasticities rather than ratios of quantities that are constant. Estimating this consumption function we obtain

$$c = 0.19 + 0.95y.$$

The savings ratio obtained from this consumption function is shown in figure 2.4(a). It is very similar to the one obtained from the linear consumption function. The level of consumption predicted by this equation is not shown, because it would be so similar to the other one that it would merely clutter up the diagram.

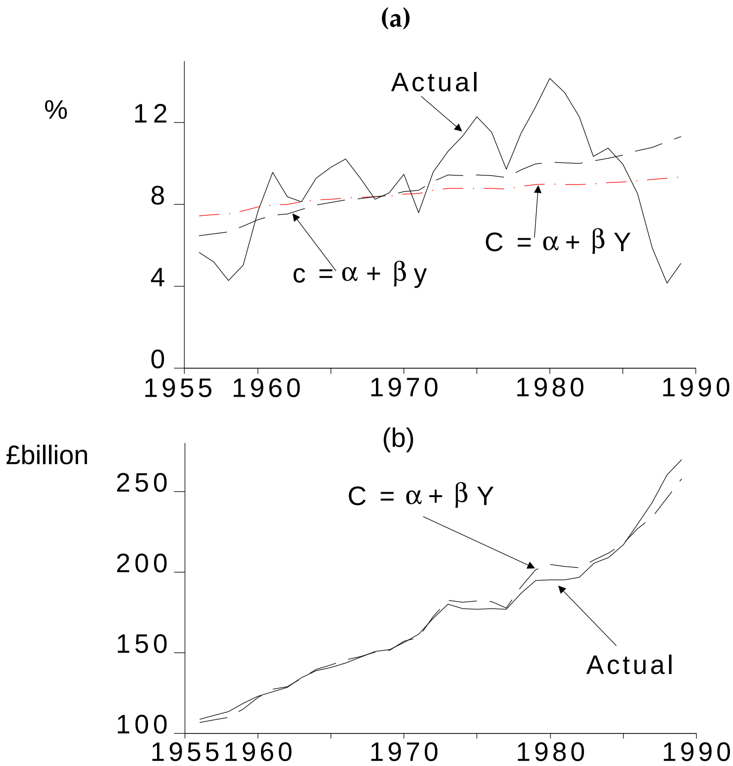

Figure 2.4 Predictions from a simple Keynesian consumption function

Source: see text.

2.3 PERMANENT INCOME/LIFE CYCLE THEORIES

The most commonly-used theory of the consumption function is the permanent income/life cycle theory (we use these two terms interchangeably as the two theories differ only in small details). This states that consumers base their consumption on expected lifetime income, saving and dis-saving so as to smooth out short-term fluctuations in income. Permanent income is defined as the constant income stream which has the same present value as an individual's expected lifetime income, and can thus be taken as a simple measure of lifetime income. It gives rise to a consumption function of the form $C = kY^p$, where Y^p is permanent income, and $k < 1$ (k is the average propensity to consume). Using logarithms of C and Y, this gives $c = \alpha + \beta y^p$, where $\alpha = \log(k) < 0$ and $\beta = 1$.

The problem, of course, is how to measure permanent income, for it depends on consumers' expectations. We consider the two main solutions to this problem: the assumption that permanent income responds with a lag to actual income; and the assumption of rational expectations.

Permanent income as lagged income

The conventional way to measure permanent income (and implicitly expected lifetime income) is to take a weighted average of past incomes. The rationale for such a measure is that transitory fluctuations in income will be random, and that if we take an average over several periods, these fluctuations will cancel each other out.

The simplest formula for y^p is one such as $y^p = (y_t + y_{t-1} + y_{t-2})/3$ (the choice of three here is not significant). Using this definition of y^p we obtain

$$c_t = 0.27 + 0.94y^p{}_t.$$

This may look very similar to the consumption function estimated in the previous section, with an elasticity of consumption with respect to permanent income of 0.94 (compared with 0.95 when y_t was used). In the short run, however, there isa big difference between the two consumption functions. To see this, consider the effect of raising current income by 10 per cent. In the first period, permanent income rises by 3.3 per cent, and consumption rises by 3.1 (= 0.94 × 3.3) per cent. In the second period permanent income rises by a *further* 3.3 per cent, with the result that consumption rises by a *further* 3.1 per cent.

The full effect on consumption is not seen until the third period, by which time permanent income has risen by a full 10 per cent, with the result that consumption has risen 9.4 per cent above its original level. In other words, with this consumption function the long-run (3 year) elasticity of consumption with respect to income is 0.94, but the short-run (one year) elasticity is only 0.31. We thus have different short and long-run consumption functions.

A more common approach to modelling permanent income is to use a more complicated lag structure which turns out to give a much simpler consumption function. This is to assume that permanent income is a weighted average of *all* past incomes, with geometrically declining weights:

$$y^p_t = (1\text{-}\lambda)y_t + (1\text{-}\lambda)\lambda y_{t\text{-}1} + (1\text{-}\lambda)\lambda^2 y_{t\text{-}2} \ldots$$

where $1 > \lambda < 0$. This can be rearranged to give

$$y^p_t = (1\text{-}\lambda)y_t + \lambda[(1\text{-}\lambda)y_{t\text{-}1} + (1\text{-}\lambda)\lambda y_{t\text{-}2} + (1\text{-}\lambda)\lambda^2 y_{t\text{-}3} \ldots]$$

$$= (1\text{-}\lambda)y_t + \lambda y^p_{t\text{-}1}.$$

If $c = ky^p$ we then have

$$c_t = k(1\text{-}\lambda)y_t + \lambda c_{t\text{-}1}.$$

This means that we can model permanent income by including lagged consumption in the consumption function. Estimating such a consumption function we obtain

$$c_t = 0.26y_t + 0.73c_{t\text{-}1} + 0.05.$$

Like the previous equation gives different short and long run consumption functions. In the short run, the elasticity of consumption with respect to income is 0.26, whereas in the long run (defined as a period sufficiently long for consumption to be constant) it is $0.26/(1 - 0.73) = 0.96$. The constant is nearly zero (further details of all these equations are given in the appendix). In figure 2.5 the long-run consumption function and two short-run consumption functions (corresponding to two different values of $c_{t\text{-}1}$) generated by this equation are plotted. They have the usual properties.

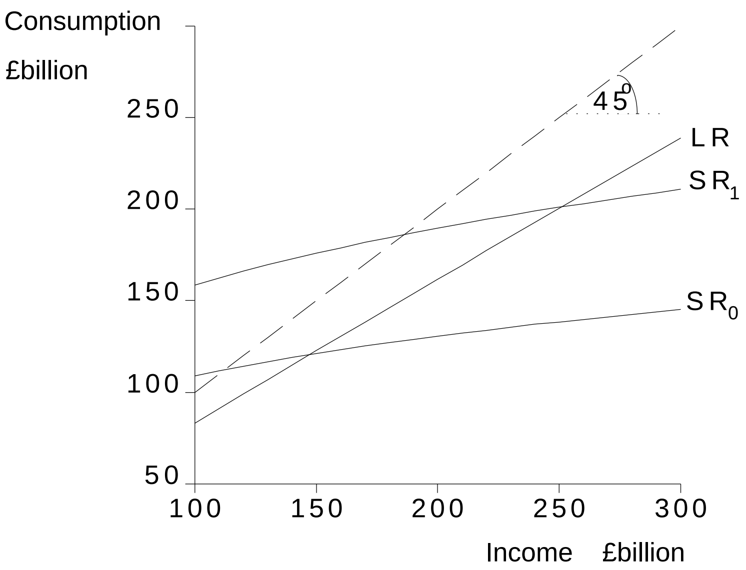

Figure 2.5 Long and short run consumption functions

Source: as described in the text.

Permanent income as determined by rational expectations

The most elegant answer to the question of how to model consumers' expectations of future income is to assume rational expectations: to assume that consumers predict income as accurately as it is possible for them to predict it, given the information available to them. This means that consumption in period t, C_t, will reflect all the information that is available up to time t. This information can be divided into two parts: information that was already known at time t-1, and new information that has become available since time t-1. Of these, information known in period t-1 will be reflected in C_{t-1}. Rational expectations imply that any new information since time t-1 must be uncorrelated with any information available at time t-1. Given that, under the life-cycle theory, consumers will be planning to smooth out their lifetime consumption, this means that the consumption function should have the form

$$c_t = \beta c_{t-1} + \varepsilon_t,$$

where ε_t is 'white noise' — a random variable with zero mean and uncorrelated with any information (including past values of ε_t) available at time t-1. Note that there is *no* constant term in this equation. If $\beta = 1$ this is a *random walk*: in any period, consumption is equally likely to rise or to fall. In practice, however, β is likely to be greater than one, for several reasons. The most important one is probably that consumption is being undertaken not by an unchanging population but by a population in which per capita incomes are rising over time. This means that each generation is wealthier than the previous generation and will plan to achieve a higher level of consumption.

Estimating such a consumption function, we obtain

$$c_t = 1.006c_{t-1} + \varepsilon_t.$$

Although an error term is implicit in all the consumption functions we discuss in this chapter, we have specified this one because the way we have to test this theory is by looking at the error term. If it is correlated with previous values of variables known in period t-1, such as consumption, income, or itself, the theory cannot be correct. The

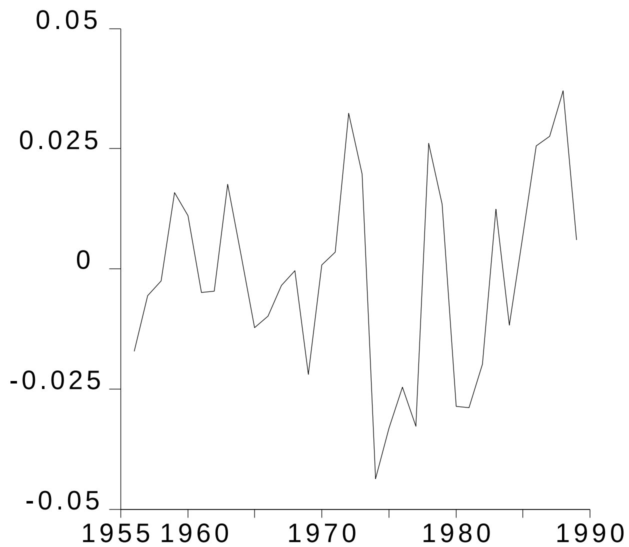

Figure 2.6 Predicted errors using the 'random walk' model of consumption

Source: as described in the text.

simplest way to test this is to look at the behaviour of ε_t, shown in figure 2.6. This appears to show a cyclical pattern, implying that each value of ε is correlated with its predecessor (the relationship can be shown to be $\varepsilon_t = 0.36\varepsilon_{t-1} + \eta_t$, where η is 'white noise'). Though this is hardly a thorough test, it does suggest that this hypothesis about consumption is not correct. More thorough testing has suggested the same conclusion.

2.4 MODIFICATIONS TO THE LIFE-CYCLE THEORY

Inflation

The consumption functions discussed in the previous section are clearly much better than the simple Keynesian consumption functions discussed in section 2.2, but they are still very bad at predicting the saving ratio, especially during the 1970s and 1980s. Additional factors clearly need to be taken into account. The first one we will consider is inflation. Inflation should affect consumption and the saving ratio because it reduces the real value of any debts denominated in money. As the value of debts is reduced, debtors gain (they receive a real capital gain) and creditors lose (they have a real capital loss). The government and the corporate sector are large net debtors, and so gain from inflation, but the personal sector is a large net creditor, so inflation reduces its real income. This reduction in real income is often referred to as *the inflation tax* on the grounds that inflation is acting as if it were a tax on holding money (or any asset the value of which is fixed in money terms). Because this tax is not taken into account in calculations of personal disposable income, we need to bring inflation into the consumption function.

We could easily add inflation to the life-cycle consumption function used in the previous section to obtain an equation such as

$$c_t = k(1-\lambda)y_t + \lambda c_{t-1} + \gamma\pi_\tau,$$

where π is the inflation rate. Rather than see how such a consumption function performs, however, we will introduce another modification.

Error correction mechanisms

One problem with consumption functions of this type is that standard consumer theory suggests that in the long run permanent income will be proportional to actual income, and hence consumption should be proportional to income (i.e. we should have $c = \alpha + y$). In the short run, however, we would not expect consumption to be strictly proportional to income. This has led economists to use what are known as *error correction mechanisms*. This involves building a consumption function from two components.

- ❑ In the long run we assume that there is some target level of consumption that is proportional to income.
- ❑ In the short run consumption will not equal the desired proportion of income (because mistakes and unexpected shocks will always be occurring). In the short run, therefore, we assume that consumers adjust their consumption towards their target level, this adjustment being spread out over time.

If we adopt such an error correction mechanism, we obtain a consumption function such as

$$\Delta c_t = \alpha + \beta\Delta y_t + \gamma s_{t-1} + \delta\pi_\tau,$$

where s is the savings ratio (because the variables are in logarithms this is equal to $y_{t-1} - c_{t-1}$).

Consumption functions incorporating inflation and error correction mechanisms were widely used around 1980, and were successful in predicting consumption and savings. However, these consumption functions failed to predict the fall in saving that took place during the 1980s. The extent of this failure is shown by estimating a version of this last consumption function on data for the period from 1956 to 1980, and using it to predict the savings ratio during the 1980s (on the assumption that income is predicted correctly — i.e. actual income is used). The equation is

$$\Delta c_t = -0.001 + 0.63\Delta y_t + 0.19 s_{t-1} - 0.13\pi_\tau.$$

The predictions from this equation are shown in figure 2.7. The equation performs very well up to 1980, but completely fails to predict the decline in the savings ratio after 1980.

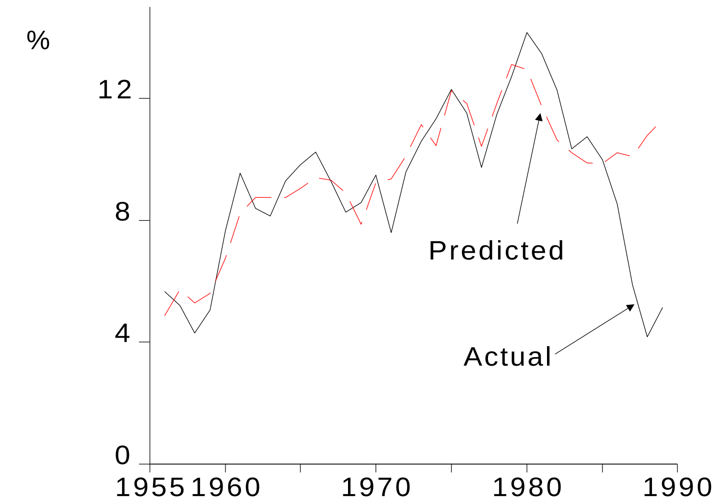

Figure 2.7 Predicting the 1980s saving ratio

Source: as described in the text.

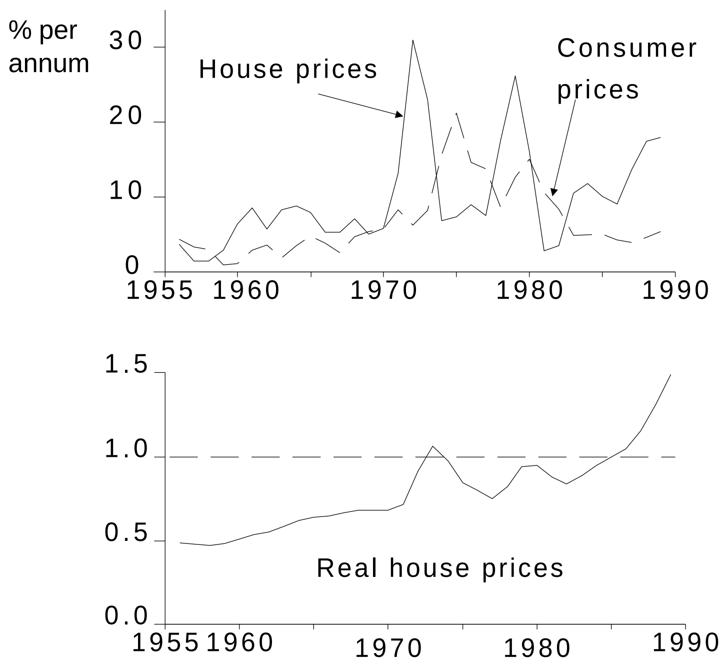

Figure 2.8 House price inflation and real house prices

Source: Nationwide Anglia index of house prices from *Datastream;* consumer price index from *Economic Trends*. Real house prices are the ratio of house prices to consumer price index.

House prices and uncertainty

A variety of explanations has been put forward to explain why consumption should have risen more rapidly than is predicted by such equations. We will consider two of these: credit liberalization and rising house prices, and reduced uncertainty about the growth rate of income.

❏ The main one concerns the joint effects of credit liberalization, which made it much easier for households to borrow than was the case in the 1960s and 1970s, and rising house prices. During the 1980s house prices rose much more rapidly than other prices, as is shown in figure 2.8, producing a very large rise in real house prices, and hence in the personal sector's wealth. This increased wealth could be used to finance higher consumption either through people selling houses (for example, ones that have been inherited) or through households borrowing more, using housing as a security. Consumption will thus have risen because households were wealthier and because fewer households faced a constraint on the amount that they were allowed to borrow.

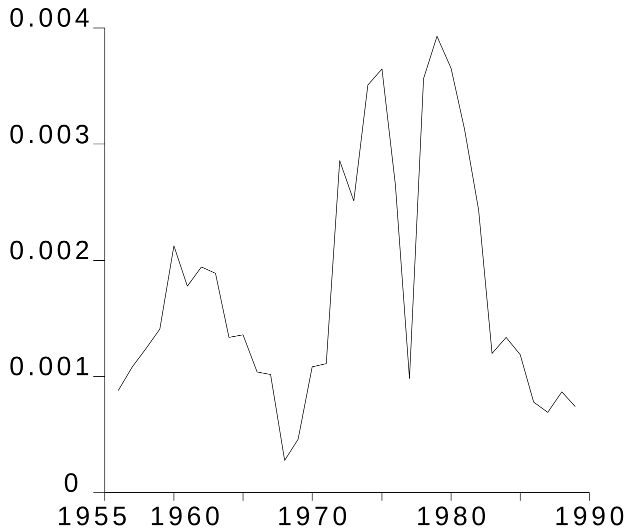

Figure 2.9 The variability of income growth, 1956-89

Source: growth rate of real personal disposable income (from *Economic Trends*), and its four-period standard deviation.

- ❏ The second argument is that households save more when there is greater uncertainty about income levels. In the 1980s personal disposable income grew much more steadily than in the 1970s, with the result that households faced less uncertainty. This will have caused precautionary saving to decline. Figure 2.9 shows the standard deviation (over the previous four years) of the growth rate of real personal disposable income, (σ). This shows that there was a marked reduction in uncertainty during the 1980s compared with the 1970s.

If we include real house prices (*RHP*) and uncertainty (σ) in our consumption function, we obtain

$$\Delta c_t = -0.009 + 0.73\Delta y_t + 0.19 s_{t-1} - 0.09\pi + 0.018RHP - 0.51\sigma.$$

The saving ratio predicted by this equation is shown in figure 2.10. This shows clearly that the equation now fits the data much better. In particular, the equation captures the decline in the savings ratio during the 1980s.

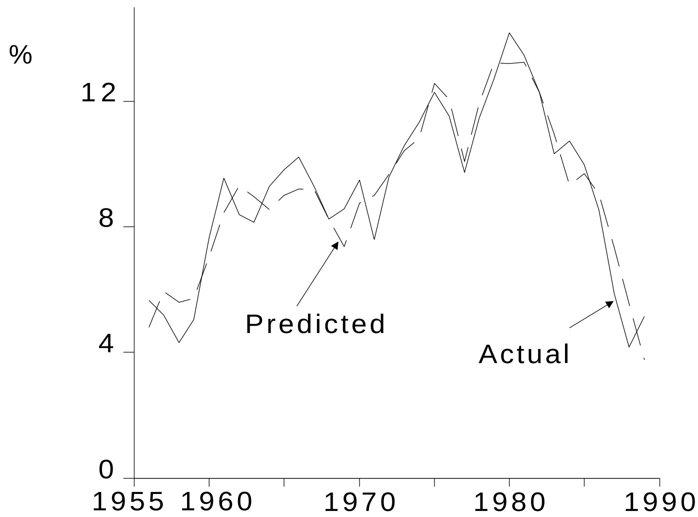

Figure 2.10 Predictions of the saving ratio

Source: as described in the text.

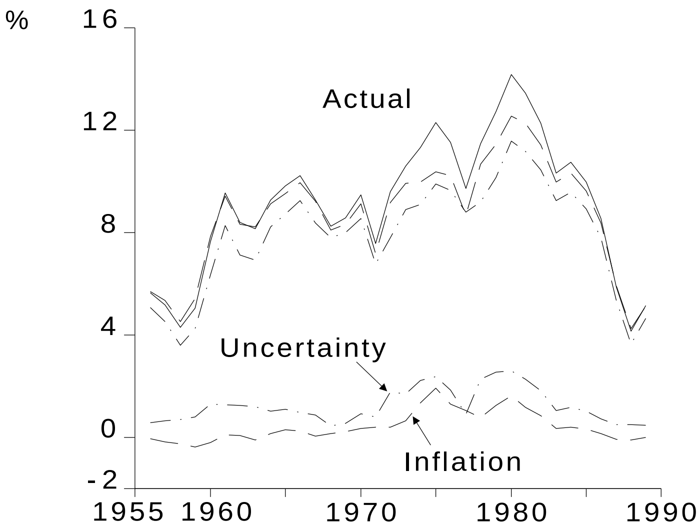

Figure 2.11 Inflation, uncertainty and the saving ratio, 1956-89

Source: as described in the text.

2.5 EXPLAINING THE SAVING RATIO

Having derived a consumption function we can use it to explain movements in the saving ratio. Using the coefficients in the last equation in the previous section we can calculate the contributions of inflation, real house prices and uncertainty about the growth rate of income to the savings ratio. The contribution of inflation to consumption in any one year is defined as $0.09(\pi - \pi^*)$, where π^* is the mean value of π. If we subtract this from c we obtain what (the logarithm of) consumption would have been if inflation had been equal to its mean value, of 6.7 per cent per annum. We can then calculate what the saving ratio would have been with inflation equal to its mean value. Similarly, the contribution of income uncertainty to (the logarithm of) consumption is -0.51σ. Figure 2.11 shows these contributions together with the adjusted saving ratios. The main feature in figure 2.11 is that during the 1970s increased inflation and increased uncertainty about income growth between them raised the saving ratio by about two to three percentage points compared with what it would have been had they remained at the same level as in the 1960s.

Figure 2.12 shows the contribution of real house prices to the saving ratio, evaluated in a similar way as $0.18(RHP - RHP^*)$ where RHP^* is

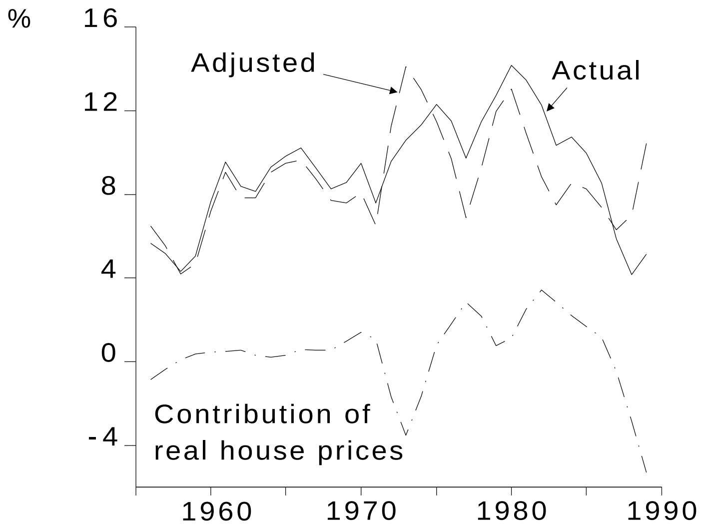

Figure 2.12 Real house prices and the saving ratio, 1956-89

Source: as described in the text.

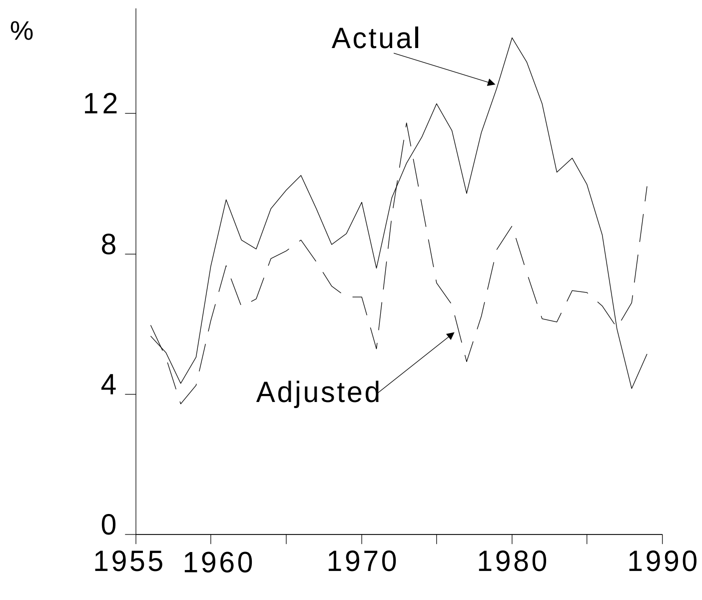

Figure 2.13 Contributions to the saving ratio, 1956-89

Source: as described in the text.

the trend value of real house prices (as shown in figure 2.8, real house prices rose steadily throughout the period). This shows that rising real house prices served sharply to reduce savings in 1972-3 and in the late 1980s. Between 1980 and 1988 the saving ratio fell from just over 14 per cent to just over 4 per cent. If we accept the estimates shown in figure 2.12, rising real house prices contributed 5 percentage points towards this fall.

The effect of adjusting for all three variables is shown in figure 2.13. If the consumption function has been estimated correctly, the adjusted saving ratio (the remainder after deducting the effects of inflation, real house prices and uncertainty) shows fluctuations in the saving ratio that arise from random disturbances and the dynamic adjustment processes implied by the consumption function. It is important, however, to note that our consumption function, elaborate as it is, is most unlikely to provide a complete account of the factors affecting consumption and the saving ratio. For example, we have assumed that real house prices had the same impact on consumption throughout the period, whereas the arguments used earlier in this chapter suggested that, because of credit liberalization, they should have had a greater impact during the 1980s than before.

2.6 CONCLUSIONS

In this chapter we started with the simple Keynesian consumption function, introducing a number of additional factors that should influence consumption. The result is a consumption function that is recognisably similar to some of the consumption functions used in serious applied work, notably that associated with Hendry and Muellbauer, cited in the suggestions for further reading. It remains, however, oversimplified in a number of respects.

- The lag structure is still relatively simple.

- The equation applies to total consumers’ expenditure, whereas separate equations would normally be estimated for durable and non-durable expenditure. The reason for this is that the factors determining these two types of consumption can be very different, consumer durables being, in some respects, more like investment goods than non-durable consumption goods.

- There are further factors that should be taken into account — such as demographic changes and changes in income distribution.

For all these reasons, therefore, even the best of the consumption functions discussed in this chapter must be used with care. Understanding them, however, will make it easier to understand more complicated consumption functions.

FURTHER READING

A good introduction is Christopher Johnson *Measuring the Economy* (London: Penguin, 1988), chapter 2, 'Personal income and saving'. The article in which error correction mechanisms were introduced is J. Davidson, D. F. Hendry, F. Srba and S. Yeo 'Econometric modelling of the aggregate time-series relationship between consumers' expenditure and income in the United Kingdom', *Economic Journal* 88(4), 1978, pp. 661-92. One of the most recent investigations of UK savings behaviour in the 1980s, on which our final equation is based, is J. Muellbauer and A. Murphy 'Why has UK personal saving collapsed?' (Credit Suisse First Boston, July 1989). This contains much technical material, but it is almost the only discussion of the role of the housing market in determining saving behaviour. Similar arguments are contained in J. Muellbauer and A. Murphy 'Is the UK balance of payments sustainable?', *Economic Policy* 11, 1990, pp. 347-96.An international perspective is provied in Andrew Dean *et al.* 'Saving trends and behaviour in OECD countries', *OECD Economic Studies* 14, Spring 1990, pp. 7-58; and Lawrence Summers and Chris Carroll 'Why is US national saving so low?' *Brookings Papers on Economic Activity* 1987 (2), pp. 607-35. Inflation-adjusted savings ratios, and discussion of the 'inflation tax' are published in the *Bank of England Quarterly Bulletin* in May of each year. See also E. P. Davis 'The consumption function in macroeconomic models: a comparative study', *Applied Economics*, 1984.