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# CHAPTER 2

# CONSUMPTION THEORY

*Much of the most insightful empirical work in macroeconomics over the past twenty years has been concerned with consumption...*
*(Romer 1996:309)*

## 2.1 INTRODUCTION

This chapter commences with an account of the relevant economic theory of consumption expenditure, to support the theoretical derivation for a model of private consumption. Reference to a number of studies on private consumption expenditure is made, paying particular attention to the effect of aspects like wealth, prices, liquidity constraints and expectations on consumption. The specification of consumption functions in some well-known international macro-models are compared to conclude the chapter. In Chapter 5, the South African situation is evaluated against the backdrop of the above analysis when an empirical estimation of private consumption expenditure functions is presented.

## 2.2 THE KEYNESIAN VS THE NEW CLASSICAL APPROACH

A Keynesian economist thinks about consumption theory in terms of private domestic behavioural relations underlying the IS schedule. The effects of income and interest rates on consumption would be stressed and adding the LM schedule would complete the model. A new classical economist on the other hand, would specify a production function and then would allow prices and interest rates to adjust to clear all markets (Abel 1990:726).

A number of different theories of consumption have been developed in response to the deficiencies in the simple Keynesian consumption function. Since the 1950s, economic models of consumption behaviour have explicitly recognised that in making consumption decisions, consumers consider their lifetime resources rather than simply their current income. Both the *life-cycle model* of Modigliani and Brumberg (1954) and Ando and

Modigliani (1963) and the *permanent-income model* of Friedman (1957) are based on the notion that consumers prefer smooth streams of consumption over time. Hall and Taylor (1993:278) refer to these theories jointly as the *forward-looking theory of consumption*.

## 2.3 THE UNDERLYING CHOICE-THEORETIC FRAMEWORK

The life-cycle and permanent-income hypotheses, which are the major theories of consumption behaviour, both relate consumption to lifetime income.

The underlying choice-theoretic framework emphasises that a consumer has an intertemporal utility function that depends on consumption in every period of life. A first principle of microeconomics is that consumers structure their consumption plans to maximise their satisfaction or utility. According to Abel (1990:729), the consumer maximises utility subject to a single lifetime budget constraint. There is no static or period-by-period, budget constraint that requires consumption in a period to equal the income in that period. It is access to capital markets that allows consumers to choose a sequence of consumption expenditures over time, which will be smoother than the sequence of income. Access to perfect capital markets would allow consumers to borrow or lend as much as they would like, given an exogenous interest rate.

Varian (1993:179-92) examines consumer behaviour by considering the choices involved in saving and consumption over time - the consumer's intertemporal choices. The shape of the consumer's indifference curves would indicate his tastes for consumption at different times. Well-behaved preferences, where the consumer is willing to substitute some present consumption for future consumption, would be the most reasonable. How much he is willing to substitute, depends on his subjective pattern of consumption. Convexity of preferences is very natural in this context, since it means that the consumer would rather have an 'average' amount of consumption each period than a lot today and nothing tomorrow or *vice versa*. The consumer's optimal combination of consumption in any two periods, say, is where the budget line is tangent to an indifference curve.

Thomas (1993:253) makes it clear that "there is no way in which we can derive the absolute income hypothesis (the Keynesian consumption function) from a traditional microeconomic analysis". The feasible approach towards an analysis of consumer behaviour would therefore have to be conducted within a new classical framework.

## 2.4 THE BASIC FORWARD-LOOKING THEORY OF CONSUMPTION

The basic notion that individual consumers are forward-looking decision-makers is embodied in the life-cycle and permanent income theories. The life-cycle theory derives its name from its emphasis on a family looking ahead over its entire lifetime. The permanent income theory is named for its distinction between permanent income, which a household expects to be long-lasting, and transitory income, which is expected to quickly disappear. In practice the theories differ primarily in the types of equations used to express the basic idea of forward-looking consumers and how they are implemented empirically.

### 2.4.1 The life-cycle hypothesis

The analysis of section 2.3 corresponds with the work of Fisher (1907). It was later adopted and generalised by Modigliani and Brumberg (1954) in their life-cycle hypothesis. They assumed that a household plans its lifetime consumption pattern so as to maximise the total utility it obtains from consumption during its lifetime.

Assuming that households do not plan to leave assets to their heirs, algebraically a household of age T maximises a utility function of the form

$$U = U(C_T, C_{T+1}, C_{T+2}, \ldots, C_L) \tag{2.1}$$

where $C_i$ $(i=T,T+1,T+2,\ldots L)$ is planned consumption at age i and L is the household's expected age at 'death'. Since the household plans to exactly exhaust its resources during its lifetime, (2.1) is maximised subject to the lifetime budget constraint

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$$A_{T-1} + Y_T + \sum_{i=T+1}^{N} \frac{Y_i^e}{(1+r)^{i-T}} = \sum_{i=T}^{L} \frac{C_i}{(1+r)^{i-T}} . \qquad (2.2)$$

where

| | | |
|---|---|---|
| $A_{T-1}$ | = | non-human wealth (i.e. physical and financial assets) carried over from the household's (T-1)th year |
| $Y_T$ | = | household's earned or non-property income at age T |
| $Y_i^e$ | = | household's expected non-property income at age i |
| r | = | the interest rate and |
| N | = | household's age at retirement. |

Modigliani and Brumberg adopt the simplifying assumption that the utility function (2.1) is homothetic[1]. This implies that the planned current consumption is given by

$$C_T = \gamma_T W_T \qquad (2.3)$$

where $W_T$ is the household's total expected lifetime resources at age T. That is, it is the sum of all the terms on the left-hand side of the budget constraint (2.2)

$$W_T = A_{T-1} + Y_T + \sum_{i=T+1}^{N} \frac{Y_i^e}{(1+r)^{i-T}} . \qquad (2.4)$$

Similarly, planned consumption in future years is given by

$$C_i = \gamma_i W_T \qquad i = T+1, T+2, \ldots, L . \qquad (2.5)$$

The $\gamma_i$s in equations (2.3) and (2.5) will depend on the rate of interest and the household's tastes and preferences. However, they will also depend on the age of the household. Because resources are to be exhausted during its lifetime, the nearer the household is to

[1] Graphically, this would mean that the slopes of the indifference curves are the same along any straight line drawn through the origin. Thus for a given rate of interest, as $W_T$ increases and the budget line shifted outward parallel to itself, the optimal ratio $C_T/C_{T+1}$ remains unchanged regardless of the magnitude of $W_T$. The ratio $C_T/C_{T+1}$ will however depend on the tastes of the consumer, as represented by the precise form of his indifference map, and on the rate of interest.

'death', the larger the proportion of its resources it plans to expend during any given year. The important aspect of (2.3) and (2.5) is that the $\gamma_i$s are independent of the magnitude of $W_T$. Thus the household keeps the ratios of its planned consumption expenditures on any two future years unchanged no matter what the size of its lifetime resources.

Ando and Modigliani (1963) adopted equation (2.3) for empirical estimation from aggregate time series data. Problems in estimating the expected non-property income for consumers meant that their final equation simply involved regressing aggregate consumption $C_t$, on aggregate current non-property income $Y_t$, and the aggregate wealth of consumers $A_{t-1}$. Their most important finding was that, for annual US data for 1929-59, $A_{t-1}$ was a significant determinant of $C_t$. The marginal propensity to consume (MPC) out of net worth was estimated to be in the region 0.07 to 0.10. Their aggregate consumption function was therefore of the form $C_t = \alpha A_{t-1} + \beta Y_t$.

### 2.4.2 The permanent-income hypothesis

Although the permanent-income hypothesis shares many similarities with the life-cycle hypothesis, the former was developed independently and found its first definite form in the work of Friedman.

Friedman generalizes the two period case to an 'indefinitely long horizon' rather than to a remaining life-span. Friedman also introduces the concepts of present period planned of *permanent consumption*, $C^p$, and *permanent income*, $Y^p$.

According to Friedman, permanent consumption would be a function of present period total wealth W, and the rate of interest:

$$C^p = q(W, r). \tag{2.6}$$

Total wealth in the Friedman formulation is the discounted sum of all future receipts, including income from non-human assets. Wealth in period t would be

$$W_t = Y_t + \frac{Y_{t+1}}{1+r} + \frac{Y_{t+2}}{(1+r)^2} + \frac{Y_{t+3}}{(1+r)^3} + \ldots \quad (2.7)$$

where $Y_t$ is total expected receipts in period t.

Friedman also makes use of the simplifying assumption that the consumer's utility function is homothetic, and equation (2.6) then becomes

$$C^P = qW \quad (2.8)$$

where the factor of proportionality q, is dependent on the consumers' tastes and on the rate of interest.

Theoretically, permanent income is defined as the maximum amount a consumer could consume while maintaining his wealth intact. It is in fact the return on wealth, i.e. $Y^P = rW$. Equation (2.8) can thus be rewritten as

$$C^P = q(\frac{Y^P}{r}) = kY^P \quad (2.9)$$

where q = rk.

The quantity k in equation (2.9) depends on the tastes of the household and on the rate of interest. However, under conditions of uncertainty, Friedman also introduces an additional motive for saving - the need to accumulate a reserve of wealth for contingencies. Since human wealth constitutes a less satisfactory reserve than non-human wealth, the proportion of permanent income consumed, k, is made to depend, also, on the proportion of total wealth which is held as non-human wealth. For a given rate of interest, this ratio is directly proportional to the ratio of non-human wealth to permanent income for which Friedman uses the symbol w. Thus we have

$$C^P = k(r,w,u)Y^P \quad (2.10)$$

where u is a *portmanteau* variable reflecting consumers' tastes.

When attempts are made to relate the permanent income hypothesis to actual data, obvious problems are faced. Current or 'measured' income is clearly different from the theoretical concept of permanent income and even if adequate 'flow of services' data on current or 'measured' consumption were available, this would still differ from planned or permanent consumption. According to Friedman, measured income, Y, consists of two components – a permanent component $Y^p$, and a transitory component $Y^t$. Measured consumption C, is similarly divided into permanent consumption, $C^P$, and transitory consumption $C^t$. Thus we have

$$Y = Y^P + Y^t \qquad \text{and} \qquad C = C^P + C^t. \tag{2.11}$$

The empirical definition of $Y^P$ is that it is the normal or expected unfortuitous income of the consumer. This roughly corresponds to the theoretical definition but is purposely left vague by Friedman since "the precise line to be drawn between permanent and transitory components is best left to the data themselves, to be whatever seems to correspond to consumer behaviour" (Friedman 1957:23). In practice, permanent income would be whatever quantity the consumer regarded as determining his planned consumption. The transitory component of income is to be regarded that which arises from accidental or chance occurrences, while permanent and transitory consumption may be interpreted as planned and 'unplanned' consumption respectively. Based on Friedman's assumption that $Y^t$ is uncorrelated with $C^t$, any unforeseen increment in income does not result in unplanned consumption. This is obviously open to debate. Friedman however justifies this premise by pointing out that even if income is other than expected, the consumer would tend to stick to his consumption plan, but adjust his asset holdings.

### 2.4.3 Comparison of the life-cycle and permanent-income hypotheses

From the above analysis, it is clear that there are basic similarities between the life-cycle and permanent-income hypotheses. According to the life-cycle hypothesis, a change in current income $Y_T$, will influence current consumption $C_T$, only to the extent that it changes $W_T$, the household's expected lifetime resources. Normally, changes in $Y_T$, unless they lead to revisions in expectations concerning future income, i.e. to changes in the $Y_i^e$s, can be expected to have little influence on current consumption unless the household is near 'death'. Similarly, in Friedman's model an increase in current income influences current consumption only to the extent that it changes W and, hence, permanent income. Furthermore, in both cases, the 'proportionality postulate' is not vital. In the case of the life-cycle hypothesis, current consumption would remain a function of total lifetime resources, although the relationship would no longer be one of strict proportionality. In the permanent income hypothesis, $C^P$ remains a function of W and hence, of permanent income rather than current income.

There are also relatively minor, but clear differences between the models. The annuitisation of total wealth means that the stock of non-human assets does not appear explicitly in Friedman's consumption function. However, Friedman does distinguish between the influences of human and non-human wealth on consumption. The factor of proportionality, k, i.e. average propensity to consume (APC) out of permanent income, is dependent on the ratio of the two. Non-human wealth - physical and financial assets - appears explicitly in the formulation of wealth in the life-cycle model, equation (2.4). Finally, in the life-cycle model, the household merely looks ahead towards the end of its life. Friedman's annuitisation of total wealth suggests that his household has an infinite life or at any rate attaches as much importance to the consumption of its heirs as its own. One of the major implications of the life-cycle hypothesis is that saving is done by consumers when they are working to provide for consumption when they are retired. The implication will not be captured in a model in which the consumer lives and earns income forever.

## 2.5 A REVIEW OF RESEARCH ON AGGREGATE CONSUMPTION EXPENDITURE

This section highlights the development in the empirical application of the basic forward-looking theories.

### 2.5.1 Early time series estimations under the permanent-income hypothesis

Friedman (1957) adopted a distributed lag formulation with geometrically declining weights, when suggesting that, for aggregate time series data, permanent income in period t may be estimated by

$$Y_t^P = \lambda Y_t + \lambda(1-\lambda)Y_{t-1} + \lambda(1-\lambda)^2 Y_{t-2} + \ldots \qquad 0 < \lambda < 1. \tag{2.12}$$

The argument is that consumers will assign the largest weight to their current income in assessing their permanent income and successively declining weights to past income. According to Thomas (1993:263) this formulation stresses the 'expected' nature of permanent income. Equation (2.12) implies that permanent income is determined by an *adaptive expectations hypothesis*. In this case, it is

$$Y_t^P - Y_{t-1}^P = \lambda(Y_t - Y_{t-1}^P) \qquad 0 < \lambda < 1. \tag{2.13}$$

Thus differences between permanent and measured income lead to an adjustment in the perceived level of permanent income. The extent of the adjustment depends on the size of $\lambda$.

Friedman's time series work was, however, based on versions of equation (2.12). He computed various time series for $Y^P_t$ using a different value for $\lambda$ in each case, truncating after 16 terms. Using annual real per capita US data for 1905-51, he ran regressions of the form $\hat{C}_t = \hat{\alpha} + \hat{\beta} Y_t^P$ for each $Y^P_t$ series and chose the value of $\lambda$ which provided the closest fit. The highest $R^2$ was obtained for $\lambda=0.33$. For this equation, the intercept term was insignificant with a very low t-ratio and the estimate of k was $\hat{\beta} = 0.88$. This supported the hypothesis that the relationship between $C^P$ and $Y^P$ was one of proportionality. The value obtained for $\hat{\beta}$ was also close to the observed APC for the period.

It is commonly known that Friedman's estimating procedure can be simplified by application of the Koyck transformation. Evans (1969) estimated this version, using US annual data for 1929-62. He obtained the following result:

$$\underset{}{\hat{C}_t} = \underset{(0.041)}{0.280 Y_t} + \underset{(0.052)}{0.676 C_{t-1}}. \tag{2.14}$$

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Interpreting (2.14) in terms of Friedman's hypothesis yields $\lambda=1\text{-}0.676=0.324$ and a value for $k=0.280/\lambda=0.86$. Both these estimates were very close to those obtained by Friedman.

Since the data series are non-stationary, the disturbance term in (2.14) is almost certain to be autocorrelated, the combination of autocorrelated disturbance terms and a lagged dependent variable means the OLS estimators will be biased and inconsistent. This problem is addressed in section 4.2.

### 2.5.2 The effect of prices and inflation on consumption – the influential study by Davidson, Hendry, Srba and Yeo (1978): an error correction approach

The mid-1970s saw a breakdown of the form of consumption function discussed in the previous section. These functions implied a constant savings ratio and could not explain its rise during the 1970s. Davidson, Hendry, Sarb and Yeo (1978) found econometric support for the presence of an inflation term in the equation and also concluded that the rise in inflation in the 1970s was the factor behind the rising savings ratio. Their study was also highly influential in introducing the error correction approach to econometrics - the first study that attempted to deal with non-stationarity in the data and the spurious correlation problem. The study of Davidson *et al.* also represented the first explicit use in this area of the Hendry type general to specific methodology.

Davidson *et al.* concentrated on three previous studies of non-durable consumption and personal disposable income for UK data - that of Hendry (1974), Ball *et al.* (1975) and Wall *et al.* (1975) - and tried to explain why these previous investigators came to such widely different conclusions.

Their analysis proceeded by noting seven potential explanations for the main differences between the three studies, namely the choice of (i) data series, (ii) methods of seasonal adjustment, (iii) other data transformations, (iv) functional forms, (v) lag structures, (vi) diagnostic statistics and (vii) estimation methods. Even after 'standardising' the models on a common basis for (i)-(iv), the models still seemed to lead to different conclusions. Remaining possible reasons could only be (v)-(vii).

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The above standardisation by sample period, etc., enabled Davidson *et al.* to 'nest' the three competing hypotheses as special cases of a general hypothesis or estimation equation. This enabled them to test, on purely statistical grounds, which provided the best description of the relationship between income and consumption. The best model appeared to be that of Wall *et al.*, which was of the form

$$\Delta C_t = \alpha_0 + \alpha_1 \Delta Y_t + \alpha_2 \Delta Y_{t-1} \qquad \alpha_0 > 0 \tag{2.15}$$

with $\Delta C_t$ and $\Delta Y_t$ the quarterly changes in consumption and income.

Davidson *et al.* pointed out that this statistically preferred equation (2.15) had some unacceptable economic properties: first, the equation had no static equilibrium solution. Also, the equation implied that the adjustment of consumption to any change in income is complete after just two quarters, and moreover, was apparently independent of any disequilibrium in the previous levels of the variables $C_t$ and $Y_t$. The model thus accounted only for short-run behaviour. Davidson *et al.* (*op. cit.*:686) resolved the last of the above problems by adopting an error correction approach and presented the following error correction model in log-linear form ($\Delta_4$ denotes the four period or annual difference for quarterly data):

$$\begin{aligned} \Delta_4 \hat{C}_t = {} & +0.47_1 \Delta_4 Y_t - 0.21 \Delta_1 \Delta_4 Y_t - 0.10(C_{t-4} - Y_{t-4}) \\ & \quad (0.04) \qquad\quad (0.05) \qquad\qquad (0.02) \\ & + 0.01 \Delta_4 D_t^0 - 0.13 \Delta_4 P_t - 0.28 \Delta_1 \Delta_4 P_t \\ & \quad (0.003) \qquad (0.07) \qquad\quad (0.15) \end{aligned} \tag{2.16}$$

Davidson *et al.* invoked the Deaton hypothesis[2] by adding price variables to the equation in order to rectify the consistent overprediction of consumption during the period 1971-75, when there was a steady increase in the UK propensity to save.

[2] Deaton (1978) argued that it is *accelerating* inflation that reduces consumer expenditure. Davidson *et al.* followed him by including first and second differenced forms of the price variable in their specifications of UK consumption.

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Hendry and Ungern-Sternberg (1980), indicated that the importance of the variables $\Delta_4 P_t$ and $(C_{t-4}-Y_{t-4})$ can be explained in terms of a wealth effect. They began by noting that equations such as (2.16) have a major flaw as a complete account of the dynamic behaviour of flow variables. Since $C_t$ and $Y_t$ are rarely equal, this means that some latent asset stock must be changing and changes in this stock may itself affect the change in $C_t$. This, of course, is merely another way of saying that wealth effects may influence consumption.

Wealth, or 'cumulative saving' effects, were introduced into their model by assuming that consumers seek to maintain constant ratios not only between consumption and income, but also between the latent asset stock and income. They proposed an 'equilibrium relationship', $A_t = BY_t$, where $A_t$ is the latent asset stock or wealth variable.

The disequilibrium 'costs' or 'losses' are incurred if $C_t$ or $A_t$ differs from their equilibrium values. The consumer is assumed to minimise a quadratic function of these losses subject to a budget constraint. This eventually leads to an equation that is a generalisation of (2.16), since it will contain two equilibrium errors $(C_{t-1}-Y_{t-1})$ and $(A_{t-1}-Y_{t-1})$. The latter reflects the extent of the previous period disequilibrium between asset stock and income.

Drobny and Hall (1989) established that the conventional variables used in the Davidson *et al.* specification do in fact not constitute a cointegrating vector. It also failed to perform well over the first five years of the 1980s. They contributed the failure partly to relative income effects within the overall distribution of incomes. If, as empirical results suggest, the propensity to consume of higher-rate income tax payers is different from that of standard-rate taxpayers, large changes in tax differentials (such as those of 1979 in the United Kingdom) may have large effects on aggregate expenditure on non-durable goods. They therefore introduced a tax rate differential variable and, together with disposable income and the wealth-to-income ratio, they found a cointegrating vector to exist. They further added a dummy variable for announced VAT changes to the long-run equilibrium equation.

Their preferred specification for the error correction model, based on the two-step Engle-Granger estimation procedure was (*op. cit.*:459):

$$\Delta\hat{C}_t = \underset{(0.002)}{0.008} + \underset{(0.07)}{0.33}\Delta Y_t - \underset{(0.05)}{0.12}\Delta\Delta Y_t + \underset{(0.002)}{0.007}D_t - \underset{(0.05)}{0.20}\Delta P_t - \underset{(0.092)}{0.14}\Delta C_{t-1} - \underset{(0.073)}{0.19}Z_{t-1}. \tag{2.17}$$

with $Z_{t-1}$ the lagged residual from the cointegrating regression.

Prior to the study by Davidson *et al.*, Branson and Klevorick (1969) added a price variable to the simple life-cycle hypothesis to test for the effect of 'money illusion' in US consumption. Economic theory suggests that the price coefficient in the consumption function should be equal to zero. A rise in the price level, with real income and real wealth remaining constant, must imply an equiproportionate rise in money income and money wealth and hence should not change consumption expenditure. If the price coefficient is positive, then this would imply that consumers are exhibiting the phenomenon commonly known as 'money illusion'. A positive coefficient means that a rise in $P_t$, with $Y_t$ and $W_t$ constant, results in a rise in consumption. Consumers must therefore be treating the equiproportionate rise in money income and money wealth as if it were a rise in real income and real wealth and 'not noticing' the rise in prices. A negative coefficient, however, implies some sort of reverse illusion. In the face of equiproportionate changes in the price level, money income and money wealth, consumers reduce consumption. This suggests that they believe that their real income and wealth have fallen when in fact they have not. In some way they are 'noticing' the rise in prices, but not the equiproportionate rises in money income and money wealth. Branson and Kleverick found their equivalent of the price coefficient to be significantly greater than zero and concluded that a significant degree of money illusion existed in the US consumption function.

The rapid inflation first experienced by many Western economies during the 1970s led to a number of attempts to establish links between the inflation rate, rather than the price level, and consumption. The economic rationale for the inclusion of inflation was as a proxy for the inflation loss on liquid assets, but Deaton (1987) suggested an alternative explanation in that variable inflation created uncertainty, and hence a decision to postpone consumption. Greater uncertainty regarding future real income during times of high inflation will lead to greater precautionary savings. Subsequent work by Hendry and Ungern-Sternberg (1981) specifically included a liquid assets term and argued that the inflation loss on this variable should be deducted from the income variable.

### 2.5.3 Wealth effects

The second main challenge to the consumption function came in the mid-1980s, when this time models of the type discussed in section 2.5.2 failed to explain the sharp fall in the savings-ratio in the United Kingdom. According to Bai and Whitley (1997:70), modellers reacted to the impact of forecast failures in the late 1980s by assuming that financial deregulation had increased liquidity of physical assets held by the personal sector. Deregulation resulted in the personal sector increasing its debt-to-income ratio. At the same time this boost to demand stimulated a rise in asset prices (especially house prices) but the ratio of debt to assets rose in spite of asset appreciation. Physical wealth began to appear in consumption equations. The equations then began to appear more like the life-cycle models of consumption rather than the original Keynesian form.

Although researchers agreed all along that wealth is an important determinant of consumption, the reason why earlier studies did not include explicit wealth variables was basically a lack of data on total non-human wealth. In instances where researchers attempted to include some measure of non-human wealth, they had to rely either on the liquid asset component of such wealth, or construct their own series from past data on saving. Examples include Zellner *et al.* (1965), and Townsend (1976) who found liquid asset variables to be important determinants of consumption, and Stone (1973) who constructed wealth data for the United Kingdom using the relationship $W_t = W_0 + \sum_{i=1}^{t} S_i$, where $W_0$ refers to wealth in some 'bench-mark' year for which data is available and $S_i$ to saving in year i.

The study of Ball and Drake (1964) was the first study to explicitly pay attention to the precise type of consumer behaviour that may cause wealth variables to be important. In the Ball-Drake model, individuals are assumed to be short-sighted in the face of uncertainty, and their basic motive for saving is a broad precautionary one. The arguments in the consumer's utility function are current real consumption and real non-human wealth. That

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is $U_t = U(C_t, W_t)$, where $W_t$ is wealth at the end of the (short planning) period over which utility is maximised and $C_t$ is consumption during that period. That is, the consumer does not ignore the future but safeguards against its uncertainties by accumulating wealth. The more wealth he accumulates, the more secure he feels and, given his rate of consumption, the more utility he derives. The future is therefore allowed for without making the possibly unrealistic assumption of intertemporal utility maximisation required by the life-cycle and the permanent-income hypotheses.

However, these models of consumption behaviour in turn failed to explain the rise in the savings-ratio that occurred in the United Kingdom in 1990-91 and research began to focus on the forward-looking behaviour of consumers, going back to the original life-cycle model adjusted for forward-looking behaviour by Hall (1978) and subsequently adjusted by Hayashi (1982) to deal with liquidity constraints.

### 2.5.4 Liquidity constraints and credit constraints

The assumption in the basic forward-looking theory is that consumers have access to perfect capital markets and can borrow or lend at an exogenous rate of interest, while in reality, a substantial fraction of consumers is unable to consume as much as predicted by the forward-looking theory because they are unable to finance their desired level of consumption. These consumers are said to be liquidity constrained if they are unable to maintain expenditure by liquidating financial assets, or credit constrained if they are unable to borrow as much as they would like to at the prevailing interest rate.

The importance of liquidity constraints from the viewpoint of macroeconomics is that the relation between consumption and contemporaneous income is generally different for liquidity constrained consumers than it is for consumers who do not face binding liquidity constraints. The literature on liquidity constraints on consumption suggests that aggregate consumption responds to changes in both permanent and current income. This is equivalent to distinguishing between forward-looking consumers (the wealth constrained), who smooth their consumption according to the life-cycle hypothesis and backward-looking or credit-constrained consumers (liquidity constrained), whose consumption is restricted by their current incomes (Bai and Whitley 1997:73).

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Liquidity constraints were first introduced by Hall and Mishkin (1982) and tested by Hayashi (1982) and Campbell and Mankiw (1991). The basic notion is that many households have small initial values of assets and are unwilling or unable to borrow. Hence their current consumption is constrained by current income. Aggregate consumption is then given by the behaviour of both unconstrained and constrained households:

$$C_t = (1-\pi)C^U + \pi C^C . \tag{2.18}$$

The importance of liquidity constraints in consumption behaviour has been widely recognised; important empirical implementations include Campbell and Mankiw (1989), Abel (1990), Darby and Ireland (1993) and Campbell and Deaton (1989). They assume that some consumers can borrow or lend at an exogenous rate of interest while others, who would like to increase their current borrowing in order to increase current consumption, are unable to do so because of liquidity constraints.

Bai and Whitley (1997) utilises this insight as foundation for a model that behaves quite differently in the two groups of consumers.

The consumption of forward-looking consumers in their model is given by

$$C_{1t} = \beta(A_{ft} + H_{ft}) \tag{2.19}$$

where $C_{1t}$ is the consumption of forward-looking consumers, $A_{ft}$ is net financial and physical wealth (real non-human wealth) at time t, and $H_{ft}$ is human wealth at time t for forward-looking consumers.

The credit-constrained consumers' consumption is equal to their non-property income:

$$C_{2t} = YD_{2t}, \tag{2.20}$$

so that aggregate consumption is a linear function of total wealth of the two types of consumers:

$$C_t = \beta(A_{ft} + H_{ft}) + YD_{2t} + u_t . \tag{2.21}$$

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Flavin (1985) and Muelbauer and Bover (1986), also concluded that the addition of a liquidity constraint does improve the explanation of the data. The liquidity constraint contains a shadow price which operates as an interest rate, so that a consumer faced with a liquidity constraint will behave as if faced with a higher interest rate. Current consumption therefore becomes more expensive and consumers substitute future consumption.

### 2.5.5 The role of expectations in consumption

During the twenty years after the Second World War, the adaptive expectations hypothesis enjoyed considerable popularity as a simple and apparently sensible model of how economic agents form expectations. Under the permanent income hypothesis, permanent income can be regarded as determined by an adaptive expectations process, i.e. through estimation of equations such as (2.13). The deficiencies of the adaptive expectations hypothesis, however, gradually became more apparent. It was pointed out that to model expectations of a variable adaptively, implies irrational behaviour on the part of economic agents if that variable grows at a constant rate over time. The agents' forecast error will consistently be positive. If the agent continues forming expectations adaptively under these circumstances, he will soon realise he is consistently underpredicting the variable under consideratioin and a rational individual will start taking this into account when he makes his predictions.

The 1980s saw the introduction of rational expectations (also termed model-consistent expectations) into a number of forecasting models. In simple terms, rational expectations implies that agents have access to all relevant information and make the best possible use of it when forming expectations regarding any variable. Relevant information, of course, includes knowledge of government policy aims. Hall and Garratt (1992b) point out that the economic evidence for the importance of expectations is almost uniformly based on the weak form of rational expectations (i.e. that agents do not make systematic mistakes), rather than the strong form (that they use a particular model to form their expectations). It is clearly a significant step to go from the statement that agents are 'on average' correct in their expectations to the much stronger one that they use a particular model which they believe completely. Hall and Garratt learnt from practical implementation of rational expectations within a forecasting context, that the presence of rational expectations in

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models tends to cause jumps in the initial period value of the variable. This occurs because agents anticipate the future and therefore make all the required adjustments in the current period.

Learning is a natural assumption, which overcomes the complications of the rational expectations hypothesis, and also avoids the need for the unrealistic information assumption of the strong rational expectations hypothesis. It is based on the notion that expectations are formed by intelligent agents who are not fully informed but are able to learn from their environment as time progresses. A specific expectations rule is therefore set up and the parameters of this rule are allowed to change in a way which represents the process of the agents learning about the economy.

With regard to modelling consumption expenditure, price expectations may hypothetically influence current consumption. Agents have a rule for forming expectations about the next period's consumer prices, which might involve such factors as past values of, say, interest rates, the exchange rate as well as lagged values of the consumer price index. They use this rule with their best estimate of the parameters attached to the rule to form an expectation of consumer prices in the next period and this affects consumption in the current period. During the next period, agents are able to observe the actual outcome for consumer prices and to compare it with their original expectation, which then gives them a direct measure of their expectation error. Given this error, the parameters of the expectations rule may then be revised to produce a better forecast for the following period. By repeating this procedure over a number of periods, the agents come to learn a set of parameters which will give them the best forecast of consumer prices; thus they learn about the structure of the model.

In practice, a set of 'rolling' regressions may be performed, using OLS, each period adding the latest expectation error to the data set, or alternatively, a more sophisticated mechanism based on the Kalman filter may be used for the variable parameter estimation of the expectations rule. Price expectations formation and the implementation of the price expectations variable in the consumption function are addressed in Chapter 3 and Chapter 5 respectively.

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### 2.5.6 Comparing specifications in different macro-models

A brief overview of the specification of consumption functions for some of the main UK macroeconometric models (Whitley 1994:34) can be found in Table 2.1. In addition, the approach towards addressing the notion of expectations is also reported. Inevitably, focussing on models at one point in time runs the risk that the description might be outdated at present. However, it may be believed that while details may change, the underlying features remain very much the same.

According to Whitley, many accounts of consumption equations written by the modellers themselves describe the consumption equation as based on the life-cycle hypothesis. This is a rather vague description in practice, since the empirical models include explanations of consumption by income alone, a combination of real incomes and wealth, and wealth alone. From Table 2.1 it is evident that there seems to be consensus on the inclusion of a combination of wealth and income, with wealth usually defined as the sum of financial and physical assets, in the determination of consumption spending. In addition, either real or nominal interest rates are included. This suggests a life-cycle approach modified by liquidity constraints.

## 2.6 CONCLUSION

This chapter reviewed the literature on consumption theory, with specific reference to the development of the forward-looking theory of consumption.

The most common approach in the 1970s was to treat consumers as constrained in their purchase decisions by current income. The mid-1970s saw the breakdown of this form of equation in the face of rising inflation world-wide and a rise in the savings ratio, specifically in the United Kingdom. This led to the introduction of price or inflation variables to consumption functions. Researchers also became aware of the problem of non-

**Table 2.1 A comparison of specifications of consumption functions**

| **Model** | **Consumption** | **Expectations** |
|---|---|---|
| London Business School (LBS) | Real income, housing and financial wealth, nominal interest rates, demographic factors | Exchange rate either forward looking or learning approach |
| National Institute for Economic and Social Research (NIESR) | Non-credit-financed spending a function of financial wealth, real income and real interest rates | Rational in exchange rate, prices, wages, stock building |
| Liverpool University (LPL) | Private sector demand determined by wealth and long-term interest rates | Rational |
| HM Treasury (HMT) | Total wealth, inflation-adjusted income, real interest rates | Adaptive or implicit |
| Bank of England (BE) | Financial wealth, housing wealth, real income, mortgage equity withdrawal | Adaptive or implicit |
| Oxford Economic Forecast (OEF) | Income, total wealth, nominal interest rates, relative price durables/non-durables | Adaptive or implicit |

**Source:** Whitley (1994:235).

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stationary data and spurious regressions and the error correction approach was adopted in the late 1970s. The second main challenge to consumption specifications came in the mid-1980s when models failed to explain the sharp fall in the savings ratio in the United Kingdom. This gave rise to the explicit introduction of wealth variables in consumption equations. When models of consumption behaviour again failed to explain the rise in the savings ratio that occurred in 1990-91 in the United Kingdom, the forward-looking theory of consumption was adapted to deal with liquidity constraints. The most recent development in consumption specification has been to introduce a price expectations variable into the behavioural equation. This has been done in this study and is reported in Chapter 5.