

Patterns and Determinants of Irish Consumption

by Mary Ryan¹

ABSTRACT

Consumption performance in Ireland, in common with the broader domestic economic picture, has been marked by strong growth throughout the 1990s, following a more muted performance in the preceding decade. During the latter part of the 1990s, while strong by any measure, consumption growth has been pronounced relative to other EU countries and the US. This article aims to review this performance with a view to identifying the likely contributing factors to consumption, both over a long-term perspective and in the shorter term. The identification of such motivating factors precedes a more formal, technical analysis for the purposes of incorporating mathematical relationships describing these economic links in the Bank's macroeconomic model. The results of this formal analysis are also presented in this article. It was found that disposable income and wealth have roles to play in explaining long-run consumption, while short-run factors affecting consumption related to the cost of credit and to consumer confidence.

Introduction

Consumption performance in Ireland has been marked by a strong surge in consumption growth throughout the 1990s, following a more muted performance in the preceding decade. This pattern is consistent across all categories of consumer expenditure, but is more noticeable in certain areas than others. It is interesting as a prelude to a more formal quantitative analysis to first consider these consumption patterns and some of the possible contributing factors. This paper intends to review Irish consumption over the 1980s and 1990s and identify the likely determinants of both long-run and short-run consumption, within the context of including these relationships in the Central Bank macroeconomic model for Ireland. Section 1 provides some background to the development of the Bank model and its dataset, while Section 2 notes recent consumption behaviour. Sections 3 and 4 discuss the possible factors which impact on long-run and short-run consumption, respectively, while results of a more formal quantitative analysis are presented in Section 5 followed by some concluding remarks in Section 6.

¹ The author is an economist in the Economic Analysis, Research and Publications Department. This paper has benefited from helpful discussions with colleagues John Frain, Maurice McGuire and Nuala O'Donnell and research assistance from Conor Murphy. The co-operation of the CSO and the Bank Statistics Department in the provision of raw data for the macroeconomic model data project is also gratefully acknowledged. The views expressed in this paper are not intended to represent those of the Central Bank of Ireland or the Eurosystem.

1. Central Bank Macroeconomic Model of the Irish Economy and its Underlying Dataset

The motivation for this present analysis is the continuing development of the Central Bank macroeconomic model for Ireland and the data are drawn mostly from the related databank. This macro-model project has been ongoing since 1997 against the background of increased interest in model-building across the ESCB with a view to providing tools for decision-making to the Governing Council of the ECB. A first version of the model was completed in 2000 and is one of a set of linked country models that are used for policy analysis and forecasting along with a euro area-wide model at ESCB level. In “stand-alone” mode, the model is used as an input into Irish contributions to the forecasting rounds of the ESCB and also for domestic analysis. This first version of the Irish model is described in McGuire and Ryan (2000)². As noted at the time, it was intended to improve and extend this version as an on-going project.

One aspect of this improvement programme was to enhance the model databank³, which had become somewhat outdated. In particular, the underlying national accounts data had been subject to revisions and the original databank ended in 1996. A large-scale data-gathering and interpolation project was thus initiated⁴, culminating in a consistent quarterly dataset ranging from 1980 to 1999 intended to underpin the production of the second version of the Central Bank macro model. Annual series for national accounts data adjusting for breaks in series were first produced, followed by an interpolation procedure, whereby the frequency of data was increased from annual to quarterly using suitable indicator data and mathematical procedures written in the Bank⁵. This interpolation aimed to improve both the databank and the accuracy and forecasting capabilities of the model built upon it. It should be noted that, while the quarterly model databank is internally consistent, it is not compiled on the same basis as the quarterly data recently published by the CSO. Specifically, in order to have long time series, the Central Bank databank is compiled according to the older national accounts definitions, ESA 79, and is seasonally adjusted over the length of the series, while recent CSO data are compiled in accordance with ESA 95 and are not seasonally adjusted.

2 A description of the role of models in decision-making is also included in this article. As noted, the model is used as an input into the forecasting rounds of the ESCB and for domestic analysis. It is intended to expand these functions in the production of an improved model.

3 The data project team were Maurice McGuire, Nuala O'Donnell and Mary Ryan.

4 The assistance and co-operation of the CSO in relation to national accounts statistics and the Bank's Statistics Department in relation to banking statistics in this project is gratefully acknowledged.

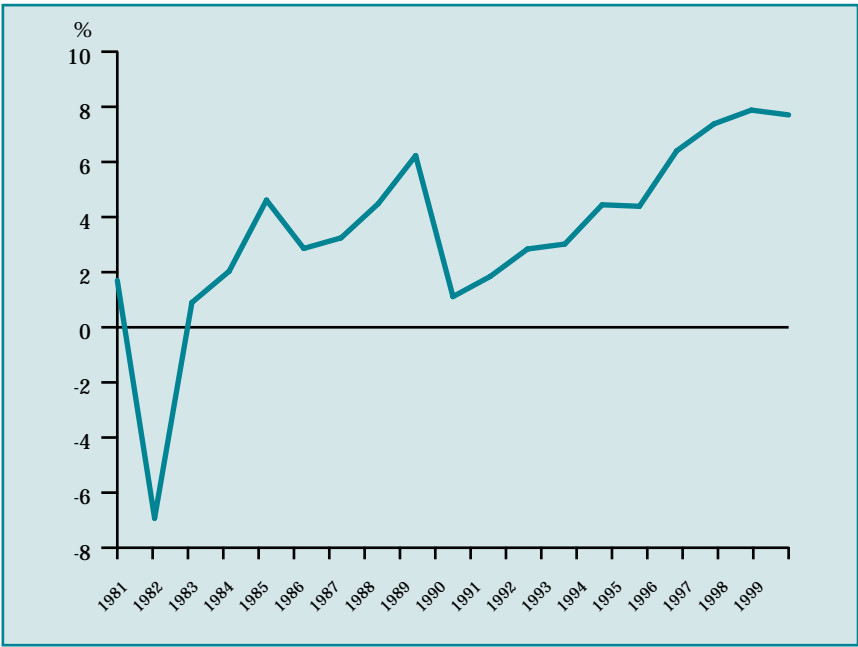
5 Procedures are based on Chow-Lin and are available from John Frain at the Bank.

The data for the consumption block of the model were derived as described in two phases. First, consistent annual series were calculated using data provided by the CSO. Breaks were removed and revisions adjusted for. Quarterly data were then derived using the CSO value and volume indices for retail sales as indicator series for personal consumption at current and constant prices respectively. These indicator series also had to be adjusted following the introduction of a new business classification in 1999. Both the annual and quarterly consumption deflator series were derived as the ratio of nominal to real consumption. Seasonal factors have been taken into account and the resulting series for consumption can be considered as seasonally adjusted.

2. Consumption Patterns

The performance of real Irish consumption throughout the 1980s and 1990s has demonstrated a somewhat varied pattern, ranging from a fall of nearly 7 per cent in 1982 to increases of around 8 per cent per annum in the late 1990s⁶. The 1990s fared better in average terms, with a mean growth rate of 4.7 per cent, compared with an average of 2.1 per cent for the 1980s. Figure 1 illustrates the range of real consumption growth over the two decades, using growth rates derived from annual data taken from the model dataset.

Figure 1: Growth in Personal Consumption



The pattern of growth can be seen to echo the economic conditions of the two decades in question, being muted in the

6 According to the Bank model data. Due to differences already noted, these growth rates may differ somewhat from those of the CSO data.

early part of the 1980s, accelerating somewhat at the end of the decade, before dipping back and then slowly gathering pace during the 1990s. The latter part of the 1990s shows high growth in personal consumption, again reflecting the prevailing strong economic conditions, and it is interesting to consider this growth in a more disaggregated manner. Table 1 shows the average of annual real growth rates in the main components of consumer spending, as derived from published CSO data. Selected sub-headings are also included.

Table 1: Average of Annual Real Growth Rates in Categories of Consumption 1995-2000

	average 1995-2000
Food, Beverages and Tobacco	3.8
Clothing and Footwear	16.4
Rent	4.8
Imputed Rent	1.3
Fuel and Power	3.5
Household Equipment and Operation	9.8
<i>of which</i> Durable Household Goods	11.9
Non-Durable Goods and Services	6.8
Transport and Communication	10.6
<i>of which</i> Personal Transport Equipment	16.4
Communication	20.9
Recreation, Entertainment and Education	6.5
<i>of which</i> Equipment and Accessories	12.2
Miscellaneous Goods and Services	8.0
<i>of which</i> Professional Services (including Medical)	7.4

Source: Table 14, National Accounts, CSO

Clearly, consumer spending has increased in real terms across a wide range of areas, but some areas warrant specific mention. Expenditure on clothing and footwear stands out as being particularly strong, as does expenditure on the sub-headings consumer durables, personal transport equipment, communications and, relating to recreation, entertainment and education, equipment and accessories. These five groupings increased their share of real consumption from 20 per cent in 1995 to nearly 30 per cent in 2001. It is also worth noting that these categories of expenditure are likely to be particularly responsive to changes in disposable income levels, which will later be seen to have increased substantially over the latter part of the 1990s.

While Irish consumption growth can be seen as strong by any measure, this is particularly the case when compared to other EU countries and the US, as can be seen from Table 2. This table contains the average annual growth rates in real consumption for all EU countries and the US for the periods 1991-1995 and 1996-2000.

Table 2: Average Annual Growth Rates of Consumption for EU Countries and the US 1991-2000

	1991-1995	1996-2000
Belgium	1.7	2.3
Denmark	2.3	1.3
Germany	1.2	1.7
Greece	1.9	2.8
Spain	1.2	3.7
France	0.7	2.1
Ireland	3.1	7.9
Italy	0.9	2.6
Luxembourg	2.6	4.4
Netherlands	1.6	4.0
Austria	2.3	2.6
Portugal	2.3	3.8
Finland	-1.0	3.6
Sweden	-0.1	3.2
United Kingdom	1.5	4.2
EU average	1.5	3.4
United States	2.6	4.2

Source: Eurostat, Statistical Office of the European Community. The data refer to final household consumption, including non-profit making institutions serving households.

As can be seen from Table 2, while higher on average, Irish consumption growth rates did not differ starkly from those of other countries for the first half of the 1990s. However, from 1995 a strengthening of growth rates relative to other countries became apparent, with notably different rates for the period 1996-2000. This is repeated in the growth rates for 2001, with Ireland showing consumption growth of about 5 per cent, with only the UK and Luxembourg close to this with rates of around 4 per cent.

3. Long-Run Determinants of Consumption

In general, most economic variables are non-stationary in levels. This means that the variables tend to drift over time and not to return to a specific value or deterministic trend. This is true of variables such as investment, output, the capital stock, consumer prices, etc., and is certainly true of consumption. The interesting task of the economic researcher is to ascertain whether this drift is a non-random process and to uncover links between variables, called cointegrating relationships, which re-establish themselves over time. This means that those particular variables have common trends. It is the identification of these links and common trends that constitutes the modelling of the “long run” determination of an economic variable. For single equations, the approach adopted to uncovering these relationships in the data is to use one of the methods specifically designed to deal with non-stationary series⁷. These include the Johansen procedure, as outlined in Johansen (1988) and Johansen and Juselius (1990), and Fully Modified Ordinary Least Squares (FM-OLS) as developed by Phillips and Hansen (1990).

7 The sensitivity of more standard statistical techniques such as ordinary least squares to the assumption of stationarity makes them inappropriate as estimation techniques.

A general feature of macroeconomic models is that the long-run relationships are well founded in economic theory. The debate relating to the long-run determinants of consumption is well known, with disposable income and wealth the main factors under consideration in the literature. In the first scenario, consumption is hypothesised to be strongly related to disposable income, with households proportionately increasing their consumption in response to a rise in income. In other words, consumption is proportional to disposable income in the long run. The more neo-classical view is that households engage in some form of consumption-smoothing behaviour as their income varies over time. This would involve borrowing or running down savings during low-income periods, with loans being repaid or savings being accumulated in times of higher incomes. Measures of wealth are used as an indicator of accumulated income over time. These wealth variables may include a measure of permanent income, including human capital measured as discounted future income flows, although a measure of financial wealth only may also be used.

This analysis considers both income and wealth factors.

Disposable Income

Disposable income is defined as total income net of direct taxes. In the Bank macroeconomic model, the quarterly data for nominal disposable income was derived by the sum of its interpolated constituent parts, namely compensation of employees, government transfers to residents and other personal income, less direct taxes including social insurance contributions. Real disposable income was derived by deflating the nominal series by the consumption deflator. Clearly, labour market conditions such as the level of employment and wage rates relative to the price level and fiscal policy factors such as tax rates and changes to the tax base will thus affect this aggregate measure of disposable income.

Figure 2 notes the evolution of real disposable income over time, while Figure 3 notes the contribution of the various components. Disposable income can be seen to have grown strongly over the sample, reflecting particularly the period of strong economic growth throughout the 1990s. Clearly, compensation of employees accounts for the bulk of disposable income, accounting for an average of 72 per cent over the sample, and has grown strongly over the same period, reflecting both the increase in numbers employed and wage growth. Other personal income also grew over the sample, although its contribution to disposable income is somewhat more volatile. Mirroring the expansion in wages earned, payments of direct taxes can be seen to have increased over the sample period, notwithstanding the reductions in personal income tax rates. Government transfers to residents has also grown somewhat over the period, although its

contribution to the calculation of disposable income has lessened over the latter part of the sample, probably reflecting the improved employment prospects of the mid-to-late 1990s.

Figure 2: Real Disposable Income and its Components

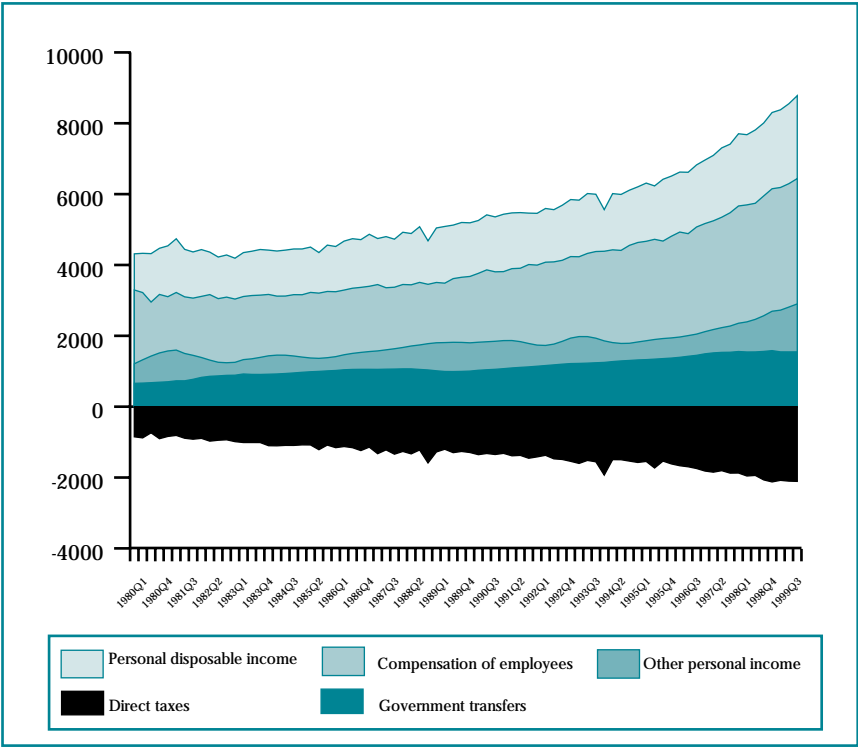
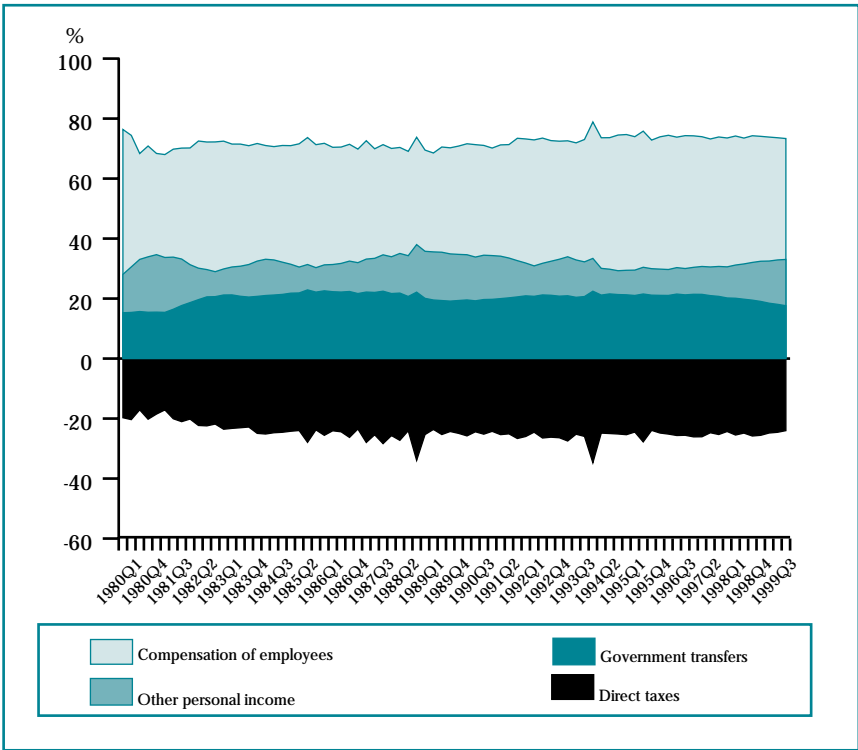


Figure 3: Contributions to Disposable Income



In real terms, the relationship between this measure of disposable income and consumption is quite visible. This is easily seen when comparing both the levels and the growth rates⁸ of these two series, as in Figures 4 and 5.

Figure 4: Real Consumption and Disposable Income

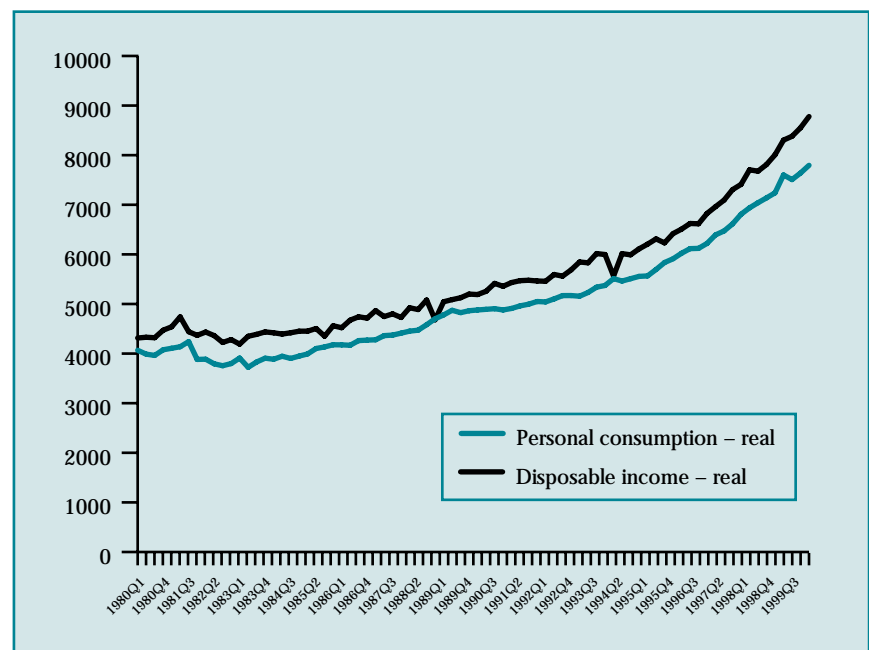
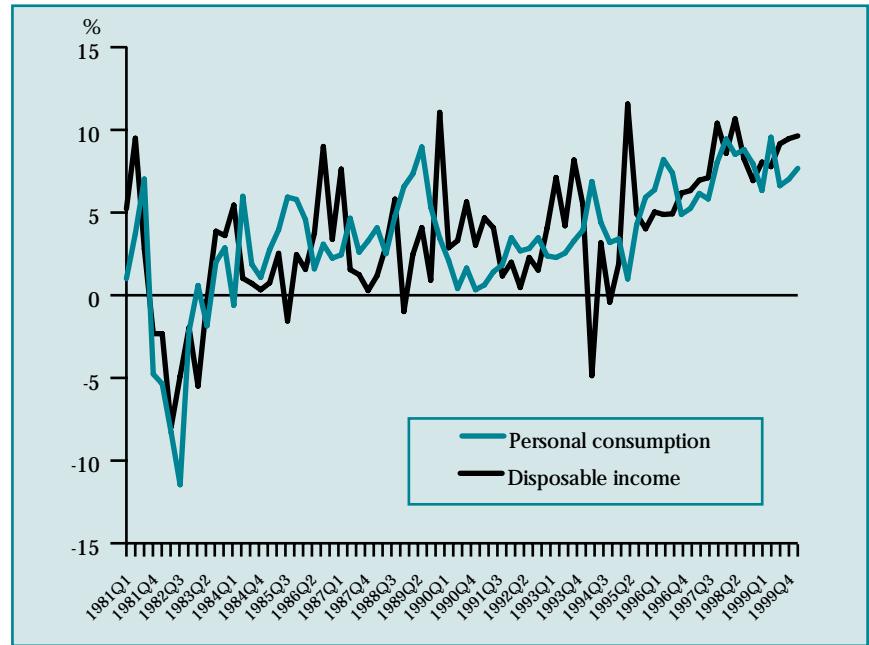


Figure 4 illustrates the real levels of personal consumption and disposable income, while the growth rates of these series are depicted in Figure 5.

Figure 5: Growth Rates of Real Personal Consumption and Disposable Income



8 Growth rates here and elsewhere refer to annualised rates, i.e. $(Q_t - Q_{t-4}) \cdot 100 / Q_{t-4}$, rather than quarter-on-quarter changes.

Clearly, it can be seen that consumption and disposable income are closely related, with both levels and quarterly series of year-on-year growth sharing similar patterns. This gives a strong *a priori* indication that we should find the type of long-run relationship between these variables as described above. Specifically, we can expect that the methods for identifying cointegrating relationships as previously mentioned should uncover a link between these variables.

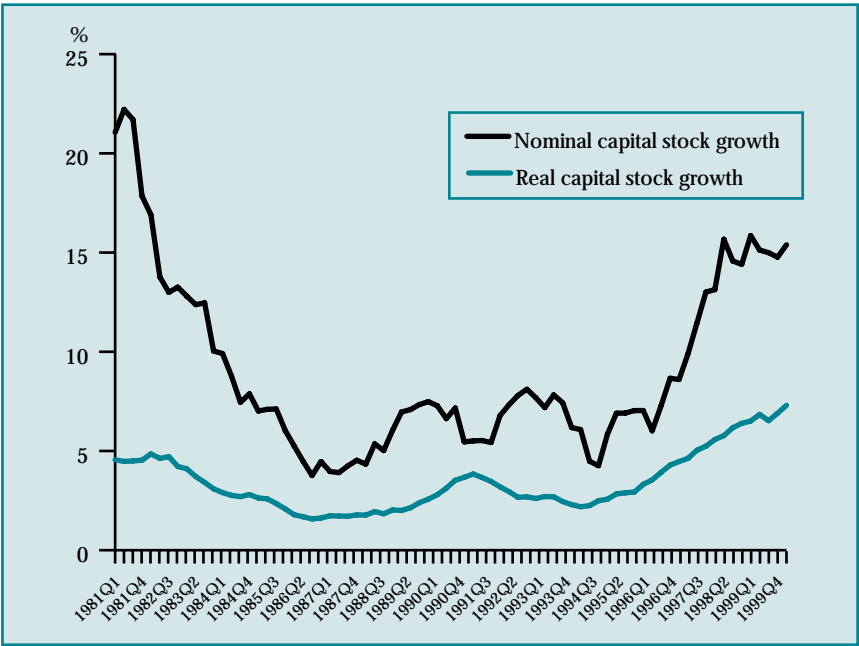
Wealth

Measures of wealth are used in assessing the determinants of consumption as a stock of available funds and as an indicator of accumulated income over time, with a view to incorporating a more long-term consumption horizon for the consumer. In other words, it is assumed that a consumer does not just make consumption choices based on their current level of income, but also bears in mind other wealth resources at hand, namely accumulated savings, and the option to borrow against future income. Clearly, a measure of financial wealth lies at the core of any calculation of wealth for the purposes of consumption analysis in order to reflect aggregate accumulated savings. In addition, wealth measures may be augmented by a measure of permanent income, including human capital measured as discounted future income flows as a means of capturing consumers' expectations about future income flows and availability of resources for expenditure. However, this requires a forecast of future income flows, which itself must come from a mathematical model of income.

The measure of wealth used for the present analysis is restricted to what is termed "financial wealth". In keeping with the other models in the eurosystem linked models, this includes the capital stock, government debt outstanding and net foreign assets. It is not considered that there is any significant loss of explanatory power as a result of the omission of permanent income measures, as preliminary assessments using a forecasted measure of income to derive a series of discounted future income flows did not yield any additional information.

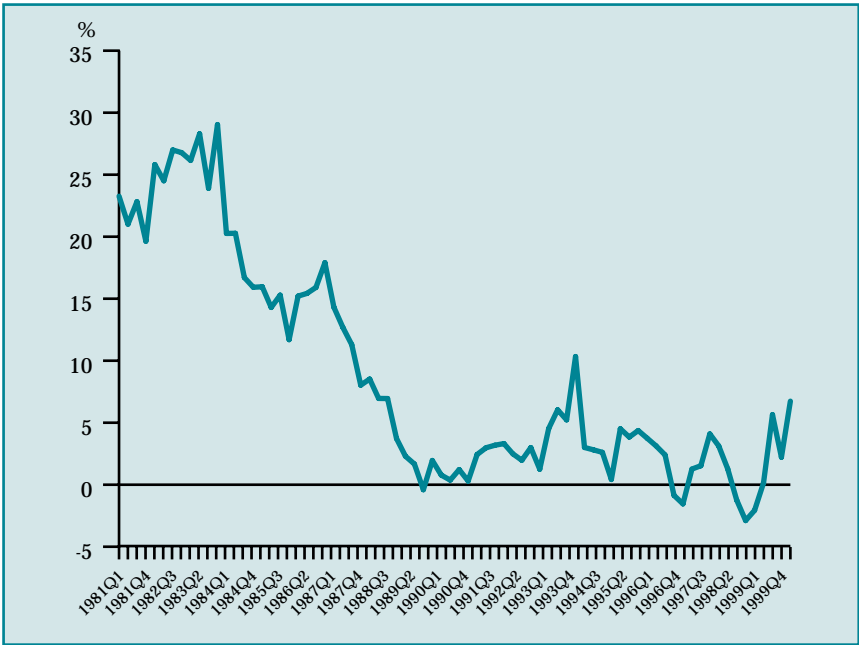
Real *capital stock* was calculated for the Bank model databank by the perpetual inventory method, namely adding to the previous value of capital stock the level of investment while adjusting for some depreciation of the existing stock. A starting value for the series was required, which was drawn from Henry (1989), using an estimate for the capital stock for the first quarter of 1981 excluding agricultural land. Having converted this estimate to base year (1995) prices, this was then used to construct the remainder of the series as described. This exercise was completed for both whole economy and private sector capital stock. This private sector capital stock was then converted to nominal values using a private investment deflator for the purposes of inclusion in financial wealth.

Figure 6: Capital Stock Growth



As can be seen in Figure 6 above, the rate of growth of the capital stock, while positive, was muted during the 1980s, reflecting the pattern of investment at the time. Real investment was somewhat subdued during this period, picking up only in the early 1990s. This was then reflected in an acceleration in the rate of growth of the capital stock, as seen above.

Figure 7: Government Debt Growth

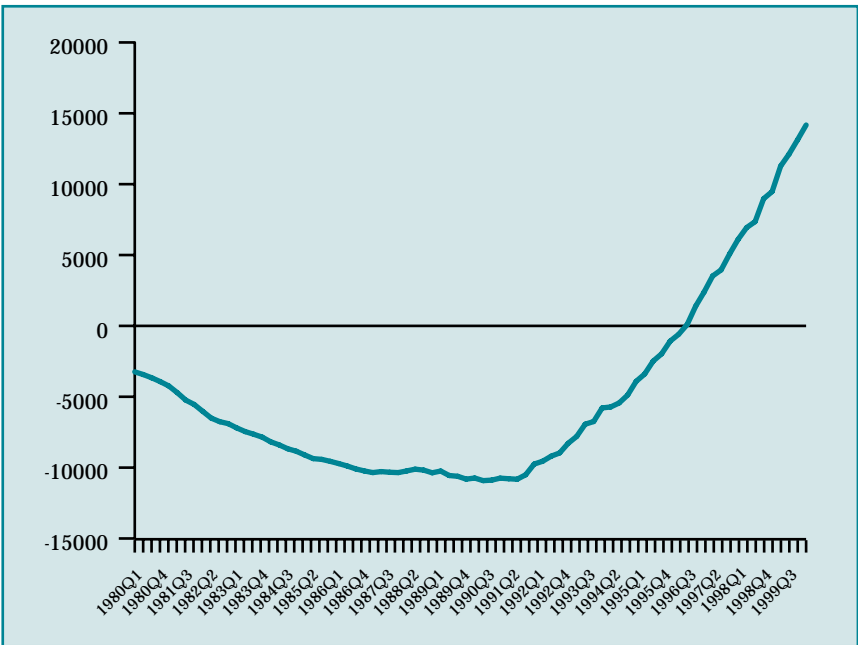


The *government debt* series used in the Bank model comprises the linking of recent quarterly debt data with interpolated data from annual series prior to 1996. As can be seen from Figure 7 above, the rate of growth of government debt fell during the

1980s and can be seen to reflect the shift in focus of fiscal policy towards smaller budget deficits and debt levels in the latter part of the decade and the early 1990s, in particular in response to the requirement to meet the Maastricht convergence criteria for entry to the Monetary Union. This was followed by a period of current budget surpluses with some accompanying repayment of government debt in the latter part of the 1990s.

Net foreign assets are calculated for the purposes of the Bank model databank in an “accumulated” fashion, i.e. the current value of net foreign assets is defined as the value in the previous period plus (minus) the surplus (deficit) of the balance of payments current account. This method required a starting value for the series, for the first quarter of 1980, which was drawn from an earlier version of the databank. This value was derived by estimate using factor income flows in 1980 and an assumed rate of return to derive an implied level of net assets. Clearly, this is not ideal, but it is worth noting that the size of current account surpluses and deficits over time have rapidly dominated this starting value.

Figure 8: Net Foreign Assets



As can be seen from Figure 8, the prolonged period of current account surpluses during the 1990s have produced a positive series for net foreign assets in the latter half of the decade, thus becoming a positive contributor to nominal wealth.

These three variables are brought together to produce a nominal financial wealth variable. It should be noted that, while the series is a current rather than constant price series, no account is taken of the effect of valuation effects on the various variables. In

particular, perceived wealth gains arising from short-term increases or falls in the market values of assets are not included in this measure of wealth, but rather it is intended to capture the accumulation of wealth over time⁹. For example, increases in the market value of the housing stock would not be reflected in this measure of wealth, but rather the accumulation of investment in housing. In any case, it is worth noting that the savings rate has not changed significantly over the 1990s, indicating that one could discount a surge in the market value of wealth as stimulating increases in personal consumption. Had the market revaluation effects of wealth been a factor in consumption decisions, there would have been a period of falling savings rates as consumers felt less need to save. Rather, savings have generally kept pace with growing personal incomes and in fact may be seen to have increased in recent years.

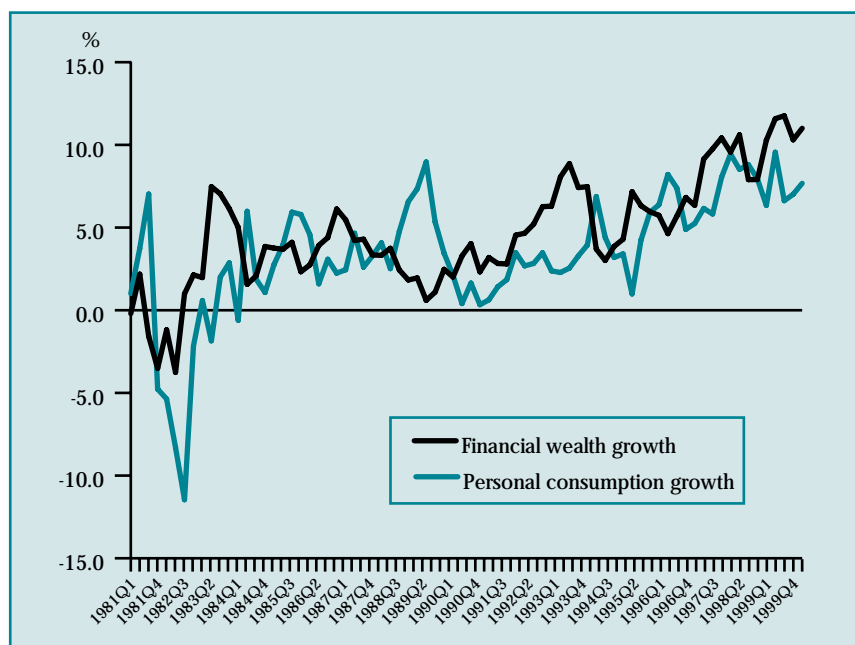
Figure 9: Savings Rate 1990-2002



Source: CSO National Accounts data.

This nominal wealth series is then deflated by the personal consumption deflator to yield a real series, representing its purchasing power over goods and services. Although the scale difference between financial wealth and consumption is pronounced and would suggest that only a small portion of wealth would typically be consumed in any given period, the growth rates of these variables look to be related over time as can be seen from Figure 10. This would indicate that a behavioural link should exist between these variables, and it is reasonable to test for a long-run relationship.

9 It is intended, as an extension of this consumption study, to revisit the issue of wealth revaluation effects.

Figure 10: Growth in Financial Wealth and Consumption

Long-Run Consumption in the Bank Model

In modelling consumption in the Bank model, a mixed approach incorporating both disposable income and wealth in the long-run has been adopted. This approach allows for the clear visual link which exists between consumption and income, while also taking a more long-term consumption horizon into account. It may be noted that this approach reflects that taken in other macroeconomic models, examples being the euro area-wide model published by the ECB, de Nederlandsche Bank's Euromon multi-country model, the Bank of England's macroeconomic model and the Banco de España block of the ESCB multi-country model. In taking this approach, the Bank is extending its current version of the model, which was based on a more neo-classical representation of consumption being determined solely in the long run by wealth. The inclusion of income in the long-run relationship may be considered as capturing some liquidity constraint effects, together with the likelihood that, in practice, households ability to foresee future income and wealth conditions is somewhat restricted and so current disposable income has more of a role to play than previously allowed for. This approach has been supported by the data and results for the long-run consumption relationship proposed for inclusion in the model are presented in Section 5.

4. Short-Run Determinants of Consumption

The formulation of short-run relationships in the model generally relate the current change in a variable to changes in other variables and to where the variable is in relation to its "long-run" value. In other words, the long-run relationships are entered into the short-run equations as error-correction terms, namely the

lagged deviation of the variable from its long-run equilibrium level. This is expected to have a negative effect on the current change, i.e. the variable should adjust back towards its equilibrium level if it was previously too high relative to the equilibrium level. The magnitude of the coefficient in the equation reflects the speed of adjustment process, a large value indicating a relatively rapid movement back towards the equilibrium value. The statistical significance of the coefficient on the error-correction term indicates whether it is appropriate to have the long-run relationship in the equation. If it is not significant, then the long-run relationship may be in doubt.

The short-term dynamics equations are freely estimated and are not heavily influenced by theory. They start from a very general specification of the equation including a number of lags of variables that might be considered relevant. Then there is a gradual process of elimination of variables until only the statistically significant ones remain. The extent and duration of short-term effects are left up to the data to establish, as indeed is the speed of adjustment to the long-run equilibrium. It is worth noting that all the variables in the short-run equations have been differenced or appear in a cointegrating combination, i.e. the long-run relationship. This means that they will generally be stationary and ordinary least squares estimation can be applied.

In relation to the short-run consumption equation, there are three categories of components under consideration for inclusion. First, the long-run relationship enters as an error-correction term as described above. Second, lagged changes in the variables involved in the long-run relationship are listed. Third, other factors which may be considered to impact on consumption in the short-run are included. In relation to this latter group, the current version of the Bank model includes for consideration interest rates, a measure of consumer confidence and the availability of credit.

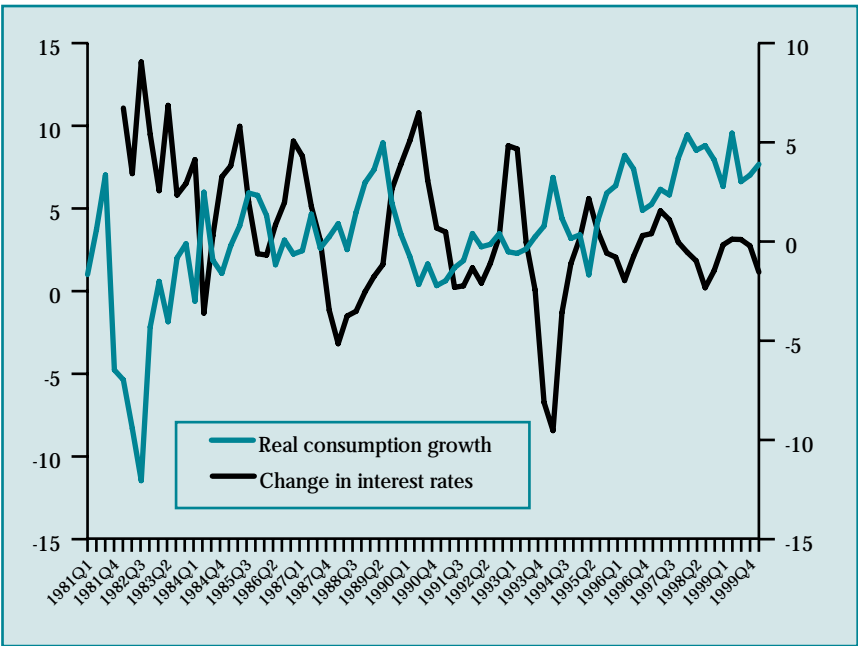
Interest Rates

Short-term interest rates are the key policy variable in putting monetary policy into effect. The modelling of the repercussions of interest rate policy actions and the time it takes for changes to filter through the economy, namely the transmission mechanism, are central to the effectiveness of any macroeconomic model. Indeed, it is true to say that this time lag between announcing a change in interest rates and the filtering of the effects thereof through the economy are in part a motivation behind the production and maintenance of macroeconomic models. Given this time lag, it is necessary for policy makers to formulate views of the future and expectations of the results of policy changes. Macroeconomic models are an important tool in producing such forecasts.

The transmission mechanism is captured in the current macroeconomic model in two main ways. First, interest rate changes are captured in cost of capital measures, and so are reflected in the investment decisions of firms. Second, they affect domestic demand through their impact on consumption. Clearly, increases in interest rates makes the cost of borrowing more expensive and savings more attractive, and so consumers may postpone or even drop their spending plans. Similarly, increased costs related to servicing mortgages will curtail funds available for consumption purposes.

The selection of appropriate interest rates for modelling consumption in the Bank macroeconomic model centred on real short-term rates. In the model dataset, nominal interest rates are adjusted by inflation as measured by the change in the consumption deflator, while the interest rate chosen is an average market rate for personal lending. It should also be noted that it is the change in the level of interest rates which is being compared to the growth rate in consumption, on the basis that it is absolute rather than relative changes in interest rates which seem to be the focus of consumer decision-making and also are the focus of policy announcements.

Figure 11: Interest Rates and Consumption



As can be seen from Figure 11, depicting changes in real interest rates and growth rates of consumption, periods of growth in consumption tend to coincide with decreasing interest rates. It is interesting to note that the more pronounced changes in interest rates are associated with significant changes in the pattern of consumption, the most notable being the large fall in retail rates over the latter part of 1993 and beginning of 1994 and the maintenance of relatively low levels since then. These patterns

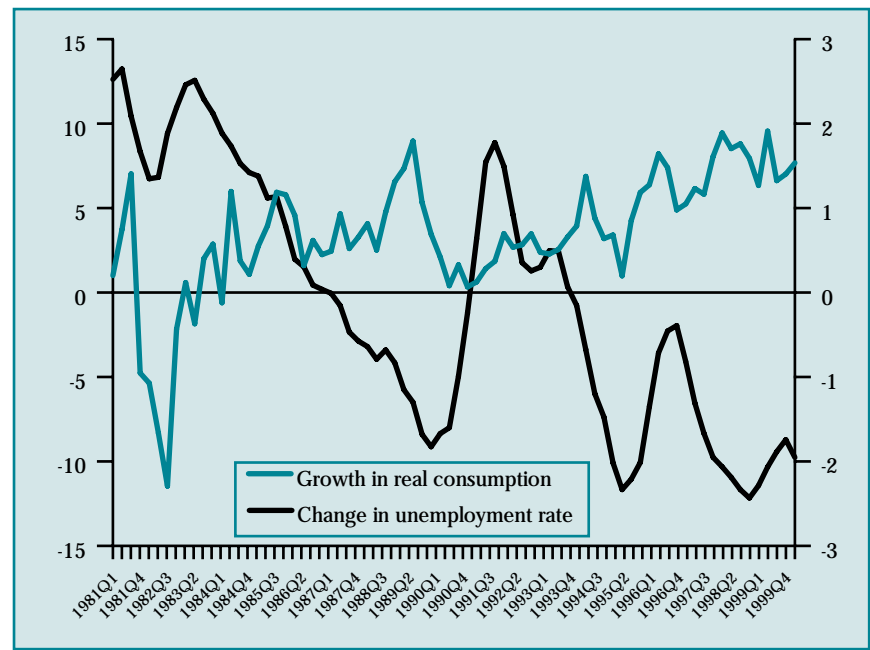
are associated with the beginning of Monetary Union and the subsequent lower interest rate regime. This fall in interest rates directly preceded prolonged strong growth in consumption, and while it is likely that disposable income developments were the primary motivator behind this growth, it is also likely that interest rates played their part.

Consumer Confidence

While consumer confidence factors would have a stronger role to play in relation to some categories of consumption rather than others (e.g. consumer durables), it is likely that some impact would be realised on consumption levels in the aggregate. Clearly, uncertainty regarding the future would impact on more significant consumer decisions, where factors relating to the ability to pay over the lifetime of a loan or hire-purchase agreement would come under consideration. For this reason, aggregate consumer uncertainty in the economy is included for consideration in the short-run consumption equation and is proxied by the unemployment rate.

Although persistently high unemployment rates are symptomatic of structural economic problems which may coexist with periods of low consumption, in terms of uncertainty measures it is likely that changes in the rate of unemployment are relevant when assessing uncertainty effects on the growth rate of consumption. Thus, in similar fashion to the treatment of interest rates, it is considered most appropriate to use absolute changes in the unemployment rate¹⁰.

Figure 12: Unemployment and Consumption



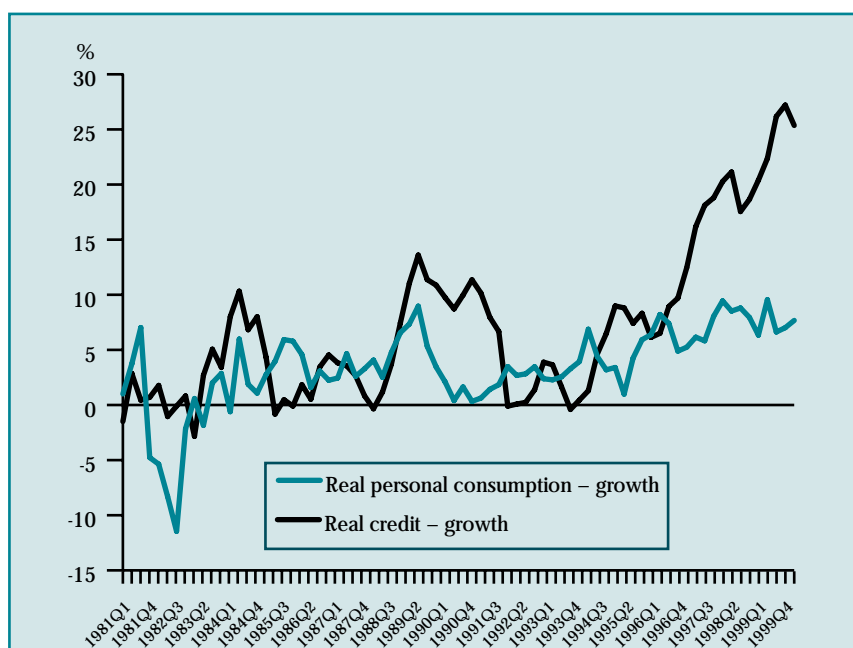
10 Unemployment rates used in the model are based on Labour Force Survey data. They may not match historical data, however, due to adjustments made to the series in joining the older annual data to the more recent quarterly data and in deriving end-year rather than using the published mid-April figures.

Clearly, a negative correlation exists between changes in the unemployment rate and growth rates in personal consumption, with periods of falling unemployment coinciding with accelerations in consumer spending.

Credit Availability

The availability of credit may facilitate consumption in the short-run by augmenting consumer cash flow. Related to the idea that wealth functions to smooth consumption patterns over the long term, increases in the levels of credit outstanding can add to consumer spending power, while repayments of debt will divert cash from spending purposes. Thus, one could reasonably expect to find, in estimating a short-run consumption function, that growth in consumption is positively related to growth in credit. As can be seen from the growth rates of consumption and private sector credit in Figure 13, this positive relationship, while not exact or contemporaneous, does seem to exist.

Figure 13: Growth in Real Consumption and Credit



It is worth noting that, according to the sectoral analysis of credit compiled in the Bank, credit extended to the household sector expanded in line with total credit throughout the 1990s, peaking at around 20 per cent year-on-year growth during the years 1997-99. Residential mortgages comprised a fairly steady 75 per cent of this personal credit from the mid-90s onwards. It is likely that the growth in residential mortgages may be part of the reason that the strong credit growth of the latter part of the 1990s has not translated into a surge in consumer spending, reflecting the fact that while loans for housing are included in credit, the resultant house purchase is regarded in statistics as an investment rather than consumer spending. Related to this, while there is as yet little evidence to suggest that equity release is being

systematically used to fund consumption expenditure, there is however anecdotal evidence of parents using equity release funds as an inter-generational transfer of wealth with a view to easing the financial burden of their adult children in buying their first properties. In addition, lending to business is included in the credit measure, which may also have contributed to the gap.

5. Results of Econometric Analysis

In order to incorporate the effects of the factors discussed above on consumption into the Bank macroeconomic model, a formal quantitative analysis was undertaken. The data, as previously mentioned, were drawn from the specially developed model dataset, and range from the first quarter of 1980 to the last quarter of 1999. Long- and short-run relationships for consumption were derived for inclusion in the model.

Long-run consumption was analysed against the two principal drivers of consumption, namely disposable income and financial wealth. The methodology used for estimating the long-run relationship was the Philips-Hansen Fully Modified Ordinary Least Squares (FM-OLS) procedure, which yielded the following:

$$C^* = 278.3426 + 0.655*PYR + 0.012562*FWR,$$

where C^* = long-run real consumption,
 PYR = real disposable income,
 and FWR = real financial wealth.

This would suggest that approximately 65.5 per cent of disposable income and some 1.2 per cent of wealth is consumed per quarter. This was considered a plausible result.

In order to incorporate this result into the short-run equation, as outlined in Section 4, it is the deviation of consumption from this long-run value that is of importance. Therefore, the error-correction term is written as follows:

$$\begin{aligned} ECM &= \log(PCR / C^*), \text{ or} \\ &= \log(PCR / (278.3426 + 0.655*PYR + 0.012562*FWR)), \end{aligned}$$

where PCR = real consumption.

The short-run equation was formulated in typical error-correction form, with lags of the dependant variable, the first lag of the ECM term, lagged variables included in the ECM term and variables specific to the short-run equation included for consideration. Insignificant variables were progressively deleted to yield the following result:

$$\begin{aligned}
 d\text{PCR} = & -0.16779 * \text{ECM}_{.1} \\
 & +0.13183 * d\text{PCR}_{.2} \\
 & +0.27847 * d\text{FWR}_{.4} \\
 & -0.0026573 * d\text{REALI} \\
 & -0.0085178 * d\text{URX}_{.2} \\
 & + 0.0051654,
 \end{aligned}$$

where d = first difference,
 dl = first difference of the log of a variable,
 CDR = credit,
 REALI = real short-term interest rate,
 and URX = unemployment rate.

For the most part, the diagnostics for the equation (see appendix) are satisfactory, with reasonably well-behaved residuals and acceptable t-statistics for the variables¹¹. Somewhat surprisingly, the growth rate of credit has dropped out of the equation, failing to remain significant. However, the presence of the change in the unemployment rate is expected to improve the forecasting and simulation capabilities of the Bank macroeconomic model.

6. Conclusions

Consumption performance in Ireland has varied throughout the past two decades, ranging from a fall of nearly 7 per cent in 1982 to increases of 8 per cent in the latter part of the 1990s. This present study has noted that, in aiming to understand the patterns of consumption, it is necessary to consider the factors which impact on consumption in both the long- and short-run. Disposable income and financial wealth were proposed as the main factors affecting long-run consumption, with the former particularly showing considerable influence. Short-run factors related to the availability and cost of credit and uncertainty risk.

With a view to quantifying these relationships, particularly in the context of incorporating a consumption block into the Bank macroeconomic model, a formal econometric analysis was undertaken. For the most part, it was found that the data upheld expectations in relation to the long- and short-run dynamics of consumption. Both disposable income and wealth were found to have roles to play in explaining long-run consumption, the former being a particularly strong influence. Some 65.5 per cent of disposable income and 1.2 per cent of wealth was found to be consumed per quarter. Changes in the unemployment and real interest rates, together with the error-correction mechanism, are important factors in determining short-run demand. The inclusion of the short-term interest rate in the equation provides one of the interest rate channels for the transmission mechanism in the

¹¹ While the coefficients of dreali and durx appear relatively small, it is worth recalling that these variables appear as changes in levels rather than percentage changes and so could be expected to have a lower coefficient.

model, while the inclusion of the unemployment rate is expected to improve the forecasting and simulation properties of the Bank model. These results will be incorporated into the Bank model, together with other new blocks currently under development, with a view to providing a new, improved version of the model to add to the Bank's existing forecasting and analysis toolkit.

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Appendix

Some Diagnostics for Long-Run and Short-Run Relationships

Included hereunder are some summary diagnostics¹² for both the long-run relationship and the short-run dynamic equation.

First, prior to estimating the long-run relationship using Fully Modified OLS (Phillips-Hansen), the cointegration of the variables was checked using unit root tests on the residuals of an OLS. Critical values for the tests were calculated using tables in MacKinnon (1991).

Unit Root Tests for Residuals

Based on OLS regression of PCR on Constant, PYR, FWR
80 observations used for estimation from 1980Q1 to 1999Q4

	Test Statistic	LL	AIC	SBC	HQC
DF	-4.8251	-451.7060	-452.7060	-453.8647	-453.1687
ADF(1)	-3.1085	-448.9999	-450.9999	-453.3174	-451.9253
ADF(2)	-2.8916	-448.9983	-451.9983	-455.4746	-453.3864
ADF(3)	-2.9554	-448.7301	-452.7301	-457.3651	-454.5808
ADF(4)	-2.4572	-448.1885	-453.1885	-458.9822	-455.5019

90% critical value for the Dickey-Fuller statistic = -3.09796

LL = Maximized log-likelihood

AIC = Akaike Information Criterion

SBC = Schwarz Bayesian Criterion

HQC = Hannan-Quinn Criterion

where PCR = real consumption,

PYR = real disposable income,

and FWR = real financial wealth.

The long-run relationship was then derived using the Phillips-Hansen Fully Modified OLS, yielding the result:

Fully Modified Phillips-Hansen Estimates: dependent variable is C*

Bartlett weights, truncation lag= 4 , Trended Case

79 observations used for estimation from 1980Q2 to 1999Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
Intercept	278.5426	197.7541	1.4085[.163]
PYR	.65500	.14781	4.4314[.000]
FWR	.012562	.0070393	1.7846[.078]

where C* = long-run real consumption.

The error-correction term as included in the short-run equation is written

ECM = log(PCR / C*), or
= log(PCR / (278.3426+0.655*PYR + 0.012562*FWR)).

12 Unless otherwise stated, diagnostics were produced using econometric package Microfit.

Regarding the short-run dynamics, results of the regression are reproduced here, together with some equation diagnostics.

Ordinary Least Squares Estimation: Dependent Variable is DLPCR
71 observations used for estimation from 1982Q2 to 1999Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
Constant	.0051654	.0019237	2.6852 [.009]
ECM(-1)	-.16779	.062332	-2.6918 [.009]
DLPCR(-2)	.13183	.076370	1.7262 [.089]
DLFWR(-4)	.27847	.12068	2.3075 [.024]
DREALI	-.0026573	.9980E-3	-2.6628 [.010]
DURX(-3)	-.0085178	.0039663	-2.1476 [.035]

where D = first difference,
DL = first difference of the log of a variable,
REALI = real short-term interest rate,
and URX = unemployment rate.

R-Squared .42506	R-Bar-Squared .38084
S.E. of Regression .011065	F-stat. F(5, 65) 9.6112[.000]
Mean of Dependent Variable .0098021	S.D. of Dependent Variable .014061
Residual Sum of Squares .0079575	Equation Log-likelihood 222.1746
Akaike Info. Criterion 216.1746	Schwarz Bayesian Criterion 209.3865
DW-statistic 1.9704	

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(4) = 2.6648[.615]	F(4, 61) = .59468[.668]
B:Functional Form	CHSQ(1) = 7.2311[.007]	F(1, 64) = 7.2573[.009]
C:Normality	CHSQ(2) = 2.5680[.277]	Not applicable
D:Heteroscedasticity	CHSQ(1) = .88404[.347]	F(1, 69) = .86997[.354]

A:Lagrange multiplier test of residual serial correlation
B:Ramsey’s RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values.

