

Modeling Consumers' Expenditure in Turkey, 1962-1994

Sule Akkoyunlu
Revised, December 2002

Abstract

The principal aim of this paper is to construct a consumption function for Turkey for policy analysis. This study commences from 1962 and extends until the end of 1994, when a financial crisis occurred in Turkey. It attempts to analyse not only the decline in the first half of the 1980s, but also the significant rise from 1986 onwards in the private saving rate, using the annual State Planning Organisation (SPO) time-series data. The Modelling is based on Dynamic Econometric Methodology that involves the estimation of the General Unrestricted Model (GUM), the cointegration and the long-run analysis, the simplifications of the GUM to a parsimonious dynamic model that is deduced by applying a sequential testing procedure. The final model is congruent: It matches the available evidence in all measured attributes and forecasts well, has white noise errors and constant parameters, encompasses the initial general model as well as other specifications in previous models. Moreover, the model is structural. Hence, the results confirm that a constructive data mining *qua* general-to-specific modelling is beneficial.

The results of the final model reveal a positive strong effect of the real interest rates, inflation and inflation uncertainty, a strong negative effect of population aged 15-44, a positive effect of one period lagged of the change in the average propensity to consume, which represents the effects of expectations, habits or adjustment costs, in addition to, the significant effects of the inverse of *Per Capita* Private Disposable Income and the change in housing wealth to income ratio on private average propensity to consume in Turkey. These findings offer an explanation for the salient features of the Turkish consumption pattern observed from the time series data.

These results also provide some policy implications such that inflation control should be strengthened and improved for consumption stabilisation. Furthermore, interest rate policy also has an important role to play in the saving process in Turkey.

JEL Classification: C5, C22, E2

Key Words: Consumption function, Dynamic Econometric Modelling, General-to-Specific Modeling, Congruency and Encompassing.

Acknowledgements: I have benefited from comments on earlier versions of this paper delivered at the Econometrics Seminar, Nuffield College, Oxford, 3 November 1998, and seminars at the Central Bank of Turkey, Ankara, 17 December 1998, and Bilkent University, Ankara, 18 December 1998. I would like to especially thank for their comments: Sumru Altug, Maureen Baker, Nicholas Dimsdale, Jurgen Doornik, David Hendry, John Muellbauer, Insan Tunali, Neil Shepherd, Bill Russell and Kamil Yilmaz. I revised this paper when I was an RTN Research Fellow at the Eitan Berglas School of Economics. I am grateful to Oved Yosha for offering me the fellowship and Phyllis Avni for technical support. Financial support from the Turkish Ministry of Education; the University of Oxford Travel Grant; Oriental Institute Travel Grant, Oxford; Raymond Carr Fund, St. Antony's College, Oxford Stahl Fund, St. Antony's College, Oxford and the EU RTN Fellowship are gratefully acknowledged.

Correspondence Address: Sule Akkoyunlu, The Eitan Berglas School of Economics, Tel Aviv University, Tel Aviv 69978, Israel. e-mail: sakkoyunlu@post.tau.ac.il Tel: 97236405824 Fax: 97236409908

1. Introduction

Aggregate private consumption accounts for a large share of GDP, and thus the fluctuations in consumption behaviour have crucial consequences for output, employment and the business cycle. Furthermore, it is impossible to understand the transmission of economic fluctuations, or the way in which fluctuations can be moderated, without an understanding of the determinants of aggregate consumption.

Although, the consumption-to-income ratio had been relatively stable in Turkey until 1985, the late 1980s saw a huge drop in this ratio, which stabilised in the 1990s.¹ Developing an understanding of this huge drop that occurred in the late 1980s is an important purpose of this paper.

The wealth effects, especially those from housing wealth, which have arisen since 1987 we believe have a strong effect on consumer expenditure in Turkey; these have been left out in much of the literature on Turkish Consumption Function. Apart from the wealth effects, the decline in consumer expenditure in Turkey can be explained by demography (demographic effects are potentially of great importance), changes in uncertainty, precautionary reasons and the direct effects of financial liberalisation, as there is little empirical evidence of a strong and stable negative real interest rate effect on consumption in the literature. Hence the new evidence on the effect of interest rates as well as inflation on consumption is intriguing. Habits or adjustment cost cause lags in behaviour.

Section 2 deals with data, measurement and modelling issues. Section 3 discusses the theory of consumption. Section 4 gives an empirical example of a (approximately) theory-consistent structural private consumption function for Turkey. The resulting equation is constant over the sample and passes the diagnostic tests. Section 5 evaluates the forecasting performance of the econometric model. Section 6 encompasses the final model with the previous models, Rittenberg (1988) and Uygur (1993). Section 7 concludes. All the empirical analyses and graphics use *PcGive*, see Hendry and Doornik (1996).

2. Data, measurement and modelling issues

2.1. Data and measurement issues

It is unfortunate that the traditional three measures of GDP; expenditure, output and income are not available historically for Turkey, since the study to estimate GDP by expenditure and income categories were begun by the State Institute of Statistics (SIS) in 1990 and 1994, respectively. These data sets start in 1987. However, following the establishment of the State Planning Organisation (SPO) in 1960, the “*General Macro Balance of the Economy*” has been estimated since 1962.

The items in the “General Macro Balance of the Economy” estimated by the SPO and items in GDP by expenditure estimated by the SIS are not consistent. The SIS has three measures of GDP: expenditure, output and income in current and in constant prices. The SIS uses the production approach (GDP by output) by kind of activity as its main method. However, in the GDP by income measure, operating surplus is derived as a residual from the GDP by output measure. Further, statistical discrepancies appear in estimates of national accounts by output and expenditure in the SIS data. GDP by output data starts in 1923 in current and constant purchasers’

¹ While C/Y has remained within the range 0.73-0.92, and hence C is highly correlated with Y, the ratio C/Y in Turkey has dropped substantially over the last thirty years.

prices (GNP also starts in 1923 in current and constant producers' prices) whereas GDP by expenditure starts in 1987 in the SIS data (see, Akkoyunlu (1999) for the history of Turkish National Accounts). However, it is possible to calculate GDP by expenditure from 1962 by using the SPO "General Macro Balance of the Economy" and the "Balance of Payments" tables. I calculated GDP by expenditure for the period 1962-1990 with an old data set in current and 1988 prices; constant price data is obtained by deflating the components of GDP with their implicit deflator by using Wijnbergen *et al.* (1992), Uygur (1987, 1991), the SIS and SPO data sets.

The three measures of GDP – expenditure, output and income are found not to have the same results due to the measurement errors which 'creep in' at the various stages of the calculations. Sefton and Weale (1995) suggest that the problem of data inconsistency can be solved by applying the concept of reliability to the income/expenditure components and this method is used to allocate the corrections across the series which make up the national accounts. The "Linear Regression Approach" is applied for allocating the Turkish accounting residuals. The results show that GDP by output measure is more reliable than the GDP by expenditure measure for Turkey (see, Akkoyunlu (1999) for the econometric estimations). Thus more weight should be given to the GDP by output measure. The matrix approach that is based on finding a vector which satisfies the accounting constraints could not be applied to the Turkish data due to the unavailability of the initial stock data in levels from the SIS and SPO.

In this study I used the SPO data from the "General Macro Balance of Economy" tables. However, the National Accounts were revised by 30% in 1987 and a 30% shift occurs on the consumption and income data in 1987. Although the new data has been available since 1987, the old data set goes up to 1990. When we look at the common data set between the old and the new data sets, we see that there is not much difference in the consumption to income ratio (C/Y) or in the savings to income ratio (S/Y).

Private Saving Ratio	1987	1988	1989	1990
Old Data	18.9	21.2	20.7	23
New Data	20	23.6	20.1	21.5

Since we are interested in the long-run properties of the data, the ability to carry out the research by taking into account this shift and not being affected by this shift in modelling is important. Therefore, we constructed a new data set after 1987 by taking into account this shift. The adjusted data is obtained by multiplying the new data set by the ratio of the mean of the old series to the mean of the new series

for the common period ($\frac{\bar{D}_{old}}{\bar{D}_{new}} \times D_{ni}$). This leaves C/Y unaltered.

The complete data set and the variables in this paper (in Section 4 and the variables in the appendix) are derived from a number of sources, the detailed list is provided in Akkoyunlu (1999).

Basic properties of the data themselves are shown in Figure 1.² Figure 1a shows that *per capita* real consumption and *per capita* real income follow each other very closely until the late 1980s, however, the gap between them widens afterwards and also the scale of growth from 6 to 6.9 over the sample is striking. Similarly,

² Graph panels are lettered nationally as a, b, c, d, ..., row by row.

although the ratio of consumption to income relative stable in the early period, the ratio fell by 22.5 % (from .925 to 0.70 in terms of the scale) over the sample, see Figure 1b. The log transformation slightly stabilises the ratio, Figure 1c.

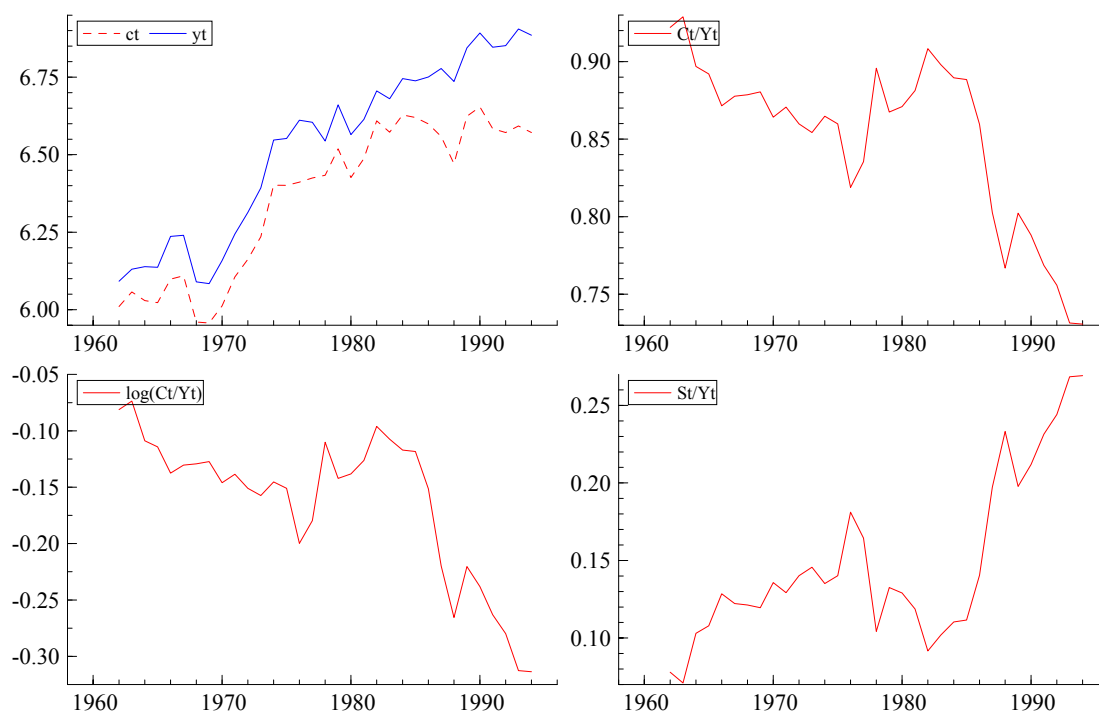


Figure 1: Log of *per capita* real private consumption, (c_t), and log of *per capita* real private disposable income, (y_t), ratio of *per capita* real private consumption to *per capita* real private disposable income, (Ct/Yt), log of the ratio of *per capita* real private consumption to *per capita* real private disposable income, $\log(Ct/Yt)=apc_t$, and ratio of *per capita* real private savings to *per capita* real private disposable income, (St/Yt)= $-\log(Ct/Yt)$.

Hence, any empirical modelling of consumption should be able to explain this large variation in the data in the late 1980s: the availability of low-cost housing credits stimulated housing starts, and this process in turn might have encouraged savings. Wealth effects, especially those from housing wealth which have arisen since 1987, might be very significant in the consumption function for Turkey, however, these have been left out in much of the literature on the Turkish consumption function. Apart from wealth effects, the decline in consumer expenditure in Turkey can be explained by demography, changes in uncertainty, precautionary reasons and the direct effects of financial liberalisation. Financial liberalisation in 1980 raised both credit demand and interest rates, as credit rationing was used less to curtail demand. Empirical studies find small negative effects of interest rates on consumption as opposed to the textbook idea that higher interest rates raise the saving rate, but these negative effects are generally not very stable when re-estimated over different samples. This study empirically investigates the effect of interest rates on Turkish consumption, especially for the period after 1980 when financial liberalisation took part. The Turkish economy entered a process, starting in the early 1980s, in which inflation became a chronic problem. The average annual inflation rate was 80%, and was very volatile, and the trend was upward. Although inflation is not an argument of the theoretical consumption function, it is significant

when added to the empirical function, so is incorporated into the consumption function, with the coefficient determined by the data. It sometimes makes sense to postpone decisions as long as possible so as to take advantage of new information as it evolves. Since Keynes (1936) and Friedman (1957), the propensity to spend out of permanent income is assumed to be a decreasing function of income uncertainty so richer and more realistic models should be able to deal with the way in which expectations of the future are affected by current events. A 3-year moving standard deviation of inflation and income growth are used to take into account inflation and income uncertainty. Demographic effects are also potentially of great importance, in particular the increase in the population of the young (aged 15-44), and the decrease in the relative number of children may have depressed consumption in Turkey, see Section 4 for the graphs. Finally, habits or adjustment costs can cause lags in behaviour.

2. 2. Modelling issues

Modelling is based on a positive and constructive data mining *qua* the general-to-specific approach that aims to build empirical models that are economically sensible and statistically satisfactory, Hendry (1995), Campos and Ericsson (1999) and Hoover and Perez (1999). Hence, I start with an over-parameterised model – General Unrestricted Model (GUM) - that nests the DGP and conduct mis-specification tests for congruence. Thus I allow for everything at the outset that might be significant and then investigate whether and how this initial general model can be reduced without significant loss of information about the parameters of interest. In this process, rigorous testing and evaluation, and some restrictions on the model are important to ensure valid statistical inference, as described in the dynamic econometric methodology (see, Hendry 1995). The primary role of the GUM is to define the innovation process in the statistical analysis, and to determine the variance of that innovation process such that no other model on the same data dominates. The residuals should therefore be innovations against available information. While the GUM is itself a reduction, it ought to be able to account for all previous results produced when analysing the same data-set. Economic theory information helps specify the vector of parameters of interest; however, the parameters of interest might come from a data-instigated model. However, theory consistency is essential, so that there is no evaluation conflict between the model and the theory interpretation. Hence, I aim to conclude with a parsimonious model which has orthogonal regressors as well as satisfying the necessary conditions for both congruence and encompassing. Parsimony is essential for test power and for interpretability and to sustain parameter constancy; whereas orthogonality is useful for robustness and for testing for the marginal significance of each variable in isolation as well as for interpretability.

However, the general-to-specific modelling *still* suffers from allegations that it mines the data pejoratively. These allegations are:

- I. **Repeated Testing:** Regressors are selected in an attempt to maximise *t*-ratios. Thus simply conducting multiple tests will induce significant outcomes by chance.
- II. **Data Interdependence:** Non-constant coefficient might result due to an omitted regressor that is correlated with the included one, and this correlation changes over time due to regime changes that generate the system.

- III. **Corroboration:** The regressors are chosen according to a criterion such as having sensible coefficient estimates. However, there might still be important omitted variables.
- IV. **Over-parameterization:** If the model is over-fitted, it uses up many degrees of freedom.

However, this paper, during the building process of the empirical model, shows that these allegations can be refuted easily.

3. Theory of consumption

Consumption functions are empirical models that explain the behaviour of consumption with relationships between consumer spending, income, wealth, assets, interest rates, *etc.* Pioneering work on consumption functions was initially done by Friedman (1957), Ando and Modigliani (1963), Ball and Drake (1964), Spiro (1962), and Stone (1964). At the micro level, these relationships are a solution to an optimisation over an individual's life cycle (LC), resulting in some version of the LC (Modigliani and Brumberg, 1954, 1979) or PIH (Friedman, 1957)- 'solved-out' or 'structural' consumption function. Since 1978, another way of modelling consumption has been the 'Euler Equation' form (see, Hall (1978)).

The life-cycle model of Modigliani and Brumberg is a corner-stone of post-war economics. The basic idea is that households try to smooth consumption so that workers save in order to spend in retirement. The appropriate basis for a theory of consumption is the theory of intertemporal choice that formalises the trade-off between present and future consumption. One macro prediction from the theory which appears satisfied is the role of wealth effects on consumption.

Under the usual assumptions of life-cycle theory, the target level of real consumption C^* is proportional to real life-cycle wealth W :

$$C^* = A(r)W \quad (1)$$

where the factor of proportionality $A(\cdot) > 0$ depends on the long-run real rate of return, r . W consists of financial and physical wealth H , and human capital defined as the discounted present value of current and expected future real non-property income Y_n . If Y_n were a random walk with constant drift, then for an infinitely lived consumer $W = H + Y_n / (r - g)$ where g is the long-run growth rate of Y_n . To obtain a log-linear functional form for consumption, we use the approximation

$$\ln W = \ln\left(H + \frac{Y_n}{r - g}\right) \approx y_n - \ln(r - g) + (r - g) \frac{H}{Y_n} \quad (2)$$

where lower-case letters denote logs, so that the linear combination of y_n and H/Y_n proxies $w = \ln W$. From (1) and (2)

$$c^* = \beta_0 - \beta_1 r + \beta_2 y_n + \beta_3 \frac{H}{Y_n} \quad (3)$$

where β_0 depends on g .

However, the standard life-cycle permanent-income theory seems to be contradicted by empirical evidence: the old save too much, in cross-sections consumption follows income too closely and consumption growth, in theory unpredictable, responds significantly to predictable income growth.

This is mainly because; the Equation (3) omits five potential important influences on consumers' behaviour:

(a) uncertainty; (b) credit constraints; (c) demographic changes; (d) liquid and illiquid assets; and (e) dynamics.

Uncertainty about labour income generally creates an additional precautionary motive for saving, as it has been repeatedly acknowledged by Friedman (1957). Precautionary behaviour is considered in the traditional consumption function that income uncertainty which is approximately equivalent to a certainty-equivalent problem, in which expected income is reduced by a discount factor reflecting uncertainty.

The major effects of the precautionary motive are as follows:

First, precautionary behaviour may enhance the stability of consumption and hence help to explain the excess-smoothness and the response of consumption to income innovations. A large positive income shock is likely to be taken as an indicator that there is more uncertainty about the new higher level of income and so lead to a smaller rise in consumption than there would be in the absence of the precautionary motive. **Second**, as far as testing the Hall model and 'excess sensitivity' is concerned, precautionary behaviour, as modelled by Hayashi (1982) implies that lagged income and other information matters. The same implication follows from the approximate Euler equation that incorporates uncertainty. Under a precautionary savings motive, a household will tend to save more earlier in life than would be the case under the Permanent Income Theory. This helps explain why consumption and income often rise together in the early part of the life cycle. **Third**, precautionary motives can also help to explain why older households dissave less than would be explained by permanent income versions of life cycle hypothesis. Uncertainty about the life span, about health and health costs, and the extreme unpleasantness of poverty in old age, combine to make older people very cautious about running down their assets. Such behaviour also explains partially the important role of accidental bequests in the transmission of wealth. Engen and Gale (1991) show that a model of precautionary savings can explain why households hold Individual Retirement Accounts (IRAs) as well as other forms of saving given that the former have both lower yields and penalties for early withdrawal. **Fourth**, the proliferation of government programmes such as unemployment insurance and welfare, by reducing income risk, could lower precautionary savings and hence contribute to a decline in the savings rates. Thus, a higher level of pension provision lowers saving out of after-tax income. Feldstein (1977, 1980), finds that increases in the extent of social security coverage and the relative level of benefits substantially depress the rate of private savings. Feldstein (1977) examines the model of household saving and retirement in an economy with social security benefits. The model reveals that there are two important ways in which a social security programme influences individual saving: *a wealth replacement effect* and *an induced retirement effect*. These programmes affect the distribution of income, both directly and indirectly, through changes in the supplies of capital and labour. Risk-averse behaviour under uncertainty suggests additional reasons for such a relationship. Unemployment benefits insure against income shortfalls, as does an income support floor present in the welfare states of advanced industrial countries. By making income less risky, these institutions reduce precautionary saving. **Fifth**, progressive taxation reduces the upper tails of the distribution of agents' uncertain future incomes.

If consumers have a precautionary savings motive and if taxes are an increasing function of incomes, then a substitution of lower current taxes for higher income taxes later will reduce the uncertainty of future income and will reduce the need for current precautionary saving. Even if the tax cuts have to be repaid in their lifetimes, current consumption will increase and the Ricardian Equivalence Proposition will fail.

The presence of borrowing constraints fundamentally alters the way in which consumers behave, even though there will often be few periods in which the constraint is binding. Borrowing is most desired when initial income and assets are low relative to expected income and when real interest rates and uncertainty are low. For those who want to borrow, limited credit is likely to be available. It is those who are impatient, whose preferences make them want to consume more heavily early in life, and whose incomes are rising over time; and who are most likely to be unable to find the unsecured loans that would enable them to carry out the consumption plans that they would like. Further, precautionary savings and liquidity constraints are closely connected. The behaviour of credit-constrained consumers is indistinguishable from the behaviour of unconstrained consumers with a precautionary motive; the average behaviour depends on the degree of *impatience*, not on the presence or absence of constraints.

Credit restrictions are an obvious reason for the tendency for consumption to follow the hump-shaped profile of life-cycle income more closely than is predicted by the life-cycle model. Thus, credit restrictions explain the ‘excess sensitivity’ of consumption changes to predictable income changes and the effectiveness of public financial policies and transitory taxes. Assets are only used as a buffer and because even a few assets can be effective in smoothing consumption; consumption and income are tied together over periods longer than a few years. In the short run; high frequencies weeks or months; consumption and income are largely independent and shocks to income have only a modest effect on consumption. Over longer periods, at low frequencies, consumption and income move together. The effective planning horizon in the buffer-stock model is the period until assets run-out, a period that the simulations suggest is a few years, not a lifetime. Income is smoothed over this much shorter time-frame, not over the lifetimes that are predicted by the life cycle theory. The presence of liquidity constraints also explains why predictable increases in income are associated with predictable increases in consumption, both on a short-term year to year basis as well as over the decades during which life cycle income patterns unfold.

Changes in population demography also may alter aggregate consumption. Although older households often have accumulated more wealth than other households, their expenditure to income ratios are low, because of bequest motives, uncertainty about age of death, unanticipated health expenditures, physical frailty reducing expenditure and the inability of house owners to unlock their housing wealth.

Equation (3) assumes equal weights on different assets even though, for example, wealth in a pension fund may be less relevant than illiquid assets for spending decisions, suggesting the use of different weights on liquid assets, illiquid assets and on debt.

In applied econometrics, lagged dependent variables represent agents’ expectations or adjustment costs, habits, or the durability of goods.

Thus, both Euler Equations and solved-out consumption functions need to incorporate the effects of age, precautionary behaviour in the face of uncertainty, credit constraints, habits or costs of adjustment and the durability of goods.

The main objective of this study is to test the validity of the theoretical propositions made above within the context of the Turkish economy, since these propositions influence the choice of the data to examine, functional forms to use and the parameters of interest to form.

4. A model of aggregate consumers' expenditure in Turkey

In this section, an aggregate private consumption function based on the life cycle hypothesis is estimated for Turkey for the period 1962-1994.³ Although we have thirty-two years of annual data, as shown in Akkoyunlu (1999) and Campos and Ericsson (1999), the sample size is only one of several factors which determine how much information is in the sample. We compare values of Turkish and UK data on the growth rate of *per capita* real income to show that the Turkish annual data set contains a relatively large amount of information. Even though the Turkish sample size is one fourth of that the UK, the standard deviation of the growth rate of *per capita* real income is over twice that for the UK. Thus, the thirty-two years of annual Turkish data have more information than three decades of quarterly UK data. Even the Turkish data has relatively few observations, the data movements so large relative to the UK data that are important for the information of data. This evidence counters fourth sense of data mining that over-parameterisation is not a concern.

Due to data availability, total private consumption - which involves durable as well as non-durable expenditure - is the subject of the study. This delivers different results as compared to the analysis of non-durable expenditure, especially in terms of responses to interest rates and inflation. Income data is also total private disposable income which involves firms as well as households. Figure 1a shows the time series of data.

Wealth in its dis-aggregated form (housing and financial wealth) is incorporated in the consumption function, along with standard explanatory variables including the government deficit, see the appendix for the additional variables. Using the general to specific modelling strategy, one final model is deduced by applying a sequential testing procedure.

In the following section I discuss the variables that may be significant in explaining the Turkish consumption. This includes the variables that have been used in the previous studies as well as the variables that have not been thought of before such as housing wealth, demographic factors, inflation and income uncertainty *etc.*

4. 1. Explanatory variables in the consumption function

4. 1. 1. Housing Wealth: Housing wealth is claimed to be a major determinant of private savings in Turkey. However, lack of proper data on this variable makes analysis quite difficult. I used the private housing investment to private disposable income ratio and the private housing investment to total private investment ratio as approximations and found that neither of them was significant. This forces us to construct housing wealth for Turkey.

³ The independent variable is the average propensity to consume, since *per capita* real private consumption has a unit coefficient on *per capita* real private disposable income.

The SIS constructs the M2 unit cost for housing. This however, only includes materials and labour cost. The lack of data on land prices is another reason for not having accurate data on house prices in Turkey.

4. 1. 1. a. A theoretical model of housing wealth:

A theoretical model is necessary in order to calculate the housing wealth in Turkey. The only available information is the housing stock or total number of households (which have been published by the SIS every five years since 1960); the CPI index (P); nominal private disposable income (Y); and nominal private investment in the housing sector I_t (I). Let **the initial housing stock**: $h_0 = \frac{N}{F}$ where

N: Population at the initial year

F: Family size

h₀: The initial housing stock = Total number of households. The resulting series is bound to be crude, but may offer a first approximation.

I intend to develop a model that will give a housing stock series (h_t) which is consistent with the published data. The generated series uses several identities and a recursive calculation assuming various ratios for the initial conditions and growth rates. Combinations of these are selected to match the observable time series.

In the calculation of housing wealth ($P_{ht} h_t = H_t$), the key variable is the initial value of P_{ht} ⁴ ($Ph_0 = \frac{I_0}{i_0}$)⁵, which will be determined by the initial real private housing investment. Therefore, the choice of the correct proportion of the initial housing stock to the initial private housing investment greatly matters. The depreciation rate is the inverse of the average ‘life’ of a house, several values were tried, namely $i_0 = \delta * h_0$ yielding 100 years and 30 years for the average life of a house respectively as $\delta = 0.01$ to 0.03 . The i_t series is obtained by dividing I_t ⁶ by P_{ht} , constructed from $\log(P_{ht}) = \log(P_{ht-1}) + \Delta P_{ct} + \alpha$

where

$$\Delta P_{ct} = \log P_{ct} - \log P_{ct-1}.$$

We assumed 2% and 5% real growth on average for α . So real house prices rise by 2% or 5% *per annum* relative to other prices. How the P_{ht} series is calculated affects the i_t ($i_t = \frac{I_t}{P_{ht}}$) and h_t ⁷ ($h_t = (1 - \delta)h_{t-1} + i_t$) series directly, as the latter provides the check (δ is the same as above).

⁴ The House Price Index.

⁵ I_0 is the initial nominal private housing investment, and i_0 is the initial real private housing investment.

⁶ I_t is the nominal private housing investment series, and i_t is the real private housing investment series.

⁷ h_t is the housing stock (constructed) series.

While there are many assumptions, some data exist to cross-check: we believe H_t / Y_t has increased somewhat over the 30 years.

4. 1. 1. b. Empirical findings:

The following tables give the summary of the results. Bold face denotes the best match.

Table 4. 1 : The additive model I

io=0.015*ho	lnPht=lnPt-1 +inflation +x ⁸	H1994 (calculated) ⁹	H1994 (official) ¹⁰	H/Y (1962) ¹¹	H/Y (1994) ¹²
Calculation (1)	x=0.04	10073928.60	13342055	2.19	2.40
Calculation (2)	x=0.0375	10394180.57	13342055	2.19	2.29
Calculation (3)	x=0.035	10735452.99	13342055	2.19	2.18
Calculation (4)	x=0.0325	11099215.88	13342055	2.19	2.08
Calculation (5)	x=0.03	11487045.56	13342055	2.19	1.99

If I take the initial investment to be 0.015 of the initial housing stock for the initial year, H_t / Y_t is increasing or almost constant, but the calculated housing stock and the official housing stock series are not close (Table 4.1).

Table 4. 2: The additive model II

io=0.017*ho	lnPht=lnPt-1 +inflation+x	H1994 (calculated)	H1994 (official)	H/Y (1962)	H/Y (1994)
Calculation (6)	x=0.04	10835048.34	13342055	1.93	2.28
Calculation (7)	x=0.0375	11198000.57	13342055	1.93	2.18
Calculation (8)	x=0.035	11584775.99	13342055	1.93	2.08
Calculation (9)	x=0.0325	11997040.59	13342055	1.93	1.99
Calculation (10)	x=0.03	12436580.90	13342055	1.93	1.90
Calculation (11)	x=0.0275	12905312.82	13342055	1.93	1.82
Calculation (12)	x=0.025	13405291.21	13342055	1.93	1.75

If I increase the percentage of the initial housing stock for the initial investment from 0.015 to 0.017, then I need to decrease the constant term in $\log P_{ht}$ from 0.03 to 0.025 in order to have a housing stock series which is consistent with the published data. However, this time H_t / Y_t decreases (Table 4. 2).

Table 4. 3: The additive model III

io=0.02*ho	lnPht=lnPt-1 +inflation+x	H1994 (calculated)	H1994 (official)	H/Y (1962)	H/Y (1994)
Calculation (13)	x=0.02	16297805.58	13342055	1.64	1.54
Calculation (14)	x=0.0225	15628106.65	13342055	1.64	1.60
Calculation (15)	x=0.025	15000543.10	13342055	1.64	1.66
Calculation (16)	x=0.0275	14412333.22	13342055	1.64	1.73
Calculation (17)	x=0.03	13860883.91	13342055	1.64	1.80
Calculation (18)	x=0.0325	13343777.66	13342055	1.64	1.88 **

⁸ x is a constant increase in LnPht.

⁹ The calculated housing stock in 1994.

¹⁰ The official housing stock in 1994.

¹¹ The housing wealth to income ratio in 1962.

¹² The housing wealth to income ratio in 1994.

Calculation (19)	x=0.035	12858760.48	13342055	1.64	1.96
Calculation (20)	x=0.0375	12403730.58	13342055	1.64	2.05
Calculation (21)	x=0.04	11976727.96	13342055	1.64	2.14

The most sensible result is obtained when the proportion of the housing stock for the initial investment is 0.02 and the constant term in $\log P_{ht}$ is 0.0325, only then does H_t/Y_t increase (Table 4. 3). The ** is the preferred outcome. The data are shown in Figure 2a. Here, housing lasts 50 years on average and the real price increases at 3.25 % *per annum*. As this exceeds the average real interest rate, H_t/Y_t rises slowly. The interpolated data on h_t closely match the official measures.¹³

I used the data constructed by using values in Calculation 18 for consumption estimation for the housing wealth data.

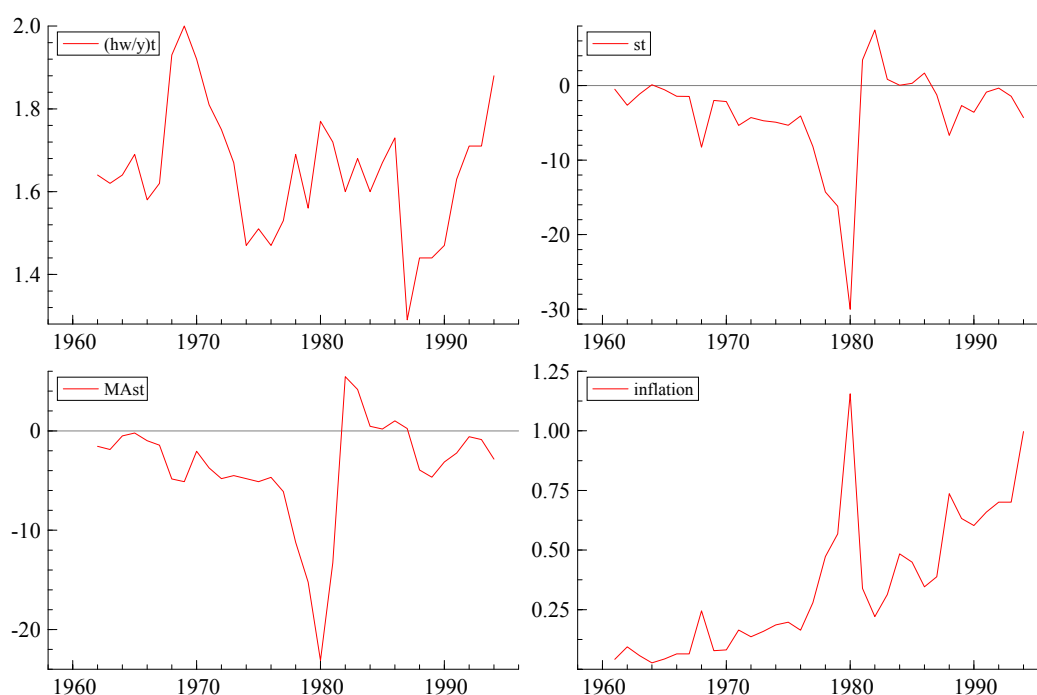


Figure 2: Housing wealth to income ratio, $(hw/y)_t$, real short-term interest rates, s_t , 2-period moving average of real short term interest rates, $MAst$, and the inflation rate, π_t ,

4. 1. 2. Short term interest rates on deposits or broad money: Pre-1980, while real interest rates on time deposits were negative; -14.3% in 1978, -16.2% in 1979 and -30% in 1980, the increase in the dwelling income index was positive 52.2% in 1978, 61.2% in 1979 and 113.6% in 1980. Thus, in the pre-1980 period most of the private sectors' savings were channelled to the housing sector. The initiation of the free interest-rate policy in 1980, did not encourage savings. Interest income was the means to sustain the level and pattern of consumption and hence, interest payments were rarely invested. One important factor was housing investments encouraged by low cost housing credits extended by public agencies in the second half of the 1980s. Another important factor in the second half of the 1980s was the rising public sector

¹³ We also tried entering inflation in a multiplicative form, but this did not give any satisfactory results.

deficits financed by domestic borrowing at larger proportions. This was achieved by higher interest rates on public securities as compared to bank deposit rates and brought about a further portfolio shift, this time towards public bonds and treasury bills from time deposits. The increase in the domestic debt stock ratio from 13.6 percent in 1980 to 22.95 per cent in 1987 indicates heavy public sector borrowing from the financial markets.

We used short term real interest rates (three month interest rates on time deposits) which represent credit rationing in the economic theory, as they seem more appropriate than the long term interest rates for a country with high credit constraints: see Figures 2b and c.

The effect of an increase in the interest rate can be divided into substitution and income effects. The substitution effect is always negative because today's consumption becomes more costly and there is a substitution towards tomorrow's consumption. The income effect works in the following manner: a higher interest rate implies a positive effect for savers but a negative one for borrowers. For the economy as a whole the total effect can either be positive or negative, depending on which effect dominates, which we will be finding with the empirical model.

4. 1. 3. Inflation and inflation uncertainty: Although inflation is not an argument of the theoretical consumption function, it is statistically significant when added to the empirical function. Bachelor and Dua (1992) offer three explanation for this phenomenon:

- 1) That it reflects the confusion between relative and general price movements,
- 2) It is proxying for the effect of inflation uncertainty, see Blinder and Deaton (1985),
- 3) That it is proxying for inflation-induced losses on assets which are not approximately incorporated in national income measures, see Hendry and Ungern-Sternberg (1981). Figure 2d shows the time series of inflation.

4. 1. 4. Demographic Changes: A number of potentially significant life-cycle groups altered in proportion in the population aged under 44. The population aged under 14 fell in proportion from 0.41 in 1962 to 0.32 in 1994, whereas the population aged between 15 and 44 increased in proportion from 0.41 in 1962 to 0.49 in 1994. The pre-retirees aged 45-64, the likely prime savers and those aged 65 and over remained constant in proportion. If we believe that the demographics reflect life-cycle saving phenomena, then we expect young people with currently low incomes but high income expectations and life-cycle needs to consume a high proportion of income; middle-aged cohorts to save in anticipation of a lower income in retirement; and old-people to use their stock accumulated savings – generating a hump-shaped life-cycle savings profile. However, the significance of age distribution in the consumption function can clearly reflect all sorts of life-cycle phenomena other than those associated with life-cycle smoothing. See Figure 3.

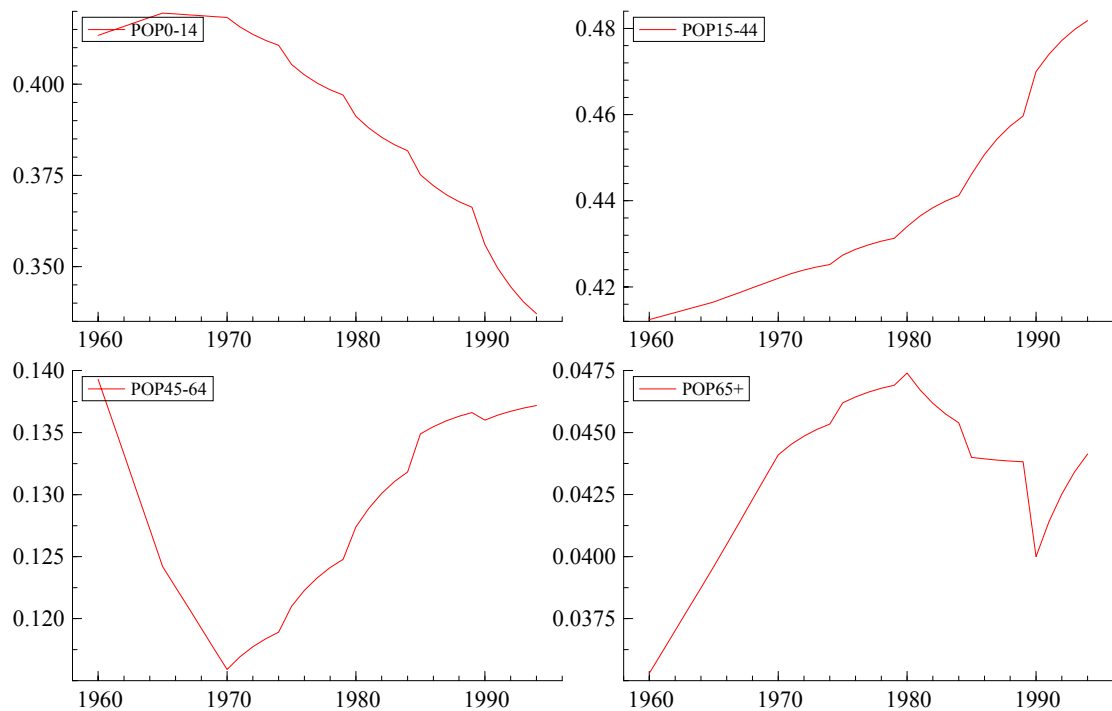


Figure 3: Population aged 0 and 14 (POP0-14), population aged 15 and 44 (POP15-44), population aged 45 and 64 (POP45-64) and population aged 65+ (POP65+).

4. 2. The general to specific approach and econometrics results

In our general model we used the average propensity to consume, apc_t (= log of the *per capita* real private consumption (c_t) minus log of the *per capita* real private disposable income (y_t)) as the dependent variable. When we do the following estimation we find consumption and income not to be cointegrated but the coefficient on per capita real disposable income to be close to unity (see, Figure 1c for the time series). c_t is a regressor and no restrictions are imposed.

Table 4. 4: Cointegration test for consumption (c_t) and income (y_t):

Lag j	0	1
Variables	[t]	[t]
Constant	0.154 (0.145) [1.05]	
c_{t-j}	—	0.891 (0.109) [8.16]
y_{t-j}	0.971 (0.079) [12.29]	-0.889 (0.125) [-7.14]

$R^2 = 0.988$ $F(3, 28) = 740.85$ [0.00] $\hat{\sigma} = 0.028$ $dw = 1.83$ $RSS = 0.0220$
 T= 33 (1962-1994)

Solved Static Long Run equation

$$c_t = +1.41 + 0.75 y_t$$

(1.29) (0.21)

$$ECM = c_t - 1.41 - 0.75 * y_t$$

Tests on the significance of each variable

		Unit-root t-test
c_t	F(1,28) = 66.6 [0.00] **	-0.995
Constant	F(1,28) = 1.11 [0.30]	
y_t	F(2,28) = 75.9 [0.00] **	0.852

In fact, the final model contains several additional non-stationary variables and Figure 1b shows a trend in C_t/Y_t , so this result is expected. We test for cointegration in the final congruent model.

We start with a general model which is probably over-parameterised with two lags for both average propensity to consume, apc_t and income, y_t and a broad set of explanatory variables (population aged 15-44 ($pop15-44$) $_t$, housing wealth to income ratio (hw/y) $_t$, the inflation rate, π_t , the real short-term interest rates, s_t and a dummy variable, D), in order to establish a baseline innovation error.

Inflation rate (π_t) is defined as $\frac{P_t - P_{t-1}}{P_{t-1}}$ where P_t is CPI (1987=1) and the

real short term interest rates is defined as $s_t = \left[\log \left(\frac{1 + S_t}{1 + \dot{P}_t} \right) \right]$ where S_t is the nominal

interest rates on three months time deposits. The dummy variable is used for the outliers in 1976=1 and 1978=-1 which are the same magnitude but are in opposite directions.¹⁴

Table 4. 5: Least squares estimates of the unrestricted average propensity to consume apc_t (Equation 1):

Lag j	0	1	2
Variables	[t]	[t]	[t]
Constant	2.388 (0.342) [6.98]		
apc_{t-j}	_____	0.254 (0.115) [2.20]	-0.245 (0.113) [-2.17]
y_{t-j}	0.025 (0.039) [0.66]	0.121 (0.073) [1.65]	-0.044 (0.062) [-0.71]
s_{t-j}	0.313 (0.139) [2.25]	0.551 (0.157) [3.50]	
π_{t-j}	0.142 (0.045) [3.18]	0.161 (0.058) [2.80]	
$(pop15-44)_{t-j}$	-2.494 (1.674) [-1.50]	-0.378 (2.485) [-0.15]	-4.854 (2.065) [-2.35]
$(hw/y)_{t-j}$	0.096 (0.032) [3.07]	-0.053 (0.031) [-1.69]	
D	-0.047 (0.008) [-5.46]		

¹⁴ Although there is a big structural change in 1980, the dummy for 1980 was found to be insignificant.

$R^2 = 0.985$ $F(15,15) = 66.694$ [0.00] $\hat{\sigma} = 0.0109$ $dw = 2.08$
 RSS = 0.00177 for 16 variables and 31 observations
 $V = 0.14$ $J = 2.34$ $SC = -7.99$ $HQ = -8.49$
 $F_{ar}(2,13) = 0.07$ [0.93] $F_{arch}(1,13) = 0.31$ [0.59]
 $\chi_{nd}^2(2) = 4.77$ [0.09] $F_{reset}(1,14) = 1.17$ [0.29] $T = 33$ (1962-1994)

R^2 is the squared multiple correlation, $\hat{\sigma}$ is the residual standard deviation, V and J are the variance-change and joint parameter-constancy tests from Hansen (1992), SC is the Schwarz criterion Schwarz (1978) and HQ is the Hannan-Quinn criterion Hannan-Quinn (1979). The diagnostic tests are the form $F_j(k, T-1)$ which denotes an approximate F -test against the alternative hypothesis j for: k^{th} -order serial correlation F_{ar} , Goldfrey (1978), k^{th} -order autoregressive conditional heteroscedasticity F_{arch} , Engle (1982), heteroscedasticity F_{hetero} , White (1980), the functional form RESET test F_{reset} , Ramsey (1969) and a chi-square test for normality $\chi_{nd}^2(2)$, Doornik and Hansen (1994).

The slightly weird effect in the standard errors of the lagged income variable suggests a model in levels and differences of income. However, the income elasticity of consumption is not equal to 1 so we use the inverse of the *per capita* real private disposable income, Y_t ($=1000/Y_t$), which converges asymptotically to a unit elasticity (see, Figure 4a). $1000/Y_t$ attributes the fall in C_t/Y_t to the rise in Y_t such that the income elasticity of expenditure is unity only in an equilibrium with very high income levels, otherwise is less than unity.

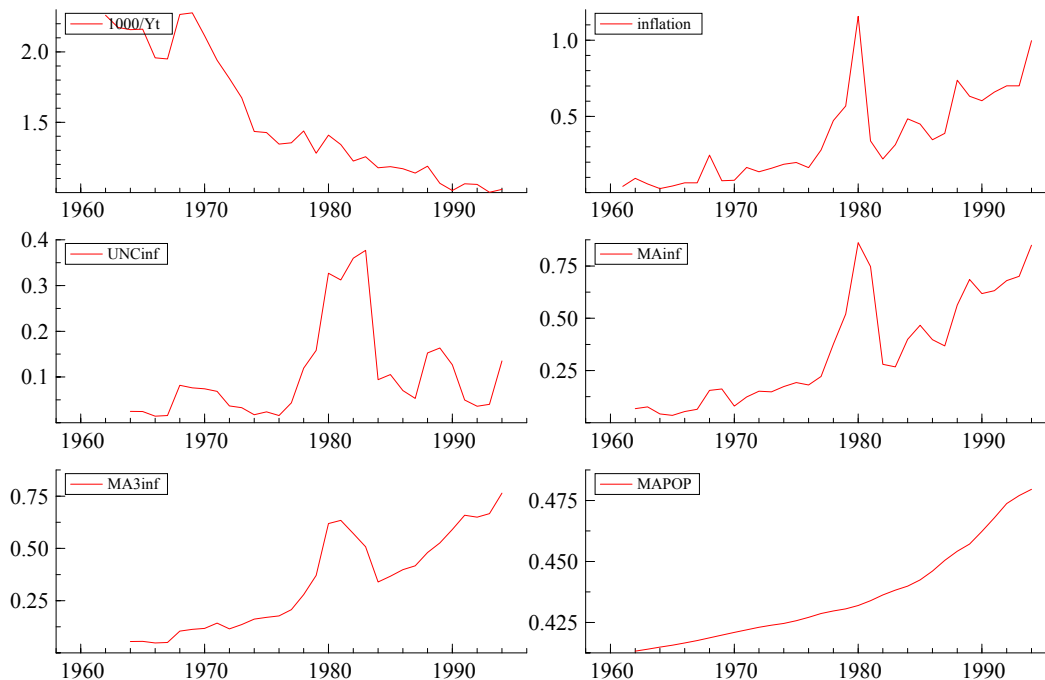


Figure 4: The inverse of the *per capita* real private disposable income, Y_t ($=1000/Y_t$), Inflation, Inflation uncertainty, $UNCinf$, the 2-period moving average of inflation, $MAinf$, the 4-period moving average of inflation, $MA3inf$ and the 3-period moving average of population aged 15-44, $MAPOP$.

Table 4. 6: Least squares estimates of the unrestricted average propensity to consume apc_t with $1000/Y_t$ (Equation 2):

Lag j	0	1	2
Variables	[t]	[t]	[t]
Constant	3.123		
(se) [t]	(0.346) [9.03]		
apc_{t-j}	_____	0.250	-0.272
		(0.109) [2.30]	(0.102) [-2.66]
$1000/Y_{t-j}$	_____	-0.060	
		(0.013) [2.38]	
s_{t-j}	0.318	0.566	
	(0.134) [3.92]	(0.145) [3.39]	
π_{t-j}	0.145	0.160	
	(0.043) [2.91]	(0.055) [-1.10]	
$(pop15-44)_{t-j}$	-1.713	-1.049	-4.948
	(1.564) [-0.45]	(2.351) [-2.63]	(1.880) [3.35]
$(hw/y)_{t-j}$	_____	0.089	-0.039
		(0.027) [-1.91]	(0.020) [-5.72]
D	-0.045		
	(0.008) [-4.51]		
$R^2 = 0.985$ F(13,17) = 83.457 [0.00] $\hat{\sigma} = 0.0104$ dw = 1.97			
RSS = 0.00185 for 14 variables and 31 observations			
V = 0.14 J = 2.16 SC = -8.17 HQ = -8.61			
$F_{ar}(2,15) = 0.002$ [0.99] $F_{arch}(1,15) = 0.42$ [0.53]			
$\chi_{nd}^2(2) = 2.39$ [0.30] $F_{reset}(1,16) = 1.21$ [0.29] T = 33 (1962-1994)			

Solved Static Long Run equation

$$apc_t = + 3.058 - 0.059 1000/Y_t + 0.866 s_t + 0.298 \pi_t$$

(SE) (0.165) (0.012) (0.076) (0.035)

$$- 7.545 (pop15-44)_t + 0.0499 (hw/y)_t - 0.044 \mathbf{D}$$

(SE) (0.388) (0.019) (0.0099)

$$ECM = apc_t - 3.058 - 0.059*1000/Y_t + 0.866*s_t + 0.298*\pi_t$$

$$- 7.545*(pop15-44)_t + 0.0499*(hw/y)_t + 0.044*\mathbf{D}$$

WALD test $\chi^2(6) = 513.44$ [0.00] **

Tests on the significance of each variable

		Unit-root t-test
apc_t	F(2,17) = 4.41 [0.03] *	-8.92**
Constant	F(1,17) = 81.49 [0.00] **	
$1000/Y_t$	F(1,17) = 20.36 [0.00] **	-4.52
s_t	F(2,17) = 28.51 [0.00] **	7.55
π_t	F(2,17) = 25.25 [0.00] **	6.81
$(pop15-44)_t$	F(3,17) = 35.28 [0.00] **	-8.86
$(hw/y)_t$	F(2,17) = 5.64 [0.01] *	2.37
D	F(1,17) = 32.68 [0.00] **	-5.72

Tests on the significance of each lag

Lag		
1	F(6,17) = 20.57 [0.00]	**
2	F(3,17) = 5.60 [0.007]	**

Tests on the significance of all lags up to 2

Lag		
1- 2	F(9,17) = 17.83 [0.00]	**
2- 2	F(3,17) = 5.60 [0.007]	**

It is immediately clear that this set cointegrates.¹⁵

There are a few steps in the reduction of the final model from the above general specification:

Table 4. 7: Least squares estimates of the simplified average propensity to consume apc_t , (Equation 3):

Lag j	0	1	2
Variables	[t]	[t]	[t]
Constant	2.292 (0.213) [10.78]		
Δapc_{t-j}		0.220 (0.081) [2.71]	
$1000/Y_{t-j}$	_____	-0.036 (0.010) [-3.60]	
MAs_{t-j}	0.492 (0.115) [4.28]		
$MA\pi_{t-j}$	0.170 (0.038) [4.44]		
$UNC\pi_{t-j}$	_____	_____	0.124 (0.034) [3.68]
$MA(pop15-44)_{t-j}$	-5.627 (0.485) [-11.60]		
$\Delta(hw/y)_{t-j}$	_____	0.0454 (0.016) [2.86]	
D	-0.047 (0.007) [-6.48]		

$R^2 = 0.982$ $F(8,20) = 137.43$ [0.00] $\hat{\sigma} = 0.010$ $dw = 2.50$
 RSS = 0.0020 for 9 variables and 29 observations
 $V = 0.059$ $J = 0.935$ $SC = -8.528$ $HQ = -8.819$
 $F_{ar}(2,18) = 2.096$ [0.15] $F_{arch}(1,18) = 0.199$ [0.66]
 $\chi_{nd}^2(2) = 3.92$ [0.14] $F_{hetero}(16,3) = 0.32$ [0.95]
 $F_{reset}(1,19) = 1.16$ [0.29] $T = 33$ (1962-1994)

The 3-year moving average of the population aged 15-44 ($MA(pop15-44)_t = \frac{1}{3} \sum_{i=0}^2 (pop15-44)_{t-i}$), the 2-period moving average of the real

¹⁵ PcGive unit-root test is used.

interest rates ($MA s_t = \frac{1}{2} \sum_{i=0}^1 s_{t-i}$) and the 2-period moving average of inflation ($MA \pi_t = \frac{1}{2} \sum_{i=0}^1 \pi_{t-i}$) are used to simplify the general model to a more parsimonious representation. The variable, $UNC \pi_{t-2}$, ($= (\sqrt{\frac{1}{4} \sum_{i=0}^3 (\pi_t - MA30 \pi_t)^2})_{t-2}$) is a 4-period moving standard deviation of inflation lagged 2 periods, which represents the inflation uncertainty [see, Muellbauer and Murphy (1993a, 1993b), Hendry *et al.* (1990), Hendry (1994) and Lattimore (1994)]. The mean of this variable is the 4-period moving average of inflation ($MA30 \pi_t = \frac{1}{4} \sum_{i=0}^3 \pi_{t-i}$), (see Figure 4c for the inflation uncertainty).

Formulating in terms of deviations from means (denoted by m), the final model is (Equation 4):

$$\begin{aligned}
 apc_t = & -0.163 + 0.220 \Delta apcm_{t-1} - 0.036 \text{ 1000}/Ym_{t-1} + 0.492 \text{ } MA sm_t \\
 & (0.0019) \quad (0.081) \quad (0.010) \quad (0.115) \\
 & [-84.81] \quad [2.711] \quad [-3.603] \quad [4.28] \\
 & + 0.170 \text{ } MA \pi m_t + 0.124 \text{ } UNC \pi m_{t-2} - 5.627 \text{ } MA(\text{pop15} - 44)m_t \\
 & (0.038) \quad (0.034) \quad (0.485) \\
 & [4.44] \quad [3.679] \quad [-11.602] \\
 & + 0.045 \Delta(hw/y)m_{t-1} - 0.047 \text{ } \mathbf{D} \\
 & (0.016) \quad (0.0073) \\
 & [2.857] \quad [-6.475]
 \end{aligned}$$

$$R^2 = 0.98 \quad F(8, 20) = 137.43 \quad [0.00] \quad \hat{\sigma} = 0.010 \quad dw = 2.50$$

$$\text{RSS} = 0.0020 \text{ for 9 variables and 29 observations}$$

$$V = 0.0588519 \quad J = 0.934563 \quad SC = -8.53 \quad HQ = -8.82$$

$$F_{ar} (2, 18) = 2.09 \quad [0.15] \quad F_{arch} (1, 18) = 0.199 \quad [0.66]$$

$$\chi_{nd}^2 (2) = 3.9 \quad [0.14] \quad F_{hetero} (16, 3) = 0.32 \quad [0.95]$$

$$F_{reset} (1, 19) = 1.16 \quad [0.29] \quad \text{Mean of } apc_t = -0.1634 \quad T = 33 \quad (1962-1994)$$

The diagnostic tests are satisfactory, hence, the model satisfies the *design criteria*. The data generating process (DGP) as a model satisfies the design criteria suggesting that the general-to-specific modelling is successful in creating a model that mimics the properties of DGP. Figure 5 shows the actual and fitted values of the final model. The graphs show how well the final model explains the data and the residuals uncorrelated and normally distributed.

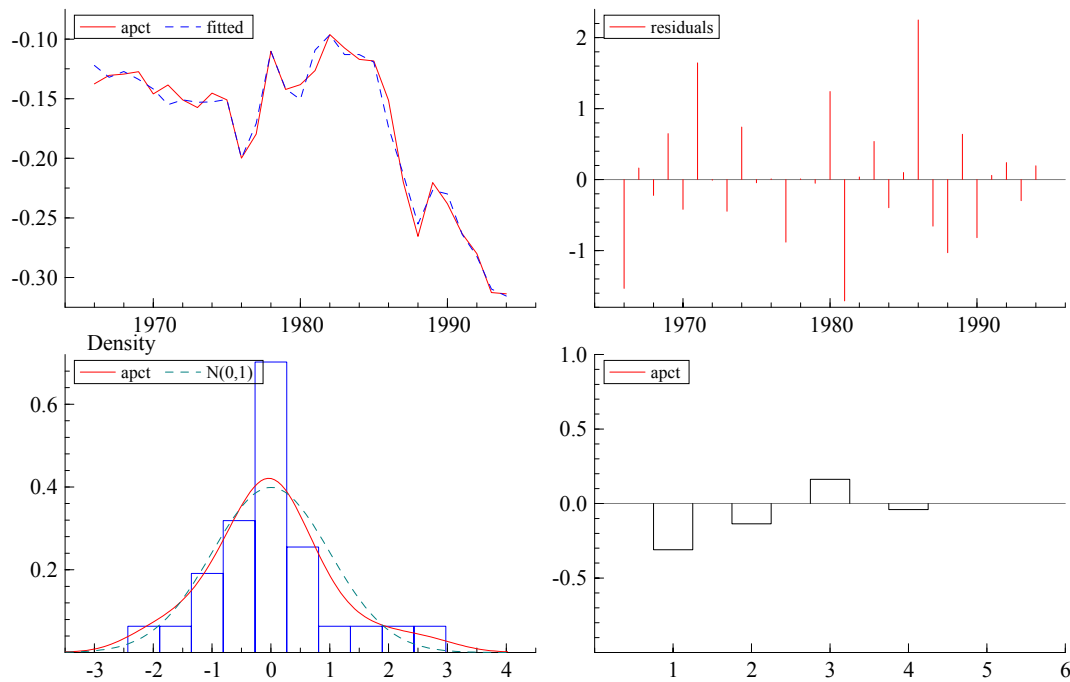


Figure 5: Actual and fitted values of consumption model from Equation (4), residuals, the histogram and estimated density of the residuals and their correlogram.

Figures 6, 7 and 8 plot the recursive estimates for the coefficients on the constant term, $\Delta apcm_{t-1}$, $1000/Ym_{t-1}$, $MAsm_t$, $MA\pi m_t$, $UNC\pi m_{t-2}$, $MA(pop15 - 44)m_t$ and $\Delta(hw/y)m_{t-1}$; their respective t -ratios; and the recursive residual sum of squares, one-step residuals, one-step Chow statistics, and break-point Chow statistics, respectively. Constant coefficients in Figure 6 in the presence of the large variations in the marginal process such as inflation imply super exogenous variables that counter the second sense of data mining. Further, the recursive t -ratios in Figure 7, increase in absolute value as the sample size increases countering the first sense of data mining. Hence, the nominal critical levels of test statistics are not affected. Even with 29 observations in the final model t -ratios are greater than three in magnitude suggesting that over-parameterisation is not a concern given information content in the data and refuting the fourth sense of data mining. Figure 8 shows that the recursive residual sum of squares increase over time and the recursive estimate of standard error $\hat{\sigma}_t$ declines over time rather than increase, hence countering the first sense of data mining. Furthermore, insignificant one-step and break-point Chow statistics support this refutation.

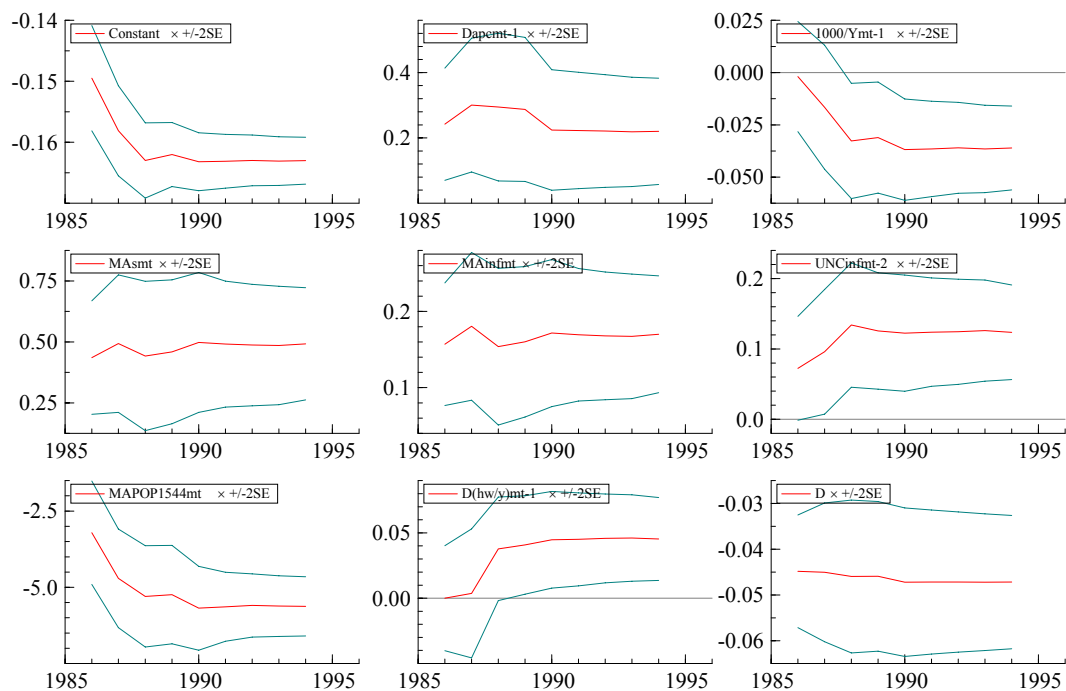


Figure 6: Recursive coefficients of consumption model (Equation 4) with \pm SE.

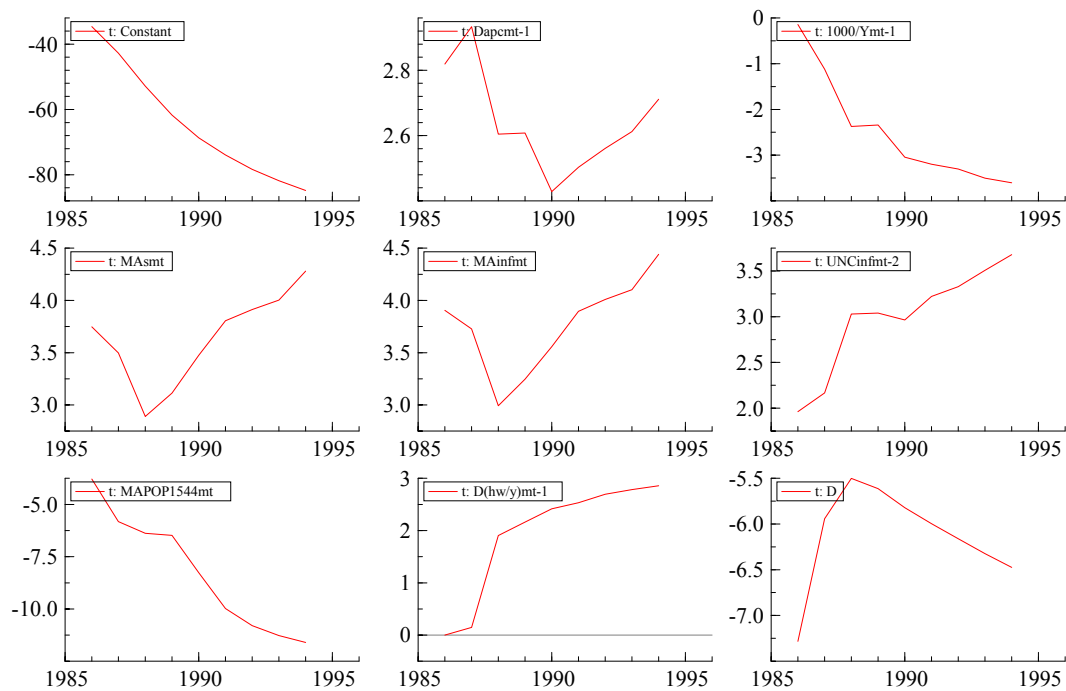


Figure 7: The recursive t -ratios.

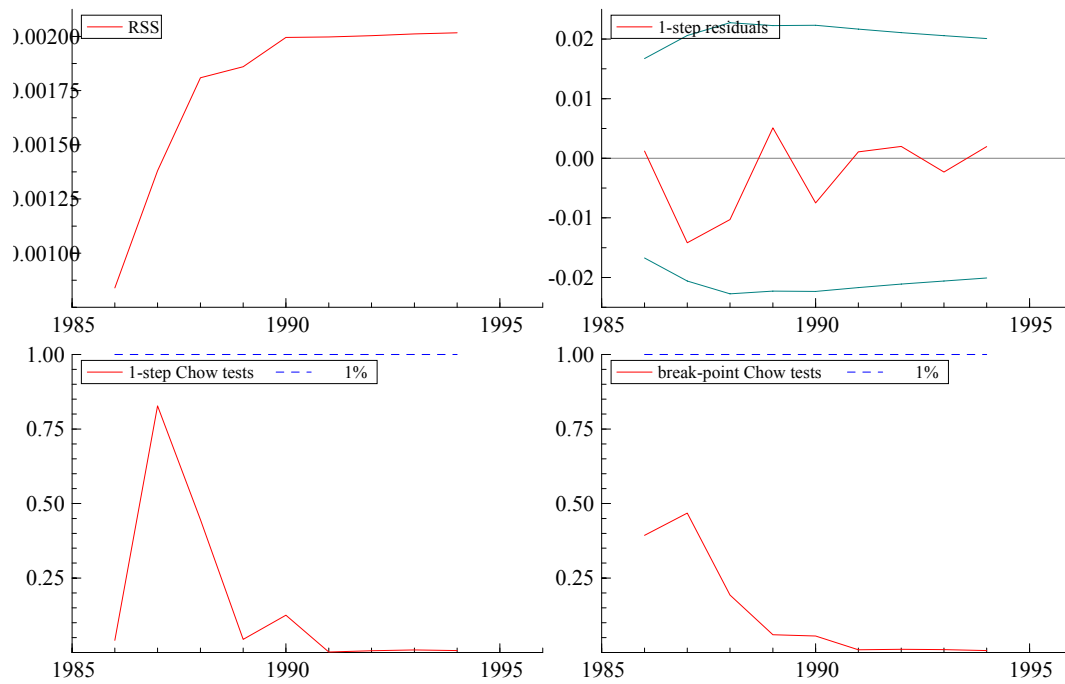


Figure 8: The residual sum of squares (RSS), one-step residuals and $0 \pm 2\hat{\sigma}_t$, one-step Chow statistics and breakpoint Chow statistics.

It is apparent that this final model “over-fits” with the SEE of only 1%, then the question arises if consumption and income are measured badly, why do we still get such good results?

We find that measurement errors to be co-integrated: Thus, I(1) measurement errors on the levels must cointegrate to I(0) if the observed series are to cointegrate in the same way as the latent variables when the measurement errors are I(0) on growth rates. Nowak (1991) calls a failure to observe the observed series to cointegrate when the cointegrated latent series is I(0) a problem of hidden cointegration. We believe that consumption and income are likely to have connected measurement errors and that the SIS and SPO correct the data (the national accounts) on such series, in a related way to avoid divergence, which suggests an I(0) measurement error for the ratio of them. When we generated housing wealth, we saw the same result in a constructed example.

The specific model (Equation 4) is a valid reduction, in the sense that it does not contradict the general model. Thus, the model is both congruent and parsimoniously encompasses the general model as well as the previous work on Turkish consumption, (see, section 6). The residual standard error in the final model is smaller than the equation standard error in the general model: this is a necessary condition for encompassing the general model and countering the third sense of data mining. The model has no lagged dependent variable, but white-noise errors so apc_t , $1000/Ym_t$, $MAsm_t$, $MA\pi m_t$, $UNC\pi m_t$ and $MA(pop15-44)m_t$ must cointegrate. Further, $1000/Ym_t$, $MAsm_t$, $MA\pi m_t$, $UNC\pi m_t$ and $MA(pop15-44)m_t$ are the mean removed values of $1000/Y_t$, MAs_t , $MA\pi_t$, $UNC\pi_t$ and $MA(pop15-44)_t$. Hence, we find the constant to be quite close to the mean value of the apc_t , which represents the long-run solution in this equation. This

further provides support for countering the third sense of data mining, as the final model has innovation errors.

In this subsection, I attempted to derive a more rigorous and wide-ranging foundation for the solved out aggregate consumption function, in the spirit of Ando and Modigliani (1963) and of Stone (1964, 1966). Apart from the changes in wealth effects, the other explanations for the increase in saving rate are demography, changes in uncertainty, habit formation, and the direct effects of financial liberalisation.

I adopted a conventional treatment of demography by entering a linear term in the percentage of population aged between 15 and 44. The advantage of the age distribution data used in this model is that there is a considerable variation in the age-distribution data over the sample period. Thus, there was a good chance of picking up the effects of the changing age distribution on coefficient in the equation. Currie *et al.* (1989), Fair and Dominguez (1991) and Lattimore (1994) find that the demographics reflect life cycle phenomena.¹⁶ That is, young people with currently low incomes but high income expectations and life-cycle needs, consume a high proportion of income, middle-aged cohorts save in anticipation of a lower income in retirement, and old people dissipate their stocks of accumulated savings – generating a hump-shaped life-cycle savings profile. The demographic effects estimated for Turkey are implausibly large in magnitude. As in other developing countries, Turkey faces the prospects of an increasing population of the young (aged 15-44) and a decreasing relative population of children. The effect of the young will dominate over the next years so that demographics will decrease the consumption to income ratio in Turkey. However, the coefficient here may reflect un-modelled factors. Moreover, while both the dependent variable and the demographic variable are trending, the relationship is not spurious. This could be explained by two arguments: one is Phillips (1986) type of nonsense regression: but the equation has white noise errors. The other one is recursive estimation: although the recursive estimation of Equation 4 is constant, the recursive estimation of the age distribution variable on the dependent variable is not constant [see, Engle and Hendry, 1993]. Thus, the effect of the age-distribution on consumption is genuine rather than a coincidence.

The real interest rate, which was low in the 1970s and rose in the 1980s is a proxy for financial liberalisation in Turkey. This could induce a positive association with consumption: Muellbauer (1994); and Murata (1994). Empirically, there is some tendency to find small negative influences of real interest rates on consumption, but they are not stable when re-estimated over different. Muellbauer and Murphy (1993a, 1993b) find a negative real interest rate effect for the US, negative but somewhat smaller importance in the UK. Lattimore (1994) omits the interest rate, because of its insignificance in Australia. Most recently, Aron and Muellbauer (2000) estimate direct and indirect effect of financial liberalisation on consumption separately. These studies use consumers' expenditure on non-durables and services as a consumption variable and personal disposable income as an income variable, whereas we used total private consumption as a consumption variable and private disposable income as an income variable in the above model.

The inflation rate has a positive and significant effect on the average propensity to consume in Turkey. The impact of inflation on private saving is separated into the effects of expected inflation and unexpected inflation. Expected inflation is used with the suggestion that households adjust their perceived disposable

¹⁶ See also, Heien (1972), Blinder (1975), Denton and Spencer (1976), Lieberman and Watchel (1980) and Auerbach and Kotlikoff (1989).

income downward as expected capital losses on their assets increase. On the other hand, expected inflation may lead to higher spending on consumer durables in developing countries in the absence of adequately indexed financial instruments. They assume that the impact of unexpected inflation on private saving would be positive according to the involuntary saving hypothesis of Deaton (1977).¹⁷ The previous studies generally have found a significant negative effect of inflation on consumption [see, Davidson *et al.* (1978), HUS (1981), Hendry (1983b), Hendry *et al.* (1990) and Hendry (1994)]. However, again they use consumers' expenditure on non-durables and services as a consumption variable and personal disposable income as an income variable, whereas we used total private consumption as a consumption variable and private disposable income as an income variable in the above model.

If marginal utility is convex, an increase in risk will increase marginal utility so that current consumption will have to decrease in order to bring the current marginal utility back into equality. Therefore, saving responds positively to uncertainty and consumption can be made to track income over the life-cycle. Fiscal policies that do not change expected life time resources can have large effects on consumption and consumers will typically behave as if they discount the future. Precautionary motives can account for large wealth holdings and they can explain why people hold a mixed portfolio of assets even where some assets dominate others in both mean and variance. However, the coefficient on 'the inflation uncertainty' has a positive and significant effect on Turkish consumption. This could be explained by 'impatience', the nature of Turkish inflation and consumption of durable goods in Turkey. If impatience is stronger, then consumers would typically want to consume today. Impatience keeps the buffer stocks small thereby providing a possible explanation of why many households save little throughout their life. Additionally, inflation in Turkey is chronic. Turkey has had high inflation periods over the years, but once inflation reaches 100%, necessary measures are taken to stabilise inflation, especially with the assistance of the international organisations. Turkish consumers believe that inflation will never be higher than today, but will be lower. Therefore, it is not surprising to see that the Turkish consumers spend on durable goods when inflation is high and when there is availability of spreading the payment over a long term with interest-free credit. We can also interpret this result as when inflation is high, preferences over durable goods dominate risk aversion. If we exclude the inflation uncertainty from the model, the coefficient on the core inflation increases by the same amount of the coefficient as the inflation uncertainty variable.

I find a significant change in wealth effect. However, relatively illiquid assets such as housing have a marginal effect on expenditure compared to liquid assets such as broad money (M2/Y). We find a positive wealth effect of illiquid assets. This confirms the role of asset values in contributing to the determination of consumer expenditure. The demand for non-housing consumption will be affected by the price of housing. A permanent change in the price of housing, after which the relative prices of non-housing and housing consumptions are expected to remain fixed, has two effects: One is a positive wealth effect for those with housing wealth and the other is a negative combined income and substitution effect from facing a higher house price. For those without housing wealth, there is no wealth effect so that the negative effect remains. The smaller the proportion of people who are not owner-occupiers but have aspirations in that direction, the more the wealth effect dominates

¹⁷ Thus, the signs of the coefficients of inflation and expected inflation are indeterminate, whereas the unexpected inflation is positive in private saving models.

at the aggregate level. In Turkey, 70.5% of households own a house in 1994. Furthermore, ownership of housing is positively correlated with income levels. While only 52% of low income families own a house, 77% of upper income families can afford a house. One might expect non-owner-occupiers to save more when real house prices rise. Furthermore, increases in real house prices tend to redistribute wealth between young households and older households, since the young have typically accumulated less housing wealth. Younger households may have smaller MPCs to spend out of housing wealth, this redistribution adds to the aggregate saving decision. It is also important to note the difference between housing wealth increases and house price increases. The accumulation of owner-occupied housing capital through investment and the transfer of publicly-owned housing into private hands are household wealth increases that do not rest on increases in real prices. Such increases have clearly positive expenditure implications. Although, there is little empirical evidence on the scale of the effect of housing wealth on consumption, and what evidence does exist is open to several different interpretations, Muellbauer and Murphy (1990) find a strong link between rising UK house values and consumers' expenditure. However, King (1990) and Pagano (1990) are sceptical that the relation reflects a causal link from changes in house values to consumption. Carruth and Henley (1990) argue that the under-prediction of the boom in consumer spending over the critical three year period up to end of 1987 by the DHSY model [Davidson *et al.* (1978)] can be eliminated once the omission of housing wealth effects from the model is corrected. Miles (1994) finds evidence that house-price effects on spending had become more significant in the 1980s and argued that this was consistent with a collateral enhancement interpretation of how price increases work, but was harder to see as a pure wealth effect. Lattimore (1994) and Murata (1994) show that there is strong evidence for the negative real house-price effect which partly offsets the positive wealth effect of illiquid assets including housing. They both report that it is otherwise hard to get sensible wealth effects for these countries. This negative real land-price effect, proxying a house-price effect, is the major reason why the Japanese household saving rate did not fall substantially at the time of the 1980s asset price boom. There is evidence for a weaker, but significant, effect of this type for UK regions, Muellbauer and Murphy (1994). However, the effect is not significant for UK aggregate data, Muellbauer and Murphy (1993b), and the poor quality of house price data before 1963 limits testing for such effect for the US, Muellbauer and Murphy (1993a).

A positive effect on current consumption of lagged consumption can represent the effects of expectation, habits or adjustment costs.

5. Forecasting performance

The forecast evaluation of the final model is as follows:

(T= 33 (1962-1994) less 6 forecasts; the forecast period = 1989 – 1994)

$$\begin{aligned}
 apc_t = & - 0.163 + 0.294 \Delta apcm_{t-1} - 0.033 \text{ 1000}/Ym_{t-1} + 0.442 \text{ } MAsm_t \\
 & (0.003) \quad (0.113) \quad (0.0138) \quad (0.153) \\
 & [-52.85] \quad [2.60] \quad [-2.37] \quad [2.89] \\
 & + 0.154 \text{ } MA\pi m_t + 0.134 \text{ } UNC\pi m_{t-2} - 5.297 \text{ } MA(pop15 - 44)m_t \\
 & (0.0514) \quad (0.044) \quad (0.830) \\
 & [2.99] \quad [3.03] \quad [-6.38]
 \end{aligned}$$

$$\begin{array}{rcl}
+ 0.038 \Delta(hw/y)m_{t-1} & - & 0.046 D \\
(0.0198) & & (0.008) \\
[1.90] & & [-5.50]
\end{array}$$

$R^2 = 0.94$ $F(8, 14) = 29.44$ $[0.00]$ $\hat{\sigma} = 0.011$ $dw = 2.53$
 RSS = 0.0018 for 9 variables and 23 observations
 V = 0.129 J = 1.34 SC = -8.22 HQ = -8.56 FPE = 0.00018

Analysis of 1-step forecasts

Date	Actual	Forecast	$Y - \hat{Y}$	Forecast $\hat{\sigma}$	t-value
1989 1	-0.220	-0.230	0.0099	0.0158	0.627
1990 1	-0.238	-0.223	-0.0152	0.0182	-0.834
1991 1	-0.263	-0.261	-0.0026	0.0178	-0.146
1992 1	-0.279	-0.280	0.0006	0.0199	0.031
1993 1	-0.313	-0.306	-0.0060	0.0215	-0.282
1994 1	-0.314	-0.314	0.0003	0.0218	0.016

Tests of parameter constancy over: 1989 to 1994

$$\chi^2_{forecast} (6) = 2.89 [0.82] \quad F_{chow} (6, 14) = 0.27 [0.94]$$

While based on part of the estimation sample, the outcome is consistent with a constant model (see, Figure 9), again refuting the first and second sense of data mining. $\chi^2_{forecast}$ is the forecast test, Kiviet (1986) and F_{chow} is a parameter constancy test over k^{th} periods, Chow (1960).

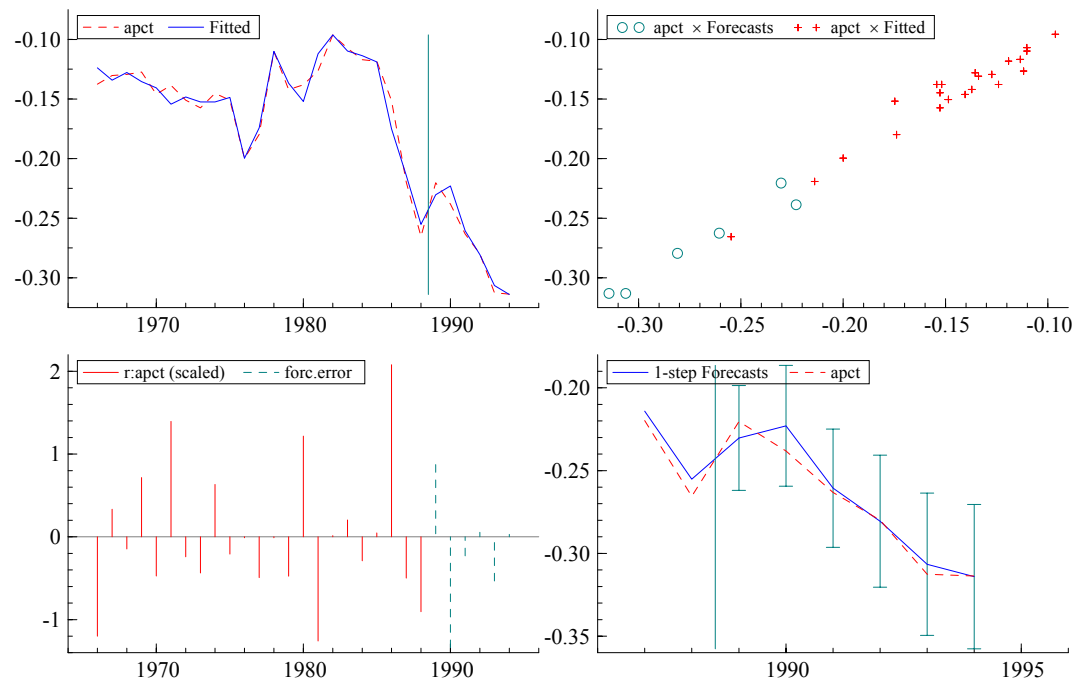


Figure 9: Forecast graphics for the consumption model (Equation 4) with 6 forecasts

6. Encompassing

Encompassing tests evaluate one model against rival models to see if they embody specific information excluded from the model under. Thus, the contending model must encompass previous empirical models of the dependent variable. Encompassing tests of alternative models are especially crucial for countering the second and third

sense of data mining as they provide an additional tool for identifying the relevant and omitted variables.

In this section we apply encompassing tests to the models estimated by Rittenberg (1988) and Uygur (1993) and to my model (Equation 3 in Section 4)¹⁸.

Rittenberg (1988, pg. 122) estimates a Private Savings function for Turkey for the 1963-1985 period where the dependent variable is the ratio of private savings to private disposable income ($Pr S_t / Pr Y_t$) and the regressors are the log of real private disposable income ($LR Pr Y_t$), the growth of real private disposable income ($\Delta LR Pr Y_t$) the real short-term deposit rate ($RSir_t$) the ratio of foreign savings to private disposable income ($FDEF_t / Pr Y_t$), the ratio of public savings to private disposable income ($PuS_t / Pr Y_t$), a dummy variable equal to 1 for 1981 (D1981) and a dummy variable equal to 1 for 1982-1986 (D82-86). The dummies have particular importance in Rittenberg's equation as without them other variables are insignificant.

We estimate Rittenberg's model with the dependent variable from her data set ($Pr S_t / Pr Y_t$) and from my data set (S_t / Y_t) for the period 1963-1985. In fact, $apc_t = \log(1 - S_t / Y_t) \cong -S_t / Y_t$ is such a close approximation here that essentially identical estimates resulted from the two dependent variables (up to all digits reported), so only those from Rittenberg's dependent variable need be recorded. We find the following results:

Table 6. 1: Rittenberg's (1988) Model with the dependent variable from Rittenberg's data set ($Pr S_t / Pr Y_t$) (identical to my data set, S_t / Y_t) (1963-1985)

	MODEL 1A ($Pr S_t / Pr Y_t$) = MODEL 1B (S_t / Y_t)	
Variables	Coefficient	t-value
Constant	-0.729	-2.25
$LR Pr Y_t$	0.078	2.66
$\Delta LR Pr Y_t$	-0.052	-0.48
$RSir_t$	0.101	1.33
$FDEF_t / Pr Y_t$	-0.146	-0.53
$PuS_t / Pr Y_t$	-0.011	-0.03
D1981	-0.066	-2.23
D1982-86	-0.094	-3.02
R^2	0.56	
F (7, 15)	2.72 [0.049]	
$\hat{\sigma}$	0.0188	
Dw	1.58	
F_{ar} (2, 13)	0.94 [0.41]	
F_{arch} (1, 13)	0.007 [0.93]	
χ_{nd}^2 (2)	3.40 [0.18]	
F_{reset} (1, 14)	0.04 [0.84]	

¹⁸ We also consider encompassing Celasun and Tansel's (1993) model with my model, however, their dependent variable is Private Savings in levels so that it is not compatible with my model.

The results are exactly the same for Rittenberg's model with the dependent variable from her data set and from my data set. I replicated the results for my model with the dependent variable from Rittenberg's data set and from my data set and find:

Table 6. 2: My Model with the dependent variable from Rittenberg's data set ($\Pr S_t / \Pr Y_t$) (identical to my data set, S_t / Y_t) (1966-1985)

	MODEL 1C ($\Pr S_t / \Pr Y_t$) = MODEL 1D (S_t / Y_t)	
Variables	Coefficient	t-value
Constant	-1.44	-1.94
Δapc_{t-1}	-0.21	-2.74
$1000 / Y_{t-1}$	0.015	0.63
$MA S_t$	-0.29	-1.65
$MA \pi_t$	-0.11	-2.05
$UNC \pi_{t-2}$	-0.12	-1.15
$MA(pop15 - 44)_t$	3.68	2.21
$\Delta(hw/y)_{t-1}$	-0.01	-0.45
D	0.039	6.97
R^2	0.93	
F (8, 11)	16.89 [0.00]	
$\hat{\sigma}$	0.0075	
dw	2.86	
F_{ar} (2, 9)	2.19 [0.16]	
F_{arch} (1, 9)	0.25 [0.63]	
χ^2_{nd} (2)	1.09 [0.58]	
F_{reset} (1, 10)	0.51 [0.49]	

The results are exactly the same with dependent variables from the different sources. We estimate joint models for the models 1A and 1C, and also for the models 1B and 1D.

Table 6. 3: The Joint Model with the dependent variable from Rittenberg's data set ($\Pr S_t / \Pr Y_t$) (identical to my data set, S_t / Y_t) (1966-1985)

	MODEL 1E ($\Pr S_t / \Pr Y_t$) = MODEL 1F (S_t / Y_t)	
Variables	Coefficient	t-value
Constant	-0.276	-0.299
$LR \Pr Y_t$	-0.070	-0.290
$\Delta LR \Pr Y_t$	0.048	0.204
$RSir_t$	-0.013	-0.148
$FDEF_t / \Pr Y_t$	0.039	0.211

$PuS_t / Pr Y_t$	-0.037	-0.550
D1981	-0.036	-0.876
D1982-86	-0.158	-1.983
Δapc_{t-1}	-0.087	-0.828
$1000 / Y_{t-1}$	-0.079	-0.598
MAs_t	0.084	0.149
$MA\pi_t$	-0.085	-0.659
$UNC\pi_{t-2}$	0.309	1.446
$MA(pop15 - 44)_t$	3.033	0.496
$\Delta(hw/y)_{t-1}$	0.049	1.426
D	0.031	4.354
R^2	0.98	
F (15, 4)	10.75 [0.02]	
$\hat{\sigma}$	0.00707	
dw	2.50	
$F_{ar} (2, 2)$	1.58 [0.39]	
$F_{arch} (1, 2)$	0.29 [0.64]	
$\chi_{nd}^2 (2)$	0.83 [0.66]	
$F_{reset} (1, 3)$	0.16 [0.72]	

As the rival theories have collinear explanations some variables are insignificant in the nesting model. However, Rittenberg's set can be deleted without loss from mine. This result is clearer with the whole sample estimation; also, the dummy variable for 1982-1986 becomes insignificant, see Table 4.

Table 6. 4: The Joint Model with the dependent variable from Rittenberg's data set ($Pr S_t / Pr Y_t$) (identical to my data set, S_t / Y_t) (1966-1994)

	MODEL 1G ($Pr S_t / Pr Y_t$) = MODEL 1H (S_t / Y_t)	
Variables	Coefficient	t-value
Constant	-1.339	-2.224
$LR Pr Y_t$	-0.098	-1.231
$\Delta LR Pr Y_t$	0.123	1.273
$RSir_t$	-0.045	-0.666
$FDEF_t / Pr Y_t$	-0.004	-0.042
$PuS_t / Pr Y_t$	0.013	0.356
D1981	0.044	1.774
D1982-86	0.016	0.486
Δapc_{t-1}	-0.211	-3.032
$1000 / Y_{t-1}$	-0.039	-0.704
MAs_t	-0.523	-1.703
$MA\pi_t$	-0.202	-3.163

$UNC\pi_{t-2}$	-0.075	-2.219
$MA(pop15 - 44)_t$	6.067	5.755
$\Delta(hw/y)_{t-1}$	-0.033	-1.969
D	0.040	6.126
R^2	0.99	
F (15, 13)	73.47 [0.00]	
$\hat{\sigma}$	0.0082	
dw	2.31	
F_{ar} (2, 11)	0.67 [0.53]	
F_{arch} (1, 11)	0.06 [0.81]	
χ_{nd}^2 (2)	4.71 [0.09]	
F_{reset} (1, 12)	1.13 [0.30]	

We test the reductions from the joint models with the dependent variable from Rittenberg's data set, model 1E, to Rittenberg's model 1A and to my model 1C, which are identical to the reductions from the joint model with the dependent variable from my data set, model 1F, to Rittenberg's model 1B and to my model 1D.

Model 1E \rightarrow 1A: F(8, 4) = 6.9696 [0.0391]* Model 1E \rightarrow 1C: F(7, 4) = 1.2059 [0.4532]

The results of the encompassing F-tests indicate that the reductions to my model from the joint models are accepted, whereas the reductions to Rittenberg's model are rejected. Hence, my model is able to explain the results of Rittenberg's model.

Uygun (1993, pg. 39) estimates the following model for the 1965-1990 period where the dependent variable is the ratio of private savings to private disposable income (PS_t / PY_t) and the regressors are *per capita* real private disposable income (PYP_t), the growth of real private disposable income (GYP_t), the real one-year deposit interest rate (RIR_t) the ratio of total time deposits to GNP (RTD_t), the share of private housing investment in total private investment (SHI_t), and the ratio of the foreign deficit to GNP (RFD_t). We estimate Uygun's model with the dependent variable from his data set (PS_t / PY_t) and from my data set (S_t / Y_t) for the period 1965-1990 and find the following results:

Table 6. 5: Uygun's (1993) Model with the dependent variable from Uygun's data set (PS_t / PY_t) and from my data set (S_t / Y_t) (1965-1990)

Variables	MODEL 2A (PS_t / PY_t)		MODEL 2B (S_t / Y_t)	
	Coefficient	t-value	Coefficient	t-value
Constant	-0.045	-1.799	-0.057	-1.850
PYP_t	0.144	7.157	0.113	4.476
GYP_t	0.308	3.968	0.393	4.044
RIR_t	0.043	1.297	-0.004	-0.099

RTD_{t-1}	-0.443	-2.933	-0.238	-1.258
SHI_{t-1}	0.126	2.340	0.181	2.676
RTD_{t-1}	-0.387	-2.035	-0.139	-0.582
R^2	0.89		0.83	
F (6, 19)	25.43 [0.00]		15.51 [0.00]	
$\hat{\sigma}$	0.0136		0.0171	
dw	1.96		1.74	
F_{ar} (2, 17)	2.32 [0.128]		2.08 [0.155]	
F_{arch} (1, 17)	1.46 [0.244]		1.77 [0.201]	
χ_{nd}^2 (2)	4.21 [0.12]		2.52 [0.284]	
F_{reset} (1, 18)	0.19 [0.66]		0.66 [0.426]	

The dependent variables in the above models differ: as in private communication with Uygur, he confirms that he collected the data from different sources, not all of which are in the public domain. If his form of model is fitted to the published data (S_t / Y_t) (Model 2B), the results significantly change; however, if my form of model is fitted to his data set (PS_t / PY_t) (Model 2C), the results do not change apart from Δapc_{t-1} and $\Delta(hw/y)_{t-1}$ -- as income and consumption measures should be modified given the different dependent variable (even without doing that, the model performs well).

Table 6. 6: My Model with the dependent variable from Uygur's data set (PS_t / PY_t) and from my data set (S_t / Y_t) (1966-1990)

Variables	MODEL 2C (PS_t / PY_t)		MODEL 2D (S_t / Y_t)	
	Coefficient	t-value	Coefficient	t-value
Constant	-1.898	-5.921	-1.941	-7.803
Δapc_{t-1}	-0.068	-0.697	-0.192	-2.524
$1000 / Y_{t-1}$	0.030	2.361	0.031	3.061
MA_s_t	-0.365	-2.400	-0.430	-3.365
$MA\pi_t$	-0.131	-2.548	-0.148	-3.728
$UNC\pi_{t-2}$	-0.103	-2.350	-0.101	-3.011
$MA(pop15 - 44)_t$	4.691	6.426	4.795	8.461
$\Delta(hw/y)_{t-1}$	-0.027	-1.368	-0.035	-2.314
D	0.042	4.830	0.040	6.050
R^2	0.93		0.96	
F (8, 16)	25.15 [0.00]		44.50 [0.00]	
$\hat{\sigma}$	0.0118		0.0092	
Dw	1.69		2.51	
F_{ar} (2, 14)	0.114 [0.89]		1.91 [0.18]	
F_{arch} (1, 14)	0.762 [0.39]		0.38 [0.55]	
χ_{nd}^2 (2)	1.268 [0.53]		1.98 [0.37]	
F_{reset} (1, 15)	5.879 [0.03]		6.15 [0.03]	

The results of the joint models show that the additional variables from Uygur's model are insignificant if added to my model. Furthermore, the constants in the joint models are closer to the constants in my models.

Table 6. 7: The Joint Model with the dependent variable from the Uygur's data set (PS_t / PY_t) and from my data set (S_t / Y_t) (1966-1990)

Variables	MODEL 2E (PS_t / PY_t)		MODEL 2F (S_t / Y_t)	
	Coefficient	t-value	Coefficient	t-value
Constant	-2.128	-2.533	-1.611	-1.646
PYP_t	0.072	0.997	0.084	1.001
GYP_t	-0.176	-1.421	-0.216	-1.495
RIR_t	0.080	1.777	0.047	0.906
RTD_{t-1}	-0.247	-1.320	0.137	0.628
SHI_{t-1}	0.178	2.534	0.196	2.383
RTD_{t-1}	-0.012	-0.076	0.284	1.575
Δpc_{t-1}	-0.258	-3.565	-0.283	-3.345
$1000 / Y_{t-1}$	0.0007	0.042	0.015	0.730
MAs_t	-0.755	-2.971	-0.637	-2.149
$MA\pi_t$	-0.315	-3.464	-0.261	-2.457
$UNC\pi_{t-2}$	0.051	1.126	-0.005	-0.099
$MA(pop15 - 44)_t$	5.127	2.316	3.738	1.449
$\Delta(hw / y)_{t-1}$	-0.005	-0.350	-0.026	-1.530
D	0.041	6.088	0.045	5.655
R^2	0.99		0.98	
F (14, 10)	48.022 [0.00]		36.318 [0.00]	
$\hat{\sigma}$	0.0067		0.0078	
dw	2.95		2.57	
F_{ar} (1, 9)	10.11 [0.11]		2.41[0.15]	
F_{arch} (1, 8)	0.197 [0.67]		0.038 [0.85]	
χ_{nd}^2 (2)	2.869 [0.24]		3.65 [0.16]	
F_{reset} (1, 9)	0.053 [0.83]		1.70 [0.22]	

We test the reductions from the joint models with the dependent variable from Uygur's data set, model 2E to Uygur's model 2A and to my model 2C, and also test the reductions from the joint model with the dependent variable from my data set, model 2F to Uygur's model 2B and to my model 2D.

<p>Model 2E \rightarrow 2A: F(8, 10) = 8.4671 [0.0014]** Model 2E \rightarrow 2C: F(6, 10) = 6.7117 [0.00461]** Model 2F \rightarrow 2B: F(8, 10) = 10.089 [0.0007]**</p>
--

Model 2F \rightarrow 2D: $F(6, 10) = 2.0496 [0.1510]$

The results of the encompassing F-tests indicate that although the reductions from the joint model 2E to my model (2C) are rejected due to differences between the dependent variable and the income and consumption measures of regressors, the reductions from the joint model 2F to my model (2D) are accepted. However, the reductions to Uygur's models (2A and 2B) are rejected in both cases.

These results show that my model is able to encompass the results of the two rival models, furthermore my model is *structural* as it is invariant over extensions of the information set (adding more variables).

7. Conclusions

The modelling suggests that housing wealth, demographic factors (precautionary savings, uncertainty and borrowing constraints¹⁹), inflation and inflation uncertainty, the real interest rates, habits and/or adjustment costs (Δapc_{t-1}), and the trend factor ($1000/Y_{t-1}$) are important in explaining short run movements in the average propensity to consume, while the constant of the equation represents the long run solution. The model is both congruent and parsimoniously encompasses the general model as well as the previous work on Turkish consumption. The residuals are also innovations against the available information. The results further support the view that a constructive data mining *qua* general-to-specific modeling is productive as it has a high probability of locating the DGP.

Furthermore, the constancy of a conditional model (average propensity to consume) in the face of a changing marginal process (the real interest rates, inflation, etc.) entails that agents do not use expectations models to predict future values of relevant decision variables, because in practice contingent planning dominates forward-looking behaviour. Furthermore, agents may form expectations without using models, but use data-based predictors, perhaps because of high costs of information collection and processing.

The ratio of the last observation in 1994 of nominal consumption of roughly 1,800,000 million TL to the first observation in 1962 of 45 million TL is more than 40,000 fold: the log ratio is almost 11. An explanation of consumption behaviour must account for such enormous growth. Here, the final model has a standard error of under 2 *per cent* of consumption, or 0.02 in log terms, which is relatively constant over 30 years and much of that is measurement error. Thus measurement errors are cointegrated.

Thus, neither theory alone nor empirical evidence alone are an adequate basis for determining how economic agents behave. We have attempted to use both together in this paper to glean whatever conclusions are feasible. The match between them must increase our confidence in both – since conflicts could have occurred but did not appear sufficiently important to induce rejection.

8. Appendix: Additional variables

¹⁹ Young risk-averse Turkish agents cannot borrow freely to consume in advance of future income, this induces a motive for holding assets (a buffer-stock theory of saving) to shield consumption against unpredictable fluctuations in income. However, no data is available on credit constraints.

a) Demographic factors: I tried the following demographic variables to take into account demographic effects:

UNEMP: Unemployment rate

DUNEMP: Change in Unemployment rate

DIVOR: Divorce Rate

TOTPART: Total Labour Participation rate

MALPART: Male Participation rate

FEMPART: Female Participation rate

D.RATE: Death rate

LIFEEXP: Percentage of Death 65+ in Total Death

LIT.RATE: Literacy rate

0-14ADR: Age Dependency Ratio of 0-14 years old

65+ADR: Age Dependency Ratio of 65 years of age and above

TAGEDR: Total Age Dependency Ratio

POP0-19: The % of the population which is aged between 0 and 19.

POP15-19: The % of the population which is aged between 15 and 19.

POP20-24: The % of the population which is aged between 20 and 24.

POP20-34: The % of the population which is aged between 20 and 34.

POP25-34: The % of the population which is aged between 25 and 34.

POP20-64: The % of the population which is aged between 20 and 64.

POP20-44: The % of the population which is aged between 20 and 44.

POP25-34: The % of the population which is aged between 25 and 34.

POP35-44: The % of the population which is aged between 35 and 44.

POP45-64: The % of the population which is aged between 45 and 65.

POP64+: The % of the population which is aged 64+.

Clearly, combinations of these variables are perfectly collinear, so relevant subsets were tried in various regressions (available from the author).

b) Current account deficit (CAD/Y): The current account deficit is defined as the total export of goods and services minus total import of goods and services. The current account deficit to GNP (both in current prices) ratio was used as an additional variable.

c) Foreign deficit (FDEF/Y): Foreign deficit is defined as the sum of deficit in the trade of goods and services plus net factor income from abroad. The ratio of foreign deficit to GNP, both in current prices was used as an additional variable and it was found to be insignificant in all cases. However, Uygur (1993) found FDEF/Y-1 to be negative and significant.

d) Monetary Depth (M2/GNP and/or PrCREDIT/GNP): Broad Money (M2) to GNP (M2/GNP) ratio is used as a financial wealth variable, since the variable substantially increased after 1983 when the residents (and non-residents) were allowed to open foreign exchange deposits with the commercial banks. They contain an element of the negative income effect and a negative redistribution effect which are observed when real deposit rates rise. Furthermore, they constitute a substantial part of the financial wealth in developing countries.

I also included total credits to the private sector as a percentage of GNP (PrCREDIT/GNP) for an easing of credit market conditions facing households.

The use of Credit Cards (CrCARDS) in order to take into account consumer credit delinquencies is left out in this model, since with the 100% inflation

environment Turkish consumers do not use Credit Cards as much as they are used in the Western Countries and the US.

e) Income Uncertainty (Yunc): *Yunc* which is a 3-year moving standard deviation of the change in Real Private Disposable Income is used as a measure of income uncertainty. The mean of this variable is MA4DY where MA4 denotes a 4 year moving average from t-3 to t.

f) Government deficit (GDEF/Y): I tried to incorporate the effect of heavy public sector borrowing from the financial markets by using the government deficit (Government Revenues - Government Expenditure) to GNP ratio (in current prices) as an additional variable.

g) The Distributional Indicator: The ratio of non-wage income (YK) to wage-income (YL) within the non-agricultural sector is used to take into account the income inequality.

However, none of the additional variables in this section had a significant effect on explaining the average propensity to consume in Turkey in the equations to which they were added.²⁰

References

Akkoyunlu, S. (1999), *Turkish Consumption and Saving*, DPhil Thesis, University of Oxford.

Ando, A., and Modigliani F. (1963), "The Life-Cycle Hypothesis of Savings: Aggregate Implications and Tests," *American Economic Review*, 53, 55-84.

Aron, J, and Muellbauer, J. (2000), "Financial Liberalisation, Consumption and Debt in South Africa", *World Bank Working Paper Series*, No: 2000-22.

Auerbach, A. J., and Kotlikoff, L. J. (1989), "Demographics, Fiscal Policy and US Saving in the 1980s and Beyond", *NBER Working Paper* 3150, Cambridge MA, NBER.

Bachelor, R. and P. Dua, (1992), "Survey Expectations in the Time Series Consumption Function", *The Review of Economics and Statistics*, 74, 598-606.

Ball, R. J., and Drake, P.S. (1964), "The Relationship Between Aggregate Consumption and Wealth", *International Economic Review*, 5, 63-81.

Blinder, A. S. (1975), "Distribution Effects and the Aggregate Consumption Function", *Journal of Political Economy*, 83, 447-75.

Blinder, A. S., and Deaton A. S. (1985), "The Time Series Consumption Function Revisited," *Brookings Papers on Economic Activity*, 2, 465-521.

Campos, J. and Ericsson N. R. (1999), "Constructive Data Mining: Modelling of Consumers' Expenditure in Venezuela", *Econometrics Journal*, 5, 226-240.

Carruth, A. and Henley A. (1990), "Can Existing Consumption Functions Forecast Consumer Spending in the late 1980's?", *Oxford Bulletin of Economics and Statistics* 52, 211-223.

Celasun, M., and A. Tansel (1993), "Distributional Effects and Saving-Investment Behaviour in Liberalising Economy: The Case of Turkey", *METU Studies in Development*, 20, 269-298.

Currie, D., Holly, S., and Scott, A. (1989), "Savings, Demography and Interest Rates", *Discussion Paper* No: 89-1, Centre For Economic Forecasting, London Business School.

²⁰ The results are available from the author.

Davidson, J. E. H., Hendry D. F., Srba F. and Yeo S. (1978), “Econometric Modelling of the Aggregate Time Series Relationship Between Consumers’ Expenditure and Income in the United Kingdom”, *Economic Journal*, 88, 661-92.

Davidson, J. E. H., Hendry D. F. (1981), “Interpreting Econometric Evidence; The Behaviour of Consumer Expenditure in the UK”, *European Economic Review*, 16, 177-192.

Deaton, A. (1977), “Involuntary Saving Through Unanticipated Inflation,” *American Economic Review*, 67, 899-910.

Denton, F. and Spencer, B. (1976), “Household and Population Effects on Aggregate Consumption”, *Review of Economics and Statistics*, 58, 86-95.

Doornik, J. A. and Hansen, H. (1994), “A Practical Test for Univariate and Multivariate Normality”, *Discussion Paper*, Nuffield College.

Engen, E. M., and Gale W. (1991), “IRAs and saving in a stochastic life-cycle model”, *University of California at Los Angeles* (Dec.), mimeo.

Engle, R. F. (1982), “Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation”, *Econometrica*, 50, 987-1007.

Ericsson, N. R., Hendry, D. F. and Tran, H.-A. (1990a), “Cointegration, seasonality, encompassing and the demand for money in the UK”, *Discussion Paper*, Board of Governors of the Federal Reserve System, Washington.

Ericsson, N. R., Campos, J. and Tran H. A. (1990b), “PCGIVE and David Hendry’s Econometric Methodology”, *Revista De Econometria*, Vol: 10, pp: 7-117.

Fair, R. C., and Dominguez, K. M. (1991), “Effects of the Changing US Age Distribution on Macroeconomic Equations”, *American Economic Review*, 81, 1276-94.

Feldstein, M. S. (1977), “Social Security and Private Savings: International Evidence in an Extended Life-Cycle Model,” in M. S. Feldstein and R. P. Inman (eds), *The Economics of Public Services*, Davidson, J. E. H., Hendry, D. F., Macmillan, pp.174-205.

Feldstein, M. S. (1980), “International Differences in Social Security and Saving,” *Journal of Public Economics*, 82, 905-26.

Friedman, M. (1957), *A Theory of the Consumption Function*, Princeton, Princeton University Press.

Goldfrey, L. G. (1978), “Testing for Parameter Instability in Linear Models”, *Journal of Policy Modeling*, 14, 517-533.

Hall, R. E. (1978), “Stochastic Implications of the Life-Cycle-Permanent Income Hypothesis: Theory and Evidence”, *Journal of Political Economy*, Vol: 96, pp.971-87.

Hannan, E. J. and Quinn, B. G. (1979), “The Determination of the Order of an Autoregression”, *Journal of the Royal Statistical Society*, B, 41, 190-195.

Hansen, B. E. (1992), “Testing for Parameter Instability in Linear Models”, *Journal of Policy Modeling*, 14, 517-533.

Hayashi, F. (1982), “The Permanent Income Hypothesis: Estimation and Testing by Instrumental Variables,” *Journal of Political Economy*, 90, 895-916.

Heien, D. (1972), “Demographic Effects of the Multiperiod Consumption Function”, *Journal of Political Economy*, 80, 125-38.

Hendry, D. F. (1983), “Econometric Modelling: The Consumption Function in Retrospect”, *Scottish Journal of Political Economy*, 30, 193-220.

Hendry, D. F. (1992), "Assessing Empirical Evidence in Macroeconometrics with an Application to Consumers' Expenditure in France", in *Macroeconomics: A Survey of Research Strategies* by A. Vercelli and N. Dimitri, Oxford, Oxford University Press.

Hendry, D. F. (1994), "HUS Revisited", *Oxford Review of Economic Policy*, 10, 86-106.

Hendry, D. F. (1995), *Dynamic Econometrics*, Oxford University Press.

Hendry D. F. and Mizon, G. E. (1978), "Serial Correlation as a Convenient Simplification, Not a Nuisance: A Comment on a Study of the Demand for Money by the Bank of England", *Economic Journal*, 88, 549-63.

Hendry, D. F., and Ungern-Sternberg T.V.(1981), "Liquidity and Inflation Effects on Consumer's Expenditure," in A. S. Deaton, *Essays in Theory and Measurement of Consumers' Behaviour*, pp. 237-260, Cambridge: Cambridge University Press.

Hendry D. F. and Doornik, J. A. (1996), *Empirical Econometric Modelling using PcGive for Windows*. London: Timberlake Consultants Press.

Hendry D. F. and Richard J. F. (1982), "On the Formulation of Empirical Models in Dynamic Econometrics", *Journal of Econometrics*, 20, 3-33.

Hendry, D. F. and Pagan A. R. and Sargan J. D. (1984), "Dynamic Specification", Chapter 18 in Z. Griliches and M.D. Intriligator (eds.) *Handbook of Econometrics*: North Holland, Volume 2, pp. 1023-1100.

Hendry, D. F., Muellbauer, J. N. J. and Murphy, T. A. (1990), "The Econometrics of DHSY", in Hey, J. D. and Winch, D. (eds.), *A Century of Econometrics*, pp. 298-334. Oxford: Basil Blackwell.

Hoover, K. D., and Perez, S. J. (1999), "Data Mining Reconsidered: Encompassing and the General-to-Specific Approach to Specification Search", *Econometric Journal*, 2, 167-191.

Keynes, J. M. (1936), *The General Theory of Employment, Interest and Money*, London: Macmillan.

King, M. A. (1990), Discussion of Muellbauer and Murphy (1990). *Economic Policy*, 11, 383-7.

Lattimore, R. (1994), "Australian Consumption and Saving", *Oxford Review of Economic Policy*, 10, 54-70.

Lieberman, C. and Wachtel, P. (1980), "Age Structure and Personal Saving Behaviour" in George von Furstenberg, ed., *Social Security versus Private Saving*, Cambridge, MA: Ballinger, pp: 315-57.

Miles, D. (1994), *Housing, Financial Markets and the Wider Economy*, John Wiley & Sons.

Mizon, G. E. and Richard J. F. (1986), "The Encompassing Principle and its Application to Non-nested hypothesis Tests", *Econometrica*, 54, 657-78.

Modigliani, F. (1947), "Fluctuations in the Saving-Income Ratio: A Problem in Economic Forecasting" *Social Research*, 14, 413-420.

Modigliani, F. (1949), "The Life Cycle Hypothesis of Saving Twenty Years Later" in M. Parkin and A. R. Nobay (eds.) *Contemporary Issues in Economics*, Manchester University Press.

Modigliani, F. (1975), "The Life-Cycle Hypothesis of Saving Twenty Years Later," pp.2-36 in M. J. Parkin and A. R. Nobay (ed.) *Contemporary Issues in Economics: Proceedings of the AUTE Conference, 1973*, Manchester: Manchester University Press.

Modigliani, F. (1988), "The Role of Intergenerational Transfers and Life-cycle Saving in the Accumulation of Wealth," *Journal of Economic Perspectives*, 2, 15-40.

Modigliani, F. (1990), "Recent Declines in the Savings Rate: A Life-cycle Perspective," *Frisch Lecture, Sixth World Congress of the Econometric Society*, Barcelona (August).

Modigliani, F., and Ando, A., (1957), "Tests of the Life-Cycle Hypothesis of Savings", *Bulletin of the Oxford Institute of Economics and Statistics*, 19, 99-124.

Modigliani, F., and Brumberg R. (1954), "Utility Analysis and the Consumption Function: An Interpretation of the Cross-section Data," *Post-Keynesian Economics*, Ne Brunswick, NJ, Rutgers University Press.

Modigliani, F., and Brumberg R. (1979), "Utility Analysis and the Consumption Function: An Attempt at Integration," in Andrew Abel (ed.), *The Collected Papers of Franco Modigliani*, Volume 2, Cambridge, Mass. MIT Press, pp.128-97.

Muellbauer, J. (1994), "The Assessment: Consumer Expenditure", *Oxford Review of Economic Policy*, Vol: 10, 1-39.

Muellbauer, J. and Murphy A. (1993a), "Income Expectations, Wealth and Demography in the Aggregate US Consumption Function", *Unpublished Paper Presented to the H.M. Treasury Academic Panel*, Nuffield College, Oxford University, Oxford.

Muellbauer, J. and Murphy A. (1993b), "Income Expectations, Wealth and Demography in the Aggregate UK Consumption Function", *Unpublished Paper Presented to the H.M. Treasury Academic Panel*, Nuffield College, Oxford University, Oxford.

Muellbauer, J. and Murphy, A. (1990), "Is the UK Balance of Payments Sustainable?", *Economic Policy*, 11, 345-83.

Muellbauer J. and Murphy A. (1994), "Explaining Regional Consumption in the UK", mimeo, Nuffield College, Oxford.

Murata, K. (1994), "The Consumption Function in Japan", *Oxford M. Phil Thesis*.

Nowak, E. (1991), "Hidden Cointegration", *Discussion Paper*, University of California at San Diego.

Pagano, A. (1990), Discussion of Muellbauer and Murphy (1990). *Economic Policy*, 11, 383-90.

Phillips, P. C. B. (1986), "Understanding Spurious Regressions in Econometrics", *Journal of Econometrics*, 33, 311-340.

Ramsey, J. B. (1969), "Tests for Specification Errors in Classical Linear Least Squares Regression Analysis", *Journal of the Royal Statistical Society*, B, 31, 350-371.

Rittenberg, L. (1988), "Financial Liberalisation and Savings in Turkey", in Nas T. F. and M. Odekon, *Liberalisation and the Turkish Economy*. Greenwood Press: New York.

Sargan, J. D. (1980), "The Consumer Price Equation in the Post-War British Economy: An Exercise in Equation Specification Testing", *Review of Economic Studies*, 47, 113-135.

Sefton, J. A. and Weale M. R. (1995), *Balanced Estimates of National Accounts for the United Kingdom, 1920-1990*, Cambridge: Cambridge University Press.

Spiro, A. (1962), "Wealth and the Consumption Function", *Journal of Political Economy*, 70, 339-354.

Stone, R. (1964), "Private Saving in Britain: Past, Present and Future," *Manchester School of Economic and Social Studies*, 32, 79-112.

Stone, R. (1966), "Spending and Saving in Relation to Income and Wealth", *L'industria*, 4, 471-99.

Schwartz, G. (1978), "Estimation the Dimension of a model", *Annals of Statistics*, 6, 461-464.

Uygur, E. (1987), SESRTCIC Econometric Model of Turkey, Ankara: SESRTCIC.

Uygur, E. (1991), "Policy, Productivity, Growth and Employment in Turkey 1960-1989 and Prospects for the 1990s", MIES on International Migration and Employment, ILO Special Topic MIES 90/4, Geneva.

Uygur, E. (1993), Financial Liberalisation and Economic Performance in Turkey, The Central Bank of the Republic of Turkey, Ankara.

Wijnbergen, S., Anand, R., Chhibber A. and R. Roberto (1992), External Debt, Fiscal Policy, and Sustainable Growth in Turkey, The Johns Hopkins University Press, Baltimore and London.

White, H. (1980), "A Heterocedastic-consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity", *Econometrica*, 48, 817-838.