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ESTIMATING THE EFFECTS OF WEALTH, INTEREST RATES AND UNEMPLOYMENT ON PRIVATE CONSUMPTION IN SWEDEN

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by

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Abstract

An aggregated consumption function based on the life cycle hypothesis using the error correction methodology is estimated for Sweden. Wealth in its dis-aggregated form is incorporated in the consumption function, along with basic standard explanatory variables including the unemployment variable. Applying Hendry's *general to specific modelling* strategy one final model is deduced. The tests of integration and co-integration indicate that the variables are both integrated and co-integrated. A spectrum of tests is applied to the final model. The final model captures the development of consumption well, without making use of neither a tax reform dummy, or a household debt variable. The tests of model adequacy indicate that the consumption function is stable and robust. The function is evaluated both from the forecasting and the theoretical point of view, and satisfies the unit elasticity assumption. Comparative statics and dynamic simulations are carried out in order to illustrate the steady state properties of the consumption function. Models without the wealth variable did not take on an error correction interpretation. Thus wealth seems to be an important variable in the aggregate consumption function, and only when it is disaggregated.

Keywords:

consumption, income, wealth, integration, co-integration, balanced, unit root, error - correction, equilibrium, elasticities, dis-equilibrium, dynamics, steady state.

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1. Introduction

Consumption is seen as the ultimate objective of the economic system, because of its close connection with economic welfare. Aggregate private consumption accounts for a large share of GDP (54% in Sweden), and thus the fluctuations in consumption behaviour have crucial consequences for output, employment, and the business cycle. The relationship between consumption and income has played a dominating role since Keynes wrote his General Theory in 1936. A further reason for studying consumption is that 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, cf. Deaton [1992].

Two papers that have generated much empirical research on the aggregate consumption function, one of which is Hall [1978]. This paper discusses stochastic implications of forward looking behaviour. It is one in a series of works on consumption that may be said to have started with Modligliani and Brumberg [1954], and Friedman [1957]. At almost the same time, Davidson, Hendry, Srba and Yeo [1978] (DHYS), developed an econometric model of consumer expenditure, in the U.K. built on the Error Correction Mechanism [ECM]. "The economic interpretation of the ECM is that at each point of time the economic agent observes his position relative to the long-run equilibrium and adjusts his or her consumption accordingly, increasing consumption if it is below equilibrium and decreasing consumption if it is above equilibrium" [see Favero [1993]. It was in fact Phelps [1954, 1957] who first introduced the terminology of ECM into economics. The idea was embodied in his analysis of feedback control for stabilisation policy. This study was followed by Sargan [1964] which was basically a study in econometric methodology dealing with various methods of estimating structural equations with auto-correlated errors. Nickell [1985] showed that ECM's can be derived from the optimal behaviour of economic agents, faced with a quadratic loss functions.

In the field of model specification, Hendry developed the top down or general to specific approach: It implies that one starts with a general dynamic model, which may be over parametrized. The model is then simplified using statistical tests, while ensuring that the long run steady state properties of the model are reasonable. Hendry's *general to specific methodology* is applied in this study following *'the three golden rules of econometrics: test, test and test'*.

In the Scandinavian context studies with ECM methodology are the Norwegian study of Brodin and Nymoen [1989], where they estimate a vector autoregressive system (VAR), Magnussen and Skjerpen [1992], presenting a model for demand for durables and non-durables, and Skjerpen and Swensen [1992], where a linear expenditure system is modelled. In Finland, Lehmussari [1990], studies the savings dynamics in the Nordic countries using annual data, and Koskela and Viren [1987], study the international differences in saving rates between countries, applying the life cycle hypothesis.

Earlier Swedish empirical studies have been based both on the permanent income and the life cycle hypothesis. Matthiessen [1972] estimated a consumption function based on Friedman's theory using yearly data for the period 1950 - 1969. This study was followed by Ettlin [1976] and Lybeck [1976], which were based on a modification of the life cycle hypothesis, and by Palmer and Markowski [1977] in Friedman's tradition.

In the Swedish context, consumption studies with ECM methodology are Berg [1989], Berg and Bergström (B&B) [1991] and B&B [1993][1], and Nordblom [1993], Kanis and Barot [1993], and finally Markowski [1994]. Kanis & Barot's study presents both a quarterly and a semi-annual consumption function, used before at the National Institute of Economic Research (NIER). All these functions are models in annual change.

In contrast to B&B [1991], and [1993], this study is based on a consecutive semi-annual difference model, and it contains the interest rate, whereas B&B encounter no significant interest rate effects on quarterly total consumption expenditures. B&B [1993] conclude that the change in household debt is an important determinant of short - run consumer behaviour indicating that households have been credit - constrained. This variable is supposed to capture the effects of the two crucial variables: the financial de-regulation and the 1990 - 1991 tax reform.

These factors were not considered in Kanis and Barot [1993]. This study takes into consideration the employment rate (E), or implicitly the unemployment rate (1-E), as an additional explanatory variable to explain consumption / savings decisions of households. Furthermore, while the above mentioned studies often present the results of various diagnostic or specification tests, none provides a really

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[1] B&B henceforth Berg & Bergström

systematic application of diagnostic testing.

Previous empirical studies on Swedish data have indicated that the relationship between consumption and disposable income is stable. Does this empirical finding hold for the last decade? The deregulation of financial markets in 1985 perhaps facilitated a debt - financed increase in buying. In addition, as a result of capital gains both on real and financial assets, the consumption demand for goods might have been stimulated. This structural shift can have affected the ratio between consumption and savings. Lastly, this study aims at contributing to the development of the consumption function in KOSMOS, a semi-annual (Keynesian) model, developed at NIER.

The direction of the development of the consumption function modelling is to incorporate the wealth variable, linking the real and financial blocks of the economy. In an even longer perspective the aim is to disaggregate financial wealth, and analyse the effect of household portfolios on the consumption/saving ratio.

In order to facilitate comparisons with B&B, four models are estimated.

(1) A model without a wealth variable (*no - wealth model*).

(2) One with wealth split into net financial wealth and real assets, with restrictions on the long-run coefficient (*the restricted wealth model*), and one without restrictions (*the unrestricted wealth model*).

(3) A model with *total wealth*, i.e. an aggregation of financial and real assets.

All four aggregated consumption functions are estimated in ECM form. Another related empirical issue examined is which interest rate to apply, the short term, three months treasury discount notes or the long run government bond rate. The above mentioned specifications are evaluated both from the theoretical and the forecasting point of view, as the ultimate goal of empirical testing in econometrics is to determine how well a theoretical model corresponds to the reality of an economic situation. Several forecasting statistics are used to evaluate the predictive accuracy of the empirical model. The forecasting performance is also compared using the *no - wealth model* and a *naïve model*. In addition, an out of sample forecast is carried out for the period 1990 - 1993. The final econometric model is diagnostically checked by the Breusch - Godfrey Lagrange Multiplier test, White test for absence of residual heteroscedasticity and recursive estimates for stability.

The Akaike and the Bayesian information criteria are applied in the model selection procedure. Simulations are carried out in order to check for the dynamic multipliers and dynamic responses of a change in the basic exogenous variables in the aggregated consumption function. Lastly we check a hypothesis of unchanged structure 1986 - 1993 compared with 1970 - 1985 using the Chow test.

Section 2 deals with economic theory and model derivation. Section 2.1 is on ECM estimation methods, followed by Section 2.2 on the ECM approach. In Section 3 the explanatory variables are discussed and motivated. Section four presents the concepts of integration and co-integration as a part of the ECM methodology. Section 5 discusses the methodological considerations of *general to specific* modelling. In Section 6 the forecasting performances of our econometric models are evaluated. Section 6.1 contains the results, stating the general fit, and the correctness of the signs of the coefficient of selected variables. In Section 6.2 the tests of model adequacy are carried out, where the stability of the equilibrium elasticities, based on recursive estimates, are depicted in Exhibits 10 - 11. This is followed by a Lagrange multiplier test of misspecification and a test for exogeneity. Subsequently, we analyze the role of the wealth variable. The results are compared with B&B [1993]. In Section 7 comparative statics, dynamic simulations, and the steady state properties of the model are presented. Finally, Section 8 concludes with the main results and contributions of this study in the light of earlier studies.

This is followed by a section on notes. Appendix 1 contains a detailed description and sources of the consumption data set. In Appendix 2 the simulation results where for each simulation the transitory aspects are illustrated, (Exhibits 16 to 23). Appendix 3 contains plots of the data set (Exhibits 24 to 31), and a list of variables of the consumption data set are given.

2. The steady state wealth model and the life cycle theory[2]

In a model with *aggregate wealth,* the relationship is now commonly expressed in constant elasticity form, disregarding stochastic terms:

$$C_t = A \cdot Y_t^{\alpha} \cdot W_t^{\beta} \; ; \quad 0 < \alpha, \; \beta < 1, \qquad [1]$$

where

C_t denotes private consumption

Y_t denotes real disposable income

W_t denotes household net wealth at the beginning of the period.

A is a constant scale term and t is the time index.

The homogeneity constraint for [1] is

$$\alpha + \beta = 1, \qquad [2]$$

and is imposed to ensure that C_t is homogenous of degree one in (Y_t, W_t), i.e. an equal proportional change in both Y_t and W_t should lead to the same proportional change in C_t, in the long run. In addition it is postulated that while both income and wealth effects are positive, the income effect is the dominant one.[3]

The homogeneity constraint can be tested. If the respective elasticities sum to unity, introducing savings (S), the consumption and total saving ratios are, using [1]:

$$1 - \frac{S_t}{Y_t} = \frac{C_t}{Y_t} = A\left(\frac{W_t}{Y_t}\right)^{\beta} \qquad [1']$$

The test involves introducing Y_t as an additional term in the dynamic counterpart to [1'] and testing whether its elasticity is zero. If this is the case then in the hypothetical steady state, income, consumption, savings and wealth would grow at

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[2] See note.

[3] See Molana [1987]

the same rate. It must be pointed out that the elasticities with respect to the different components of wealth would not be equal in [1'] as they are weighted by their shares in total wealth. Below, total wealth, (W) is essentially a geometric weighted average of net financial wealth and housing wealth, implying a unit elasticity of substitution.[4]

Introducing a model with *disaggregated* wealth, i.e. total wealth decomposed into household net financial wealth (WF) and real assets (AH), we have an analogous relationship:

$$C_t = A \cdot Y_t^{\alpha} \cdot WF_t^{\beta_1} \cdot AH_t^{\beta_2}, \text{ where } W = WF + AH. \qquad [3]$$

The homogeneity constraint for [3] would be $\alpha + \beta_1 + \beta_2 = 1$. Introducing savings again, as a consequence of the homogeneity constraint, the consumption and saving ratios are

$$1 - \frac{S_t}{Y_t} = \frac{C_t}{Y_t} = A\left(\frac{WF_t}{Y_t}\right)^{\beta_1}\left(\frac{AH_t}{Y_t}\right)^{\beta_2} \qquad [3']$$

The homogeneity test is now analogous to [1'].

A further disaggregation of real assets (AH) into real house prices (PH/P), where H is the housing stock, and P is the consumption deflator can be expressed as

$$C_t = A \cdot Y_t^{\alpha} \cdot WF_t^{\beta_1} \cdot H_t^{\beta_{21}} \cdot \left(\frac{PH_t}{P_t}\right)^{\beta_{22}} \qquad [4]$$

The homogeneity constraint for [4] would be $\alpha + \beta_1 + \beta_{21} = 1$. The homogeneity constraint can again be tested as in [1].

Analogously the consumption and saving ratios are:

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[4] Barnett, Fisher & Serletis [1992].

$$1 - \frac{S_t}{Y_t} = \frac{C_t}{Y_t} = A\left(\frac{WF_t}{Y_t}\right)^{\beta_1}\left(\frac{H_t}{Y_t}\right)^{\beta_{21}}\left(\frac{PH_t}{P_t}\right)^{\beta_{22}} \qquad [4']$$

(Note that AH = H * PH/P, and dividing through by Y implies that one merely divides H by Y to keep it neat). The homogeneity test analogously involves introducing Y as an additional term in [4'] and checking whether its elasticity is zero. In case $\beta_{21} = \beta_{22} = \beta_2$, the implication is that [4] is equal to [3].

The steady state constancy in all ratios requires compositional constancy in wealth and a constant wealth / income ratio. Real assets / income or (housing assets / income) are constant for constant real home prices, which may be regarded as proportional to a Tobin's Q of unity (the consumption and housing investments deflators move in close step over long periods). A third way of writing [4] is obtained by replacing real housing prices by real assets using the identity AH = H * PH/P:

$$C_t = A \cdot Y_t^{\alpha} \cdot WF_t^{\beta_1} \cdot H_t^{(\beta_{21}-\beta_{22})} \cdot AH_t^{\beta_{22}} \qquad [5]$$

The homogeneity constraint is identical to case [4], which can be tested in [5'] below, by introducing Y_t as an additional term in [5'] and checking whether its elasticity is zero:

$$1 - \frac{S_t}{Y_t} = \frac{C_t}{Y_t} = A\left(\frac{WF_t}{Y_t}\right)^{\beta_1}\left(\frac{H_t}{Y_t}\right)^{(\beta_{21}-\beta_{22})}\left(\frac{AH_t}{Y_t}\right)^{\beta_{22}} \qquad [5']$$

A fourth nested equivalent form to [4] and [5], using the same identity, is:

$$C_t = A \cdot Y_t^{\alpha} \cdot WF_t^{\beta_1} \cdot (AH_t)^{\beta_{21}} \cdot \left(\frac{PH_t}{P_t}\right)^{(\beta_{22}-\beta_{21})} \qquad [6]$$

The homogeneity condition is now again the same as before, as is the test. Analogously the consumption and saving ratios are:

$$1 - \frac{S_t}{Y_t} = \frac{C_t}{Y_t} = A\left(\frac{WF_t}{Y_t}\right)^{\beta_1}\left(\frac{AH_t}{Y_t}\right)^{\beta_{21}}\left(\frac{PH_t}{P_t}\right)^{(\beta_{22}-\beta_{21})} \qquad [6']$$

Equation [4], [5] and [6] are in fact the long term relations within the ECM term of the dynamic nested models.

In the case $\beta_{21} = \beta_{22}$ we have B&Bs' model. For $\beta_{21} \neq \beta_{22}$, the implication is that the housing stock influences consumption not only via housing assets but also directly. The justification for specifications [4], [5] and [6] is that one should not expect a priori the elasticities for the components to be identical as there exists a possibility that they can differ. The argument is based on Tobin's Q of investment. Q is an indicator for a shortage of houses, i.e. the profitability of producing a new flat (home). Tobin's Q is a measure of the ratio of the price of old flats and the cost of producing an equivalent new flat. In the short run, in times of shortage, Q > 1, and it is profitable to build new houses since the old ones are more expensive, while Q < 1 implies that old is cheaper than new and thus it is not profitable to build. With Q = 1, in the long run, the market would clear and the housing assets, deflated by production prices, would be the stock. Assuming that the consumer deflator and house prices tend to move together over long periods thus has the implication that the long run ratio of house prices (i.e. the deflator of housing investment in small homes) to the consumer deflator would be proportional to Tobin's Q. The transitory character of relative prices in the short run, departing from the long term constancy, suggests that the volume and price components have different implications for real assets and by that for consumption plans of households. Nevertheless, it may also be the case that the extra housing stock effect could just be a proxy for some omitted wealth variable, e.g. social security or net government debt, cf. Kanis & Barot [1993].

An alternative functional form, commonly used by modellers in Bank of England and B&B is

$$C_t = f(W_t, ...)(1+\epsilon_t). \qquad [7]$$

where ϵ_t is a stochastic error term. For small ϵ_t

$$\ln C_t = \ln f(W_t, ...) + \epsilon_t. \qquad [8]$$

Inclusion of a stochastic error term in a stylized model of Muellbauer & Lattimore [1994] yields the functional form

$$C_t = (\alpha W_{t-1} + \beta Y_t)(1+\epsilon_t). \qquad [9]$$

In logarithmic form [9] is approximated as

$$\ln C_t = \beta_1 \ln W_{t-1} + \beta_2 \ln Y + \epsilon_t, \qquad [10]$$

where the homogeneity condition is $\beta_1 + \beta_2 = 1$. This is an aggregated form of [4] [5] and [6] and compatible with the life cycle hypothesis, with wealth aggregated. The long run justification is that in the steady state, according to the life cycle hypothesis, consumption, income, and wealth would grow at the same rate.

2.1 Estimation methods

The most widely used test and modelling of co-integration is the Engle-Granger (E-G) [1987] two-stage procedure. In the first stage, an OLS regression is run on the levels of the variables believed to comprise a co-integrating vector and in the second stage the short-run dynamics are modelled, given the long run relationship obtained from the first stage. In the first stage it is important to establish that a co-integrating combination has been found. The usual procedure is to check this with an Augmented Dickey-Fuller (ADF) test or some variant thereof. Although extensively used, E-G has been criticized for potential biases and inefficiencies in the first-stage regression, due to simultaneity and autocorrelation (see Banerjee et al, 1986). Wickens and Breusch [1988] argue that more efficient estimates are obtained when estimating both the long-run and short-run parameters simultaneously. They show that the misspecification of the short -run dynamics does not have much of an effect on the estimator of the long run parameters. In this study the *general to specific* approach has been applied where both the long-run and short-run parameters are estimated simultaneously, and thus avoiding the above mentioned problems.

2.2 The error-correction method

As a result of the path breaking work of DHSY, the ECM has become widely used to model consumption in UK and elsewhere. A model specifications is said to be balanced when the left-hand and the right-hand side variables are of the same order of integration and the residuals are stationary, cf. Favero [1993]. Error-correction terms were used by Sargan, Hendry and Andersson [1977], and Davidson et al. as a way of capturing adjustments in a dependent variable which depended not on the level of some explanatory variable, but on the extent to which an explanatory variable deviated from an equilibrium relationship with the dependent variable.

Hendry emphasised the importance of *general to specific modelling,* see Mizon [1977], and in this context the ECM can be interpreted as a re-parameterisation of the general 'auto-regressive distributed lag' (ADL) or 'dynamic linear regression' (DLR) models. For a single-equation model with two variables c_t and y_t and one lag, the EC representation is:

$$\Delta c_t = \beta_0 + \beta_1 \Delta y_t + (1 - \beta_3)(c - By)_{t-1} + \epsilon_t \quad \epsilon_t \sim N(0, \sigma^2) \qquad [11]$$

where ϵ_t is independent and identically distributed variable.

It is a common practice that c and y are in logs of the underlying economic series, C and Y. The rate of growth of C_t depends not only on that of Y_t (short run impact), but also on the past disequilibrium $(c - By)_{t-1}$. If the long-run equilibrium is static ($\Delta c = \Delta y = 0$), then [11] implies $C = K * Y^B$, where $\ln K = (\beta_0 / (1 - \beta_3)$, which simplifies to proportionality for $B = 1$.

For steady-state growth with $\Delta c = \Delta y = \tau$, [11] implies $C = K'Y^B$, where $\ln K' = [(\beta_0 + (\beta_1 - 1)\tau]/(1-\beta_3)$. The economic justification of a model like [11] follows because many economic theories suggest long-run proportionality, e.g., the permanent income hypothesis and the quantity theory of money. In addition, [11] can be derived from a certain kind of optimizing behaviour, with agents responding to their past dis-equilibrium. For instance, growth in C_t will be greater than β_1 times the growth in Y_t if C_{t-1} was less than its long-run desired value. For a comparison with other dynamic specifications, see Hendry, Pagan, and Sargan [1984].

In the *general to specific* modelling, equation [11] is equivalent to the unrestricted dynamic regression of c on y:

$$c_t = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 c_{t-1} + \epsilon_t \qquad [12]$$

where $B = (\beta_1 + \beta_2) / (1 - \beta_3)$. If Y and C are proportional in the long run, then $B = 1$ or equivalently, $\beta_1 + \beta_2 + \beta_3 = 1$.

Many economic theories have proportional forms in static equilibrium. Hence ECM can be expected to occur frequently. In addition, as we do not have forward looking data which would imply introducing expectations into the ECM, and hence in this study ECM is backward looking. The ECM models seem appropriate as the dynamics of both short-run (changes) and long-run (levels) adjustment processes, are modelled simultaneously. The dynamic model, suggested by HUS [1981] and von Ungern-Sternberg [1981] which was a further development upon work of DHSY, takes the following form:

$$\Delta \ln C_t = \beta_0 + \beta_1 \ln \Delta Y^*_t + \beta_2 \ln (C / Y^*)_{t-1} + \beta_3 \ln (L / Y^*)_{t-1} + \epsilon_t \qquad [13]$$

where L_t denotes the end period stock of net liquid assets of the personal sector and Y^*_t is the log of disposable income adjusted for inflation losses on net liquid assets.

"The economic interpretation of the ECM is that at each point of time the economic agents observe their position relative to the long-run equilibrium and adjust their consumption accordingly, increasing consumption if it's below equilibrium and decreasing if it's above equilibrium", cf. [Favero 1993]. However it must be pointed out that in the ECM, consumers are allowed to make mistakes in the short- run which will be corrected in the long-run. An important feature of this model is that it takes time to reach the desired level of stocks of a particular good. The reason for this adjustment process is transaction costs which can be a consequence of eg. lack of information, or financial problems. Theses are merely two interpretations of an ECM model. For alternative interpretations of ECM, see Campbell and Mankiw [1989], Jappelli-Pagano [1989] and finally Alogoskoufis [1991].

3. Explanatory variables

3.1 Disposable income

Aggregate disposable income is considered to be one of the most important factors that determine the consumption and saving decisions of household. A typical household will receive income from a variety of sources and depending upon a variety of factors. This 'measured income' may typically include a large component of labour income (73.9% of disposable income in 1993), that depends upon wage rates, salary scales, the amount of overtime, and transfers, various taxes, social security and pension contributions that are deducted at source. Secondly, measured income may include sums accruing from the ownership of various forms of wealth especially net interest payments (-2.5% of disposable income). Finally, measured income of a typical household may, in any period, include a variety of transitory components of the 'windfall' variety - e.g. unexpected gifts, gambling winnings, or tax repayments. In this study a households' total demand, real income, i.e. effective purchasing power, becomes one of the main determinants, with relative prices determining the composition, rather than the total. A change in the relative price of one good may change the household's total demand, but this effect arises because the price change results in a new real income - the household's money income can buy more of all goods if the price of one good falls. Current income is therefore the main determinants of a household's private consumption. The a priori sign is positive.

3.2 Inflation

There are several reasons for including the price variable: According to, cf. Deaton [1977] and the misperception hypothesis, economic agents do not have sufficient information to distinguish between relative and general, price movements, when both are changing simultaneously. Under these circumstances unanticipated inflation is misinterpreted as a rise in the relative prices of goods, agents are currently buying, so the real saving may increase. However, the main reason and motivation is to capture the effect of income uncertainty, as a household's recorded, *real* income would deviate from what is anticipated. An 'anomaly' in many empirical estimates of the time series consumption function is that, although inflation is not an argument of the theoretical consumption function, it is statistically significant when added to the empirical function. Three explanations have been offered for this phenomenon by Bachelor and Dua [1992]:

(1) that it reflects the confusion between relative and general price movements,

(2) it is proxying for the effect of inflation uncertainty, cf. Blinder & Deaton [1985] and

(3) that it is proxying for inflation-induced losses on assets which are not appropriately incorporated in national income measures, cf. HUS [1981].

3.3 The real after tax interest rate

The real rate of interest is a potentially important explanatory variable, affecting both long and short run variations in consumption and saving. The effect of an increase in the interest rate can be divided into a substitution and an income effect. 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 positive or negative, depending on which effect dominates. Palmer [1981] was the first to examine an after-tax real interest rate using Swedish data.

3.4 Wealth

In addition to depending on income, consumption is assumed to depend on the real value of the stock of assets held in the economy. The greater is the stock of wealth, the higher is consumption, cf. Laidler [1972]. Wealth was in fact mentioned as a possible determinant of consumption in the original Keynesian specification, and since 1973 the inclusion of wealth has been associated with the quantity theory of money. In the contemporary discussion, the estimation of the effect of liquid assets, rather than that of total wealth has become popular for two reasons:

(a) it is argued that, it can be more reliably measured than total wealth, and

(b) liquid assets are a more relevant element of wealth, cf. Wallis [1973].

Studies by Zellner, Huang and Chau [1965] had included a real balance effect in the consumption function. Any imbalance in the consumer's liquid assets position is postulated to affect the consumers behaviour. The interpretation is that if liquid assets are sufficient with respect to some desired position, consumption plans will be carried out, but if they are insufficient, expenditures will be reduced. For a recent study on the real balance effect, see Markowski [1994].

Pesaran and Evans [1984] and Patterson [1984], make a distinction between liquid and illiquid assets. In the contemporary discussion there has been emphasis on the role of housing wealth. However these studies leave some doubt about whether each of the primary components of wealth has an equal role. The wealth variable in this study is split into financial wealth (WF) and real assets (AH). The real assets are further disaggregated into the housing stock component (H) and the house price component (PH/P). Total wealth is the sum of the subaggregates; financial wealth and real wealth.

3.5 House prices

The reason for including house prices is that they have a vital impact on the wealth holdings of individuals, the composition of their portfolios and the interpersonal distribution of wealth (i.e. the redistribution of wealth, eg. between young and old households). In addition the changes in house prices result into short-term fluctuations in real assets as capital gains or losses. According to Muellbauer and Lattimore [1994], the real price of owner-occupied houses have two effects on non- housing consumption: a positive wealth effect for owner-occupiers and a negative income / substitution effect for everyone whose price of housing services is affected by the market price of owner occupied housing. This in turn implies two different types of saving and spending behaviour among consumers. In recent international studies on consumption there has been emphasis on different effects of housing wealth and house price increases. In addition, house prices reflect income expectations based on the fact that the value of a house is a discounted present value of future housing services. For the importance of dynamics of house prices, see Englund [1994], and on the crisis in the Swedish housing market see Jaffee [1994].

3.6 Value added tax

There are two value added tax variables, DVATX, and EDVATX. The dummy EDVATX captures the hoarding effect, i.e. with the announcement of an increase in the value added tax, it's assumed that consumption increases. The dummy DVATX captures any residual response in the period of actual VAT- change, see Kanis & Barot [1993].

3.7 Other Dummies

To account for the semiannual seasonal effects to sum to zero over the year, the dummy DS is (1 and -1) in the first and second half - years, respectively. In order to account for differences in seasonal pattern before and after 1980 (spliced periods originally with different base years), each seasonal dummy is multiplied by the period dummy. In order to capture the effects of deregulation of the financial markets 1986, DREG has been used. It is 0 prior to de-regulation and 1 in the period after.

3.8 Unemployment

The reason for including unemployment in the consumption function, besides the effect of unemployment via the income-expenditure mechanism, is to measure uncertainty, see Markowski and Palmer [1977]. An increase in the unemployment rate can cause consumers to become generally pessimistic and, hence, as the argument goes, they consume less and save more out of given disposable resources. The expected sign is negative. The issue worth discussing here is if it's the change, and not the level of unemployment rate that matters, or may be both. In case it's only the change, it's likely to be a good proxy for uncertainty about labour income, while the level will be correlated with early retirement, and thus with the shifts in the distribution of consumption between the retired and pre-retirement population of households. According to Muellbauer and Lattimore [1994], this is bound to make unique interpretation difficult. The estimates in this study indicate that only the level matters.

The interpretation of the employment rate as a proxy for uncertainty can be summarized as the net constellation of many influences:

(1) A minority of relatively newly unemployed may try to save more but may be attached to previous consumption habits or expect re-employment soon. Their savings presumably fall with income, but their incomes are highly insulated by generous unemployment insurance,

(2) A minority of persons in programs have generally been unemployed a longer time in open unemployment in order to qualify for programme, and face termination of unemployment insurance. Some risk occupational extinction, i.e. no reemployment. Such persons have had time to adjust wage and employment expectations, and this would lead to a fall in consumption, and

(3) A majority of persons in households of those remaining in regular employment, or retired, will not be affected. Nevertheless they may fear the 'expected future' believing:

(a) Unemployment will spread to them,

(b) Lower wage increases, less overtime and thus lower employment income, and

(c) Fiscal reforms associated with budget deficits eg. higher payroll or income taxes, lower pension entitlements, and eventually lower unemployment benefits.

The influence of all these factors no doubt depends on the relative size of unemployment.

There are other important and relevant explanatory variables, for example demographic variables as life expectancy, retirement age, age distribution, family size, female participation rate, public pension schemes and financial intermediation and capital markets, and public debt, see OECD [1983]. However this particular study is limited in its scope to the above mentioned factors.

3.9 The data set

In contrast to B&B who use a quarterly data set for the period 1970 - 1992, which extends the number of observations, my study uses semi-annual data for the sample period 1970 - 1993. Among the advantages of working with semi-annual data is that they have smaller measurement errors. Secondly, one would expect lower seasonal variations in semiannual data compared to quarterly data, and finally the data base of Kosmos is built on semi-annual data. For a detailed description and sources of the data set, see Appendix 1.

4. Testing for integration and co-integration

As a preliminary step to co-integration analysis, the order of integration of the consumption data set is to be tested. Several procedures are available (see Dolado et al., [1990], for a survey); in the present analysis, the ADF test is employed. Co-integration analysis has been carried out using the (E-G) procedure.

4.1 Integration

A direct way of testing for integration is running the autoregressive equation:

$$x_t = x_{t-1} + \epsilon_t. \qquad (4.1)$$

where ϵ_t represents a series of independent and identically distributed variables with zero means.

A direct procedure would be a test for $\alpha = 1$ in the autoregressive equation

$$x_t = \alpha\, x_{t-1} + \epsilon_t, \qquad (4.2)$$

The DF test is a test of the hypothesis that $\alpha = 1$ in (4.2), is called a unit root test. An equivalent regression to (4.2) by subtracting x_{t-1} from each side is

$$\Delta\, x_t = \beta\, x_{t-1} + \epsilon_t\ ; \qquad (4.3)$$

where $\Delta x_t = x_t - x_{t-1}$, rewritten as

$$x_t = (1 + \beta)\, x_{t-1} + \epsilon_t$$

The null and the alternative hypothesis are:

$$H_0 : \beta = 0 \quad (x_t \text{ nonstationary})$$

$$H_A : \beta < 0 \quad (x_t \text{ stationary})$$

Acceptance of the null hypothesis implies that the series is integrated of order one. As Exhibit 1 indicates, the null hypothesis is accepted for all the variables in the data set. The ADF test is carried out with a maximum of 2 - 3 lags of the dependent variable are included, to pre-whiten the residuals, see Charemeza & Deadman [1992]. A constant, a linear and a quadratic trend can be included while conducting the integration test. To test without a constant has been deemed to be too restrictive for economic time series.

Exhibit 1: Testing for integration by using the ADF and equation (4.3).

Variable	With Constant	With Constant & Trend	Conclusion
ln [C]	-2.31	-2.38	I(1)
ln [Y]	-1.65	-2.30	I(1)
ln [P]	-1.41	-1.01	I(1)
RS	-2.22	-2.27	I(1)
RL	-1.54	-0.09	I(1)
T	-1.07	-2.76	I(1)
ln [C/Y]	-2.27	-2.14	I(1)
ln [WF/Y]	-2.48	-2.03	I(1)
ln [AH/Y]	-2.68	-3.11	I(1)
ln [H/Y]	-2.46	-2.74	I(1)
ln [E]	-1.70	-2.35	I(1)
ln [PH/P]	-2.05	-2.91	I(1)
Critical value 5%	-2.92	-3.50	

Note: All variables are in natural logarithms except RS, RL and T, See Appendix 1 or list of variables in Appendix 4. The intercept reflects the possibility that, under the alternative of stationarily, the intercept is not zero. A further variation introduces a time trend into the equation to allow the alternative to be trend-stationarily. Maximum number of lags is 2, and 3 for ln [AH/Y], which pre-whitens the residuals.

4.2 Co-integration

The E-G [1987] test of co-integration could be based on the residuals ϵ_t in the regression:

$$\ln C_t = \beta_1 \ln Y_t + \beta_2 \ln WF_t + \beta_3 \ln AH_t + \beta_4 \ln H_t + \beta_5 \ln E_t - \beta_6 (RS^*(1-T))_t + \epsilon t \quad [14]$$

The null and the alternative hypothesis are:

H_0: ϵ_t in (14) has a unit root and hence C_t, Y_t, AH_t, H_t, E_t, and $(RS^*(1-T))_t$ are not co-integrated.

H_A: ϵ_t in (14) is stationary and hence C_t, Y_t, AH_t, H_t, E_t and $(RS\text{-}(1-T))_t$ are co-integrated

The basic idea of co-integration is that individual economic time-series wander considerably, but certain linear combinations of the series do not move too far apart from each other. Economic forces tend to bring them into line, e.g., as hypothesized by some economic theory. According to Ericsson and Irons [1994], co-integration links the notion of a long-run relationship between economic variables to a statistical model of these variables. In case a long-run relationship exists, the variables involved are said to be co-integrated. Two properties of co-integration should be emphasized. First, E-G show that co-integrated series have an EC representation and that EC mechanisms imply co-integrated variables. In addition co-integration brings together short-and long-run information in modelling the data. The number of cointegration vectors is important but the E-G approach lacks means to estimate the number. The E-G test is only capable of examining one potential cointegrating vector at a time. The Johansen test could be used to examine if there is a cointegrating matrix. The test indicates that there are four cointegrating vectors.

"Cointegrating vectors can be thought of as representing constraints that an economic system imposes on the movement of the variables in the long-run. Consequently, the more cointegrating vectors there are, the 'more stable' the system", (Dickey et al, 1991).

DF and ADF tests, with and without trends are carried out on the residuals from the first stage of the E-G procedure. The co-integration equation from the first - stage is reported below.

$$\ln (C_t/Y_t) = 0.11 * \ln (WF_t/Y_t) + 0.39 * \ln (H_t/Y_{.t}) + 0.16 * \ln (AH_t/Y_t) \quad [15]$$

$$+ 0.58 * \ln (E_t) - 0.02 * DS*D70s + 0.03 * DS - 0.20 * RS_t*(1-T_t))$$

$$- 0.78 + \epsilon_t$$

$R^2 = 0.9849$ R^2-adj $= 0.9822$ D.W.= 1.50

Exhibit [2] shows that co-integration is achieved. Hence in equation [15] each coefficient provides a guide only as the first-stage E-G estimators and do not have a standard t-distribution. The estimated elasticity from the cointegrating equation for the housing stock is 0.39 while for financial wealth is 0.11. and housing wealth is 0.16. The homogeneity constraint is tested on the cointegrating equation by introducing $\ln (Y_t)$ as an additional term and checking whether its elasticity is zero. The test confirms that the homogeneity constraint is satisfied. The derived long run income elasticity is 0.34. The housing wealth elasticity should be higher than the financial wealth elasticity because housing wealth consistutes a larger proportion of total wealth. The after tax short term interest rate is postulated to be part of the long run influencing the long term choice between consumption and saving. The employment rate is also part of the long run effect, implying that over-employment would result in under-saving and vice versa, in the long run. The estimated elasticities differ compared to the one derived by applying the *general to specific* approach.

The Ando-Modigliani consumption function takes the form $C_t^* = f(Y_t{}^{(+)}, WF_t{}^{(+)}, AH_t{}^{(+)}, RS_t * (1-TAX_t)^{(+/-)}, E_t{}^{(+)})$. If a robust empirical relation between macroeconomic aggregates exists then there exists a cointegrating vector, see Bachelor & Dua [1992] and Molana [1991]. Co-integration is a purely statistical concept based on the properties of the time series considered. It is "A-theoretical Econometrics". Thus, co-integrated relationship need not necessarily have any economic meaning, see Maddala [1988].

Exhibit 2: Engle-Granger co-integration test of disaggregated wealth

	t - value	ADF	DF
ADF No Trend	-5.07	-5.07	
ADF With Trend	-5.01	-4.98	
DF No Trend	-5.22		-5.07
DF With Trend	-5.17		-4.98
Critical value 5%	ADF -4.15	DF -4.70	

Note: Mackinnon's [page 275,1991] Table 1. Response surface estimates of critical values are used to compute the critical values.

5 The General to Specific Approach

The ECM here estimates the long-run parameters and the short-run dynamics jointly. As the model specification is balanced, one can formulate a general ADL model. The general model is probably over-parameterized with two lags for both consumption and income, and a broad set of explanatory variables (the inflation rate, the acceleration in inflation, the employment rate, capital gains, the value added taxes, de-regulation dummy, the after tax interest rates, seasonal dummies and finally the ECM terms):

$$\begin{aligned} \text{Dln}\,[C] = \text{f}[(&\text{Dln}\,[C]_{-1}, \text{Dln}\,[C]_{-2}, \text{Dln}\,[Y], \text{Dln}\,[Y]_{-1}, \text{Dln}\,[Y]_{-2}, \text{Dln}\,[PH/P], \\ &\text{Dln}\,[WF]_{-1}, \text{Dln}[EDVATX], \text{Dln}\,[EDVATX]_{-1}, \text{DiffA ln}\,[P], \\ &\text{Diff(DiffA ln}\,[P]), [(RS^*(1\text{-}T)]_{-1}, \ln\,[C/Y]_{-1}, \ln\,[AH/Y]_{-1}, \ln\,[H/Y]_{-1}, \\ &\ln\,[WF/Y]_{-1}, \text{Dln}\,[E], \ln\,[E]_{-1}, DS, DS^*D70S, DREG, \epsilon_t)]; \end{aligned}$$

where DREG: Credit de-regulation dummy = 1 from 1986, otherwise 0 , and f is linear.

The intermediate steps in the search process, departing from the general model and deducing the specific model are described below. The t-statistic of the coefficient for lags of income and consumption are insignificant, and are dropped. The model is reestimated and now lags of capital gains, the change in employment rate and value added tax are dropped. Lastly, on the basis of the F-statistic and Likelihood ratio test (LR), cf. Kmenta [1990], one tests for the unit elasticity restriction of the income and wealth variables. Recursive estimating is carried out because it gives more information on how well the long run unitary wealth elasticity of consumption holds. For a well specified consumption function for Sweden the sum of elasticities should be 1. For variables in logarithmic form this long-run consistency of consumption and wealth, for a given development of income, is based on the identity $\Delta W = Y_t - C_t$, see Berg [1993]. Except for the first years of the 1980's the F and LR values of the unit elasticity tests are statistically insignificant, and one accepts the hypothesis of unit elasticities. The results are shown in Exhibits 3 and 4. The conclusion we draw is that, as the estimates seem quite close to those implied by the restrictions, the specific model is valid, in the sense that it did not contradict the general model. The final specification is exhaustively tested to establish whether variables omitted at an earlier stage should be re-introduced. No mechanical procedure is guaranteed to uncover the true data-generating process.

The specific model is:

$$\begin{aligned} \text{Dln}[C] = & -\underset{(5.02)}{0.49} + \underset{(7.25)}{0.39}*\text{Dln}[Y] + \underset{(5.50)}{0.26}*\text{Dln}[PH/P] + \underset{(2.13)}{0.17}*\text{Dln}[EDVATX] + \underset{(4.30)}{0.47}*\ln[E]_{-1} \\ & -\underset{(2.49)}{0.19}*\text{Diff(DiffA}\ln[P]) - \underset{(7.64)}{0.82}*\ln[C/Y]_{-1} + \underset{(4.58)}{0.07}*\ln[WF/Y]_{-1} + \underset{(2.54)}{0.07}*\ln[AH/Y]_{-1} \\ & +\underset{(6.37)}{0.30}*\ln[H/Y]_{-1} - \underset{(3.06)}{0.31}*[RS*(1-T)]_{-1} + \underset{(3.67)}{0.04}*DS - \underset{(6.84)}{0.02}*DS*D70S + \epsilon_t \end{aligned}$$

$R^2 = 0.96$ $\quad R^2$-adj $= 0.94$ $\quad \sigma = 0.0083$ $\quad$ D. W. = 2.24

where the change in consumption is explained by the change in disposable income, the change in house prices, the change in the value added tax, the acceleration in the price level, the after tax short term interest rate, and the levels terms composed of the employment rate, financial wealth, the housing stock and housing assets plus the seasonals. The models have been estimated by OLS. This log-linear specification can be justified by the fact that as we are interested in studying several price - like variables, such as interest rates; the logarithmic form is convenient, producing estimates of elasticities.

Exhibit 3: The Likelihood ratio test [LR] of imposing the unit elasticity restriction, recursive estimates. Non - linear restrictions

Sample	Computed LR	Probability of H_0 is true
1982:S1	14.08*	0.0028
1982:S2	22.21*	0.0001
1983:S1	22.36*	0.0001
1983:S2	10.90*	0.0123
1984:S1	5.88	0.1176
1984:S2	3.59	0.3093
1985:S1	2.40	0.4936
1985:S2	1.76	0.6237
1986:S1	1.85	0.6041
1986:S2	2.37	0.4992
1987:S1	2.48	0.4789
1987:S2	1.86	0.6020
1988:S1	2.49	0.4771
1988:S2	2.35	0.5030
1989:S1	1.57	0.6662
1989:S2	1.03	0.7940
1990:S1	1.12	0.7722
1990:S2	0.92	0.8206
1991:S1	0.45	0.9297
1991:S2	0.15	0.9852
1992:S1	0.10	0.9918
1992:S2	0.04	0.9979
1993:S1	0.02	0.9993
1993:S2	0.00	1.0000

Note: For the 5% significance level the computed LR value should be greater than 0.216 but less than 9.348, while for the 1% significance level the corresponding values are 0.0717 and 12.84. LR = N*log[(RRSS-URSS) where RRSS denotes: Error sum of squares restricted model. URSS denotes: Error sum of squares of the unrestricted model. An insignificant computed LR suggets that one might accept the hypothesis that the non-linear restrictions are valid. Only in 4 periods marked in the Exhibit, are the restrictions not valid, perhaps due to a regime shift [1983] according to the Chow-test [1983].

Exhibit 4: F-test of imposing a unit elasticity restriction, recursive estimates, linear restriction

Sample	Computed F	5% significance level	Probability of H_0 is true
1982:S1	2.93	3.59	0.0811
1982:S2	5.72*	3.49	0.0115
1983:S1	5.91*	3.41	0.0090
1983:S2	2.32	3.34	0.1197
1984:S1	1.17	3.29	0.3540
1984:S2	0.70	3.24	0.5657
1985:S1	0.47	3.20	0.7071
1985:S2	0.35	3.16	0.7896
1986:S1	0.38	3.13	0.7685
1986:S2	0.50	3.10	0.6865
1987:S1	0.53	3.07	0.6666
1987:S2	0.40	3.05	0.7544
1988:S1	0.55	3.03	0.6532
1988:S2	0.53	3.01	0.6660
1989:S1	0.35	2.99	0.7895
1989:S2	0.23	2.89	0.8746
1990:S1	0.26	2.96	0.8535
1990:S2	0.21	2.95	0.8886
1991:S1	0.11	2.93	0.9536
1991:S2	0.04	2.92	0.9891
1992:S1	0.02	2.91	0.9961
1992:S2	0.01	2.90	0.9986
1993:S1	0.00	2.89	1.0000
1993:S2	0.00	2.88	1.0000

Note: The F is computed as = [(RRSS-URSS)/(NPAUR-NPARR)]/[(URSS)/(NOBS-NPARUR)] where RRSS denotes: Error sum of squares *restricted model*.
URSS denotes: Error sum of squares *unrestricted model*.
NPARUR: Number of parameters in the *unrestricted model*.
NPARR: Number of parameters in the *restricted model*. NOBS: Number of observations.
The computed F value is statistically insignificant except for 3 periods marked in table, perhaps due to a regime shift according to the Chow - test in 1983. Thus one may accept the hypothesis that the restrictions are valid, except possibly for the period 1982 - 1983.

6. Forecasting performance

Before presenting the results, we address the following questions:

(1) Is there a good consumption income model?

(2) How is the consumption function affected by the inclusion of the wealth variables? This study will be confined to three models, one without the wealth variables (*no - wealth model*), and one with the wealth variables disaggregated (*restricted wealth model*), with the imposition of unit elasticity on the long run coefficient and finally the *naive model*. The models will be evaluated both from a theoretical and from a forecasting point of view. In order to do this in a realistic manner, we perform ex-ante (out of sample) forecasts for the period 1991 - 1993 using data for 1970-1989. There are several commonly used measures of predictive accuracy: the Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Theil's Inequality Coefficient (TIC), the Mean Absolute Proportional Error (MAPE), and finally the Mean Percentage Error (MPE). Our basic econometric models, the *wealth model*, the *no-wealth model*, and a *naive* (or AR) *model* will be evaluated with respect to this forecasting statistics. MPE is included since it gives information about tendencies of the forecasts to under- or overestimate the actual values. The difficulty with MAPE and RMSE measures is that there is no absolute standard against which they can be compared. The TIC is the only measure which implies a comparison of a given forecast with the naive alternative, see Kottas [1990]. The *naive model* has been estimated with the following specification:

$\ln(C) = f(\ln C_{-1}, \ln C_{-2}, \ln C_{-3}, DREG, TREND, DS, DS*D70S)$, where f is linear.

The results in Exhibit 5 below indicate that the *wealth model* performs better than both the *naive* and the *no-wealth model.*

Exhibit 5: Forecasting statistics

Forecasting statistics	Wealth model	Naive model	No-wealth model
MSPE	0.0065	0.0314	0.0391
MAPE	0.0057	0.0242	0.0325
MAE/MAD	0.2005	0.8359	1.1563
TIC	0.0033	1.04	0.0203
R^2	0.98	0.74	0.13
CV	0.0039	0.0151	0.0281

Note: All figures except Theil in percentages. Number of periods used for forecasting is six **MSPE** mean percentage error **MAE** mean absolute error. **CV** Standard error / mean, regression of actual on forecast **MAD** mean absolute deviation of actual. $\mathbf{R^2}$ Determinant co-efficient, outcome on forecast **MAPE** mean absolute proportional error. **THEIL-U** Theil inequality coefficient.

6.1 General fit and correctness of the signs of the regression estimates

The results of the three basic models are presented in Exhibit 6. The *no-wealth model* has no ECM interpretation in the semi-annual version. According to DHSY, what one needs is a model generating plausible long run properties of the relationship between consumption and income, due to the fact that the earlier economic theories indicated a long run proportionality between consumption and income. However in the semi-annual Swedish data set we cannot obtain such a plausible relationship empirically.

The restricted model contains the wealth variables. Exhibit 6 is structured as in B&B [1993], facilitating comparisons with their best quarterly *unrestricted* and *restricted models*. From *the restricted wealth model* with the wealth variables, the model fits the data well explaining 96% of the total variance in the change in consumption. The annual percentage changes of the forecast and actual of the *restricted wealth model* are shown in Exhibit 7. The out of sample forecasts are accurate in the sense that both the down turn in the 1990's and the upturn in 1993 is captured as shown in levels in Exhibit 8.

The standard error of the *restricted wealth model* is 0.0079. The signs of most of the short - run dynamic variables are in agreement with prior theoretical expectations. The *restricted wealth model* with justifiably imposed long run elasticities of income, financial wealth, housing assets and housing stock which sum to unity, satisfying the homogeneity condition. This implies that the average propensity to consume (APC) is constant in the long run. The long run steady state equilibrium elasticities are illustrated in Exhibit 9.

The equilibrium elasticities for financial wealth and real assets are of the same magnitude. There are merely marginal differences between the *restricted* and the *unrestricted* wealth models as the parameter values used in imposing the restrictions are from the *unrestricted* wealth model. The long run interest rate is significant in the *restricted model*. The coefficient of the *unrestricted* model is of the same magnitude as in the *restricted* case. The *restricted* model is superior as the standard error is smaller. All the coefficients are statistically significant and carry their expected signs under the theory outlined.

Exhibit 6: Presentation of the results

unrestricted model *restricted model* *nowealth model*

Regressor	Coeff	σ	HCSE	T-Stat	Coeff	T-Stat	Coeff	T- Stat
Constant	-0.49	0.095	0.092	5.02	-0.49	8.96	0.02	2.70
DlnY	0.39	0.052	0.041	7.25	0.39	8.28	0.29	2.98
Dln(PH/P)	0.26	0.046	0.039	5.50	0.26	7.45		
Dln(EDVATX)	0.17	0.078	0.066	2.13	0.17	2.25	0.37	2.48
Diff(DiffA(lnP)	-0.19	0.073	0.062	2.49	-0.19	2.69	-0.23	1.61
$\ln[E]_{-1}$	0.47	0.107	0.073	4.30	0.47	4.62		
$[RS*(1-T)]_{-1}$	-0.31	0.099	0.072	3.06	-0.31	4.22	-0.34	2.59
$\ln[C/Y]_{-1}$	-0.82	0.105	0.102	7.64	-0.82	9.09	-0.04	0.49
$\ln[WF/Y]_{-1}$	0.07	0.014	0.015	4.58	0.08*	9.09		
$\ln[H/Y]_{-1}$	0.30	0.046	0.042	6.37	0.37*	9.09		
$\ln[AH/Y]_{-1}$	0.07	0.025	0.026	2.53	0.08*	9.09		
DS	0.04	0.009	0.007	3.67	0.03	3.90	0.05	2.95
DS*D70S	-0.02	0.003	0.003	6.84	-0.02	7.69	-0.04	7.08
σ	0.83				0.79		0.016	
R^2	0.96				0.96		0.79	
R^2-adj	0.94				0.94		0.76	
DW	2.24				2.24		1.77	

Note: The asterisk are for long run elasticities (rounded) for the ECM terms.The test confirms that the homogeneity constraint is satisfied. The derived long-run income elasticity is 0.47.

The restricted version of the model has been derived from the unrestricted version by constraining the long - run elasticities of the wealth variables to sum up to one. σ denotes the standard error for the unrestricted model. HCSE are the heteroscedastic consistent standard errors. If these values and those for the standard errors differ markedly, heteroscedastic may be inferred. The null is that the errors are homoscedastic or, if heteroscedasticity is present, it is unrelated to the explanatory variables. It must be pointed out that this is an informal approach to deciding the presence of heteroscedasticity. The computations have been carried out in PCGIVE.

WHITE [1980] test statistic, for heteroscedasticity is obtained by regressing the squared residuals on the explanatory variables and alternatively on the explanatory variables squared and is distributed as χ^2 (q) where q is the number of regressors and squared regressors in the test regression. The estimated value is 24.53, and the 5% critical value of χ^2 (23) is 35.17. The test for heteroscedasticity was passed. There are two reasons why there is less probability of presence of heteroscedasticity: (1) The variables are in logs. (2) The variables are in ratios. The implicit assumption behind all the tests on heteroscedasticity test is that the variance(u_i) = $\sigma^2{}_i$ = σ^2 f(z_i), where z_i is an unknown variable and the different tests use different proxies or surrogates for the unknown function f(z_i), see Maddala [1988].

Test for Normality JB: Jarque Bera test statistic for normality in the distribution of the residuals and distributed as $\chi(2)$. The critical 5% per cent value is 5.99 and the computed value is: Normality $\chi(2)$ = 0.32558. Skewness = .237915. Excess Kurtosis = .058380 . DW: is the Durbin Watson statistic. A coefficient estimate is said to be significant if its t - statistic exceeds 2 in magnitude. ln (Y.1) is added to the unrestricted model and is insignificant

.Exhibit 7:

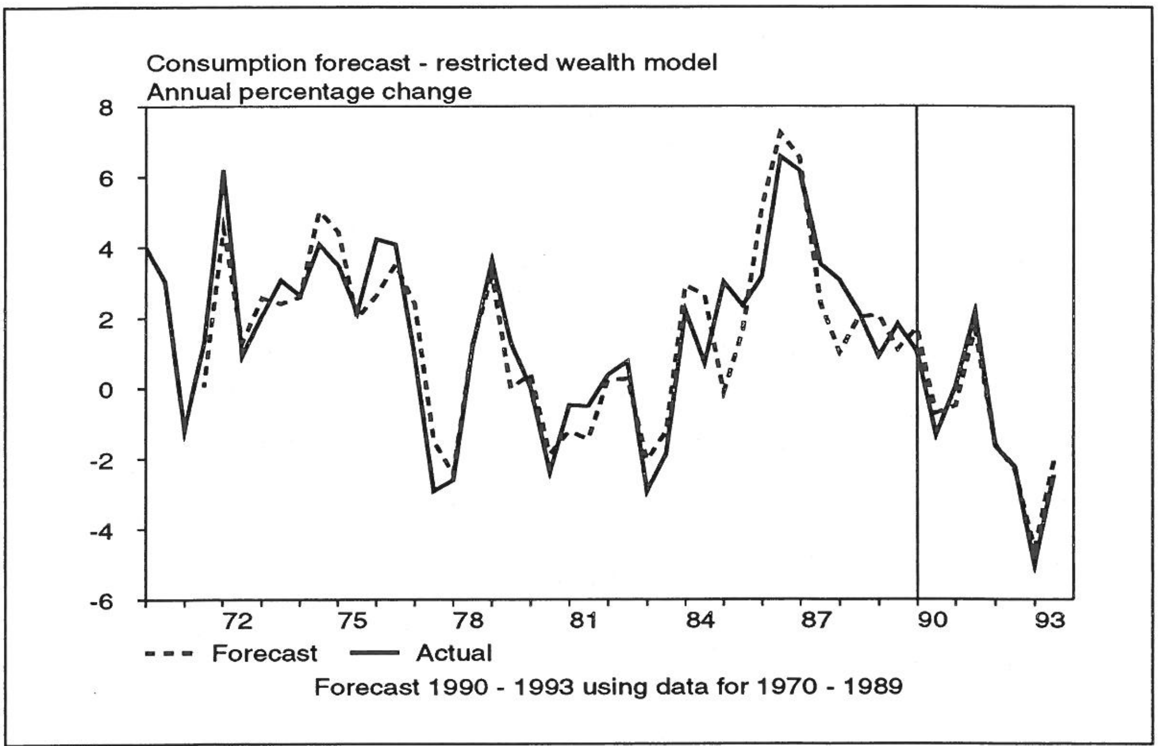


Exhibit 8:

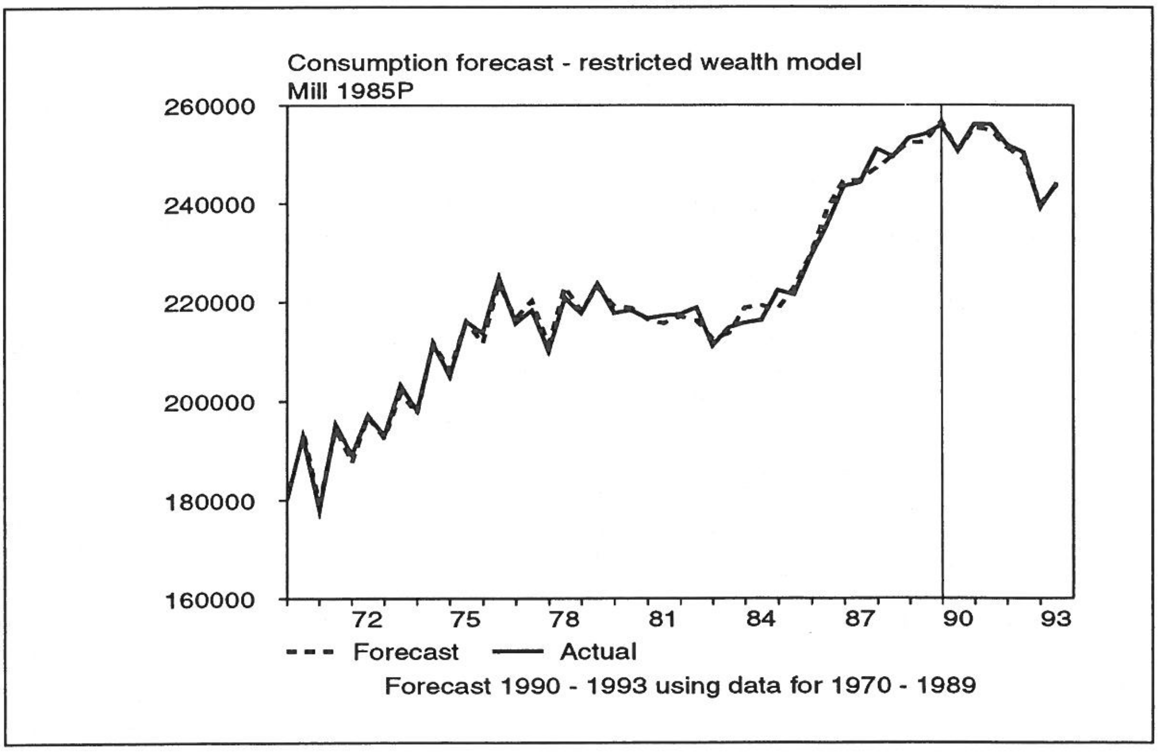


Exhibit 9: Steady state (equilibrium) elasticities for the restricted wealth model

	WF	AH	H	Y
C	0.08	0.08	0.37	0.47

6.2 Tests of model adequacy

6.2.1 Recursive estimates of stability

Exhibit 10 and 11 provide some evidence on parameter stability for both the *unrestricted* and the *restricted models*. They are based on recursive estimates of the equilibrium elasticities for the period 1982 - 1993, for the respective models. The initial instability of the parameters estimates for the interest rate and the unemployment rate reflects the small number of observations used to estimate them at the start of the recursion. However in the *restricted wealth model*, both the parameter estimates become more stable over time.

Exhibit 10:

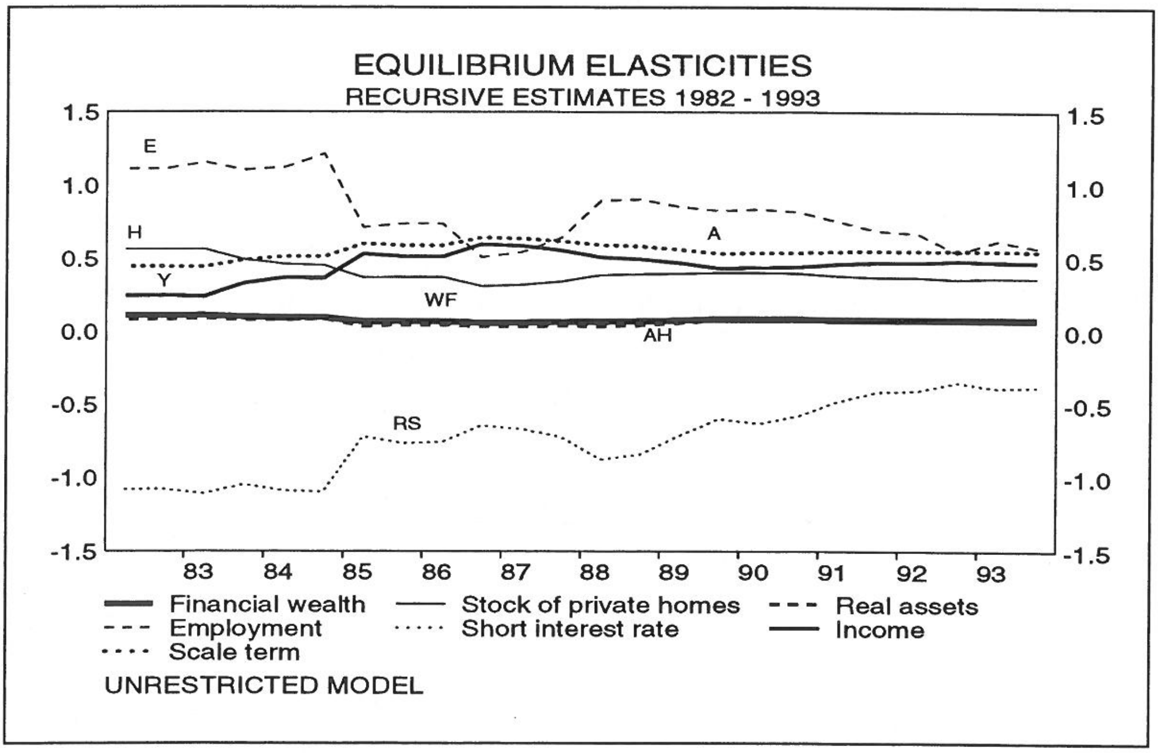
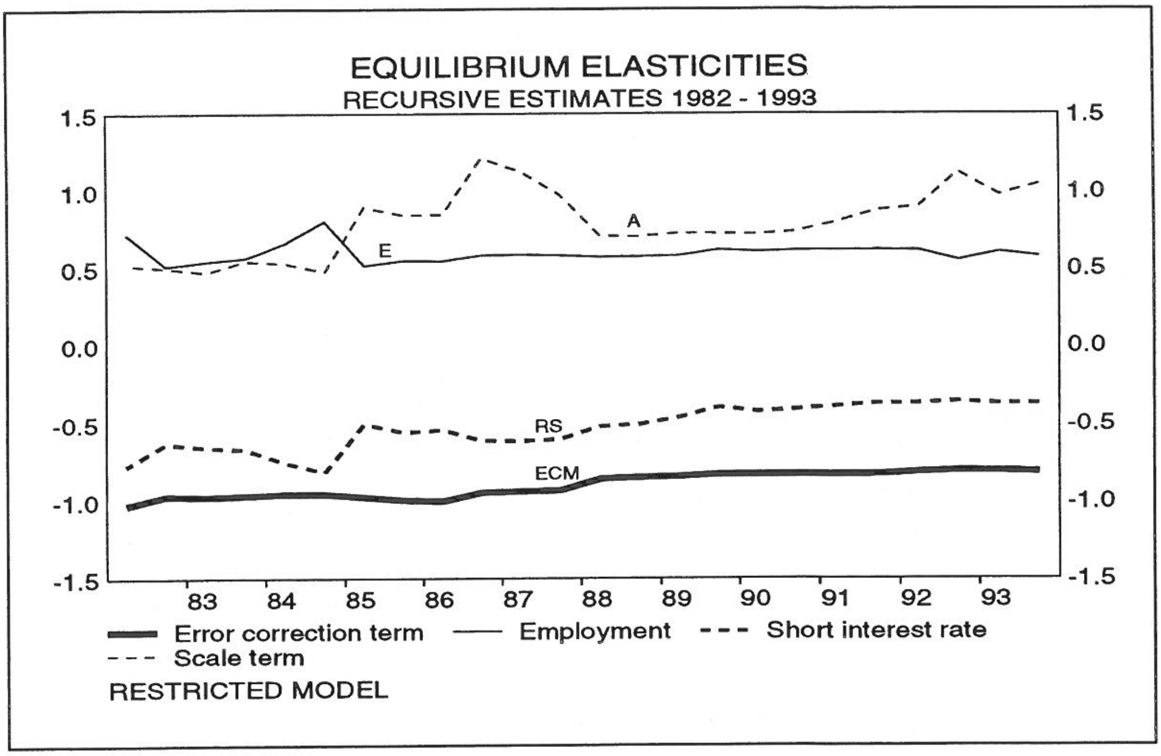


Exhibit 11:



6.2.2 Lagrange multiplier test

In order to evaluate the possibility of misspecification, the Lagrange multiplier test (LM) for serial correlations in residuals up to lags 9 for both the *restricted* and the *unrestricted wealth models* and also for the *no-wealth model* have been carried out. They are illustrated in Exhibit 12.

Exhibit 12: LM test

Models	Unrestricted Model	Restricted Model	No Wealth Model
LM Test $\chi^2(1)$	2.62 (p=0.11)	1.76 (p=0.19)	0.68 (p=0.41)
LM Test $\chi^2(2)$	4.27 (p=0.12)	1.75 (p=0.43)	0.69 (p=0.71)
LM Test $\chi^2(3)$	5.14 (p=0.16)	2.76 (p=0.43)	2.04 (p=0.56)
LM Test $\chi^2(4)$	5.59 (p=0.23)	3.56 (p=0.47)	2.42 (p=0.66)
LM Test $\chi^2(5)$	6.02 (p=0.30)	3.57 (p=0.61)	4.38 (p=0.50)
LM Test $\chi^2(6)$	7.22 (p=0.30)	4.44 (p=0.62)	8.55(p=0.20)
LM Test $\chi^2(7)$	8.63 (p=0.28)	7.44 (p=0.38)	10.58 (p=0.16)
LM Test $\chi^2(8)$	12.12 (p=0.15)	11.19 (p=0.19)	13.74 (p=0.09)
LM Test $\chi^2(9)$	13.78 (p=0.13)	12.72 (p=0.17)	17.26 (p=0.05)

Note: ç(p): is the Breusch - Godfrey Lagrange Multiplier test statistic, for autocorrelation is obtained by regressing the regression residuals on the explanatory variables and the lagged residuals up to lag p and is distributed as χ^2. The critical values at the 5% level of significance for LM(4) = 9.49, for LM(6) = 12.592. and LM(9) = 16.92 The results indicate no signs of autocorrelation up to lags 9, except in the last lag of the no - wealth model. p denotes the probability of H_0 is true.

6.2.3 The Akaike and the Bayesian information criteria for a nested model

The Akaike and the Bayesian information criteria have been computed for the *unrestricted wealth model*. They are criteria contrasting accuracy of estimation to parsimony in parametrization. The idea behind the AIC criterion is to select the model which has the minimal loss of information, i.e. the smallest AIC. For models with the same number of parameters estimated on the same sample, this leads to selecting the model with the smallest residual sum of squares or, in other words, with the largest R^2, cf. Maddala [1988] . In this study the model selection criteria have been computed for the optimal specification and then each of the variables has been dropped one at a time. The results are presented in Exhibit 13.

Exhibit 13: The Akaike and the Bayesian Information criteria

Models	Akaike Criterion	Bayesian Criterion
The Final Model	-9.07	-8.60
Dropping DlnY	-8.22	-7.70
Dropping Dln(PH/P)	-8.49	-7.98
Dropping Diff(DiffΔln(P))	-8.99	-8.48
Dropping DS	-8.82	-8.30
Dropping $[RS*(1\text{-}T)]_{-1}$	-8.90	-8.39
Dropping DS*D70s	-8.28	-7.76
Dropping Dln[EDVATX]	-9.02	-8.50
Dropping $\ln[C/Y]_{-1}$	-8.15	-7.64
Dropping $\ln[WF/Y]_{-1}$	-8.68	-8.16
Dropping $\ln[AH/Y]_{-1}$	-8.97	-8.46
Dropping $\ln[H/Y]_{-1}$	-8.37	-7.86
Dropping $\ln[E]_{-1}$	-8.74	-8.22

Note: The formulas for the respective criteria's are as follows:
$AIC = \ln(\delta^2) + 2*(n/N)$
$BIC = \ln(\delta^2) + n/N*Ln(N)$
where δ the standard error.
n is the number of parameters.
N: is the number of observations.

6.2.4 A test of exogeneity

At present it seems common knowledge that the issue of exogeneity is of crucial importance to econometric modelling. Attempts to test for exogeneity have been scarce and mostly recent. Following Steel [1987], the general instrument variable approach and a variable additional test is adopted in this study. Analogously to Steel, reaction functions for income, financial wealth, unemployment rate and housing wealth are searched. A first simple check is to introduce the ECM term in the reaction function. The t-test is insignificant and we conclude that income, financial wealth, the unemployment rate and housing wealth can be considered weakly exogenous for the long-run parameters. Alternatively, in the context of linear regression model, testing for exogeneity simply requires a variable additional test, cf. Rao [1994]. Treating income, financial wealth, housing stock and housing assets, and the unemployment rate as potentially endogenous, we regress each on a set of instruments, save the residuals from the five regressions and add them to the *restricted wealth model*. The joint significance of the additional regressors can be tested via an F-test. Under the null of exogeneity the extra regressors should be insignificant. The results are reported in Exhibit 14 below.

Exhibit 14: Testing exogeneity

F - tests on exogeneity

Variable Name	Value	Probability
Y:RESIDUALS	1.85	0.18
WF:RESIDUALS	1.67	0.20
AH:RESIDUALS	0.89	0.35
H:RESIDUALS	0.05	0.83
E:RESIDUALS	0.12	0.73

Note

The F-tests of each of the hypotheses:

$b_0 = 0$; $b_1 = 0$, $b_2 = 0$;---- $b_k = 0$. These test the significance of each of the basic variables in turn. In case H_0 $b_i(1) = 0$ cannot be rejected, there is no significant level effect from the variable under consideration.

Under the null of exogeneity the extra regressors should be insignificant. The results suggest that the possible endogeniety of the tested variables do not result into inconsistent estimates. The 5% significance level F(1,33) is 4.13 The F-test has been carried out in PC-GIVE..

The maintained model passes the main criteria conventionally reported i.e. goodness - of - fit, absence of residual autocorrelation, accuracy of predictions and parameter constancy, White test for absence of residual heteroscedasticity, Jarqua-Bera test for normality in the distribution of the residuals, test for exogeneity, and finally the Akaike and Bayesian information criteria, for parsimony.

6.2.5 Comparisons of results with Berg & Bergström [1993]

To facilitate comparisons of results with B&B [1993], despite data being in different frequencies, both their best *unrestricted* and the *restricted quarterly wealth models*, are referred to below. From their best *unrestricted wealth model* the long-run elasticities on financial wealth are 0.10 (model 7) and 0.12 from (model 5) in comparison to my estimate of 0.08. For housing assets my estimated elasticity is 0.08, whereas B&B finds it insignificant. Wealth is important when it is disaggregated into its respective components. In contrast to B&B this study finds an additional effect of housing stock on consumption [model 5]. This can be interpreted as an aspect of declining housing shortage of government-subsidised houses, thus indicating that the housing stock could represent a supply constraint, see Kanis & Barot [1993]. An alternative interpretation in the nested model [model 4], is the difference in the elasticities with respect to the stock and price components of housing assets as argued earlier. Finally a third interpretation which is similar to Muellbauer and Lattimore [1994] in [model 6], is that non owner-occupiers save more when real house prices rise.

As regards the variables representing the short-term dynamics, the coefficient for the change in income is significant and is of double size. Neither B&B nor this study find the annual inflation rate significant, while the acceleration in inflation is significant in my study. While B&B find an additional short run effect of financial, and housing wealth, I do not encounter any such dynamic effects. Recent empirical evidence of house prices having both a short run and a long run effect is supported by this study. The increase in house prices in the short run can be interpreted as a capital gain effect, while the negative relative price effect in the long run is in agreement with Lattimore [1993], Muellbauer and Murphy [1994]. The Vat rate dummies have the correct signs in both studies, although the magnitude of the coefficient is different. The vital short run dynamic variables in B&Bs' study are the household debt variable and the tax reform dummy. There are vast differences in the functional specification of the respective studies. In contrast to B&Bs' study which finds the change in household debt indicating that households have been credit constrained, this study indicates no such effect. As net financial wealth has been used as a measure of household financial wealth, the use of the household debt variable may be redundant, as it results in double counting and multicollinearity. When financial wealth is netted it captures simultaneously the financial assets and liabilities of the households in the estimated coefficient, while when it is decomposed it would have two different coefficients for the respective components (net worth and indebtedness). In order to carry out a deeper analysis of the role of the household debt variable, an analytical framework from Fisher [1932,1933] is given in Söderström [1993].

Contrary to the OECD [1994], which finds that neither unemployment nor capital gains on housing stock have any significant effect on saving behaviour, this study indicates such effects. The high unemployment prevailing in 1990 - 1993 created uncertainty about future expected income and resulted in increases in the saving rates and thus in a reciprocal fall in consumption. According to Pagano and Giavazzi [1995] the employment variable in my study acts as a proxy for the fiscal crisis in 1990's. Moreover, the unemployment rate is determined simultaneously with consumption and therefore suggests that it should be instrumented in a consumption function. Pagano's suggestions are followed and unemployment is instrumented. The results indicate that there is no statistically significant difference between the two coefficients (0.46 and 0.35) of the unemployment variable. In addition, the test for exogeneity in Exhibit 14 indicates that the unemployment variable is exogenous. Takala [1995] finds the unemployment variable relevant for the Finnish consumption function. He argues, as in this study, that households prepare themselves for increased unemployment by saving more. Another interpretation of unemployment would be based on the Keynesian theory, implying that increased saving would lower the effective demand and result in unemployment through the multiplier effect.

According to the OECD study, Chow-tests indicate that a structural break occurs between 1985 and 1986, while this study indicates no structural break, F(17 17): 0.6838. The conclusion I draw is similar to Englund [1990], that the issue of financial deregulation effects on consumption is uncertain or *'in the air for Sweden'*, in contrast to studies on Norway and Finland, see Englund [1990]. This confirms the earlier empirical findings of Lehmussaari [1989]. In contrast to B&B [1993] both the short term interest rate and the long term interest rate (in the *restricted model*) are significant, where as B&B do not encounter any such effect. Capital gains on real assets are another crucial short run variable in this study, so is the unemployment rate. A dramatic increase in precautionary savings can be interpreted as being caused by the sharp increase in the unemployment rate from 2-3% in 1990 to 14% in 1993. The recession in Swedish consumer spending for the period 1990 - 1993 can thus also be explained by the unemployment variable and not only by household debt and the tax reform, according to this study.

7. Comparative statics and dynamic simulations with the aggregated consumption function

A simulation of a model might be performed for a variety of reasons, including model testing and evaluation, historical policy analysis and forecasting. Here we analyse comparative statics and examine dynamic properties of the *unrestricted model*. Such analyses can also shed light on responsiveness to policy measures.

7.1 Equilibrium (steady state).

In order to carry out the simulation experiments we must start with some initial equilibrium path values for the exogenous variables which are arbitrary but on the whole characteristic for the years 1992 - 1993. To establish a steady state path for the exogenous variables, disposable income is assumed to grow at 1.5%, the short - term interest rate (RS) is 6%, the consumer deflator (P) and house prices (PH) both grow at 1.6%, the relative housing deflator (PIHS/P) is 1, the unemployment rate (U) is 14%, the financial wealth/income ratio (WF/Y) is 206, the housing stock/income ratio (H) is at 400, and the marginal tax on interest income (T) is 30%. The consumption ratio is 92.9% of disposable income (1993 values). The endogenous variables are, consumption, total savings, financial savings and financial wealth. For a steady state to be maintained financial wealth and income must grow at the same rate.

Total savings (S) have been defined as income minus consumption, while financial savings have been defined residually as S - real savings (SR). Given the growth rate and the exogenous values of the consumption function, the real saving rate is constant and there is a one to one relation between WF/Y, S/Y and SF/Y. Assuming that the real housing price deflator (PIHS/P) is unity and income and housing stock grow at the same rate, the real savings ratio is calibrated to be positive at 1.6%[5], on an annual basis, which is consistent with the housing stock income ratio.

With these initial values we solve for the baseline steady state. The high financial wealth build up with high current saving rates in 1993 - 1994 can not be maintained, as an increase in the financial saving rate leads to an increase in financial wealth and further on to higher consumption and lower savings.

The equilibrium (base line) solution indicates a fall of the total saving rate from 7.1% to 3.1%, where the sub-components, the financial saving rate is 1.5% and real saving rates is 1.6%. The interest rate is assumed neither to effect the housing stock income ratio nor real savings, but affects financial wealth via savings.

7.2 Comparative statics.

For the comparative statics a number of simulations are run. The alternative growth rates assumed for the exogenous variables are:

(1) An alternative growth rate in income of 2%.

(2) A rise in nominal interest rate form 6% to 8%.

(3) A fall in the unemployment rate from 14% to 12%.

(4) A rise in real house prices by 10%.

Assuming different growth rates for the exogenous variables, the values for the solved endogenous variables are shown in Exhibit 15.

A two percentage point permanent increase in disposable income results in a slight fall in the WF/Y ratios. The total saving rate increases from 3.1% to 4.0% while the financial saving rates increase from 1.5% to 1.9%. A gradual fall in unemployment from 14% to 12% decreases WF/Y and also the respective saving rates. The total saving rate falls from 3.1% to 2.7%, while the financial saving rate decreases form 1.5% to 1.1%. An increase in house prices by 10% results in a fall in the saving rate

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[5] See note 2

to 3.0%. Financial saving rate falls marginally to 1.4%, and WF/Y falls too. Finally a rise in the interest rate by 2% point increases the total saving rate from 3.1% to 3.2%, while the financial saving rate rises from 1.5% to 1.6%. There is an increase in WF/Y, due to higher savings.

Exhibit 15: Results of comparative statics

	(S/Y)	(SR/Y)	(SF/Y)	(WF/Y)
Baseline	3.1	1.6	1.5	2.06
ΔGY = 2%	4.0	2.1	1.9	1.89
ΔRS = 8%	3.2	1.6	1.6	2.17
ΔU = 12%	2.7	1.6	1.1	1.57
ΔPH/P =10%	3.0	1.6	1.4	1.91

Note: GY denotes the growth rate in income. Y denotes disposable income. RS denotes the short term interest rate. U denotes the unemployment rate. PH denotes the house prices. (WF/Y) denotes wealth income ratio. (S/Y) denotes total savings rate, (SF/Y) denotes the financial saving rate and finally (SR/Y) denotes the real saving rate.

7.3 Dynamics.

A consequence of the model is that the permanent shocks result in an alternative steady state, while a temporary shock results in a temporary deviation from the baseline steady state. The dynamic effects are the temporary effects. The dynamic simulations are carried out by inducing a temporary shock during a year or so. The reduction in income by 5% relative to baseline results in a fall in consumption and a fall in the respective saving rates. Consumption falls but not by as much as the fall in income. It reacts as an automatic stabilizer.

A transitory rise of the interest rate form 6% to 8% results in merely marginal adjustments. The interest rate change does not effect disposable income in the simulations. Under the assumptions that the housing stock is constant, the interest rate does not really matter much for the long run. The dynamic simulation of a 2% rise in the interest rate indicates merely a half percentage point fall in consumption just a year after, see Exhibit 18. King [1985], concludes in a survey of empirical studies on household savings and the interest rate that "hence it will be difficult to conclude from aggregate data that the response of consumption to changes in interest rates is anything other than small".

A reduction in unemployment over 2 years by 2% gives a inter-temporal rise in consumption, and a fall in the saving rates as expected, see Exhibit 20 & 21.

A temporary rise in real house prices by 10% over a two year period results in an increase in consumption, as people spend the capital gains initially, but hardly affects the saving rates compared to the baseline. There is more consumption but the saving rates are stable at 3% and 1.5%, see Exhibit 22 & 23.

8. Conclusions

In this study we have formulated three empirical relationships to explain the aggregate consumption function. In addition to the common explanatory variables the study has taken into consideration the influences exerted by disaggregated wealth and unemployment. The model strategy applied is Hendry's general to specific modelling. A specific model has been derived applying a sequential testing procedure. The *no wealth model* does not yield an ECM interpretation. The *restricted model* has been derived from the *unrestricted wealth* model by imposing the unit elasticity restriction, supported by data. The parameters of the estimated wealth models are robust. The *restricted wealth model* proves to be the best and the signs and the magnitudes associated with the short-run dynamics and the long-run equilibrium are plausible. From the forecasting point of view the restricted wealth model has been successful in capturing both the downturn and the upturn in private consumption and satisfies the ultimate goal of empirical testing in economics, which is to determine how well a theoretical model corresponds to the reality of an economic data.

In the light of earlier studies, this study does indicate that the consecutive period difference semiannual model performs equally well as or better than a quarterly model. There is no indication of a structural break. Thus wealth is an important variable from a model specification point of view, and it only works when it is disaggregated. The special housing stock effect can be interpreted either as a housing shortage effect, even if non owner-occupiers save more when the real house price rises. The aggregate wealth model expressed in this study does not fit well and thus the results from it are not presented. We have seen that incorporating wealth is necessary in order to make a proper consumption function for Sweden. Both the short - term treasury notes and the long term interest rate are statistically significant, but only as alternative explanations. No statistical significance could be obtained for the difference between the short and long term interest rates which was used as a proxy for credit availability in Kanis & Barot [1993]. In comparison to B&B, this study does not find any relevance either of household debt or of the tax reform. However, what it finds important is the interest rate, the employment rate, and house prices. The *restricted wealth model* captures the development in private consumption well without any dummies for the tax reform and credit de-regulation.

Notes:

Note 1: Life cycle hypothesis

The life cycle hypothesis suggested by Modigliani and Brumberg [1954] and Ando & Modigliani [1963] has the following formulation:

We assume that a consumer has a life span of L periods, where L = N + M, where N denotes the number of earning periods and M the number of retirement periods. We assume that the consumer has perfect knowledge of his future income, and that he distributes his income throughout his life, such as to derive the following utility form consumption during his life span:

$$U = U(C_t, C_{t+1}, \ldots\ldots C_L) \qquad [i]$$

where C_t denotes consumption, in the *t*th period of his earning span. The problem for the consumer is to choose C_i for i = t, t+1,....L, subject to the budget constraint

$$W_{t-1} + Y_t + \sum_{\tau=t+1}^{N} Y^e_\tau / (1 + r)^{\tau-t} = \sum_{\tau=t}^{L} C_\tau / (1+r)^{\tau-t} \qquad [ii]$$

Assuming that the rate of interest r does not to change in (ii) we denote the following definitions

W_{t-1} : consumer's assets at the beginning of the *th* period

Y_t : non-property income in period t

Y^e_τ : non-property income expected in period τ

C_τ : denotes consumption in period τ

We further assume that the utility function is such as to make the consumer's optimal consumption through the period the same, independent of the level of his income. Then, aggregating over all individuals aged t years, the optimal aggregate consumption C_t equal to $\Sigma c_{t,}$ where $c_{t,}$ is the optimal consumption in period t of a consumer's earnings, becomes

$$C_t = \Sigma c^*_{t,} = \alpha W_{t-1} + \beta Y_{tL} + \delta(N - T)\, Y^e_{tL} \qquad [iii]$$

and Y_{tL} denotes aggregate non-property income of individuals aged t, W_{t-1} denotes aggregate net wealth of individuals aged t, Y^{e}_{tL} denotes aggregate non-property income expected of individuals aged t, α, β, δ are constants.

Summing C^{*}_{t} over all ages, the total aggregate consumption for all ages is obtained. However, its possible that assets and income are correlated with age. But if α, β, and δ, the age structure, and the distribution of income do not change through time, see Ghosh [1991], then

$$C = \alpha'_1 Y_{Lt} + \alpha'_2 Y^{e}_{Lt} + \alpha'_3 W_{t-1} \qquad \text{[iv]}$$

where C is aggregate consumption

W_{t-1} is net worth

Y_L is aggregate non-property income

Y^{e}_{L} is aggregate expected non-property income

α'_1, α'_2, α'_3 are constants.

For alternative derivations of the life cycle hypothesis see Nickell [1985], Molana [1991] and Favero [1993].

Note 2: The real saving rate

The real saving rate is calibrated on an annual basis using the following relationship:

$$SRL/YL = PIHS/P * SR/Y$$

where

$$Y = (1 + G_y)\, Y_{-1},$$

$$SR = SRL/PIHS,$$

$$= \alpha\, \Delta H = \alpha\, G_h * H_{-1}$$

$$SRL/YL = \alpha * [(PIHS/P)*(G_h / 1+G_y) * (H/Y)_{-1}$$

The estimation of the above relationship gives a coefficient of $\alpha = 0.534$ from a regression on annual observations (1970 - 1993). We assume in the steady state that PIHS/P = 1, and that $G_h = G_y = G$. $H/Y = (H/Y)_{-1} = 4$ on annual basis. But for the semi-annual data we use (H/2) = 2, thus SRL/Y = .534*{(1*.015/1.015*4/2)} = .016.

Appendix 1.

The description of the data set.

The data set comprises the following variables in real terms and in 1985 prices: total private consumption (C), its deflator (P: 1985 = 1), and disposable income (Y) from the National Accounts. Disposable income consists of the compensation of employed, less employer contribution for private group and social insurance, other earned income, net interest and dividens and transfers less taxes.

The market price index for private homes, (PH: 1985 = 1 fastighetsprisindex, weighted mean of primary and secondary homes), the stock of private homes (H), i.e. the sum of the stocks of primary and second homes computed according to the perpetual inventory stock method (approximately equal to Statistics Sweden's gross stock), the value of house assets (AH) is the stock of primary and secondary homes at constant 1985 prices, multiplied by the property price index and linked backwards using 1970 purchase price co-efficient. Berg [1990] used real estate taxation data and Markowski (1994) the net stock. Our stocks differ from those above in the sense that the computations are based on the total relevant building category. The PIHS deflator (1985=1), is used for investment in small homes. The short interest rate (RS) is from Markowski's Minimac model extended forward using treasury bills (statskuldsväxlar) and backward 1969q1 - 1970q3 as the three month treasury bill rate (Centralbank) + 1.5% point (mean absolute difference between forecasts in 70q4 - 71q4). The long government interest rate (RL: ten years, recently five years), is the mean of months from SCB's Monthly Digest of Swedish Statistics. For earlier years, the marginal tax rate on interest (T), is computed from tax returns (Statistics Sweden Income & Wealth Distribution figures 1975 - 1980), and is the interpolative guess linked to estimates in Forslund [1991], for industry worker pre 1975. Later the statutory maximum applicable to interest deductions on tax returns has been reduced from 50% in the 1980's to 30% in the present period.

The value added tax change variable (EDVATX) has been defined as:

$EDVATX_t = (1 - m_{t-1} / 100) / (1 - m_t / 100)$ i.e. the ratio between the current price of goods including the Vat rate (m_t) and the previous price with the Vat rate (m_{t-1}).

The expected $EDVATX_t = EDVATX_{t+1}$. DVAT is the value added tax change, price expost/exante. The data has been collected from the Business & Industry Information Group (Näringslivets Ekonomifakta).

Total household net wealth (W) has been defined as the sum of net financial wealth and real assets (housing assets). The statistics for financial wealth and liabilities have been collected from SCB's financial accounts. The stocks have been computed at the NIER. Household net financial wealth (WF) is defined as the sum of notes, coins, bank deposits and the National Saving Scheme (Allemanssparande), bonds and treasury discount notes (statsskuldväxlar), private insurance savings, listed and non-listed equity shares and other assets, minus total direct lending. The annual stock figures for household financial assets and liabilities were taken from the Financial Accounts (Finansräkenskaper) 1970 - 1993.

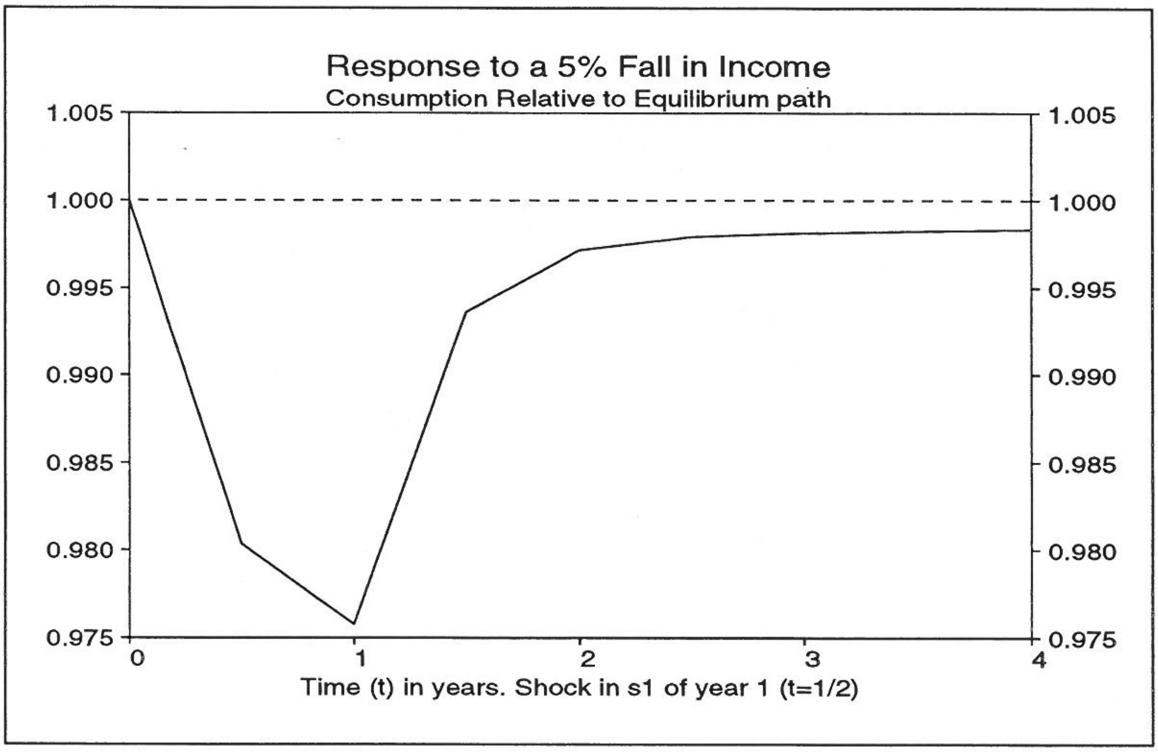
The employment rate (E) is the ratio of persons in regular employment to the total labour force (the number of persons in labour market programs and the number of persons in open unemployment). The data has been collected from Labour Force Survey, Statistics Sweden.

The semi-annual seasonal effects sum to zero over the year, implying that the intercept is an average over the year i.e. dummy (DS) = (1, -1), in the first and second half years respectively. In order to account for differences in seasonal patterns between the 1970S and 1980S the seasonal dummy is multiplied by a period dummy (DS*D70s), which equals zero from the 1980S on, see Kanis & Barot.

The data set is available on request.

Appendix 2: Exhibits of dynamic simulations

Exhibit 16 & 17:



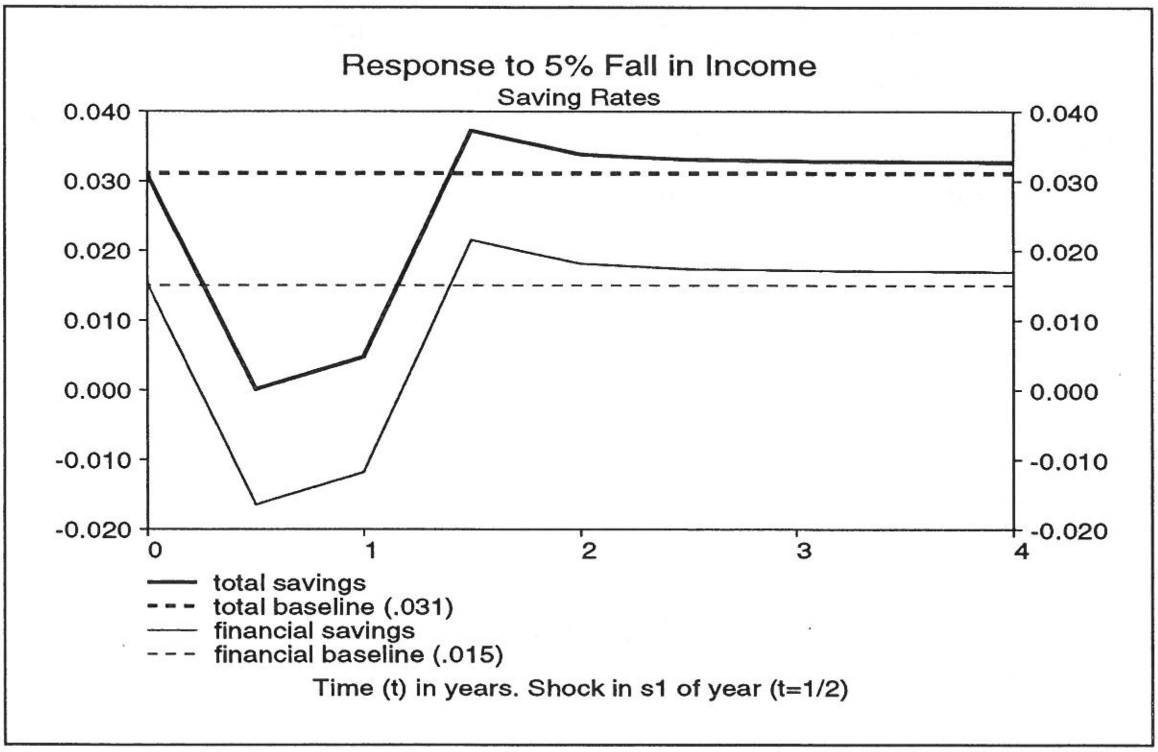
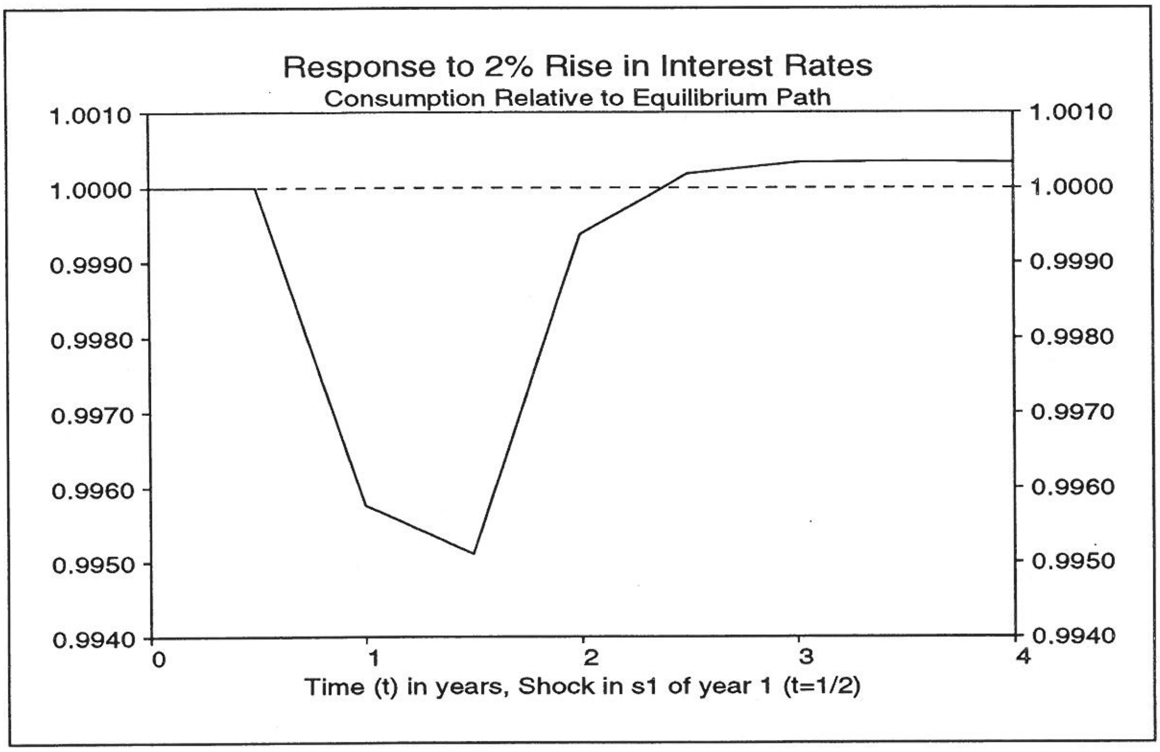


Exhibit 18 & 19:



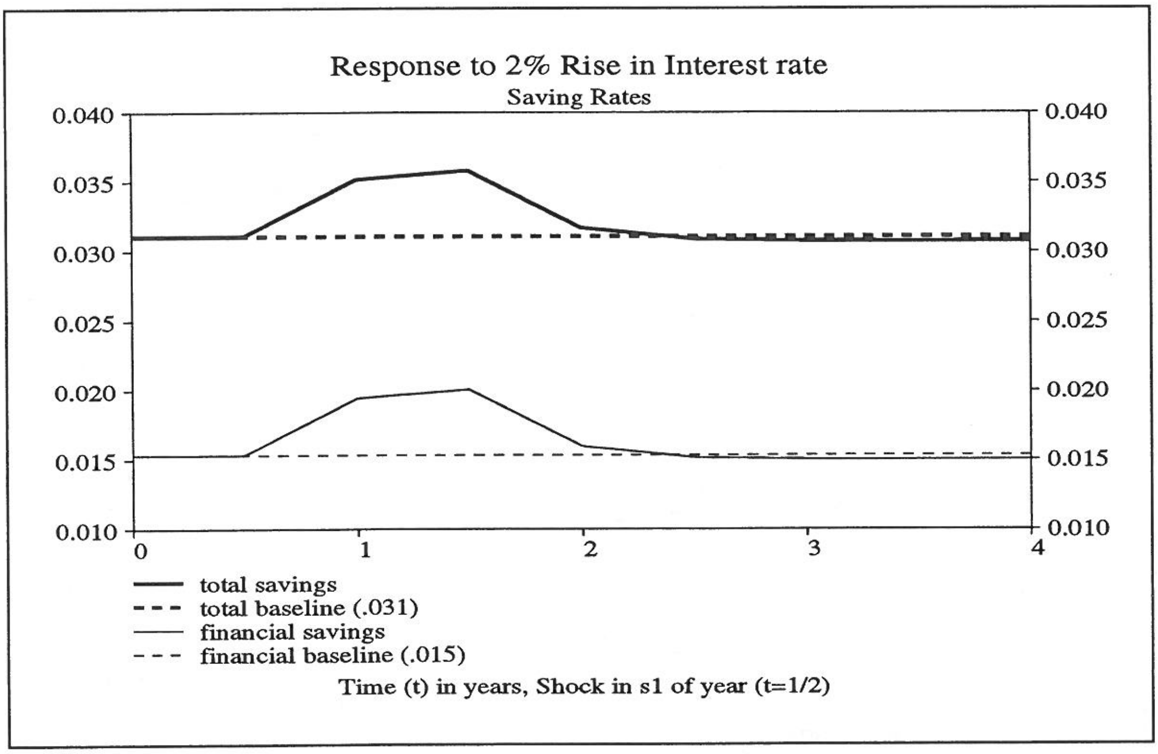
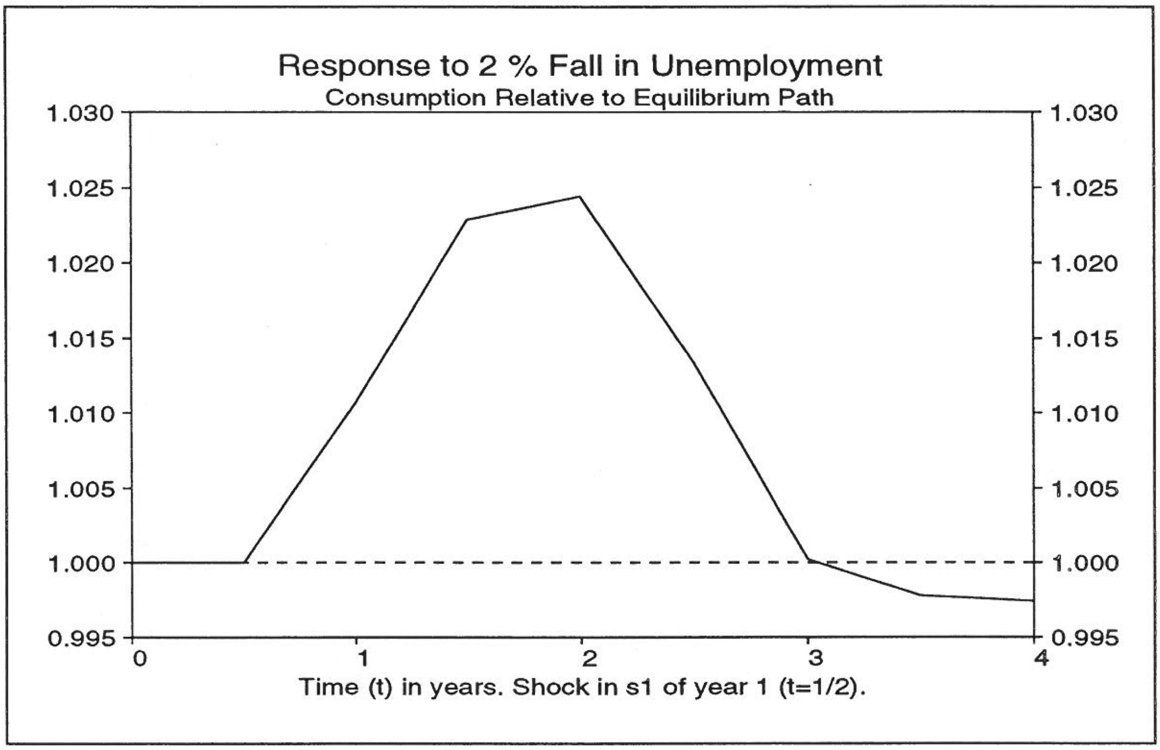


Exhibit 20 & 21:



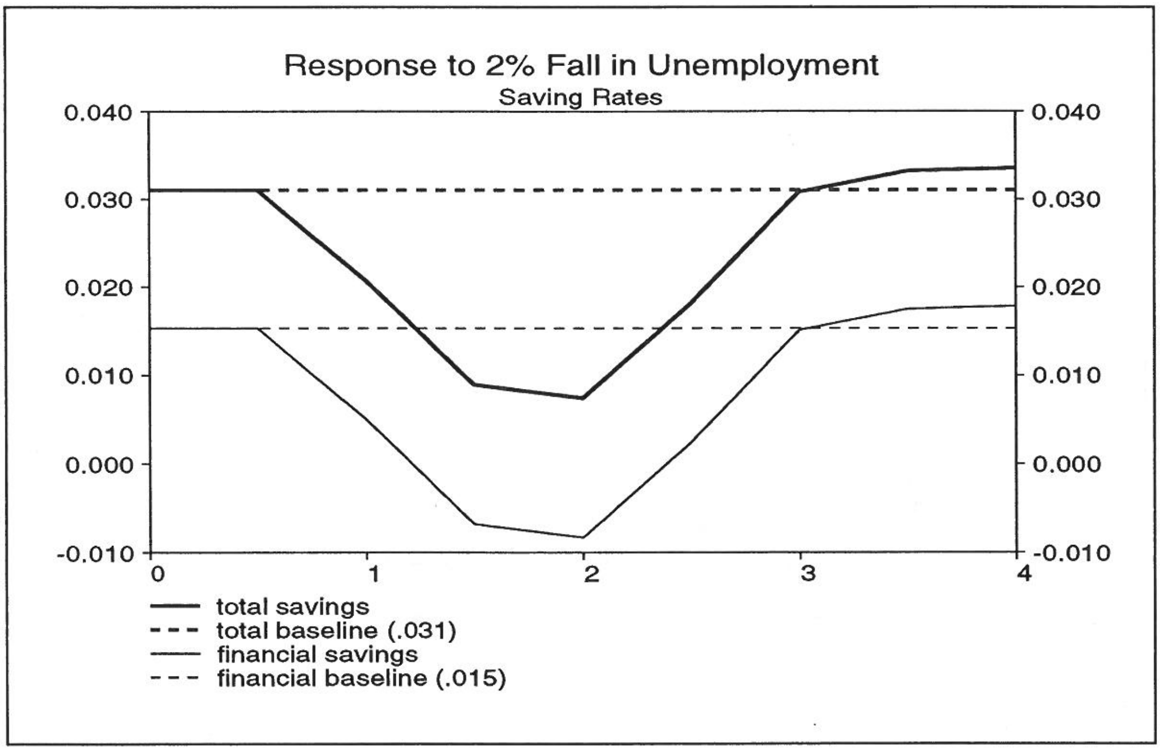
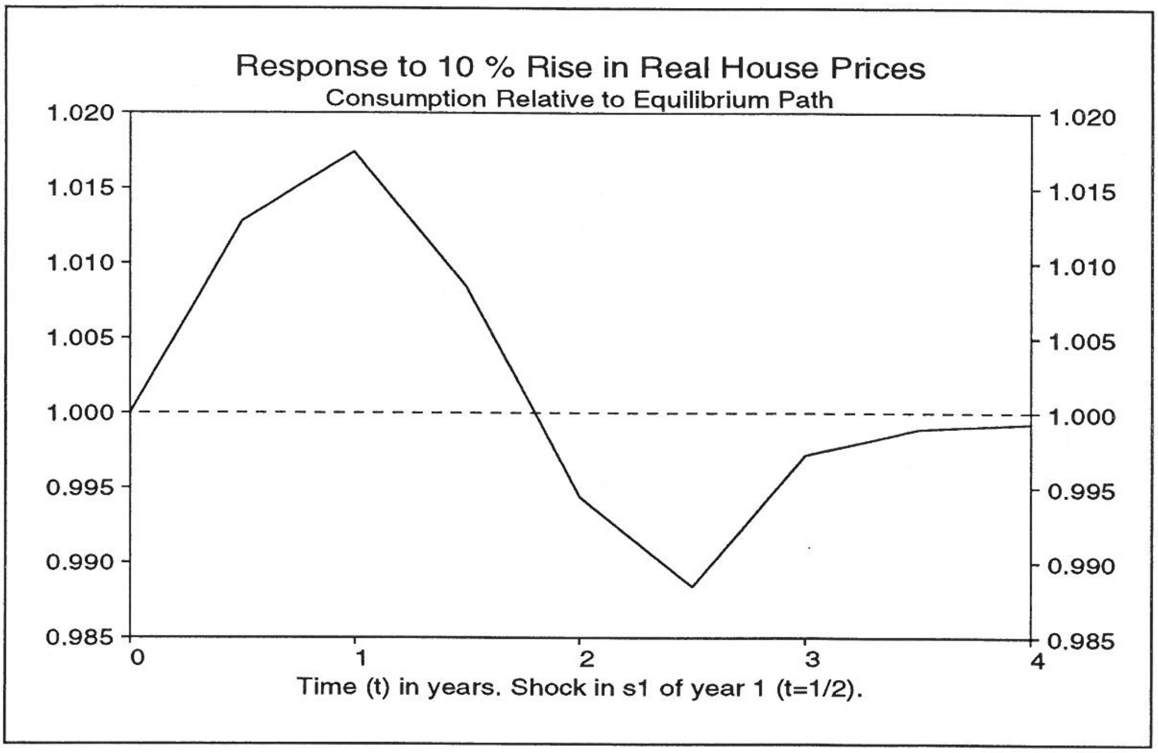
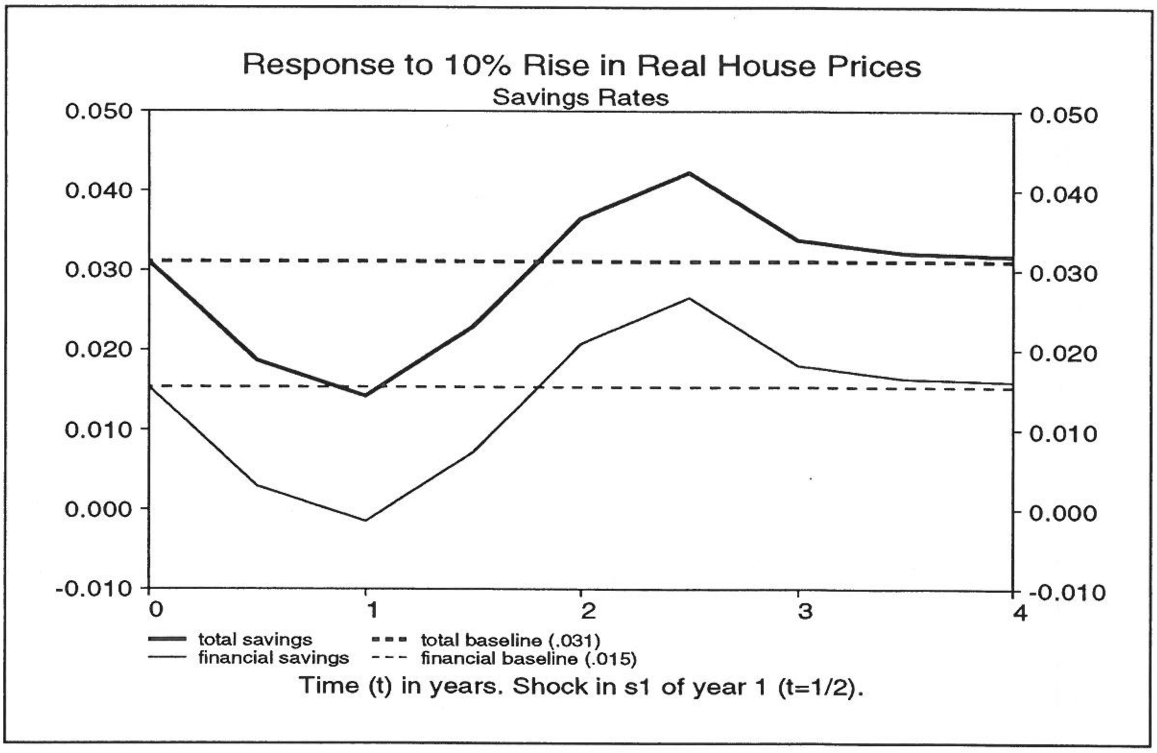


Exhibit 22 & 23:





Appendix 3: Plots of the data set

Exhibit 24:

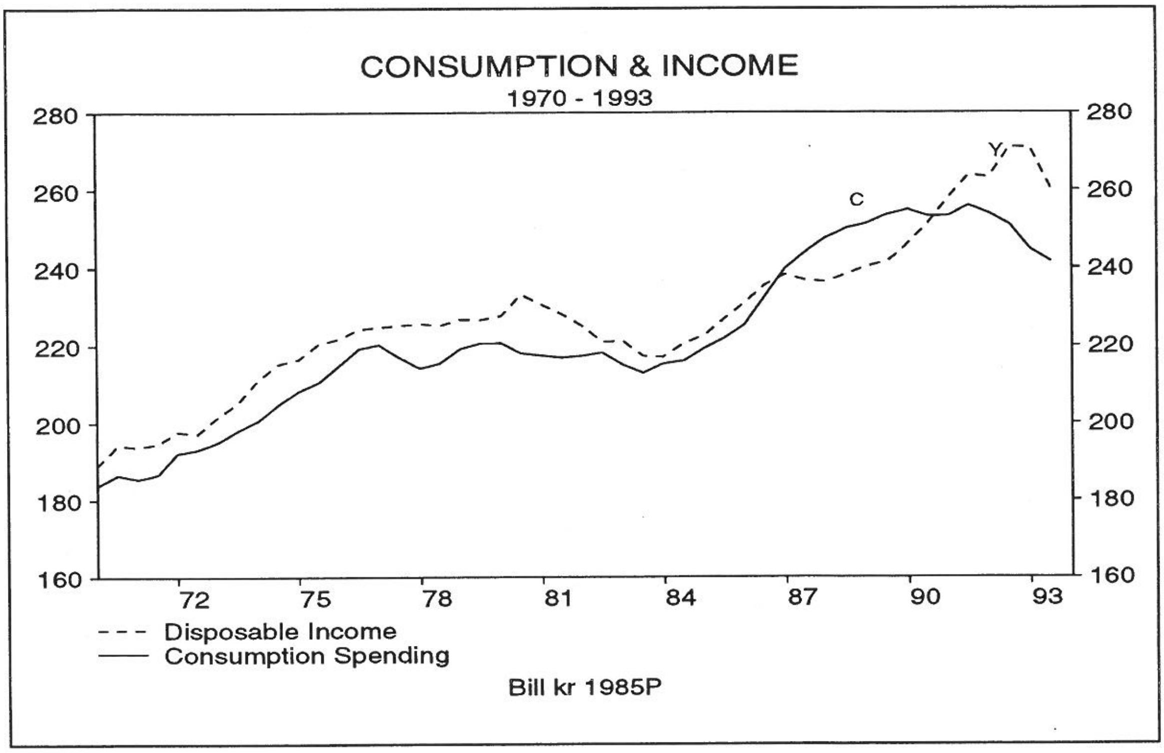


Exhibit 25:

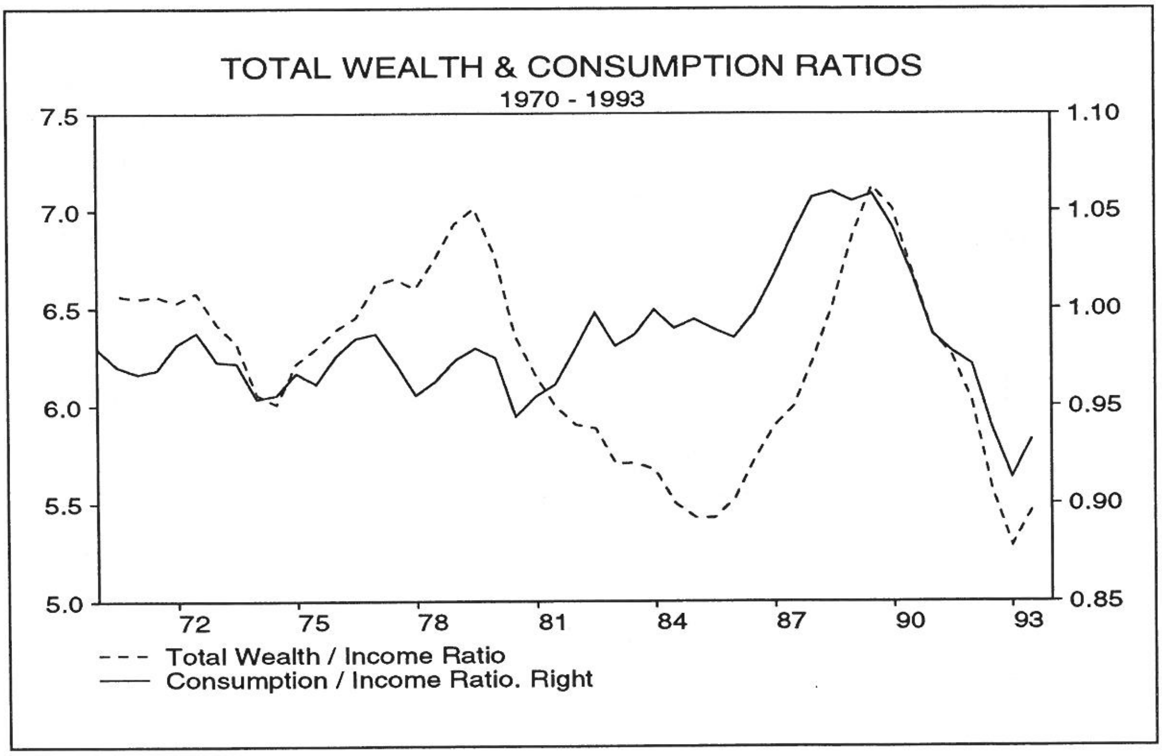
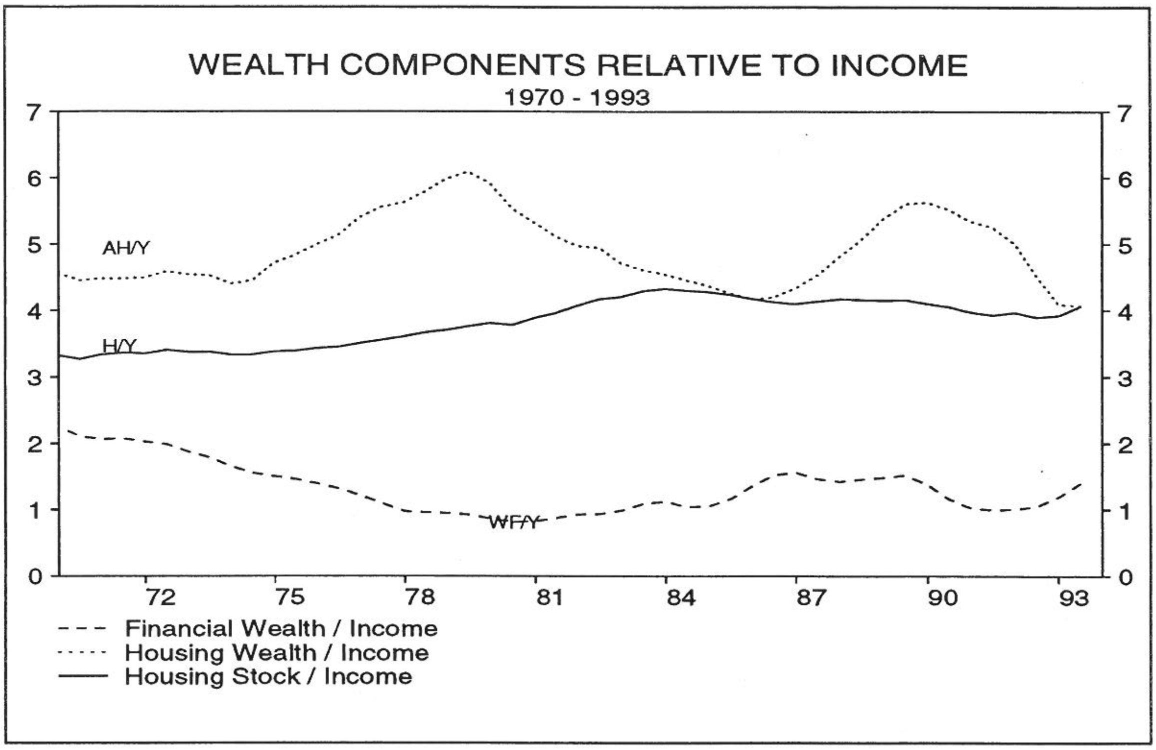


Exhibit 26:



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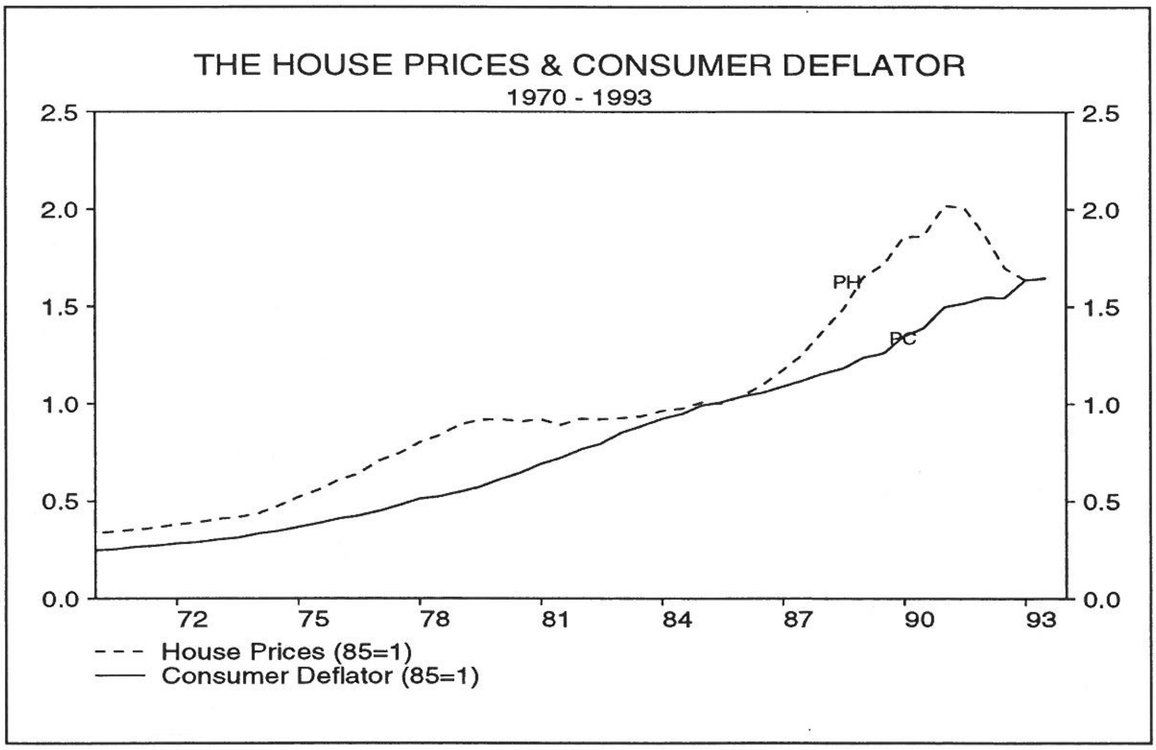
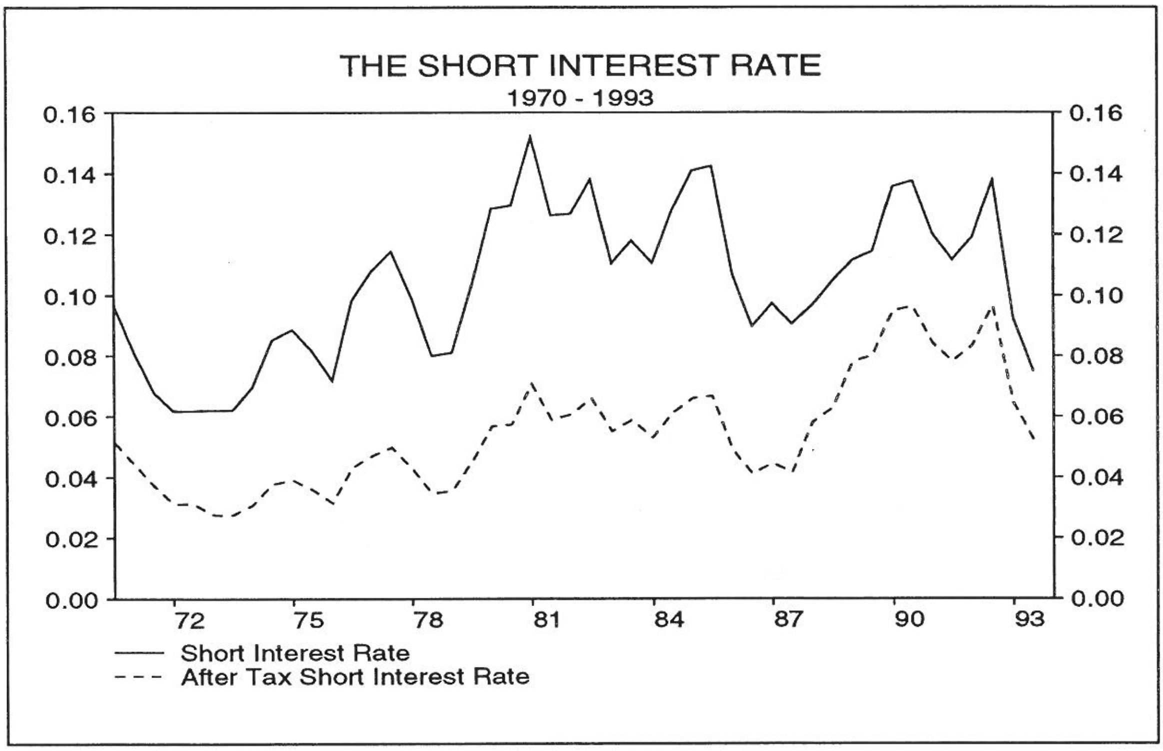


Exhibit 28:



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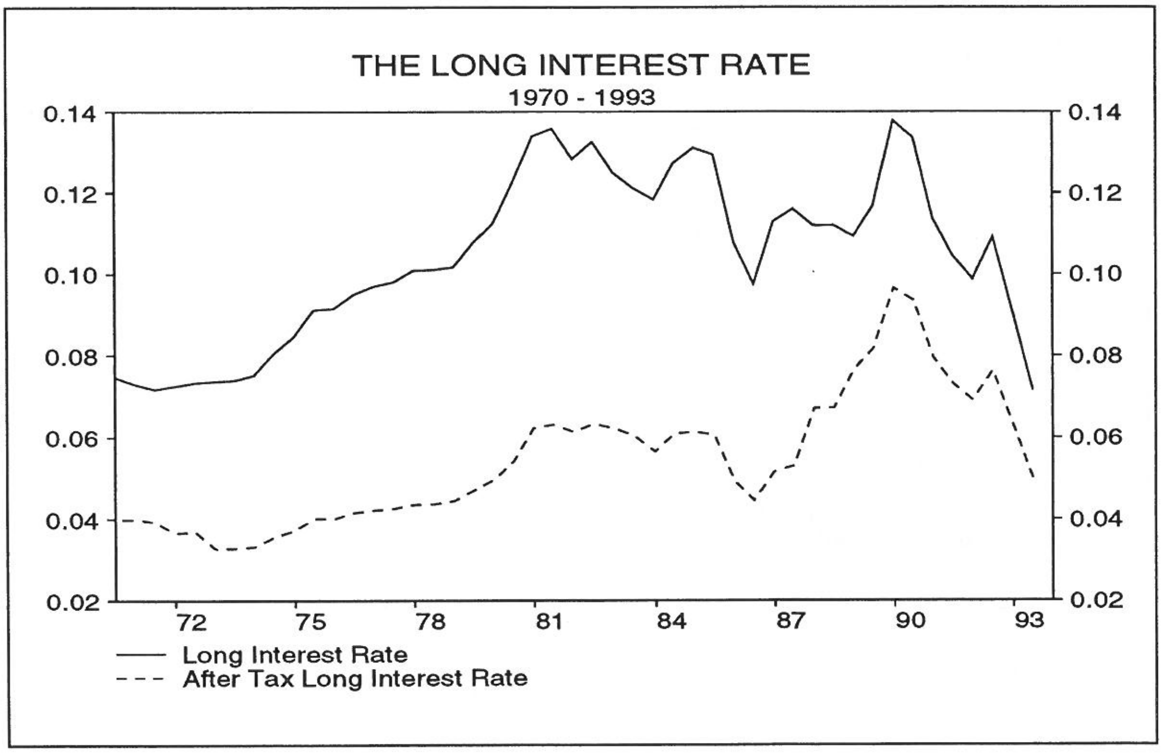
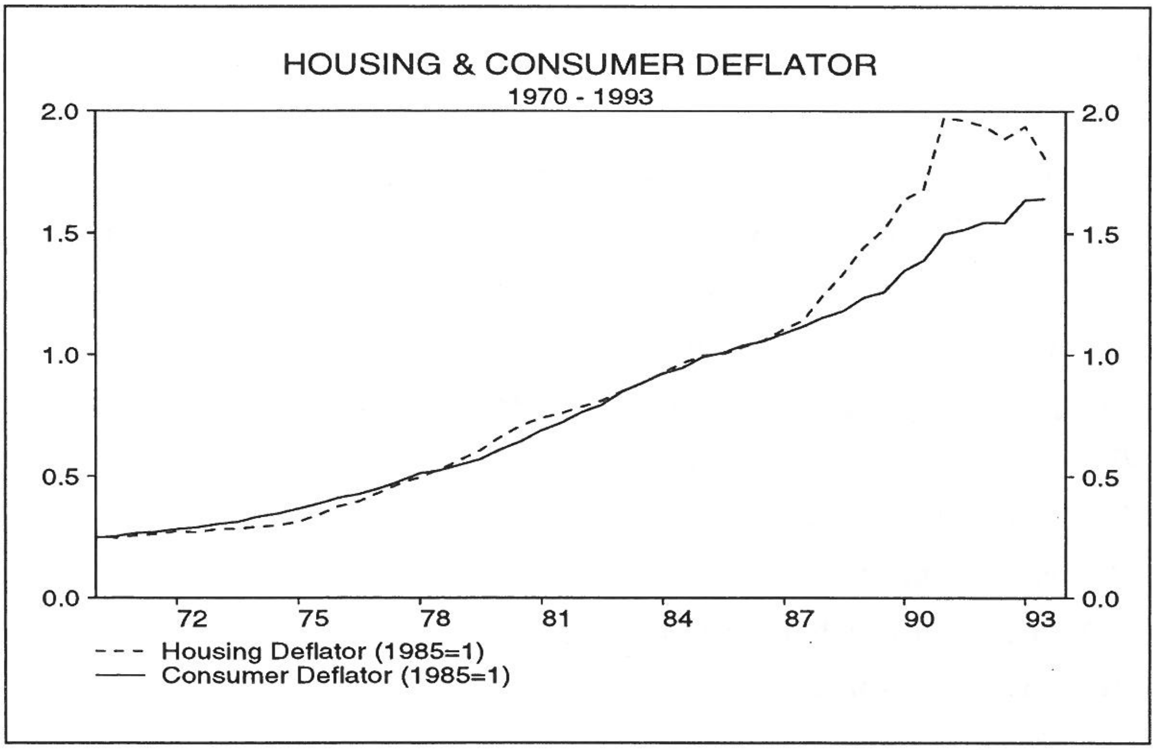


Exhibit 30:

Exhibit 31:



List of variables

C: Total private consumption, mill SEK 1985 prices.

Y: Disposable income, mill SEK 1985 prices.

P: Consumption deflator (85=1).

PH: Market price index for private homes (85=1), weighted mean of real estate price index, one family houses (fastighetsprisindex egnahem) and second homes (fritidshus).

PIHS: Deflator for housing investment in one family houses.

AH: Household real assets (mill. SEK, 1985 prices).

H: Stock of private homes (mill. SEK 1985 prices), sum of stock of primary and second homes.

WF: Household net financial wealth mill. SEK, 1985 prices.

T: Marginal tax rate on interest deductions leading 1 year.

RS: Treasury bill rate three-months or short interest rate.

RL: Long govermentt interest rate (10 years, recently 5 years).

EDVATX: The expected VAT price change (=DVAT[+1]).

DVAT: Value added tax change. Price ex-post/ex-ante.

D70S: Dummy equal to unity before 1980s.

DS: Dummy, 1 in the first half year and 0 for the second half year.

DREG: Credit de-regulation dummy, 1 for 1986-1993, otherwise 0.

TSY: the time trend.

NREMP: Number of persons in regular employment, millions.

NLFIADJ: Number of persons in labour force = nremp+nlmp+nunp, in millions.

NUNP: Number of persons in open unemployment, in millions.

NLMP: Number of persons in labour market programs.

E: Employment rate (regular / labour force inclusive programs), in millions.

S/Y: Saving rate.

SF/Y: Financial saving rate.

SR/Y: Real saving rate.

WF/Y : Financial wealth income ratio.

H/Y: Housing stock income ratio.

AIC: Akaike information criteria.

BIC: Bayesian information criteria.

H.C.S.E. Heteroscedastic consistent standard errors.

σ: Standard errors.

G : Growth rate

ln(X): Natural log(X).

Dln(X): The logarithmic difference, $\ln(X_t / X_{t-1})$.

DiffAln(X): The annual logarithmic difference for series X i.e. the logarithmic difference between a period and the same period a year ago. ln(X / X.n) where n is the number of periods in each year.

Diff(X): The simple difference between successive values in series X.

DW: Durbin-Watson test statistic.

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SAMMANFATTNING

I denna licentiatavhandling undersöks med hjälp av traditionell regressionsanalys den aggregerade privata konsumtionens bestämningsfaktorer (hushållens inkomst och förmögenhetsutveckling, kort och lång ränta efter skatt, momsförändringar, huspriser, förändringar i inflationstakten, och arbetslöshet). I avhandlingen analyseras, förutom förmögenhetseffekter (finansiella och reala), även arbetslöshetens roll som förklaringsfaktorer.

Avhandlingen bygger på en s.k. felkorrigeringsmodell (error-correction model), enligt vilken konsumtionen efter hand anpassar sig till en långsiktig jämvikt. I denna typ av modell används ekonomisk teori för att specificera ett långsiktigt samband, medan data får bestämma modellens kortsiktiga dynamik. Tre sinsemellan hierarkiska ('nested') modeller tas fram, vilket ger flexibilitet när det gäller tolkningen av resultaten. Tidigare undersökningar av t.ex Berg & Bergström [1993] av svensk konsumtion har inte inkluderat arbetslösheten.

De skattningsresultat som framkommer överensstämmer med underliggande teoretiska uppfattningar. Resultaten jämförs med Berg & Bergström:s och OECD:s studier. Resultaten framhäver husprisernas (såväl nivå som förändring) och arbetslöshetens roll för den svenska konsumtionen. De senaste internationella forskningsresultaten stödjer detta.

Den skattade funktionen testas och diagnosticeras i Hendrys anda, vilket innebär att man går från en allmän mot en mer och mer specifik modell. En rigorös testning utförs bland annat av det exogena antagandet. Diagnostiken indikerar att den skattade modellen är stabil och robust. Simuleringarna illustrerar den skattade modellens dynamiska egenskaper. Kosumtionsfunktionen är av värde både som underlag vid löpande konjunkturbedömning och för vidare utveckling av KOSMOS.

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