A Quarterly Consumption Function for Sweden 1970 - 1989

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Abstract

The latter part of the 1980s has seen a dramatic change in consumer behaviour in Sweden at the same time as a financial deregulation occurred. In order to test whether "traditional" models can explain this development models were formulated on the basis of a life cycle model specification with error correction terms. Wealth was considered both in aggregate form and disaggregated as housing and net financial wealth. Unit root tests indicated that consumption, income and wealth were all integrated of order one and that the variables cointegrate if wealth is disaggregated. HEGY-tests did not reveal seasonal integration in consumption and income.

Models were estimated both on the basis of first and seasonal differences. Both sets of models produced reasonable results in dynamic models, while the long-run properties of the first difference models were rather doubtful.

The error correction terms were found to be important and inclusion of wealth in disaggregated form improved the models significantly compared with inclusion of wealth in aggregated form. The properties of the models were tested during the prediction period 1986-89, which has seen a major decrease in the savings ratio. While the models were not able to reflect this development completely, the results obtained were rather promising and a hypothesis of unchanged structure in 1986-89 compared with 1971-85 could not be rejected. Models without the wealth variables failed completely to explain the development during the latter part of the 1980s.

1. INTRODUCTION

During the 1980s the savings of the Swedish households decreased markedly. According to National account statistics, the savings ratio dropped by more than 8 percentage points; from 5 percent in 1980 to -3.5 percent in 1989. The average propensity to consume out of disposable income thus increased. As can be seen from Figure 1, real disposable income for households was greater than real private consumption expenditures until 1986. The gap between income and consumption expenditures narrowed at the end of the 1970s and from the beginning of the 1980s the average propensity to consume was almost identical to unity.

During the early part of the 1980s, real disposable income actually decreased after having been constant during the latter part of the 1970s. Consumption expenditures in constant Swedish Crowns were almost unchanged between 1976 to 1983. In 1984 both real disposable income and expenditures started to grow. One feature of the Swedish experience is that when the income growth declined after 1986 the growth rate of consumption expenditure did not decline.

Data in Figure 1 reveal among other things that the relationship between disposable income and consumption expenditures may have changed during the last decade. Previous empirical studies in the field have pointed to a stable relationship between consumption expenditures and disposable income.[1] From Figure 1 it is obvious that the two variables show the same trend until the end of the 1970s which indicates a high degree of correlation between them. Another possibility is that the connection between income and consumption expenditure is stable and other variables should be brought into the analysis to explain the different development of these two variables during the 1980s.

The development of income and consumption has stimulated a debate about

[1] See Palmer (1981), Berg (1983) and SOU 1989:11 for references.

the determinants behind the savings behavior of the Swedish households. A drastic decrease in the savings ratio is not a unique Swedish experience. It is shared with, among others, the Nordic countries, the United Kingdom and the United States.[2] Different arguments have been put forward in the debate to explain this phenomenon. The arguments in the Swedish debate are summarized below.[3]

* The composition of the population: The share of individuals in age groups that are supposed to save has fallen since the 1950s.

* Social security: The growth of the public and supplementary collective pension schemes have reduced the motive for households to save for their retirement. The entire post war expansion of the "social safety net" which is intended to replace temporary or permanent losses in income and thereby reduce uncertainty about future income may also have stimulated consumption.

* Real rate of return: During the 1970s and part of the 1980s the real after-tax interest rates on financial assets have been negative. High marginal taxes and the tax deductibility of interest payments (even if the tax-reform in the early 1980s limited the tax deductibility) have not fostered savings. The consumer borrowing was limited by financial market regulation.

* Deregulation of financial markets: Prior to 1984 most interest rates were regulated and credit growth was limited through lending ceilings. The deregulation of credit markets relaxed the borrowing constraints on households causing many to adjust their financial portfolios and increase debts.

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[2]For a discussion about the development in the Nordic countries see SOU:11 and Lehmussaari (1990). See also Brodin and Nymoen (1989) for an analysis of the Norwegian experience. For a general discussion about savings trends for Norway see "Spareutredningen" (1990) and for Denmark "Den private opsparing (1989). For a discussion about saving trends in the United Kingdom see for example Muellbauer and Murphy (1989) and for the United States see Bovenberg and Evans (1990).

[3]For a more complete discussion see Berg (1989), SOU 1989:11 and Englund (1990).

* Capital gains: The deregulation of financial markets and the increase in liquidity in the economy have caused prices on real and financial assets to grow faster than the general price level. Capital gains have arisen from equities, owner occupied houses and flats. This increase in the wealth of households may have stimulated the demand for consumption goods.

* Income-expectations: The consumer sentiment index about future income has increased in the second half of the 1980s (see Ågren and Jonsson 1991). Deregulation of financial markets has made it possible for the gross majority of households to discount future income by borrowing.

The first two arguments above may be important determinants behind a declining trend in the savings ratio in the long run but cannot be expected to explain large short-run changes. Some of the other factors, on the other hand, can possibly explain the changes during the 1980s.

In the second half of the 1980s the real after-tax interest rates for financial assets have increased due to higher nominal rates of interest, lower marginal taxes and a decrease in the rate of inflation. This may have had an effect on savings.

The deregulation of financial markets may have caused a temporary increase or overshooting in household indebtedness and thus a drop in savings. In periods with a regulated credit market many households are rationed and cannot take on debts to the required extent. Once households have adapted to the deregulation, savings should revert to its more long term level. The credit market for households has been deregulated since the end of 1985, as both the regulations of bank lending rates and loan ceilings on banks were abolished in that year. From Figure 2 it can be seen that the ratio between gross assets of households (the sum of debts, housing and financial net wealth) and disposable income between 1985 and 1989 increased by about 35%. The net asset ratio (owner occupied houses and financial assets) increased less during the same period.[4]

During the 1970s and 80s, considerable capital gains and losses on financial and real assets of the households occurred. As can be seen from Table 1 the real price of equities decreased during the 1970s. The trend for the 1980s is quite the opposite; the real price of equities has increased five fold. The price of owner occupied houses increased more than the general price level during the 1970s, but dropped by more than 25 percent during the earlier part of the 1980s. An increase of a similar size then followed during the latter part of the decade.

Thus considerable changes in the net wealth of households have taken place during the last two decades. Some of the effects of the changes in the real price of owner occupied houses can also be traced in Figure 2. For households the ratio between the value of real estate and disposable income was over 1.5 at the end of the 1970s, while five years later the ratio was well below 1.5. The capital gains for equities and houses during the second half of the 1980s occurred simultaneously with an increase in the average propensity to consume (see Figure 1). The average propensity to consume was even greater than one for some of these years. According to Figure 2 the net wealth-income ratio increased by more than 25 percent between 1985 and 1989.

2. The problem, the basic model and the data.

The aim of this paper is to analyze whether the relationship between consumer spending and income in Sweden has been stable during the 1970s and the 1980s. The relationship between these two variables is the oldest statistical regularity of macroeconomics. As we have already noted, a few additional variables may enter as important determinants and ought to be brought into consideration when consumer behavior is analyzed.

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[4]Note that at the same time as the household indebtedness ratio increased even the net financial assets ratio increased. One explanation of this phenomenon is that some financial assets have yielded such a high return that, in certain cases, it has paid to finance them with loans. The tax system in the 1980s with possibilities of tax arbitrage might be an important factor in this respect.

In a recent paper Lehmussaari (1990) examines the savings dynamics in the Nordic countries. The author estimates consumption-saving functions based on the life-cycle hypothesis and one conclusion of the paper is that only in the case of Sweden is there a stable consumption function. For the other three Nordic countries, structural changes have occurred in connection with the introduction of financial deregulations.[5][6]

The basic model used in the present paper is based on the standard life-cycle hypothesis. According to this theory, the average propensity to consume is, for a given ratio of net wealth to income, a function of the income growth rate. Today's consumption of a household depends on current and future income and current net wealth. In a few previous studies the life-cycle hypothesis has been used to test the behavior of Swedish households.[7] The empirical work in these earlier studies was based on yearly data. In the present paper we use quarterly data, the sample period being 1970-89. The number of observations and the periodicity of the data make it possible to include variables in the consumption functions that are assumed to affect the short run behavior of households. We also test whether the consumption function should be specified with an aggregated net wealth variable or if this variable should be split into two categories (housing and net financial wealth).

Inclusion of the wealth variables in the consumption function enables us to analyze, among other things, whether the deregulation of financial markets has brought about a fundamental change in consumer behavior. As has been pointed out, the deregulation of financial markets may have had an impact on capital gains on equities and owner occupied houses This increase in the wealth of households in turn may be one explanation of the

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[5]Lehmussaari estimates functions, on yearly data, 1971 to 1985. His conclusion is based on two years of out of sample forecasts. In the case of Sweden the wealth variable used consists only of net financial wealth.

[6]The results reported by Lehmussari are not supported by the findings of Brodin and Nymoen (1989) on Norwegian data. Their results indicate a stable relationship between consumption expenditures on the one hand and income and net wealth on the other hand.

[7]In these studies - see Bentzel and Berg (1983), Berg (1983) and Berg (1988) - income, net wealth, social security wealth, composition of population and capital gains were important determinants.

unusual behaviour of income and consumer expenditures in recent years.

The split of the net wealth variable also makes it possible to compare the increase in the value of owner-occupied houses and its effects on consumption expenditures in Sweden with the experience in the UK. Muellbauer and Murphy (1989 and 1990) in explaining the consumer boom in the UK during the 1980's accords a key role to the housing market and financial deregulation.

Earlier in this paper a list of arguments was put forward as factors that might be important determinants for the development of consumption. Among these factors we do not consider the composition of the population and the social security wealth in the present paper. We concentrate on analyzing the remaining arguments and their relationship with consumption.

In the empirical analysis we are going to use error-correction models that are formulated on the basis of the life-cycle theory. Error-correction models in the context of the consumption function were first used in the seminal paper by Davidson et al, DHSY,version of the DHSY model for quarterly data can be written

$$\Delta_4 c_t = \beta_0 + \beta_1 \Delta_4 y_t + \beta_2 (c_{t-4} - y_{t-4}) + \epsilon_t \qquad (2.1)$$

where c denotes consumption and y disposable income. (All bold lower case letters indicate that the variable is expressed in fixed 1985 Swedish Crowns and as natural logarithms.) In addition to the basic variables, the estimated equations include variables denoted D744 etc, which capture the effects of changes in the VAT level. The variables take the value -1 in the quarter preceding the change (e.g. 74:3), 1 in the quarter of the change (74:4) and 0 otherwise.

Hendry and Ungern-Sternberg, HUS, (1981) extended this basic model to include a so called integral-control mechanism. The basic HUS model can be written

$$\Delta_4 c_t = \gamma_0 + \gamma_1 \Delta_4 y_t + \gamma_2 (c_{t-4} - y_{t-4}) + \gamma_3 (w_{t-4} - y_{t-4}) + \epsilon_t \qquad (2.2)$$

where w denotes total net wealth. In models with wealth disaggregated, wh denotes housing wealth and wf net financial wealth.

We are going to consider generalizations of these models, which in addition to a more complicated lag structure will also allow for error correction terms of a more general type. Different effects of financial and housing wealth will be allowed. In the development of the error correction terms we are going to employ recent results on the integration and cointegration of time-series.

In addition to the variables included in the basic formulations (2.1) and (2.2), we will also consider the effects of inflation (p denotes the annual inflation rate) on consumption. There are several reasons why inflation may influence consumption. Thus inflation may influence the value of and return on assets, it can make the recorded real income deviate from that perceived by households and it may capture the effect of income uncertainty (for a more detailed discussion, see e.g. DHSY 1978, HUS 1981, Deaton 1977 and Koskela & Virén 1985).

Although the life-cycle hypothesis emphasizes the distinction between consumer expenditures and pure consumption, we have used consumption expenditures as the dependent variable. Data for pure consumption variables are not available and it has not been possible to construct such variables. Disposable income for households follows standard National Accounts conventions and thus excludes capital gains or losses.

In the Swedish National Accounts, interests and dividends are credited to the households during the fourth quarter of each year. The disposable income series mainly used by us is adjusted for this in such a way that the annual interest incomes are evenly divided between the four quarters. Results of analyses with the unadjusted series will also be reported in some cases.

In the Swedish National Accounts no distinction between households and non-profit organizations are made. Both consumer expenditures and disposable income thus include the consumption and income of non-profit organizations. The implicit price-deflator for private consumption is used as the price-index.

The wealth variable is developed from the Berg (1988) data set.[8] In the present paper quarterly data for the financial and real wealth of households have been computed and used. Net financial wealth consists of deposits, shares (at market value), bonds, assets in pension funds (voluntary life insurance savings), other financial assets and loans (deducted). Real assets consist of the market value of owner-occupied homes and holiday homes and is denoted housing wealth in the following. In comparison with Berg (1988) owner occupied flats, farms and the stock of consumer durables owned by households are not included in real assets.[9]

3. Testing for integration and cointegration.

3.1. The basic methodology

The testing for cointegration among several time series should be preceded by a determination of the order of integration of the individual series. Two different types of tests are usually employed in this context. Sargan and Bhargava (1983) suggest a test based on the Durbin-Watson statistic. The null hypothesis tested is that the observations follow a random-walk, which implies that the differenced series is integrated of order 0,I(0). The Durbin-Watson statistic in the regression of the original series on just a constant term is computed. Under the null the D-W value should be very small, while if the series is I(0) larger values should be expected, exactly how large depending on what type of alternative hypothesis that is the true one. Sargan and Bhargava present critical values for some selected sample sizes. This test is usually called the CRDW-test.

An even more important test is the Dickey-Fuller test (Fuller 1976 and Dickey & Fuller 1981). The relationship

$$y_t = \alpha + \beta y_{t-1} + \epsilon_t \qquad (3.1)$$

can be written

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[8]Berg (1988) constructs a yearly wealth variable for the period 1950-1986 where the variable consists of ten variables; six of them are financial variables and the remaining four are real assets variables.

[9]For a description of data see Berg (1990).

$$\Delta y_t = \alpha + \gamma y_{t-1} + \epsilon_t \tag{3.2}$$

$\beta = 1$ in (3.1) is equivalent to $\gamma = 0$ in (3.2), while $\beta < 1$ obviously implies $\gamma < 0$. To test the null hypothesis that the series is I(1) we could use (3.1), but the expression (3.2) is usually the basis for the test. The alternative hypothesis considered is $\gamma < 0$. The test can be based on the OLS estimates of (3.2) and the standard t-ratio can be used as the test-statistic. However, this statistic does not follow the usual t-distribution under the null. Critical values for some sample sizes are available.

When the residuals of the relation (3.2) are not white noise, the basic Dickey-Fuller (DF) procedure is improved by a test based on the OLS-estimation of the relationship

$$\Delta y_t = \alpha_0 + \alpha_1 \Delta y_{t-1} + \alpha_2 \Delta y_{t-2} + \ldots + \alpha_k \Delta y_{t-k} + \gamma y_{t-1} + \epsilon_t \tag{3.3}$$

where as many terms Δy_{t-i} are included as is required to make the residuals white noise. The t-ratio for the variable y_{t-1} is the basic statistic for this, the Augmented Dickey-Fuller (ADF) procedure. The distribution is again non-standard and different from that in the DF case.

The basic model (3.2) can be extended to include a linear deterministic time trend. This changes the distribution of the t-statistic. Integration testing of individual series is a far from straightforward business, as the distributions are different depending both on whether the true model includes a constant term and/or linear trend and also on whether the corresponding parameters are estimated or not (for a discussion see Haldrup & Hylleberg 1989).

Cointegration of variables means that certain linear combinations of possibly non-stationary variables are stationary. To test if such a linear combination is stationary or not, a regression is run between the variables in level form with a suitably chosen variable as the dependent one. The residuals from this regression are computed and analyzed in the same way as an individual series as described above. The fact that residuals are used, however, implies that the critical values are not the same as those valid in the analysis of individual series. The distributions of the test-statistics depend among other things on the number of variables included, the distributions of these variables and the sample size. Critical values for some special cases are available, but in practical applications we often have to resort to approximate critical limits.

3.2 The order of integration of individual series

The results of various integration tests are shown in Table 2. In addition to the basic model we also consider a model with four augmented lags of the dependent variable and a model with a deterministic trend. Models both with and without seasonal dummies are estimated. The results for the period 1970-85 are similar and are not reported. We give both the t-values and the estimated parameter, as the size of the latter gives some information on whether an insignificant value is due to low power.

From Table 2 it is immediately clear that the inclusion or exclusion of the seasonal dummies influence the results to a considerable extent. This illustrates another difficulty with Dickey-Fuller testing. The usual tables do not allow for seasonal dummies, which means that they are not strictly possible to use in such cases. One solution to the problem is to use the usual critical values but allow for somewhat "fatter tails" (Brodin & Nymoen, 1989). In fact, the results can be highly misleading as to the long-run properties if seasonal dummies are not included. An example of this is consumption where the Durbin-Watson statistic is reduced from 0.51 to 0.08 when the seasonal dummies enter the model. Similarly we reject the hypothesis of a unit root in the simple model without seasonal dummies, but the introduction of such dummies alters the conclusion and changes the estimated γ parameter from -0.27 to -0.038.

The effect of the seasonals is much smaller in models that have been augmented with lagged values of the dependent variable. The general conclusion for all variables considered in the cases where no deterministic trend is included is that a unit root hypothesis cannot be rejected. This is also true for the error correction variable c-y. For this variable, the introduction of lagged values of the dependent variable changes the picture from indications of stationarity to non-rejection of the unit-root hypothesis.

The process generating the data need not be of the type considered so far. Instead of an autoregressive process with or without a unit root, a deterministic trend may also be part of the process generating the data. There are indications of a positive deterministic trend for c and y, in both cases combined with tendencies towards a stationary process around the deterministic trend. The positive trend, however, is not significant, which means that the results reported above without deterministic trend may be relied upon. For the wealth variables, the tendency towards a deterministic trend is weaker and even with such a trend component included, the unit root hypothesis cannot be rejected. For the error correction variable c-y there are indications of a stationary process around a deterministic trend.

3.3 The cointegration of the variables

From the discussion in section 3.2, it is obvious that the variables that we are discussing are not stationary. To find cointegrating relationships is consequently important if the variables are to be included in regression models. Tables 3 and 4 show some of the major results. Standard errors are included to give some information on the importance of the variables, although they are not "true" standard errors in this situation. We again notice that the inclusion or exclusion of the seasonal dummies has a decisive effect on the results obtained. Thus for the simple model with y as the only explanatory variable the income elasticity is 0.74 without dummies while a much more acceptable 0.96 is obtained after the introduction of seasonal dummies. Extension of the observation period to cover the last four years 1986-1989 increases the elasticity to 1.23. This is a clear indication of the reduced savings ratio observed during the last few years. A simple Dickey-Fuller test of whether c and y cointegrate rejects the unit root hypothesis. The opposite conclusion is arrived at if the model is augmented with lags of the dependent variable. If a deterministic trend is allowed, we obtain indications of a stationary process around a deterministic trend.

The introduction of the wealth variable into the cointegrating equation reduces the income elasticity to 0.69 for the period 1970-85 and 0.70 for the full period. Thus in this case there is not much effect of the last few years on the estimated income parameter. The wealth parameter on the other hand increases from 0.19 to 0.30 indicating considerable wealth effects during the last few years. There is some evidence of a linear deterministic trend for this cointegrating equation and the unit root hypothesis is rejected in the presence of such a linear trend.

Disaggregating wealth into financial wealth, wf, and housing wealth,wh, we find that the effects of different types of wealth on consumption differ in the long run. The elasticities are 0.13 and 0.24 respectively and they remain quite stable even after the inclusion of the period 1986-89 (0.11 and 0.19). There is hardly any evidence of a linear deterministic trend. Without lagged dependent variable-augmentation the unit root hypothesis is firmly rejected. The inclusion of the lagged dependent variables hardly changes the estimated value of $1-\gamma$ at all, 0.39 compared with 0.27, but reduces the t-value from -5.90 to -2.98. This is an indication of the multicollinearity that is so often found and which reduces the power of the test considerably. In conclusion it seems reasonable to consider c, y, wf and wh as cointegrated.

4. The testing of seasonal integration and cointegration

4.1. The basic methodology

Standard testing for unit roots is made on the assumption that there are no other unit roots than that corresponding to a zero frequency peak in the spectrum. As many time series contain seasonal components of considerable magnitude, this need not be true. A general seasonal process can be modelled by three different classes of models. They are

1) Deterministic processes which can be represented by nonstochastic seasonal dummies. In this case the shape of the seasonality never changes.

2) Stationary processes which can be exemplified by the following process for quartely data.

$$z_t = \rho z_{t-4} + \epsilon_t \qquad (4.1)$$

where we require that the absolute value of ρ is smaller than 1. This process has peaks at the seasonal periodicities one and two cycles per year as well as at the zero frequency.

3) Integrated processes which are obtained when there is a seasonal unit root in the autoregressive representation of the series.
   In (4.1), $\rho = 1$ leads to such a case.

One important property of an integrated seasonal process that distinguishes it from a deterministic process is that the basic seasonal pattern can be changed, "summer" can change into "winter". This is also a reason why such processes in practice may be less realistic than deterministic processes.

A general class of time series models is the following

$$\phi(B)x_t = D(B)\varphi(B)x_t = \mu_t + \epsilon_t \qquad (4.2)$$

where B is the lag-operator, $\varphi(z)$ represents the stationary part of the process with all roots outside the unit circle, D(z) the integrated part with all roots on the unit circle and μ_t finally the deterministic part.

Hylleberg et al (1990) recently have developed a methodology for the testing of seasonal unit roots. In the following we call this the HEGY methodology. A starting-point for the procedure is the fact that we can write the fourth difference of a variable in the following way

$$(1-B^4)x_t = (1-B)\ (1+B)\ (1-iB)(1+iB)x_t \qquad (4.3)$$

which means that we have four different unit roots 1, -1, i and -i corresponding to the zero frequency, two cycles per year and one cycle per year. Using a result for the representation of any rational polynomial, Hylleberg et al show that $\phi(B)$ can be written as follows

$$\phi(B) = \pi_1\left[B(1+B+B^2+B^3)\right] + \pi_2\left[-B(1-B+B^2-B^3)\right] +$$
$$+ (\pi_4 + \pi_3 B)\left[-B(1-B^2)\right] - \phi^*(B)(1-B^4) \qquad (4.4)$$

A root at 1 is equivalent to $\pi_1 = 0$, a root at -1 to $\pi_2 = 0$ and a root at +i or -i to both π_3 and $\pi_4 = 0$. Using (4.4) a general expression of the type (4.3) can be rewritten as

$$\phi^* (B)(1-B^4)x_t = \Big[\pi_1 B\left[(1+B+B^2+B^3)\right] + \pi_2 \left[-B(1-B+B^2-B^3)\right] + (\pi_3 B + \pi_4)\left[-B(1-B^2)\right]\Big] x_t + \epsilon_t \tag{4.5}$$

The testing procedure implies that the following variables are introduced

$$\begin{aligned} y_{1t} &= (1+B+B^2+B^3)x_t \\ y_{2t} &= -(1-B+B^2-B^3)x_t \\ y_{3t} &= -(1-B^2)x_t \\ y_{4t} &= (1-B^4)x_t \end{aligned} \tag{4.6}$$

Assuming $\phi^*(B)$ to be equal to 1 we can now write (4.5) as

$$y_{4t} = \pi_1 y_{1t-1} + \pi_2 y_{2t-1} + \pi_3 y_{3t-2} + \pi_4 y_{3t-1} + \epsilon_t \tag{4.7}$$

This expression can be estimated by OLS and ordinary statistics used for inference on the π's. If $\phi^*(B) = 1$ does not produce white noise a suitable number of lagged values of y_{4t} are introduced.

Tests for integration at the zero frequency are based on π_1 and tests for integration at the biannual frequency use π_2. The situation is slightly more complicated as regards the annual cycle. It is possible either to test $\pi_3 = 0$ assuming π_4 to be 0 or to test that both π_3 and π_4 are 0 using an F-like test. In the former case the test can be preceded by a test of the hypothesis that π_4 equals 0. The tests on π_1-π_4 can all be based on ordinary t-ratios but are one-sided and the critical limits given by the ordinary tables for the t-distribution do not apply. The t-ratios required for significance in general are absolutely larger than those of the standard case. Hylleberg et al include critical values for selected sample sizes.

The theory for seasonal cointegration has only very recently started to be developed. Reference is made to a paper by Engle et al (1990).

4.2 HEGY-tests

Results of an application of the HEGY-methodology to the two most important variables are shown in Table 5. The maximum lag considered for the dependent variable in the augmentation is 5. Significant lags only are included in the models selected. It is immediately obvious that the results are heavily dependent on the deterministic components included. For consumption it is found that for models without deterministic seasonal terms, four out of five possible lags are significant. For disposable income two lags are sufficient in the corresponding cases. In models with deterministic seasonals, the necessity to augment the models by lagged values of the dependent variable is much smaller. Lag 4 in the case of disposable income is the only variable that has to be included. Not only the augmentation but also the results are strongly dependent on the deterministic augmentation. In models without deterministic seasonals, we can in no case reject the hypothesis of a unit root. This is true for both consumption and disposable income and for the zero frequency as well as the frequencies 1/2 and 1/4.

Inclusion of deterministic seasonals completely changes the picture. We are now able to reject the unit root-hypothesis at the frequencies 1/2 and 1/4, although only just in the former case for disposable income. We are not able to reject the unit root hypothesis at the zero frequency, although we are closer to rejection when a deterministic trend is included. We are also closer to a rejection for disposable income than for consumption.

As a conclusion, it can be stated that the order of integration of consumption and income is such that cointegration of the series is possible. This contrasts with the results for the UK obtained in Hylleberg et al (1990). They find that consumption and disposable income cannot be cointegrated at the annual cycle as consumption has a unit root at this frequency, while this is not the case for disposable income.

As the seasonal variability in the wealth series is small, a HEGY-testing of these series has not been undertaken.

Before we turn to the estimation of dynamic models, it should be pointed out that there is one further way of testing the cointegration between the variables of interest. This is the methodology based on VAR models introduced by Johansen (1987). This approach among other things allows a test of the number of cointegration relationships. The procedure has been employed by Jacobson (1991) on a data set closely related to the present one and we refer to his paper for results.

5. Dynamic models

5.1 General considerations

It is nowadays generally considered that a dynamic model should incorporate elements that describe both the short- and long-run development. The most common way of accomplishing this is by inclusion of both difference and level terms in the model. The latter are often included in the form of error correction terms. With quarterly data both seasonal ($\Delta_4 y$) and first differences (Δy) can form the basis for the analysis, at least when working with seasonally unadjusted data.

One of the aims of using quarterly differences is to eliminate most of the seasonal variability prior to estimation. In addition to possibly simplifying the estimated equations, the series obtained are often easier to interpret than first-difference series, where the seasonal variability often completely swamps the remaining variability, which is what we are primarily aiming to capture.

Our interpretation of the results of the seasonal integration tests is that it is not necessary to use seasonal differences in the dynamic modelling. However, in view of the argument given above there are strong reasons for performing the analysis with seasonal differences. This has also been very common in recent years.

Thus Hendry and coauthors in their very influential series of papers on consumption in the UK (DHSY 1978, HUS 1981, Davidson & Hendry 1981 and

Hendry 1983) mainly work with seasonal differences. The same is true of Carruth & Henley (1990) in yet another study on UK data and Brodin & Nymoen (1989) in a study on Norwegian data. The Carruth-Henley study includes a model based on first differences but with seasonally adjusted data, while the Brodin-Nymoen study also considers a first-difference model based on unadjusted data, actually choosing this alternative as the preferred model (admittedly without too much discussion on its merits compared with their models based on seasonally differenced series).

One important difference between the approaches that should be noticed, is the time required for the error-correction mechanism to work. In the seasonal case it is four quarters, while in the first difference case the reaction is much faster, one quarter.

We are going to present results using both approaches, all the time working with seasonally unadjusted data. The analysis will be performed within a general framework that allows effects of the differenced variables with a delay of up to five lags in addition to levels in the form of either direct error-correction terms or as lagged level terms of relevant variables. From this general specification we eliminate unnecessary terms to obtain a more parsimonious representation that nevertheless accounts for the main features of the data generating process.

The modelling of the price effects merits some further discussion. Following DHSY (1978) a common way of modelling the price effects has been through terms written as $\Delta_4 \ln P$ and $\Delta\Delta_4 \ln P$, where P denotes the consumer price index or some similar measure. In our notation $\Delta_4 \ln P$ is of course basically the annual inflation rate, p, and $\Delta\Delta_4 \ln P$ is the change in the inflation rate. Written in this way, the price terms are looked upon as short-run effects and the basic variable is the price level, P, and not the inflation rate, p. In the long-run part of the model, the price level is usually not included.

If, on the other hand we were to consider the inflation rate as the basic variable, a consistent model formulation would imply the inflation rate itself in the long-run part of the model and the differenced inflation rate in the short-run part of the model. To consider the inflation rate rather than the price level as the basic variable seems more reasonable, as an assumption of effects on consumption of the price level in the long run hardly seems realistic. As a consequence of this, a seasonal difference of the inflation rate would be most logical as the short-run effect in models based on seasonal differences. On the basis of these considerations, we have considered both the inflation rate and the differenced inflation rate, and the latter both as a first and a seasonal difference in the estimated dynamic models.

5.2 Models based on seasonal differences

Model (5) in Table 6 is basically similar to the error correction model in DHSY (1978), while model (6) includes the "integral-control" variable w-y introduced by HUS (1981). The latter variable is found to be insignificant in contrast to the basic error correction variable c-y, which is significant with the expected negative sign. We obtain a strong and fairly large short-run effect of the rate of growth of disposable income, $\Delta 4y$, while there is a negative effect of the change in this variable that in general is not quite significant. Significant short-run price effects are obtained. The standard deviation of the residual is 1.63% and the residuals seem to be random.

Model (1) includes an error correction term based on c and y only and the results are fairly similar to those obtained with the error correction term c-y, which is not unexpected as the parameter of y in the EC expression is 0.96. A model with an EC term that includes aggregated wealth slightly improves the model without much change in the estimated parameters. Allowing financial and housing wealth to have different long-run effects produces a more substantial improvement, R^2 increasing from 0.6661 to 0.7342. Model (4) shows the effect of allowing no seasonal effects in the long-run relationship but instead including seasonal factors in the dynamic model. The model with no seasonals in the EC term is slightly better. Short-run effects of the wealth variables have been considered, but none were found.

Table 7 shows results of an application of what is sometimes called Stock's nonlinear estimation method. Instead of including EC terms from the first stage of the Engle-Granger procedure, we include the variables in the EC term in unrestricted form. Model (1) in Table 7 is superior to model (1) in Table 6, the implied long-run elasticity of 0.73 being considerably smaller than the 0.96 of EC1. Addition of aggregated wealth to this model does not produce a significant improvement. If, however, we introduce wealth in disaggregated form, both wealth variables are significant and R^2 increases from 0.7015 to 0.7855. The other parameters of the model are virtually unchanged with the exception of the parameters of the inflation rate and lagged consumption, which are reduced in size.

As regards price effects, models containing both the inflation rate and differences of the inflation rate (first or seasonal) showed that the important variable was the change in the inflation rate. As to the choice between a representation in the form of a first or a seasonal difference, the results were fairly similar. There was a marginal advantage for the first difference and consequently results with this variable will be reported throughout.

An evaluation of the model during the sample period yields very satisfactory results. Thus there is no tendency towards autocorrelation in the residuals and the residuals seem to be normally distributed and homoscedastic.

One of the crucial tests of a model is of course whether the model can produce reasonably accurate forecasts. This is particurlarly important in the present situation where we suspect that structural changes may have occurred. The forecasts for the period 1986-1989 indicate some misspecification of the model. The forecast errors are positive in most cases and there are some quarters where the errors are fairly large. The model is least successful for the year 1986 and the single quarter 1988:1. Otherwise the accuracy is reasonable for the years 1987 - 1989. A Chow-test of stability gives indications of the structural changes discussed above although the test is not significant at the 5% level (P = 0.086).

It is interesting to investigate models that do not include the wealth variables somewhat more. A full dynamic specification with lags up to the order five has been considered, but no additional significant variables were found. Thus we can perform the further analysis on the basis of equation (1) in Table 7. The test-statistics within the sample period are all reasonable. The Durbin-Watson statistic is further away from 2 than with e.g. model (3), but the LM-test which is to be preferred to the Durbin-Watson statistic in the present situation does not reveal significant autocorrelation in the residuals.

If we study the behaviour of model (1) in Table 7 in the forecast period 1986-1989, large inadequacies are revealed. The model underestimates the dependent variable in every single quarter during this period and the errors are large in many cases. A Chow test for parameter constancy yields a strongly significant result (P = 0.0172). Thus the inclusion of wealth variables vastly improves the model performance during the last few years.

5.3 Models based on first differences

In the models based on first differences the explanatory level terms used are lagged one period. This is the most common choice of lag length, although not the only one (thus Carruth and Henley (1990) use a lag of three quarters in their first difference models). In some cases composite variables have been constructed when the suitability of this was indicated from the unrestricted estimation.

The main results are shown in Table 9. From the table it can be inferred that no lags of the dependent variable were significant. A considerable short-run effect of disposable income is present as well as a more doubtful negative effect of changes in inflation lagged 1-2 quarters. The lagged level terms are all strongly significant with indications of a long-run elasticity close to 1. Use of the error correction term obtained earlier gives less good results than the unconstrained estimation (model (2) compared with model (3)).

The test statistics in general are adequate for the preferred model (3), with no indications of autocorrelation, heteroscedasticity or lack of normality. The performance of the model in the forecast period is remarkably good. The Chow-test for parameter constancy is insignificant and only one of the 16 one-step ahead forecasts is significant at the 5%

level (that of 1988:1).

A model without wealth terms produces a less good fit in the sample period, but the difference in R^2 is not dramatic. In the forecast period the differences are much more marked. Thus all the one-step ahead forecasts underestimate the true development and half the actual values are outside the 95% forecast interval. The errors seem to be of the same size during the whole forecast period. The Chow test produces a probability value of 0.019, confirming the unimpressive forecast performance of this model.

A look at Figures 5 and 7 immediately reveals that a comparison between the models using seasonal and first differences is far from straightforward. In the first difference case, the seasonal effects are so dominant that an interpretation of the remaining variability becomes difficult. A comparison of the models in terms of R^2 encounters the same problem. The much higher R^2 in the first difference case, 0.9686 compared with 0.7855, does not necessarily mean that the first-difference model is superior, as the seasonal variability is included in the dependent variable in this case. The standard deviation of the residuals is a more reliable measure, the advantage of the first-difference model disappearing, 1.34% compared with 1.35% (the sample periods are not quite the same). A recomputation of R^2 in terms of levels gives a slight advantage to the first-difference model, the figures being 0.9669 and 0.9604 for the period 1971:2-1985:4.

As regards the forecast performance, the first-difference model has an advantage. The average error of this model is very small, 0.32 percentage points, while the average error of the seasonal model is 0.85 percentage points. The difference in the corresponding absolute errors is also considerable, 1.17 compared with 1.49 percentage points.

Before leaving the estimation of the dynamic models a word about the simultaneity bias problem. The use of OLS requires that variables that are included in unlagged form must be weakly exogenous. In the literature based on DHSY-type of models, OLS is used in general and where comparisons with instrumental variables estimates are included (see e.g. Brodin &

Nymoen 1989) little indication of simultaneity bias is usually found. For basically the same data set as the one used by us, Jacobson (1991) finds that income and prices are weakly exogenous in the context of VAR modelling using the Johansen methodology.

5.4 Long-run properties

The first-difference model (3) of Table 9 with sample period 1971-85 and an assumption of a 2 percent annual growth rate in income and consumer expenditures implies the following long-run properties (strictly the results are valid only for the first quarter, but the differences between quarters are small).

$$c = -3.41 + 1.04y + 0.11wf + 0.12wh \qquad (5.1)$$

The results are similar when the period is extended to cover the years 1986-1989.

The corresponding results based on the seasonally differenced models (3) of Table 7 are as follows:

$$1971\text{-}85{:}\ c = -0.87 + 0.64y + 0.16wf + 0.23wh \qquad (5.2)$$
$$1971\text{-}89{:}\ c = -1.50 + 0.75y + 0.16wf + 0.18wh \qquad (5.3)$$

In a model based on the life-cycle theory, the sum of the long-run parameters of the income and wealth variables is of considerable interest. If they sum to 1, a basic homogeneity constraint is fulfilled in the sense that a one percent increase in income and wealth will increase consumption by one percent. This means that the average propensity to consume is constant in the long run. As pointed out in Brodin & Nymoen (1989) this constraint is also required in order to ensure the long-run consistency of consumption and wealth, given the development of income, on the assumption that the data fulfill the identity $\Delta W_t = Y_t - C_t$. Our data are not consistent in this respect, but nevertheless we should consider the constraint.

The sum of the income- and wealth parameters of model (5.1) is 1.27.

Although the uncertainty of this estimate is considerable, it is significantly different from 1 (a Wald-test based on a Taylor-expansion-computed variance leads to $\chi^2(1) = 4.44$). The large sum of the elasticities is compensated by the large negative constant term, but the results do not seem wholly convincing and must cast some doubt on the model. It should be pointed out, however, that it is not unique to find that the homogeneity constraint is not fulfilled. Thus the Brodin-Nymoen study produces a parameter sum that is considerably smaller than 1, and an imposition of the constraint leads to a less satisfactory model.

With the seasonally differenced model, the constant is insignificant while the sum of elasticities is 1.03 and 1.09 respectively. In both cases this sum does not differ from 1 (similar Wald-test to that above giving $\chi^2(1)$ = 0.09 and 1.48). Thus the equations are compatible with similar growth rates in consumption, income and wealth.

The estimated elasticities are in accordance with conventional results for life cycle consumption functions, with a rather high elasticity with respect to income and similar elasticities with respect to the two wealth components[10]. However, the elasticities of the wealth variables are significantly different for the shorter period ($\chi^2(1) = 4.90$), while this is not the case for the extended period ($\chi^2(1) = 0.50$). Thus the assumption often made that the elasticities with respect to different types of wealth are the same is somewhat doubtful[11].

[10]Even if the elasticity is high, the marginal propensity (MPC) to consume out of housing wealth is small. Multiplying the elasticity with the ratio between consumption and housing wealth (mean value 0.16 for the 1980s) gives average MPCs for housing wealth of 0.037 and 0.025 for Equations (5.2) and (5.3). The average MPC for financial wealth is 0.08 for both equations (the average value for the ratio between consumption and financial wealth was 0.5 for the 1980s).

[11]Notice the difference between including two separate wealth terms in a multiplicative model with an assumption of the same parameter and including just one composite wealth variable. The latter approach is significantly less successful with our data.

5.5 The growth of consumption during the 1980s

Before considering some of the results in greater detail, it is appropriate to extend our previous discussion of the development during the 1980s somewhat more. The real growth rates of consumption, income and the two wealth variables show large changes during this decade as illustrated in Table 11. During the period 1986-88 the growth rate of consumption exceeded that of income by a considerable margin. This resulted in a negative savings ratio during the years 1987-89, a unique experience for Sweden during the post-war period.

The wealth variables show remarkable changes in growth rates during the decade. The increase in the financial net wealth was very fast in the mid-1980s, while housing wealth after a decline during the earlier part of the decade increased considerably during the last three years.

The fall in the financial net wealth in 1987 was an effect of the financial deregulation. Both in 1987 and 1988 the indebtness of the households increased considerably (see Fig 1), at the same time as the real prices of houses rose (cf Table 1). The effects of the financial deregulation is consequently indirectly reflected in the wealth variables.

Table 12 shows the effects of different groups of variables on the annual growth rate (model (3) of Table 7 with the time period 1971-89). With the exception of the year 1986 the model is quite accurate. The price effects are small, the largest effect being that for 1984 when the reduced inflation rate had a noticeable positive effect on consumption. It is clear that the model would not be able to explain the development during the latter part of the 1980s without the error correction term and the wealth variables included in this part of the model.

The financial deregulation is an important factor behind the increased wealth during the second half of the 1980s. This increase in wealth has resulted in an overshooting in consumption growth. In this respect our results are in accordance with those reported by Muellbauer and Murphy (1989) and (1990) for the UK.

6. Conclusions

Consumption behaviour in Sweden during the 1970s and 80s was analyzed on the basis of a life cycle model specification formulated as an error correction model. Wealth was considered both in aggregate form and disaggregated as housing and net financial wealth. Unit root tests indicated that consumption, income and wealth were all integrated of order one and that the variables cointegrate if wealth is disaggregated. HEGY-tests did not reveal seasonal integration in consumption and income.

Models were estimated both on the basis of first and seasonal differences. Both sets of models produced reasonable results in dynamic models, while the long-run properties of the first difference models were rather doubtful.

The error correction terms were found to be important and inclusion of wealth in disaggregrated form improved the models significantly compared with inclusion of wealth in aggregated form. The properties of the models were tested during the prediction period 1986-89, which has seen a major decrease in the savings ratio. While not being able to completely reflect this development, the results obtained were rather promising and a hypothesis of unchanged structure in 1986-89 compared with 1971-85 could not be rejected. Models without the wealth variables failed completely to explain the development during the latter part of the 1980s.

An important explanation of the rapid changes in wealth in Sweden during the latter part of the 1980s was the deregulation of the financial markets. The financial liberalization gave consumers the ability to rearrange their portfolios and effectively made illiquid wealth more liquid.

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Table 1 Real price of equity and owner occupied houses, ultimo yearly values 1970-1989.

	Shares	Houses
70	1.26	0.97
71	1.43	0.95
72	1.48	0.96
73	1.37	0.95
74	1.20	0.97
75	1.39	1.02
76	1.28	1.07
77	0.96	1.11
78	1.02	1.14
79	0.93	1.14
80	1.00	1.00
81	1.41	0.88
82	1.72	0.83
83	2.57	0.76
84	2.14	0.74
85	2.53	0.72
86	3.66	0.75
87	3.18	0.81
88	4.56	0.92
89	5.34	0.99

Source: Affärsvärldens generalindex and Berg (1990).

Table 2 Sargan-Bhargava and Dickey-Fuller tests of individual series. 1970-89.
SD = seasonal dummies.

	CRDW		Dickey-Fuller tests							
			A		B		C		D	
	(1)	(2)	γ	t	γ	t	γ	t	γ	t
c	0.51	0.08	-0.27	-3.40	-0.038	-1.27	-0.031	-0.96	-0.033	-1.23
y	1.00	0.27	-0.53	-5.30	-0.159	-2.77	-0.079	-1.45	-0.082	-1.69
w	0.05	0.04	0.009	0.34	0.023	1.16	-0.008	-0.31	0.001	0.04
wf	0.06	0.04	-0.012	-0.42	0.002	0.08	-0.018	-0.61	-0.007	-0.25
wh	0.03	0.03	-0.022	-1.12	-0.016	-0.92	-0.034	-2.15	-0.030	-1.93
c-y	1.37	0.57	-0.69	-6.32	-0.27	-3.30	-0.053	-0.55	-0.041	-0.50

	E				F			
	γ_1	t	γ_2	t	γ_1	t	γ_2	t
c	-0.94	-8.13	0.0031	6.90	-0.20	-2.88	0.0007	2.57
y	-0.81	-7.21	0.0017	4.21	-0.34	-3.98	0.0006	2.76
w	-0.043	-0.96	0.0003	1.40	-0.004	-0.11	0.0002	0.90
wf	-0.045	-1.51	0.0011	2.52	-0.029	-1.14	0.0009	2.71
wh	-0.027	-1.13	0.0001	0.36	-0.020	-0.94	0.0001	0.34
c-y	-0.95	-8.34	0.0012	4.45	-0.70	-6.30	0.0009	5.04

A = Basic D-F test
B = A + SD
C = A + four lags of the dependent variable
D = A + SD + four lags of the dependent variable
E = A + linear determ trend
F = A + SD + linear determ trend

Table 3 Long-run relationships with c as the dependent variable 1970-85

	(1)	(2)	(3)	(4)	(5)	(6)
Const	3.00	1.68	0.45	0.97	-0.35	-0.83
D2			0.0448	0.0407		0.0426
D3			-0.0406	-0.0333		-0.0278
D4			-0.0386	-0.0029		0.0075
y	0.74 (0.07)	0.57 (0.07)	0.96 (0.06)	0.69 (0.09)	0.58 (0.07)	0.66 (0.09)
w		0.24 (0.05)		0.19 (0.05)		
wf					0.133 (0.035)	0.127 (0.025)
wh					0.269 (0.048)	0.244 (0.042)
R^2	0.6747	0.7588	0.8609	0.8867	0.7906	0.9140
$\hat{\sigma}$	0.0406	0.0353	0.0272	0.0248	0.0331	0.0218
DW	1.63	2.14	1.19	1.02	2.58	1.45

Table 4 Cointegration tests 1970-85. A, C and E defined as in Table 2.

Dickey-Fuller tests

	CRDW	A		C		E			
		γ	t	γ	t	γ_1	t	γ_2	t
EC1	1.19	-0.59	-5.07	-0.19	-1.41	-0.95	-7.42	0.0008	4.57
EC2	1.02	-0.51	-4.58	-0.21	-1.51	-0.68	-5.55	0.0004	2.74
EC3	1.45	-0.73	-5.90	-0.61	-2.98	-0.79	-6.16	0.0002	1.55

EC1 y with SD model (3) in Table 3
EC2 y, w with SD model (4) in Table 3
EC3 y, wf, wh with SD model (6) in Table 3

Table 5 HEGY-tests 1970-1989. I denotes a constant and Tr a linear trend.

Variable	Auxiliary regression		t				F
	Determ	Augmentation	π_1	π_2	π_3	π_4	$\pi_3 \cap \pi_4$
c	I	1,3,4,5	-0.23	-0.37	-0.93	-1.10	1.02
	I,Tr	1,3,4,5	-1.77	-0.35	-0.94	-0.96	0.91
	I,SD		-0.12	-4.55*	-4.14*	-2.03*	11.82*
	I,Tr,SD		-1.05	-4.55*	-4.18*	-1.99*	11.94*
y	I	2,5	-2.23	-0.83	-1.05	-0.96	1.04
	I,Tr	2,5	-2.94	-0.77	-1.03	-0.92	0.95
	I,SD	4	-2.02	-3.00*	-5.55*	-1.23	17.71*
	I,Tr,SD	4	-2.68	-3.12*	-5.72*	-1.10	18.52*

* denotes significance at the 5% level

Table 6 Dynamic models in 1971:2-1985:4. Dependent variable $\Delta_4 c$.
EC1-EC3 as defined in Table 4. EC4 from model (5) in Table 3.

	(1)	(2)	(3)	(4)	(5)	(6)
Const	.0042 (.0024)	.0034 (.0023)	.0044 (.0021)	.0048 (.0040)	.0005 (.0055)	-.0470 (.0818)
D2				.0161 (.0069)	.0053 (.0075)	.0062 (.0077)
D3				-.0257 (.0057)	-.0257 (.0070)	-.0259 (.0070)
D4				.0080 (.0057)	-.0175 (.0071)	-.0152 (.0082)
$\Delta 4c_{-1}$	.3419 (.1013)	.3584 (.0978)	.2849 (.0894)	.3254 (.0885)	.3809 (.1021)	.3857 (.1032)
$\Delta 4y$	.4026 (.1058)	.4445 (.1049)	.4692 (.0936)	.4273 (.0921)	.3853 (.1068)	.4094 (.1152)
$\Delta\Delta 4y$	-.1451 (.0907)	-.1703 (.0883)	-.1774 (.0788)	-.1885 (.0774)	-.1613 (.0904)	-.1712 (.0927)
Δp	-.4674 (.1560)	-.4443 (.1529)	-.3834 (.1374)	-.4205 (.1371)	-.5216 (.1574)	-.5165 (.1587)
$EC1_{-4}$	-.3452 (.0873)					
$EC2_{-4}$		-.4281 (.0985)				
$EC3_{-4}$			-.6084 (.1003)			
$EC4_{-4}$				-.5809 (.0984)		
$(c-y)_{-4}$					-.3128 (.0869)	-.3385 (.0980)
$(w-y)_{-4}$						.0231 (.0396)
D744	-.0303 (.0121)	-.0300 (.0118)	-.0295 (.0105)	-.0352 (.0108)	-.0355 (.0126)	-.0352 (.0127)
D804	-.0202 (.0118)	-.0194 (.0116)	-.0157 (.0104)	-.0214 (.0106)	-.0260 (.0123)	-.0258 (.0124)
R^2	.6498	.6661	.7342	.7597	.6734	.6757
$\hat{\sigma}$	.0163	.0159	.0142	.0139	.0162	.0163
DW	1.90	1.82	1.85	1.85	1.98	1.95

Table 7 Dynamic models estimated by Stock's nonlinear estimation method. Dependent variable Δ4c. Model (3') uses the unadjusted disposable income variable.

	71:2-85:4			71:2-89:4	71:2-85:4	71:2-89:4
	(1)	(2)	(3)	(3)	(3')	(3')
Const	1.0325 (.4911)	1.2071 (.4975)	-.4971 (.7087)	-.7193 (.4340)	.3736 (.6923)	.0573 (.3815)
D2	.0040 (.0073)	.0061 (.0073)	.0172 (.0071)	.0140 (.0062)	.0084 (.0068)	.0061 (.0060)
D3	-.0249 (.0067)	-.0252 (.0066)	-.0256 (.0058)	-.0268 (.0059)	-.0211 (.0061)	-.0201 (.0059)
D4	-.0083 (.0082)	.0007 (.0099)	.0044 (.0093)	-.0079 (.0092)	-.0138 (.0160)	-.0200 (.0167)
$\Delta 4c_{-1}$	.3704 (.0988)	.3801 (.0976)	.2814 (.0895)	.3537 (.0856)	.3522 (.0929)	.4179 (.0876)
Δ4y	.2928 (.1122)	.3303 (.1133)	.3569 (.0993)	.3174 (.0974)	.2922 (.1034)	.2680 (.0963)
ΔΔ4y	-.1352 (.0883)	-.1544 (.0879)	-.1604 (.0771)	-.1126 (.0758)	-.1523 (.0749)	-.1302 (.0712)
Δp	-.4978 (.1525)	-.4772 (.1510)	-.4061 (.1340)	-.4764 (.1397)	-.4461 (.1476)	-.5157 (.1510)
c_{-4}	-.3305 (.0844)	-.4049 (.0963)	-.5782 (.0969)	-.4824 (.0860)	-.4396 (.0902)	-.3406 (.0764)
y_{-4}	.2414 (.0906)	.2276 (.0898)	.3702 (.0892)	.3636 (.0872)	.1814 (.0648)	.1594 (.0627)
w_{-4}		.0620 (.0405)				
wf_{-4}			.0906 (.0219)	.0747 (.0147)	.0736 (.0228)	.0650 (.0152)
wh_{-4}			.1356 (.0364)	.0896 (.0324)	.1303 (.0398)	.0951 (.0352)
D744	-.0373 (.0122)	-.0370 (.0121)	-.0362 (.0106)	-.0354 (.0113)	-.0339 (.0114)	-.0331 (.0120)
D804	-.0257 (.0119)	-.0249 (.0117)	-.0205 (.0104)	-.0218 (.0110)	-.0260 (.0112)	-.0273 (.0118)
R^2	.7015	.7160	.7855	.7379	.7455	.7003
$\hat{\sigma}$	.0156	.0154	.0135	.0147	.0148	.0157
DW	1.97	1.90	2.01	1.99	2.05	2.01

Table 8 Tests of selected models from Table 7.

Model (3):

Chow test for parameter constancy
1970-85 vs 1986 -89 $F(16,45) = 1.68$ ($P = 0.086$)

LM-test for autocorrelation : $\chi^2(5) = 0.38$

Jarque-Bera test for normality: $\chi^2(2) = 0.88$

ARCH-test: $\chi^2(5) = 4.41$

White test for heteroscedasticity: $F(23,21) = 0.42$

Model (1):

Chow test for parameter constancy
1970-85 vs 1986-89 $F(16,47) = 2.23$ ($P = 0.0172$)

LM-test for autocorrelation: $\chi^2(5) = 1.95$

Jarque-Bera test for normality: $\chi^2(2) = 1.36$

ARCH-test: $\chi^2(5) = 7.66$

White test for heteroscedasticity: $F(19,27) = 0.73$

Table 9 Dynamic models. Dependent variable Δc. EC4 as in Table 6.

	1970:4 - 85:4 (1)	(2)	(3)	(3')	1970:4 - 89:4 (3)
Const	.1483 (.4247)	-.0088 (.0091)	-1.6966 (.7678)	-1.6905 (.7893)	-1.4678 (.4737)
D2	.0490 (.0105)	.0406 (.0105)	.0426 (.0102)	.0629 (.0153)	.0443 (.0101)
D3	-.0517 (.0159)	-.0505 (.0157)	-.0554 (.0150)	-.0434 (.0229)	-.0600 (.0152)
D4	.0641 (.0133)	.0568 (.0138)	.0499 (.0134)	.0314 (.0191)	.0548 (.0133)
Δy	.3638 (.0633)	.3506 (.0587)	.4162 (.0618)	.3133 (.0476)	.3908 (.0602)
$\Delta y_{-1}+\Delta y_{-2}$	-.1584 (.0619)	-.0856 (.0593)	-.1971 (.0674)	-.1264 (.0524)	-.1978 (.0662)
$\Delta p_{-1}+\Delta p_{-2}$	-.1993 (.0993)	-.1282 (.0928)	-.1540 (.0921)	-.1283 (.0970)	-.1526 (.0899)
$EC4_{-1}$		-.4059 (.0926)			
c_{-1}	-.3466 (.0820)		-.4979 (.0934)	-.4674 (.0829)	-.4456 (.0811)
y_{-1}	.3315 (.0899)		.5158 (.1120)	.4671 (.0973)	.4883 (.1000)
wh_{-1}			.0547 (.0360)	.0684 (.0366)	.0295 (.0279)
wf_{-1}			.0611 (.0210)	.0632 (.0215)	.0463 (.0114)
D711	-.0410 (.0109)	-.0397 (.0108)	-.0382 (.0102)	-.0379 (.0105)	-.0405 (.0105)
D744	-.0472 (.0110)	-.0447 (.0109)	-.0407 (.0105)	-.0394 (.0110)	-.0448 (.0107)
D804	-.0187 (.0112)	-.0148 (.0110)	-.0167 (.0105)	-.0234 (.0110)	-.0196 (.0108)
R^2	.9639	.9627	.9686	.9653	.9645
$\hat{\sigma}$	.0144	.0142	.0134	.0141	.0140
DW	2.05	1.76	1.92	1.75	2.02

Table 10 Tests of selected models.

	(3)		(1)	
Chow-test for parameter constancy 1970-85 vs 1986-89	F(16.47)=1.36	(P=0.20)	F(16.49)=2.18	(P=0.0190)
LM-test for autocorrelation $\chi^2(5)$	6.22		6.47	
Jarque-Bera test for normality $\chi^2(2)$	0.98		0.72	
ARCH-test $\chi^2(5)$	4.02		2.08	
White test for heteroscedasticity	F(23.23)=0.61		F(19.29)=1.11	

Table 11 Real annual growth rates (percentage) in consumption expenditures, disposable income, financial net wealth and housing wealth 1980-89.

	Consumption	Disposable income	Financial wealth	Housing wealth
1980	-0.8	1.3	11.5	-5.1
81	-0.5	-1.4	22.5	-9.3
82	0.7	-2.6	2.6	-5.8
83	-2.2	-1.4	31.5	-7.7
84	1.7	1.4	-13.1	-1.3
85	2.8	3.2	32.6	0.1
86	5.2	3.7	18.7	1.9
87	4.6	0.8	-5.2	7.6
88	2.5	0.8	7.9	12.9
89	0.7	2.1	12.6	14.3

Table 12 Actual and model based development of consumption based on model (3) of Table 7 1971-89. Annual growth rates averaged over the four quarters[1].

		Model results			
	Actual consumption	Short-run effects (excluding prices)	Error-correction effects	Price effects	Total effects
1980	-0.8	-0.3	0.2	-0.3	-0.4
81	-0.6	-0.8	0.3	0.1	-0.4
82	0.7	-0.6	0.7	0.1	0.1
83	-2.3	-0.9	-1.1	-0.1	-2.1
84	1.7	0.7	1.0	0.5	2.1
85	2.8	1.8	0.5	0.1	2.4
86	5.0	2.6	0.6	0.2	3.3
87	3.9	2.0	1.9	-0.2	3.6
88	3.0	1.5	1.3	0.0	2.8
89	0.7	1.0	0.6	0.0	1.5

[1]This definition differs from that of Table 11, which is based on growth rates computed by a comparison of yearly data.

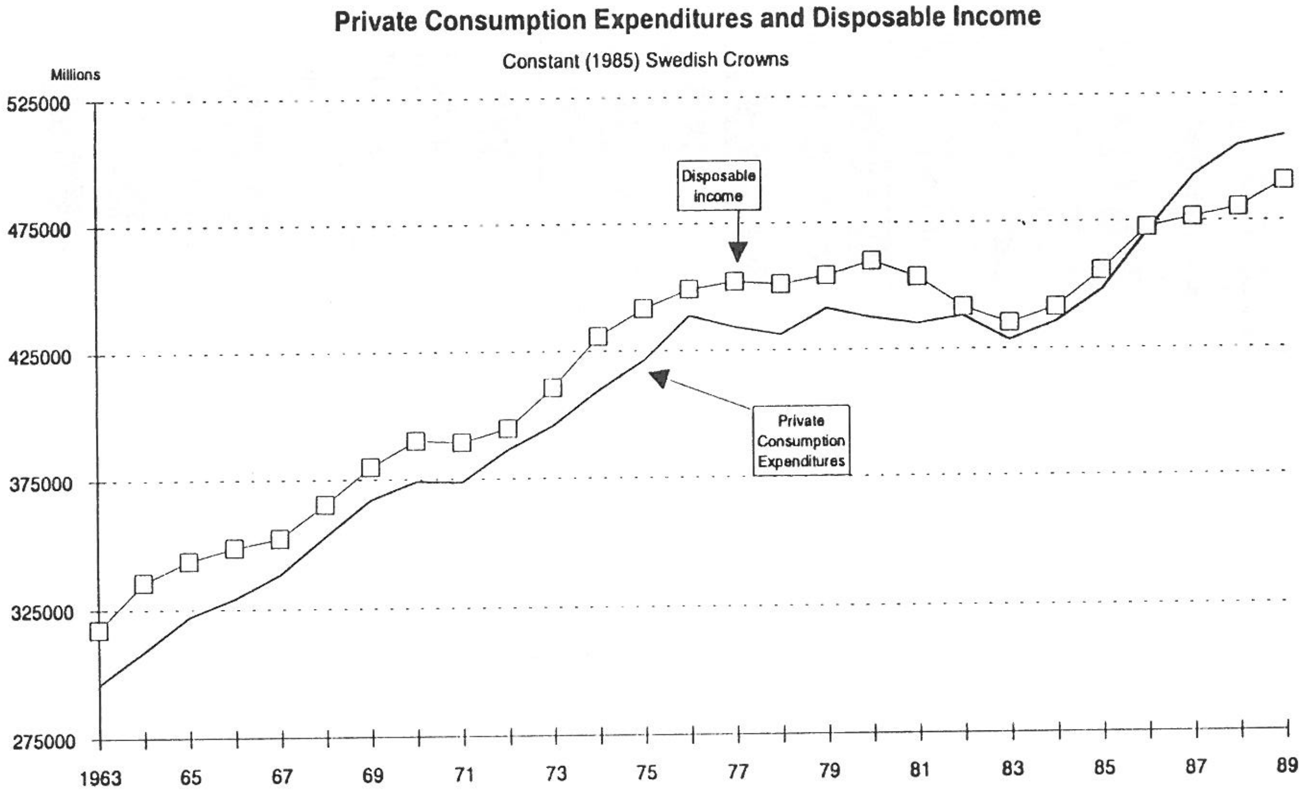

Fig.1 Private Consumption Expenditures (-) and Disposable Income (◻) in Constant (1985) Swedish Crowns (SEK).

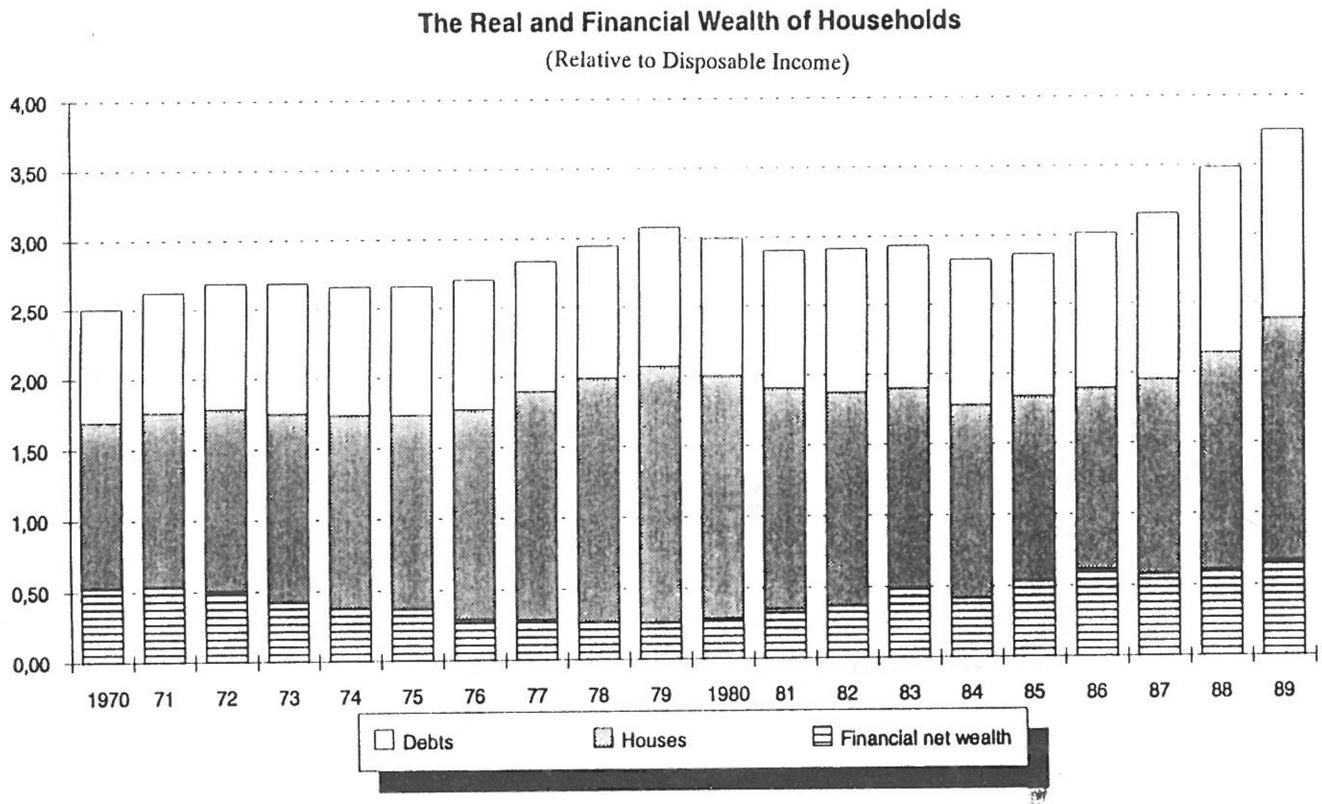

Fig.2 The real and financial wealth of households relative to disposable income.

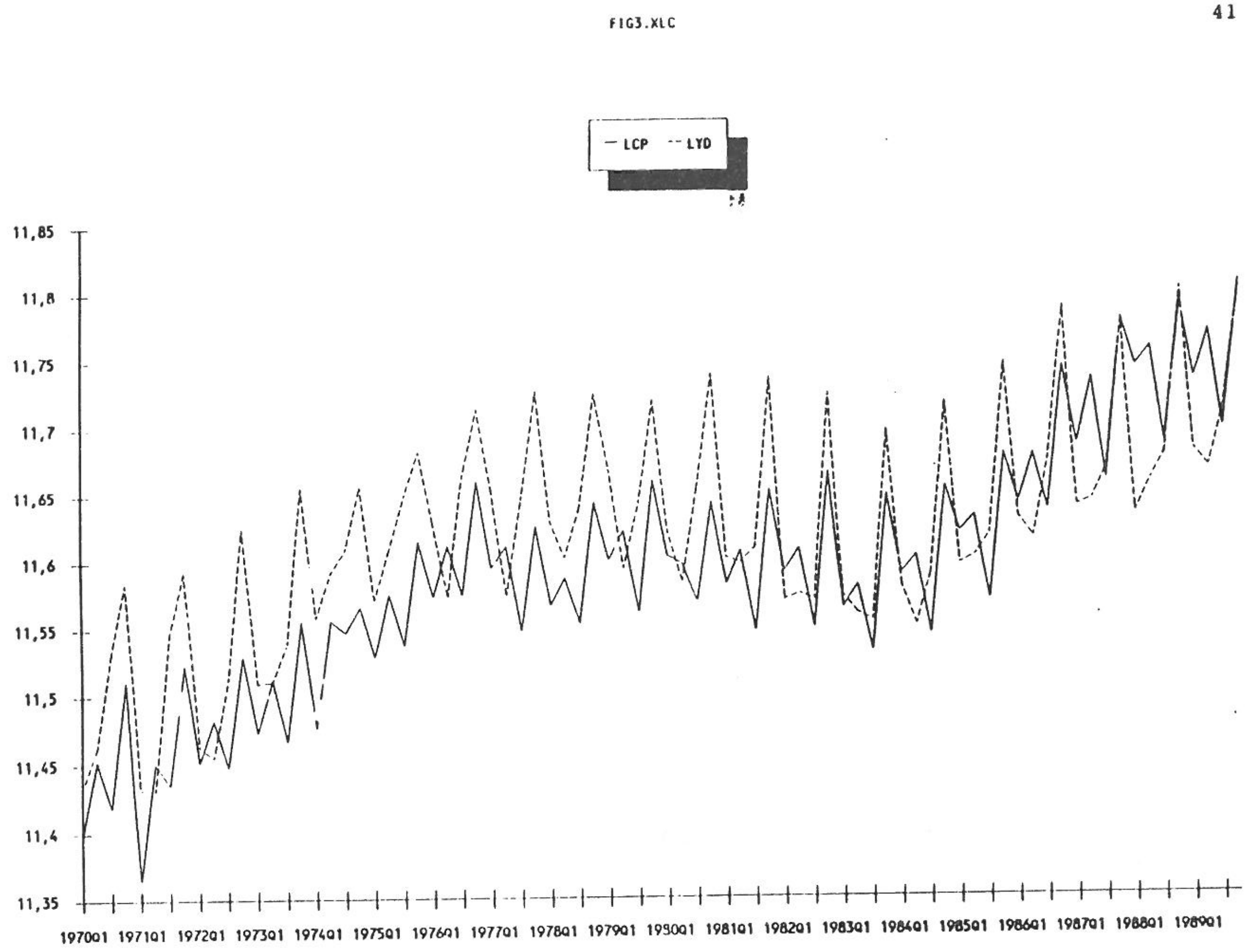

Fig. 3 Private consumption and disposable income 1970-89. Logarithmic values.

FIG4.XLC

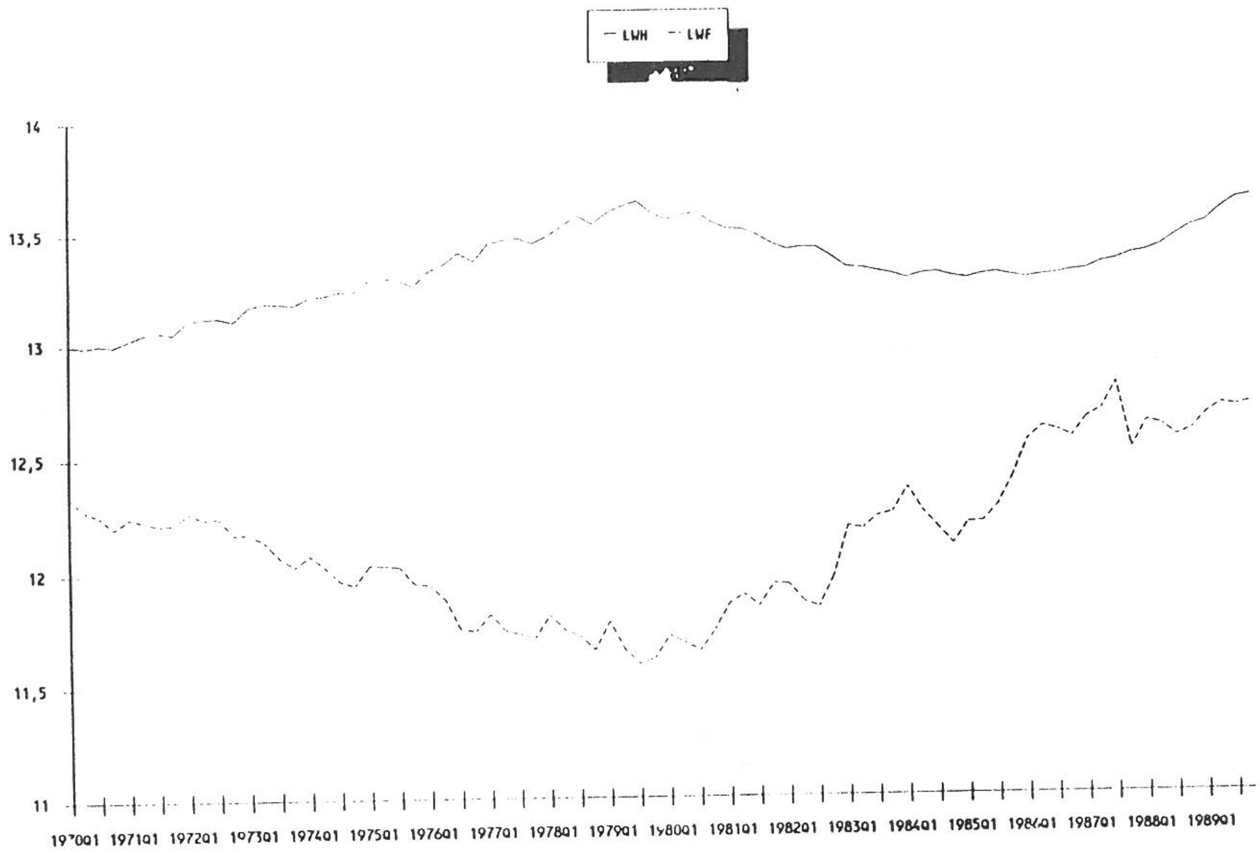

Fig 4 Housing and net financial wealth 1970-89. Logarithmic values.

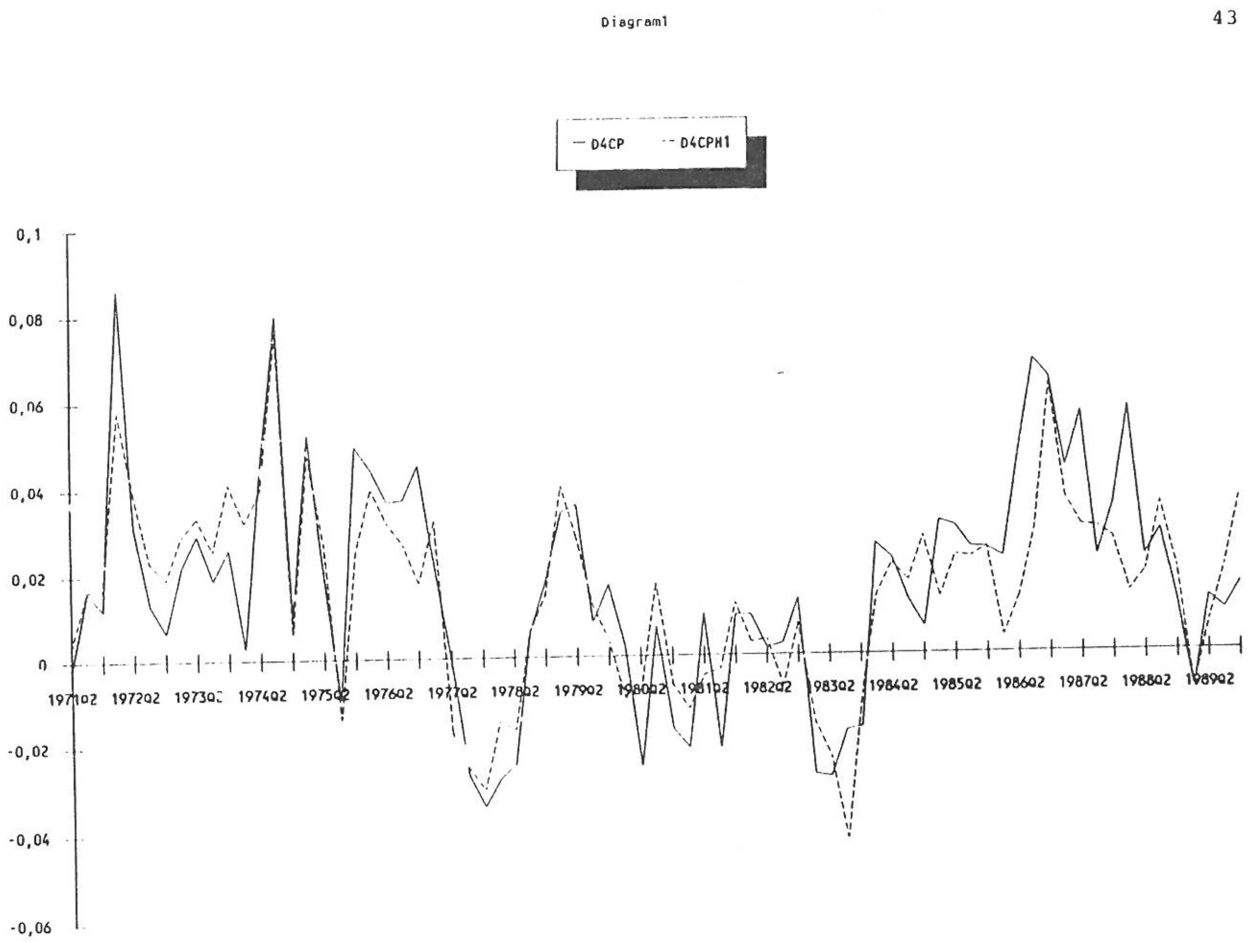

Fig 5 Actual (CP) and model based (CPH1) development of consumption. Model (3) Table 7. Seasonal differences. Estimation period 1971-85. Within-sample period development 1971-85. Out of sample performance 1986-89.

Diagram2

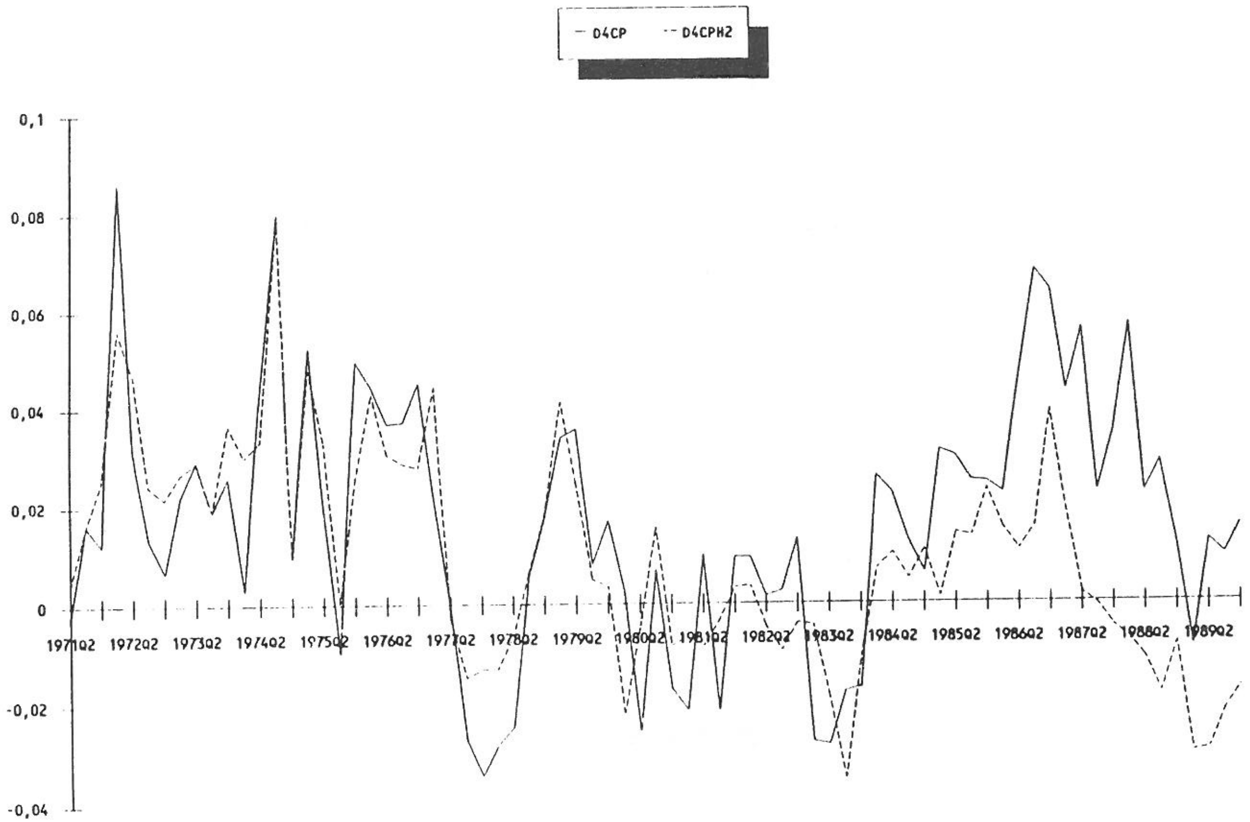

Fig. 6 Actual (CP) and model based (CPH2) development of consumption. Model (1) Table 7. Otherwise as Fig. 5.

FIG2.XLC

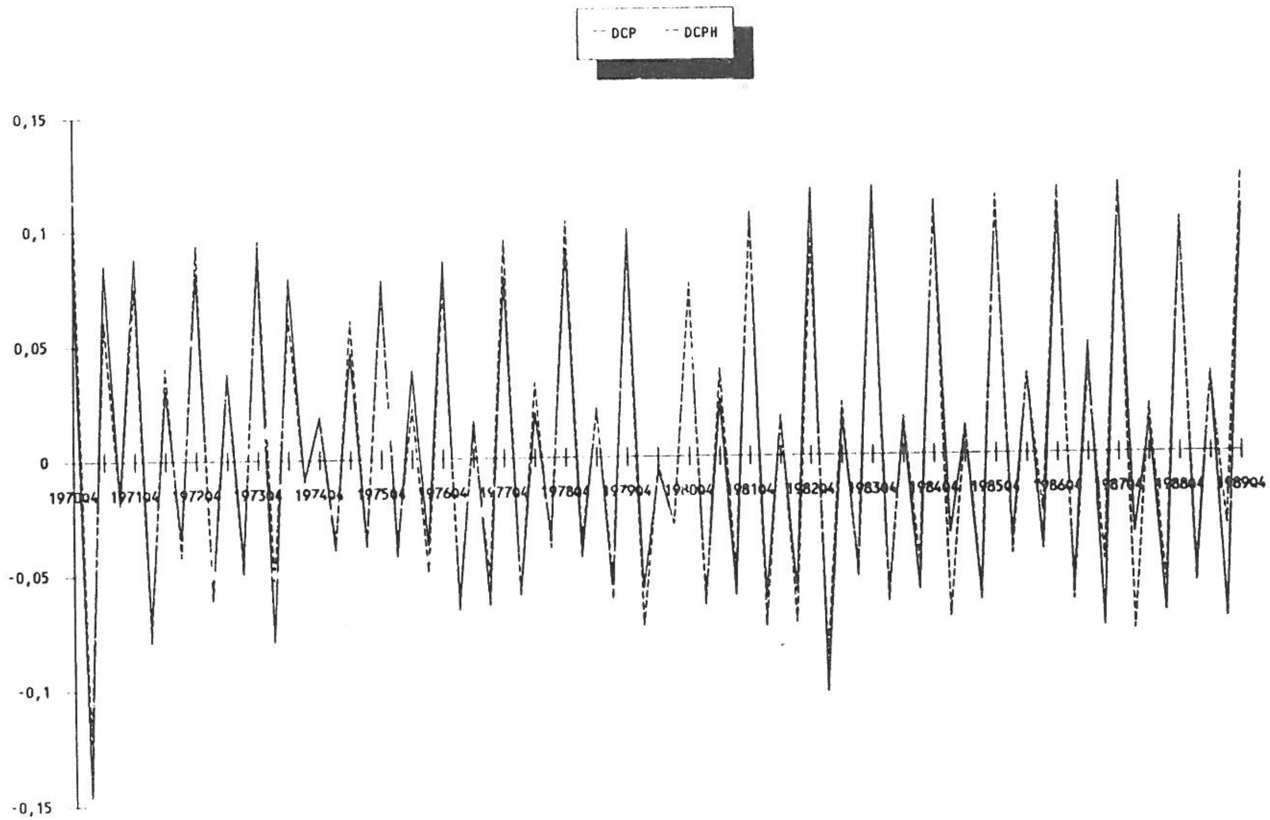

Fig. 7 Actual (CP) and model based (CPH) development consumption. First differences. Model (1) Table 9. Otherwise as Fig.5.