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Consumption, Income and Household Wealth

Georgi Chukalev

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1000 Sofia, 31 Aksakov Str.; tel. 9859 56 01, 981 65 97; fax: 981 33 58;
e-mail: aeaf@aeaf.minfin.bg; www.aeaf.minfin.bg

Consumption, Income and Household Wealth

Georgi Chukalev*

Abstract

The real increase of the households' consumption contributes largely to the economic growth. The consumption function is an important element of each macroeconomic model. The current research aims at explaining the factors, which impact on households' consumption in long-term and short-term period. The relationship between consumption and income and consumption and income and households' personal wealth has been studied by means of cointegration analysis. Additionally, the influence of credits and relative prices on consumption has been evaluated. The detailed results from the econometric tests and the used vector error correction models have been published in the appendices.

Key words: consumption, income, households' wealth, consumption function, cointegration, vector error correction model, relative prices

JEL Classification: E21, E25

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* Agency for Economic Analysis and Forecasting, e-mail: g.chukalev@aeaf.minfin.bg

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Foreword

The research paper aims at examining the factors shaping household consumption in both a long- and short-term perspective. At the same time, while it incorporates an in-depth analysis of the impact of the individual factors, it also offers a model of interpreting consumption rather than forecasting it in any way.

The research is focused on household consumption in general, and of non-durables in particular. From a theoretical point of view, most economic literature examines the consumption of non-durable goods and services. But since the share of durables within total consumption was steadily rising over the period from 1998 to the second quarter of 2006, the paper has also attempted to provide a model of aggregate consumption.

The study follows all the basic theoretical models of the consumption function while taking account of the econometric model of the functional relationship as well. On the theoretical side, there is a strong long-term link between final household consumer spending, income and wealth, with a key hypothesis referring to a single co-integrating vector between the three variables. Furthermore, short-term imbalances may be corrected not only by adjusting consumption but also without being involved in the adjustment of the system to long-term equilibrium. That is why a system/set of vector equations (error correction including) has been applied while testing all the three variables for weak exogeneity. In addition, special attention has been paid to the sensitivity of income (total income and income from labour) to consumption.

The impact of loans on consumption has been also tested not only by including the real loan interest rate variable but also by examining loans themselves as an additional variable.

Inflation has been also dealt with as a factor on its own. The relative price of durables to non-durables is not a constant but tends to go on the decrease, giving solid grounds to test it for its effect on consumption.

Section 1 highlights the theoretical and empirical research the paper is based on. This is followed by a description of the data, sources of information and methodology used. Some of the variables employed herein have been estimated by the author himself. Section 3 gives an account of the way the variables surveyed have changed over time, incorporating an econometric analysis of the data. It also examines the long-term relationship between consumption and total income, on the one hand, and consumption, income from labour and wealth, on the other, using the co-integration approach. In addition, it sheds light on the impact of credit and relative prices on consumption. The conclusion contains the basic results of the survey, with more detailed information of the models and econometric tests used being given in the appendices.

1. Theoretical Background

Aggregate consumption and savings can help explain changes in the economy. Because of its high relative share within GDP the consumption function is an indispensable element of each and every macroeconomic model.

The basic theories describing consumption are as follows: Keynesian theory on disposable income, Modigliani's life cycle hypothesis and Friedman's theory on permanent income. However, the consumption function has been further developed owing to the wide range of empirical studies carried out and econometric methods used. Its development can be said to be the history of econometric analysis.

1.1. Major components of the consumption function

How much to consume today and how much tomorrow is a dilemma everyone is faced with. At a macroeconomic level, it implies that the consumption function has to be maximized. Most often, consumption is presented as being dependent on one's initial wealth (financial and other assets), real interest rates and labour income. Human life is divided into two periods, in each of which individuals earn some labour income.

The assets in period 2 depend on the real interest rates, and also on what portion of total wealth – assets plus labour income, has been spent on consumption in period 1:

$$A_2 = (1 + r_2)(A_1 + Y_1 - C_1) \quad (1.1)$$

where A are the assets or accumulated wealth, r is the real interest rate, Y – labour income, and C – consumption. The assumptions here are that consumers are able to adjust their consumption over time by saving or borrowing loans and that the value of assets will be zero at the end of the second period, which is also the end of one's life cycle.[1] Therefore, consumption in period 2 will be the sum of assets and labour income, or $A_2 = C_2 - Y_2$. If we use this to substitute it for A_2 in equation (1.1) above and divide the two sides by $(1 + r_2)$, we will obtain:

$$C_1 + \frac{C_2}{1 + r_2} = A_1 + Y_1 + \frac{Y_2}{1 + r_2} \quad (1.2)$$

[1] The assumption is that interest rates do not change and remain constant over time.

The latter equation also brings in the problem of the budget constraint in relation to consumption. According to (1.2), life-time resources (the right-hand side of the equation) should be spent on consumption. Total life-cycle consumption is directly proportional to initial assets and labour income. Increases in initial assets and labour income act so as to increase consumption, whereas an increase in the real interest rate may come to the following effects[2]. Two of them, i.e. the substitution effect (cheaper consumption in a future period) and the human capital effect (reduced present discounted value of labour income in period 2) act so as to cut current consumption while the income effect allows for more consumption in period 2, given the same resources. The discount factor $1/(1+r)$ is the price of consumption tomorrow as related to the price of consumption today. However, the effect of the real interest rate on consumption cannot be unequivocally defined from a theoretical point of view.

Friedman's permanent income theory and Modigliani's life cycle hypothesis introduce expectations as an important factor determining consumption. The employment of expectations in consumption research has to do with uncertainty in the future, as manifested in the form of shocks, e.g. to labour- loss of a job, or to financial assets – investing in risk assets. However, if asset management is by and large predictable, uncertainty in future labour income is greater. It should be also noted that what is herein meant by uncertainty is not only deterioration but stronger income variations as well.

According to Friedman's theory, consumption depends on permanent income, and one of the many definitions of permanent income is that it is the annual value of current financial assets and labour income earned. Permanent income can be dealt with not only inside a year but a longer time span as well, even a lifetime. The hypothesis distinguishes between current and permanent income and current and permanent consumption. Also in determining how much to consume, agents take into account not only their current income, but future income as well, placing special emphasis on expectations. Consumers tend to maximize the utility function throughout their lifetime while considering the constraints on the resources, financing their consumption.

The two theories have a lot in common. Modigliani's hypothesis focuses, too, on consumers who look in the future, trying to maximize their lifetime utility depending on the money they have. Current consumption depends on current labour income, whereas the expected annual income on wealth in the preceding period, too. Savings in short periods of time, e.g. a year, depend on the deviation of current income from the average value of lifetime resources.

At the same time, a major difference is that the life-cycle hypothesis highlights some important factors behind income fluctuations having to do with retirement, middle age, household size,

[2] Deaton (Deaton 1992) studies the development of the theoretical models of consumption.

and last but not least, the inheritance motive. Another difference is that the permanent income theory considers consumption behaviour in the short term only.

1.2. Econometric consumption functions

A number of econometric models were constructed in 1970s trying to explain consumption in terms of not only level but change too, drawing upon the permanent income hypothesis. The variable has often been involved in regressions, showing that it depends on current income and income in earlier periods, i.e. lagged income. Alternatively, and perhaps more appropriately, consumption can be dealt with as a function of its lagged values and current income.

However, there have appeared many a serious problem as econometric research and theory testing based on time series were further developed. Some of them had to do with the consumption function itself, others questioned the efficiency of econometric analysis, giving rise to Lucas's famous critique of 1976. Relying on the permanent income hypothesis and rational expectations theory[3], the author insists that there is no reason to expect a stable lagged relationship between consumption and income, as consumption depends on income expectations. On the other hand, under the influence of rational expectations there should exist some structured relationship between permanent income and permanent consumption.

Robert Hall shared Lucas's critique. According to a study dated 1978, the first lag of consumption may have a coefficient other than zero when explaining current consumption, whereas lagged income should not enjoy any explanatory power:

$$C_{t+1} = C_t + \varepsilon_{t+1} \qquad (1.3)$$

where C is consumption, and ε_{t+1} – error (Hall 1978). It follows (1.3) that consumption change is unpredictable $(\Delta C_{t+1} = \varepsilon_{t+1})$. Hall also concludes that only unexpected economic policy amendments may affect consumption, as expectations have already been incorporated in current consumption. He defines permanent income as a proportion of the expected lifetime wealth, which is the sum of income from labour and financial assets. Therefore, consumption can be said to be a linear function of initial wealth and the present value of expected income in the future.

Empirical work on the permanent income hypothesis, given rational expectations, has been further complicated, as some of the variables, e.g. permanent and expected income and wealth that are indispensable to explaining or forecasting consumption cannot be directly observed.

[3] Consumers are reasonable individuals who look to the future. They determine their current consumption on the basis of their expectations of disposable income and interest rates.

This, however, is not the main reason why economists have refuted the permanent income and rational expectations theories.

According to Flavin (1981), consumption changes over time with changes in permanent income, triggered by fluctuations in current income. In addition, calculations have provided solid evidence against the permanent income hypothesis because a large amount of consumption change between two periods is due to income change and lagged income change. Flavin has employed eight lags altogether, using the consumption of non-durables, alongside services, as an dependent variable.

The impact of current income on consumption is known in economic literature as excess sensitivity of consumption in response to current and previous change in income.

A study by Campbell and Mankiw (Campbell and Mankiw 1987) also supports the idea that a significant part of consumption change is due to changes in the current period. They employ instrumental variables representing the first difference of consumption and income, lagged twice (quarters)[4]. Their model distinguishes between two groups of economic agents. The first group consumes their current income $C_{1t} = \lambda \mathrm{Y}_{1t}$, whereas the second group consumes their permanent income $C_{2t} = (1-\lambda)\mathrm{Y}_t^p$. The sum of the two incomes is equal to total income. Taking the first difference for agents consuming their current income, we obtain $\Delta C_{1t} = \lambda \Delta \mathrm{Y}_t$, and for agents consuming their permanent income – $\Delta C_{2t} = \mu + (1+\lambda)\varepsilon_t$, where μ is a constant, and ε_t is the innovation in agents' assessment of permanent income Y_t^p between time $t-1$ and time t:

$$\Delta C = \Delta C_{1t} + \Delta C_{2t} = \mu + \lambda \Delta Y_t + (1+\lambda)\varepsilon_t \qquad (1.4)$$

[4] The reason why more than two lags are employed has to do with timing of consumption decisions. It is possible that some part of consumption change is due to the different times of statistical data reporting and change in household expectations of their income, which will affect consumption. Thus, for example, we cannot be certain that the quarterly data used correspond to the period in which consumers make new consumption decisions. A problem with the time consumption arises when the planning interval is shorter than the period of data reporting. According the permanent income hypothesis, consumption change reflects changes in permanent income expectations $(\Delta C_t = \varepsilon_t)$, which are not correlated to earlier information, e.g. to a change in income in an earlier period $\Delta Y_{(t-1)}$. Drawing upon the permanent income hypothesis, Campbell and Mankiw (Campbell, Mankiw 1989) and Deaton (Deaton 1992) prove that the ΔC_t on $\Delta Y_{(t-1)}$ delivers a spurious correlation because of the overlapping of the same periods in ΔC_t and $\Delta Y_{(t-1)}$. However, this can be avoided by including more lags, starting with period (-2).

Campbell and Mankiw give ample evidence that taken without lags, one-third of consumption growth is due to an increase in current income. However, using the lagged consumption change, the λ coefficient takes even higher values of 40 to 50%.

One reason why the permanent income hypothesis has been empirically rejected has to do with liquidity constraints. For example, suppose a consumer gets new information about a favourable development in his/her future income, then they may be willing to consume more now, without waiting for the future development to materialize. However, in case of little savings or no saving at all and poor creditworthiness because of no tangible and realisable collateral to back up a loan, consumers must wait until the income increase is actually received. It follows that consumption will rise in response to a predictable income increase in a previous period, exhibiting excess sensitivity to current income (Deaton 1992). The fact that some empirical studies question the permanent income hypothesis does not necessarily mean that they reject it altogether. One assumption under this theory is that the capital markets are developed and consumers can lend/borrow money without any restrictions.

In the late 1970s as a result of research refuting or supporting the permanent income theory and the lifetime cycle hypothesis, there appeared a number of publications focusing on the reasons for the difference in results provided all empirical studies drew upon similar economic theories and employed more or less the same data series. In the part referring to the models used, Davidson, Hendry, Srba and Yeo[5] (Econometric Modelling 1978) offer a dynamic model that is later to become known as the error-correction model. The main advantages of the model are that no information is lost as it estimates the variables included in both a long and short-term perspective. Furthermore, by calculating the error, the speed of adjustment to long-term equilibrium in case of short-term imbalances is also estimated.

According to the theorem of Engle and Granger (Engle and Granger 1987), an error correction mechanism can be applied to consumption and disposable income because both variables are co-integrated. Each of them is integrated of first order, which implies that following the calculation of the first difference of the variables, taken as a level, they will be stationary. There is a linear combination between disposable income and consumption, taken as a level, which is stationary. Savings $S_t = Y_t^d - C_t$ are equal to the difference of disposable income Y_t^d and consumption C_t and are also stationary, i.e. Y_t^d and C_t are co-integrated. The savings equation can be therefore interpreted as follows: if consumption in period *t* is relatively high vis-à-vis income, consumers expect their income to rise in the future according to the permanent income theory.

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[5] The authors touch upon problems having to do with the data used, methods of seasonal adjustment, lagged values and last but not least the models employed.

Different empirical studies show that a constant or equilibrium long-term relationship between current consumption and current income is unlikely. The presence of a trend component in these variables points to significant deviations from long-term equilibrium. However, in order to obtain a statistically stable relationship, describing long-term consumption patterns, we need to provide further evidence that it depends on "secondary variables" other than long-run income, e.g. personal wealth, relative prices, income size or population distribution by age (Fernandez - Corugedo 2004).

Modern studies on consumption modelling draw upon a co-integration relationship between consumption, income from labour and wealth, employing various indicators to estimate wealth. Most often wealth is seen as the sum of financial (or net financial) and non-financial (household real estate acquisitions only) assets. At the same time, the relative prices of durables and non-durables (goods and services) are also used to explain long-term consumption.

The co-integration analysis of consumption is most commonly based on the hypothesis that there is a single co-integrating vector between the variables, described above. This, however, does not imply that we need to apply a single error correction equation instead of a system of vector error correction equations. Using data on the US economy, Lettau, Ludvigson and Barczi (Lettau, Ludvigson и Barczi 2001) claim that it is wealth (rather than consumption) that tends to adjust to keep a long-term equilibrium between consumption, income and wealth. Or put in other words, if income and wealth alone are weakly exogenous (in this case), then it is suitable to use a single error-correction equation to estimate consumption.

A study by Fernandez-Corugedo, Price and Blake (Fernandez-Corugedo, Price and Blake 2003) uses a vector system of error-correction equations to estimate consumption, providing evidence of a co-integrating vector between the consumption of non-durables (goods and services), disposable labour income, wealth (net financial assets plus the value of housing assets) and the relative prices between durables and non-durables. They conclude that the adjustment of the system of endogenous variables to long-term equilibrium takes place via changes in wealth. The elasticity coefficients to labour income, wealth and relative prices are 0.6, 0.25 and 0.09.

In the case of Germany, the long-term coefficients of elasticity to income and wealth are 0.31 and 0.74 respectively, with the deviations from the system's equilibrium being corrected by adjustments in income (Hamburg, Hoffman и Keller 2005).

In a paper on the consumption function in Bulgaria Petrova, Stoyanova and Georgiev (Petrova, Stoyanova and Georgiev 1996) construct a consumption model based on the permanent income hypothesis and estimated with co-integration analysis techniques. Employing household budget survey data over the October'92-December'95 period, they find that consumption is very sensitive to income (from employment, pension benefits, entrepreneurship, property, etc.). The long-term elasticity of consumption to income is 0.91, and its short-term one is 0.94.

2. Data and methodology

Research on household consumption draws upon GDP data at a macroeconomic level and household budget survey data at a microeconomic level.

The present study employs data on household consumption as part of GDP. The main advantage of aggregate consumption data analysis is that the results obtained can be directly interpreted.

2.1. Data sources and periodicity

The data on consumption, wages, deflators and market house prices have been provided by the National Statistical Institute (NSI). The study also makes use of BNB balance of payments statistics on net current transfers and income and interest rates on BGN consumer loans (both short- and long-term) as well as Ministry of Finance figures on personal income tax and employee-paid social security and health insurance contributions.

The data employed are quarterly and refer to the period from the first quarter of 1998 to the second quarter of 2006. For some of the indicators the author uses his own estimates based on yearly data, e.g. in calculating total household disposable income and the market value of housing assets owned by households, described in the methodological notes below.

2.2. Data methodology

All indicators have been estimated at 1998 constant prices. When first tackled, the methodology of compilation and ways of obtaining real-term estimations for each indicator are described in detail.

Household consumption data are presented as the sum of expenditures on non-durable goods and services and durable goods.

Household purchases of goods- total
Non-durables
Durables (non-food items)

The series at constant prices have been obtained following calculations of the quarters in the base year of 1998 at prices in the same year. The consumption series at 1998 prices were derived on the basis of data on physical volume change (by quarter on a year earlier). The deflators – the price indices of consumption (1998=100) were estimated by dividing of current with constant prices.

Total household disposable income. According to the System of National Accounts, disposable income is a balancing item of secondary income distribution. It is used for final consumption and saving. The indicator has been estimated following the methodology of EC and employing AMECO database.

Household Sector

	Gross operating surplus and mixed income
+	Compensations of employees
+	Net income from property
+	Current transfers, debit
-	Current transfers, credit
-	Current taxes on income and wealth
=	**Total disposable income**

NSI applies the same methodology to the compilation of the annual income accounts. The data used are annual, and broken down by institutional sector made public until 2004.

The construction of the total disposable income indicator based on quarterly data draws upon two assumptions referring to the gross operating surplus and mixed income and net income from property. NSI publishes the indicators on an annual basis only and does not release quarterly data. The first assumption is that the relative share of the gross operating surplus and mixed income of the household sector vis-à-vis the gross operating surplus and mixed income overall for the economy, as obtained on the basis of annual data, is the same as the share estimated on the basis of quarterly data. The other assumption is that net income from property is taken away from total disposable income estimations as the historical data until 2004 indicate that its relative share within the total disposable income runs at about a bare 0.2%.

However, the total disposable income indicator constructed on the basis of quarterly data does not cover net income from labour and net current transfers from non-residents, which is why they have been subsequently added. It should be also noted that income and transfers refer to households alone. Net income is the net value of the compensations of employees, taken from the analytical presentation of the balance of payments, whereas net transfers have been derived from the standard presentation of the balance of payments and refer solely to transfers other than transfers to the government.

Data on disposable labour income have been, too, estimated by the author himself. The methodology of neither the system of national accounts nor AMECO provides a direct description of the indicator construction paradigm. Under AMECO, the sum of the gross operating surplus and mixed income and net income from property makes up an indicator that can be called non-labour income. It follows that income form labour can be estimated as a resultant value, and any estimations of disposable income from labour should be based on assessments of the taxes on labour:

$$DLI = TI - NLI - \frac{LI}{TI} * T \qquad (2.1)$$

where *DLI* is disposable labour income, *TI* is total income, *NLI* – non-labour income, and *LI* – labour income (*LI=TI–NLI*). The taxes on labour have been derived as *T* – total amount of taxes on income and wealth, multiplied by $\frac{LI}{TI}$ – the relative share of income from labour to total income.

The values of total disposable income and disposable labour income at constant prices are obtained by dividing the data at current prices with the deflator of total household consumption[6].

Data on housing assets owned by households have been estimated on the basis of annual residential area figures (in thousands of m^2), data on newly built residential area[7] and the average market price of m^2 of residential area, as delivered from NSI quarterly house price surveys by district city (28 altogether). The aggregate data are the sum of the values obtained by district.

The annual data on newly-built residential area have been transformed in quarterly data by the quarterly seasonal weights of gross output in construction. The data on newly-built residential area have been added to the annual residential area figures of the end of 1997 to obtain the assets owned by households in thousands of m^2. Finally, the data are calculated on the basis of the average quarterly market price of square meter of residential area.

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[6] All indicators described below have been estimated at constant prices using the same deflator.

[7] The data on newly-built housing area published at NSI website http://www.nsi.bg/otrasal.php?otr=20 date back from 2004. Until then, newly-built housing area had been taken to be the difference between the assets in m^2 owned in two consecutive years.

Net financial assets of households are household financial assets minus financial liabilities[8]. Generally speaking, household financial assets and liabilities amount to:

Household financial assets
Foreign currency and deposits
Securities other than shares
Insurance technical reserves
Household financial liabilities
Consumer and mortgage loans

Real interest rates. The present paper draws upon BNB statistics on BGN interest rates on short- and long-term loans. The data used are monthly and represent the effective annual interest rate. The nominal interest rates are estimated in real interest rates using the rate of inflation in the period the nominal effective annual interest rate referred to. For example, the inflation rate in January 1999 on a year earlier has been subtracted from the nominal interest rate in January 1998. For some months of 2006, the author has made use of monthly inflation forecasts.

The real monthly interest rates are re-calculated in quarterly figures using an arithmetic mean.

[8] Methodology of household financial wealth data by Gergana Mihaylova (Mihaylova 2004).

3. Data analysis and results

This section deals with the data given above, with the relationship between the variables used being visualized by way of tables and figuress in the first part of the analysis. The second part of the analysis employs a co-integration approach and vector error-correction models aimed at giving a quantitative assessment of the key factors affecting household consumption in both a long- and short-term perspective.

3.1. Analysis of consumption, income and wealth change

Table 3.1 gives an account of the most significant indicators handled in the present paper, which have been already outlined in terms of data sources and methodology of construction.

Table 3.1: Growth in income, wealth and consumption over the 1998 – 2005 period

Indicators	Abbreviation	Increase in %
Gross national disposable income (GNDI)	GDI	40
GDP	GDP	37
Final consumption	C_tn	49
Household consumption - national	C_hn	50
Non-durables (goods and services)	C_hnd	31
Durables	C_hdur	124
Total net assets	A	96
Market price of housing assets	HA	93
Net financial assets of households:	NFA	140
household financial assets	FA	237
household credit	CR	1103
Total disposable income of households	DTI	29
Disposable income from labour	DLI	53
wages (from the income account of GDP)	W	35
Disposable income from other sources	DOI	-2

In the period surveyed, aggregate consumption stepped up by 49%[9] and aggregate income (GDP) by 37%. GNDI growth ran higher than GDP increase due to the positive net transfers and net income from abroad. Savings in the economy were positive throughout the period.

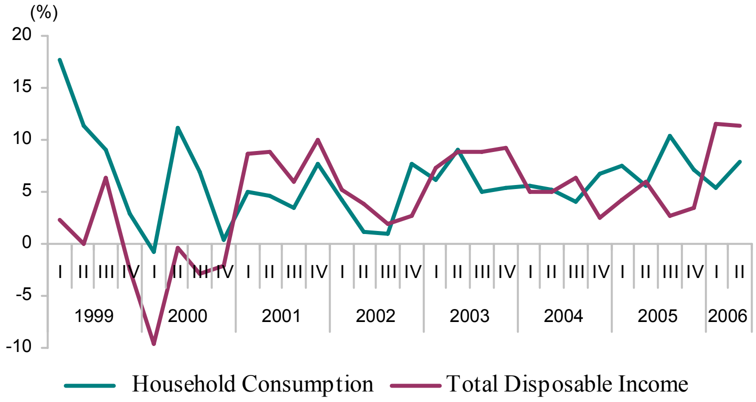
[9] Throughout the text, we have estimated only the real percentage growth of the variable, as calculated at constant 1998 prices.

Household consumption rose by 50% and their total disposable income increased by 29%. The latter figure included labour income growth of 53% and that of income capital, which was negative (-2%)[10]. The reduced tax burden for all income groups was the reason why disposable income from labour outpaced wage growth. According to NSI data, household savings over the 1998-2004 period ran negative (NSI 2006).

As there are reasonable grounds for questioning NSI data on the negative household savings in the economy, the indicator will be left unconsidered. However, the underestimations of some other items of the income account system for the household sector raise further doubts.

Income proves to be the factor affecting consumption growth, as revealed by the strong relationship between total disposable income and consumption and disposable income from labour and consumption in figures 3.1 and 3.2. The percentage change in the variables is given by quarter on a year earlier, eliminating the impact of seasonal factors on the indicators examined[11].

Figure 3.1: Total disposable income and household consumption
(Quarterly data - annual rate of change)



Source: NSI, AEAF

Household wealth is one of the "secondary factors" affecting consumption. Their spending is limited by the wealth they create in their lifetime. It is possible that households respond to a growing wealth by consuming more now or in the future. Net financial assets held by households are the major components of wealth as is the net purchase of physical assets, in particular house investment. These are the official measures gauging wealth. Net financial assets

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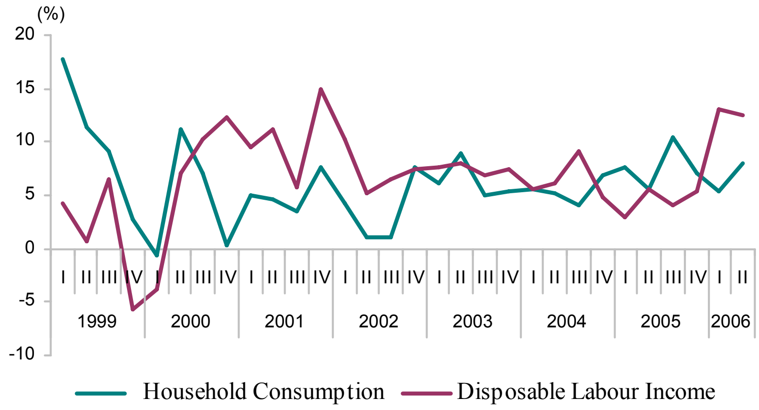
[10] Drawing upon annual NSI data for the household sector over the 1998-2004 period, we derived a decrease in real disposable income other than from labour.

[11] The percentage change by quarter on a year earlier is used only to visualize the relationship between the variables. Section 3.2.1 describes the data employed in the econometric analysis.

and net investments made by households are savings as this is money set aside by them in earlier periods. Some valuables as well as consumer durables can be also added to the unofficial measures/estimators of wealth.

Figure 3.2: Disposable labour income and household consumption (Quarterly data - annual rate of change)



Source: NSI, AEAF

Net financial assets remained positive in the period surveyed. Since they are the most liquid assets held by households they can be said to affect consumption growth (Fig. 3.3). The positive net financial assets were also an indication that household savings were positive.

According to Mihaylova (Mihaylova 2006), household behaviour, i.e. whether they are net savers or net borrowers can be traced by the household sector accounts published by NSI as well as household financial balance sheets, which contain the financial assets households have put their idle money in and the financial liabilities they have undertaken to provide for additional financial resources. These two approaches should yield the same results as they are based on basic macroeconomic identities. All too often, however, the results differ greatly. In her study Mihaylova estimates the financial balance sheets of households, drawing upon the officially published statistical data. The estimated net financial assets indicate that household financial wealth tended to increase, i.e. households were *net savers*.

A publication of BNB also dwells on the difference in NSI data on the national accounts and banking statistics and the sources of financing household consumption[12].

Obviously, household consumption is financed from other sources, too, that make up wealth – household financial and non-financial assets. Net financial assets went up by 140% in the period surveyed. Despite the credit boom of 2002-03, the net financial position of households was

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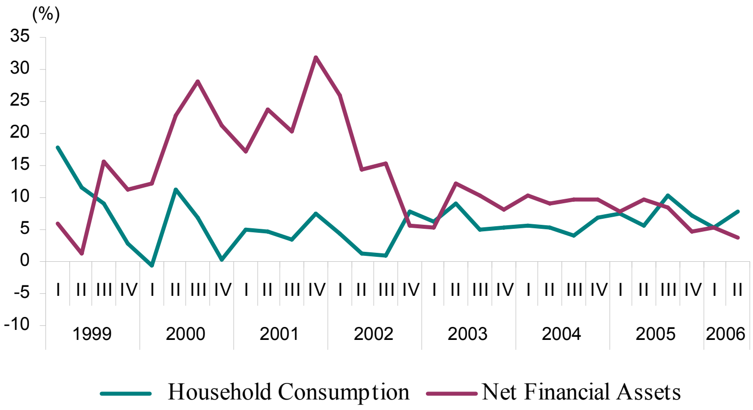
[12] Economic Review, 2006, № 2, p. 35-36.

positive and carried on improving, though at a slower pace compared to the 1998-2001 period (Fig. 3.3).

Figure 3.3: Net financial assets and household consumption
(Quarterly data - annual rate of change)



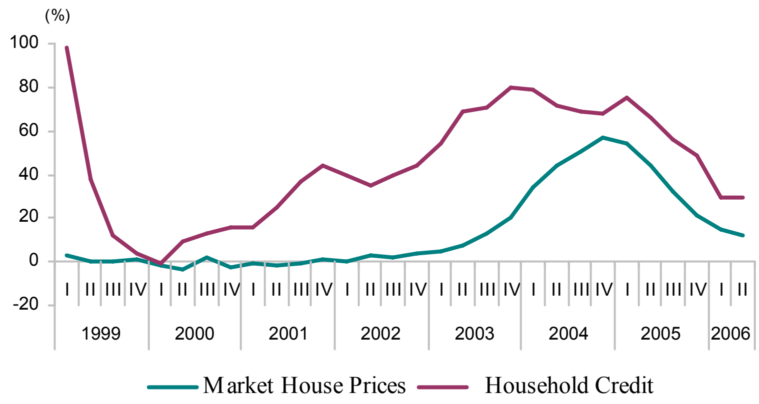
Source: NSI, AEAF

On the whole, a relationship of direct proportionality between growth in wealth and consumption cannot be expected. It is impossible for the whole wealth growth alone to account for a higher future increase in consumption. The factors that affect the wealth-consumption relationship are wealth distribution and the source of wealth change. Some characteristics of net financial assets may influence household spending capacity outside capital gains. These assets are characterized by liquidity, low risk in the future and visibility. Deposits are the easiest to spend as they are in stable nominal values and visible. By contrast, indirect investments such as insurance and retirement funds tend to produce a longer-term effect. They are also highly liquid from the point of view of households. They may be received earlier but at a very high price. In addition, they can be used as a loan collateral but they bear a lower income compared to housing assets.

Housing wealth differ from financial wealth in a number of ways. Housing assets are less liquid and visible and characterized by high maintaining costs and legal fees in case of a changeover of ownership. These assets preserve value and are also a source generating housing services. Measured as imputed rents, these services are included in consumption, implying that housing wealth affects consumption in nominal terms but not necessarily in real terms. If real housing assets remain unchanged, then housing wealth will not impact consumption. Homeowners, however, may borrow resources against a rising house price or be extended a loan that will affect consumption indirectly.

Market house prices have stepped up significantly due by and large to the rising selling prices rather than increases in the floor area owned by households. Over the 1998-2005 period, real house prices[13] rose by 79% on average and floor area increased by 7% in physical terms. An increase in floor space presupposes higher consumer spending on home appliances and equipment and services. However, higher real house prices do no have a direct effect on consumption. On the one hand, higher real house prices trigger an increase in the price of home-related services. On the other, a homeowner may sell it or move to a cheaper home to extract equity. However, house prices may produce a direct effect on consumption via the loan market. Homes can be used as loan security. In addition, homeowners are offered eased terms and conditions of borrowing. The decrease in loan interest rates leads to higher consumption. Furthermore, competition in the banking sector makes it possible for interest rates to step down. Consumers who are also homeowners have eased access to the mortgage loan market.

Figure 3.4: House prices and household credit
(Quarterly data - annual rate of change)



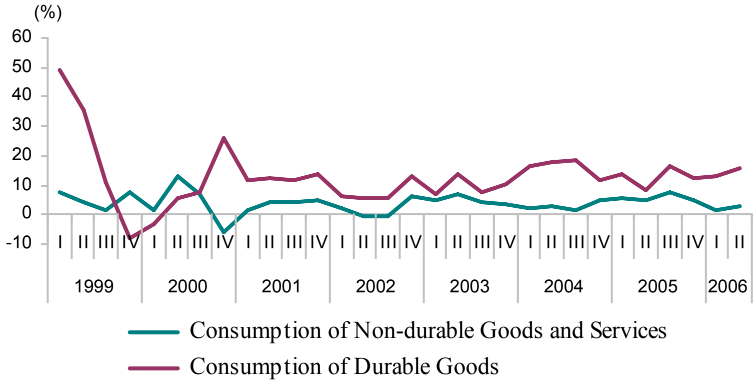
Source: NSI, AEAF

As can be seen on Fig. 3.4, the increase in market house prices coincided with the rise in household loans due largely to the financial flows in the country and the country and the rest of the world. The sizable current account deficit was financed by the financial account surplus of the balance of payments. This had to do with the strong lending activity of banks which were forced by the enormous financial inflows to pursue aggressive policies aimed at effectively investing the newly-assumed liabilities (AEAF 2006). The country's accession to EU and follow-up expectations of a future income increase as well as the relatively high return on investment in local real estate assets were the main reasons for the ever-rising house prices, which as part of household wealth affected consumption.

[13] The increase in home prices is divided by the price index (deflator) of final household consumption.

The stronger growth in the consumption of durables vis-à-vis non-durables was an important characteristic of household consumption in the period surveyed (fig. 3.1). This was mainly due to recovered consumption in the post-crisis period of 1996-97 although durables continued to report a faster pace in the years of financial stabilisation to follow (fig. 3.5).

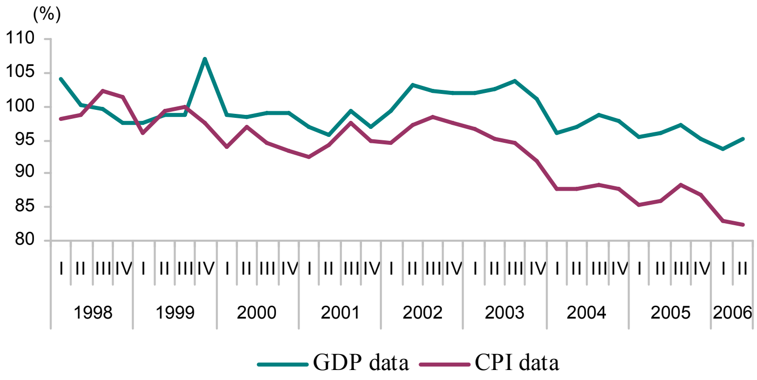
Figure 3.5: Household consumption of durables and non-durables (Quarterly data - annual rate of change)



Source: NSI, AEAF

Growth in real income and household wealth was the reason behind the higher share of durables in consumption and the downward trend in the relative price of durables to non-durables (fig. 3.6).

Figure 3.6: Relative Price Index – durables to non-durables (1998=100)



Source: AEAF

In the figure above, the dynamics of relative prices is shown on the basis of GDP and CPI data.[14] Durables are subject to international trade and therefore defined as tradables. Facing competitive imports, under a liberalized foreign trade regime the prices of these goods tend to rise at a slower pace than non-durables.

The house prices and the consumption of durables exhibited the strongest relationship, matching fully household credit dynamics. The purchases of durables were financed by loans, showing greater sensitivity to interest rate change. As evident from fig. 3.4, credit change was correlated with house price change. If homes can be used as possible loan security, then this generates a strong correlation between the consumption of durables and house prices. Both homes and durables "render" services over time. When consumers find that their income increases, it is more likely for them to increase their demand for durables, homes including, immediately rather than the demand for non-durables. The increase in the purchases of homes and durables not only leads to higher current consumption, but also ensures its future growth along the lines of the services related to homes and durables. It follows that past decisions can affect the current patterns of consumer behaviour.

3.2. Econometric analysis

3.2.1. Integration of variables

Prior to estimating the co-integration relationships between the variables we need to test the data for the order of integration. A necessary condition is that the time series data are integrated of order one I(1) to meet the co-integration equation requirements. A variable is said to be integrated of order I(1), when taken as a level, it has a unit root and when first differenced it is stationary. When a time series, taken as a level, is stationary, it is integrated of order I(0). Stationary I(0) variables can be included in the co-integration analysis, but each of them creates an additional co-integration equation. Variables of I(2) order are unacceptable in the analysis.

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[14] The CPI data series gives a clearer idea of the tendency of relative decrease in the prices of durables. CPI uses Laspeyres's formula, which gives a better account of the pure price change unlike the price indices (deflators) of GDP based on Paasche's index. The latter reflects not only price change but changes in household consumption structure. The econometric analysis draws upon GDP data to calculate relative prices as we have chosen to employ consumption deflators instead of CPI.

Table 3.2: Testing the variables for the order of integration

Variable	Abbreviation	I (0)		I (1)	
		ADF			
Consumption – total	C_HN	-0.416		-16.883	*
Consumption of non-durables	C_HND	0.210		-3.957	*
Consumption of durables	C_HDUR	-0.234		-11.043	*
Total disposable income	DTI	1.881		-2.979	**
Disposable income from labour	DLI	1.099		-12.512	*
Total assets	A	-1.032		-3.157	
Net financial assets	NFA	-2.108		-9.862	*
Financial assets	FA	0.353		-11.431	*
Credit	CR	1.330		-2.710	
Housing assets	HA	-2.637		-3.200	
Relative price - durables/non-durables	RELP	-3.188	**	-5.468	*
Real interest rate on credit - total	RIRL	-1.906		-5.047	*
Real interest rate on consumer loans	RIRC	-2.111		-5.010	*

* MacKinnon critical values for the t-statistics at the 1% significance level.
** MacKinnon critical values for the t-statistics at the 5% significance level

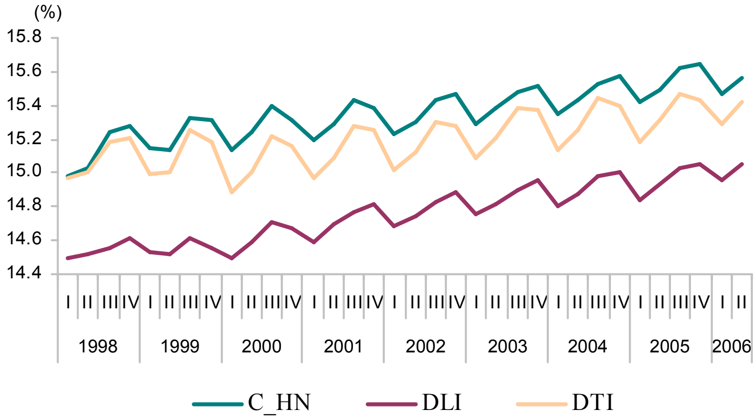
The econometric analysis is based on the EViews 4.1 statistical programme. All data but the real interest rates series are taken as logarithms. The data are not seasonally adjusted. We will follow the interpretation of Wallis[15] (Wallis 1974) that any individual adjustment of the data series may distort the relationships between the pair of series, in this case the consumption-income relationship. We have chosen a model of consumption behaviour based on seasonal dummy variables as the raw data on consumption and income indicated a strong seasonal component of the quarterly data.

The unit root tests draw upon the augmented Dickey-Fuller test (ADF), given the inclusion of only a constant and automatic selection of the optimal lag of the dependent variable based on the Schwarz info criterion (SIC).

All variables are integrated of order I(1) at the 1 and 5% levels of significance, the only exception being the relative price of durables to non-durables I(0). The latter will not be employed in the co-integration equation, estimating the long-term relationship between consumption, income and wealth. However, it can be used as an exogenous variable explaining consumption in a short-term perspective.

[15] Mentioned by Davidson, Hendry, Srba and Yeo (Econometric Modelling 1978).

Figure 3.7: Household consumption, total disposable income and disposable labour income (logarithms of the data, taken as levels)



Source: AEAF

The test for the order of integration of loans, housing assets and total wealth of households (A=NFA+HA) is conducted again on the basis of an ADF-test by including a dummy variable accounting for the robust increase in loans and house prices (fig. 3.4). For the period 1998:1 – 2003:2 the value of the variable was 0, and in the 2003:3 - 2006:2 period it stood at 1. The inclusion of only one constant in the tests provides evidence that the series are integrated of order one.

However, given the little number of observations, it is difficult to identify a distinct linear deterministic trend component in the series. Additional tests have been carried out to prove the presence of a linear deterministic trend[16] in the series. Therefore, the results obtained on the basis of a constant and a trend in the ADF-test will not change but remain integrated of I(1).

The presence of or the assumption that there is a linear deterministic trend in the series is used to test co-integration between consumption, wealth and income as well as to estimate the relationship between them in a long-run perspective.

The consumption, income, wealth and real interest rate data series are integrated of order I(1), giving us grounds to attempt a test for cointegration of the variables.

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[16] The test for a linear deterministic trend was carried out by running a regression of the type: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + u_t$, where Y_t is the estimated variable, and t is time. The null hypothesis is that $\delta = 0$ when $\delta = (p-1)$. It follows that the series has a unit root, i.e. it is non-stationary and has a stochastic trend component. The significance of the t-statistics is tested for coefficient δ. If in absolute terms it is bigger than the Mackinnon critical values, the null hypothesis is then rejected, implying that the series is stationary and has a deterministic trend.

3.2.2. Cointegration

Cointegration is based on the idea that in regression there may exist a linear combination between non-stationary integrated variables which is stationary. Cointegration analysis estimates the long-term relationship between variables. For example, if x and y are I(1), then there is β, where $y - \beta x$ is I(0). β is called a cointegrating vector. However, a key question that needs to be answered is: is there a cointegrating vector? Some of the most commonly used tests for cointegration are the method of Engle-Granger (Engle and Granger 1987) and the Johansen procedure (Johansen 1988).

The Engle-Granger method is based on a two-step approach. The estimations of the cointegrating vector draw upon the least square method by applying a regression (called cointegration regression) to the variables examined, taken as levels. To begin with, the regression residuals are checked for stationarity. The test for the critical values of ADF-test is carried out on the basis of the Mackinnon critical values (MacKinnon 1991). As a next step, a dynamic model including the first regression residuals, lagged once (error correction coefficient), and the first difference (change) of the cointegration variables, lagged accordingly, is estimated.

The Johansen procedure is based on a number of statistics. The estimates of the cointegrating vector are part of the error correction model. The procedure is mainly applied to capture the behaviour of more than two variables in the long-term.

The econometric estimates of income and consumption have been made using both methods. However, only the results obtained under the Johansen procedure are published here. The estimates involving a third endogenous variable, viz. wealth are carried out under the Johansen procedure alone.

The method of estimating the models of vector error correction is as follows:

- obtaining the optimal lag used to estimate the vector autoregression model of error correction. The estimates of the vector regressions start at a maximum length of the values in earlier periods 3 while following strictly the Schwarz information criterion;
- testing for a long-term relationship between the endogenous variables examined. The cointegration test can be applied to either option 2 and 3 (in EViews), i.e. the absence of a linear trend in the data and inclusion of a constant in the cointegration equation (but not in the short-term part of the model) or the presence of a linear deterministic trend component in the data and inclusion of a constant in both the cointegration equation and the vector regression by employing differences. Despite the suppositions

of a linear deterministic trend component of the data, we have chosen option 2 – absence of a linear data trend due to the small number of observations available[17].

- testing the α coefficients for significance, indicating the speeds of adjustment to long-term equilibrium. Significance is tested on the basis of the t-statistic and also under the condition that some of the α coefficients are zero. When proven that some of the α coefficient equals zero, the system of equations can be reduced to a single error correction equation or to a system of equations with significant α coefficients.

3.2.3. Impact of total disposable income on consumption

The first step of the analysis is to obtain an appropriate lag and use it to estimate the vector autoregressive model of error correction and the cointegrating vector under the Johansen procedure. The number of lags is determined by estimating a vector autoregressive model where income and consumption are taken to be endogenous variables and the three seasonal dummy variables plus a constant are exogenous to the model (Appendix 1.1, table 1). All information criteria but that of Schwartz (pointing to 1 lag only) show three lags. However, following SIC and also attempting to maximize the degree of freedom as we have only 34 observations available, we have chosen to employ only one lag.

As a next step the variables examined are tested for a long-term (cointegration) relationship between them. The assumption is that there exits one cointegrating vector between consumption and income, which is established by the Johansen tests -– trace statistic and max-eigen statistic. The trace statistic shows the presence of one cointegrating vector at the 5% level, whereas the max-eigen statistic indicates one cointegrating vector at both the 5 and 1% significance levels (Appendix 1.1, table 2).

The result for the estimated long-term relationship (Appendix 1.1, table 3) is as follows:

$$C\_HN = \underset{(0.12)}{0.20} + \underset{(9.04)}{1.008}\,DTI \qquad (3.1)$$

The t-statistic is given in brackets. The coefficient to income is 1.008, suggesting that a 1.008% increase in consumption in the long term corresponds to a 1% rise in total household disposable income. The elasticity coefficient fully satisfies the hypothesis that consumption equals income in the long term. The coefficient showing the degree of adjustment of the deviation in the short-term from its long-term equilibrium is -0.33. It has an expected negative value and a significant

[17] All models used in the present study have been estimated given a linear trend too (option 3) in the data that were not published. For all of them the presence of a single cointegrating vector is confirmed at the 5% significance level. Also, the coefficients of elasticity in both the long and short term do not differ significantly from the coefficients estimated under option 2 – absence of a data trend component.

t-statistic (-3.32). The same coefficient in the income equation is not significant (Appendix 1.1, table 3). The test for weak exogeneity of the income variable is confirmed (Appendix 1.1, table 4). Therefore, the two-equation system can be reduced to a single error correction equation.

Going back to the consumption equation (Appendix 1.1, table 3), we can see that only two of the seasonal dummy variables have significant t-statistics in the part explaining the short-term relationship. Consumption and income change, lagged once, does not take part in short-term consumption change. This does not contradict the permanent income theory, which supports the idea that changes in consumption affect income change expectations.

There is a lot of empirical research refuting the use of regression where income change, lagged once, explains change in consumption. This is the so-called timing of consumption problem[18]. The consumption and income changes, lagged at least twice, and taking part in the regression instead of a first lag are known as instrumental variables. According to studies on the excess sensitivity of consumption change, it is best measured on the basis of a regression of *current* income change by adding instrumental variables[19]. The use of instrumental variables leads to altered elasticity coefficients of consumption to income. It is also possible that the significance of the t-statistic decreases vis-à-vis the first lag case but this is one way to avoid any spurious positive correlation between income change and consumption.

Having established on the basis of the Johansen procedure that the long-term cointegration relationship (3.1) takes part only in the consumption equation, we can now include the estimate in a single error correction equation using instrumental variables. The estimation of the single error correction regression corresponds to step 2 of the Engle- Granger method. In their paper (1987) Engle and Granger recommend to start with an assessment of the simplest error correction model and then test the model for additional lags in consumption and income, i.e. proceed from the specific to a more general and extended estimation of the model:

$$\Delta C\_HN = \underset{(-3.12)}{-0.06} + \underset{(9.12)}{0.84}\Delta DTI - \underset{(-3.54)}{0.40}\left(C\_HN_{(-1)} - 1.008\, DTI_{(-1)} - 0.20\right) \quad (3.2)$$

$$\overline{R}^2 = 0.94,\ DW = 2.28,\ SEE = 0.028,$$

$$X^2_{sc}(1) = 1.01[0.32],\ X^2_n(2) = 0.40[0.82],\ X^2_{hs}(1) = 0.83[0.59].$$

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[18] Dealt with in Section 1.2 as footnote 5

[19] For a theoretical explanation of the instrumental variables approach to consumption models, see Campbell and Mankiw (Campbell and Mankiw 1989; Campbell and Mankiw 1991) and Deaton (Deaton 1991).

Note: T-statistics in the equation are given in brackets[20].

In (3.2) the coefficient showing the speed of adjustment of consumption in the long term is changed from -0.33 to -0.40 with a significant t-statistic (-3.54). In a short-run perspective, the sensitivity of consumption change to changes in income is very high 0.84 (8.89). The coefficient indicates that a very large amount of the increase in current income goes to consumption.

3.2.4. Impact of disposable labour income on consumption

The *Data and Methodology* Section describes the calculation of disposable labour income without extrapolations (as in the case of total disposable income). That is why we take this indicator to be a more reliable estimator than total disposable income.

Given the number of lags chosen, all statistics indicate one lag only. The tests for the cointegrating vestor are confirmed at both the 1 and 5% significance levels. The statistics of the cointegration relationship between consumption and disposable labour income are given in Appendix 1.2.

The long-term relationship between consumption and disposable labour income is as follows:

$$C\_HN = \underset{(7.23)}{4.71} + \underset{(16.48)}{0.72}DLI \qquad (3.3)$$

The elasticity coefficient to labour income is 0.72. Consumption in the long term increases by 0.72% responding to a 1% rise in disposable labour income. The error correction coefficient (-0.51) is significant in the consumption equation, whereas the coefficient in the labour income equation has a low t-statistic (1.19). Nevertheless, we run a test to check if the cointegrating vector is also maintained in the income equation. As evident from table 4 of Appendix 1.2, disposable labour income is a weakly exogenous variable enabling us to reduce the estimates to a single error correction equation.

As in the total disposable income equation there are no significant coefficients in the part estimating the short-term change, lagged once with the exception of the dummy seasonal variables. The equation is, therefore, reduced to a dynamic error correction model employing the long-term relationship (3.3). We have already highlighted the necessity for the inclusion of

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[20] $\overline{R}^2$ - corrected coefficient of determination, gauging the amount (percentage) of change of the dependent variable, as estimated on a the basis of a regression model, SEE – standard error of estimation; $X^2_{sc}(1)$ - F-test for autocorrelation of fist-order residuals; $X^2_n(2)$ - test for the normal distribution of residuals; $X^2_{hs}(1)$ – test for heteroschedasticity. F-tests are given first, and probability in square brackets.

current income change in the regression and addition of instrumental variables in Section 3.2.3. The instrumental variables employed here are consumption change and income change, taken with lags from 2 to 4. The single error correction equation, estimating the impact of disposable labour income on consumption is as follows:

$$\Delta C\_HN = \underset{(-2.24)}{-0.02} + \underset{(8.53)}{0.76}\Delta DLI - \underset{(-3.85)}{0.68}\left(C\_HN_{(-1)} - 0.72 DLI_{(-1)} - 4.71\right) \qquad (3.4)$$

$$\overline{R}^2 = 0.95,\ DW = 1.92,\ SEE = 0.026,$$

$$X^2_{sc}(1) = 0.08[0.79],\ X^2_{n}(2) = 0.70[0.70],\ X^2_{hs}(1) = 0.41[0.94].$$

The error correction coefficient derived is -0.68. It shows what part of the disequilibrium between two variables in a given period can be made up for in the next period (quarter).

In the short run, a 1% increase in income affects consumption growth by 0.76%.

3.2.5. Disposable labour income, wealth and consumption

We here add household wealth to the factors explaining consumption. The *Data and Methodology* Section describes the construction of this indicator – the sum of net financial and non-financial assets of households.

First, we shall examine the cointegration relationship between disposable labour income and wealth drawing upon the underlying assumption that there is one cointegrating vector between the three variables. The results of the analysis obtained are given in Appendix 2.

As it often happens, the different number of optimal lags results in different findings (Appendix 2, table 1). The Schwarz information criterion shows again that the optimal lag is one.

In the cointegration test the *trace statistic* indicates the presence of one cointegrating vector at both the 5 and 1% significance level, whereas the *max-eigen statistic* reveals two cointegrating vectors at the 5% level and one vector at the 1% significance level. We assume that there is one cointegrating vector (Appendix 2, table 2). Under the variant exploiting a linear deterministic trend in data, the two statistics indicate clearly the existence of one cointegrating vector at the 1% and 5% significance level alike.

The long-term relationship between consumption, labour income and wealth is as follows:

$$C\_HN = \underset{(10.37)}{5.50} + \underset{(8.91)}{0.50}DLI + \underset{(4.84)}{0.15}A \qquad (3.5)$$

The sum of elasticities to labour income and wealth is 0.65. We, however, expected it to run higher than 0.72 – equation (3.3) where consumption is explained by labour income alone. The t-statistic for labour income in (3.5) is 8.91, whereas in (3.3) it amounts to 16.48. Obviously, there is multicolinearity or an internal correlation between the two explanatory variables. The coefficient of correlation between the two variables, taken as levels, is very high - 0.8. We do not accept the assumption that any of the variables – *DLI* or *A,* is unnecessary in equation (3.5), as the coefficient of determination (R^2) in the estimated additional regressions[21] are not higher than (R^2) in regression (3.5).

According to economic theory, income and wealth are the two variables that explain consumption. As from an econometric point of view they are independent of each other, it is practically impossible to say what the pure effect of any of them on consumption is, using data on the whole economy.

The error correction coefficients are significant in both the consumption equation -0.52 (-4.20) and the wealth equation 0.59 (3.49). Again, we run an LR-test to check which variables are weakly exogenous (Appendix 2, table 4). The test confirms the significance of the error correction coefficients with both consumption and wealth. In a long-term perspective, the adjustment of the system to equilibrium takes place via changes in both consumption and wealth. Labour income is a weakly exogenous variable. Therefore, the estimated long-term relationship in (3.5) is maintained in both the consumption and wealth equation. It is only the income equation that can be eliminated from the system of error correction equations (Appendix 2, table 3).

The consumption and wealth equations should be considered together. A lot of information will be otherwise lost if only the consumption equation is estimated.

The seasonal dummies are the only significant variables in the part examining the short-term effect of the variables, whereas in the wealth equation it is the elasticity of wealth change in a previous period that is significant.

3.2.6. Impact of interest rates and loans on consumption

The impact of loans on consumption has been estimated in two ways: first, by employing the real interest rate on loans, and, second, by examining the direct effect of credit.

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[21] By additional regressions we mean equation (3.3) and the regression of consumption on wealth. There is an cointegration relationship between consumption and wealth, with the derived coefficient of elasticity to wealth being estimated at 0.36 (5.43).

The calculations involving the interest rates[22] indicate that long-term interest on credit (total) and long-term interest on consumer loans are significant variables having a certain effect on consumption. It follows that any increase in the interest rates will have an adverse effect on consumption in the long run.

An increase in the real interest rates on long-term consumer loans of 1% triggers a decrease in household consumption of 0.68% in the long run. Other variables included in the model are labour income and the seasonal dummy variables. In the short term the first differences of the endogenous variables do not have significant t-statistics. The results of this vector error correction model have not been published.

Real interest on credit has been employed to prove indirectly the effect of loans on consumption. The estimated inverse proportionality between the real interest rates on loans and consumption has been expected. It can therefore be assumed that loans have a healthy effect on long-term consumption. This is further evidenced by the credit variables specified in the household consumption model. On the other hand, being part of the net financial assets of assets households, loans are also liabilities. When positive, net financial assets facilitate consumption financing in the long run. The inclusion of loans together with the other variables (labour income and financial assets) in the model evidence the existence of more than one cointegrating vector.

As a next step we have included credit change (first difference of the data, taken as levels) in the vector error correction model as an exogenous variable. The results are given in Appendix 3. Variable A_2 represents wealth minus credit[23].

We are not going to discuss the elasticity coefficients of the long-term relationship between *DLI* and A_2. The adjustment of the system to equilibrium takes place via changes in both consumption and wealth A_2. The results yielded are very close to the model estimates given in Appendix 2.

The consumption equation shows that the elasticity of consumption change to credit change in the short tem is 0.31 (3.52). The percentage increase in household loans leads to higher consumption in the short run.

[22] The interest calculated is the real interest rate on BGN loans.

[23] $A_2 = FA + HA$, see table 3.1.

3.2.7. Impact of relative prices on consumption

The analysis in section 3.1 suggests that durable consumption tends to rise at a faster pace than non-durables (fig. 3.5) and that the relative price of durables to non-durables tends to decrease (fig. 3.6). The econometric estimates below are aimed at determining the effect of relative prices on consumption.

Another exogenous variable – the relative price of durables to non-durables has been added to the model specified in Appendix 3. As already pointed out in section 3.2.1, relative price is *I(0)*, i.e. it is stationary and herein included as an exogenous variable for that reason. The results obtained are given in Appendix 4.

Both cointegration tests (trace statistic and max-eigen statistic) indicate the presence of one cointegrating vector at 5% and 1% levels of significance (Appendix 4, table 3). The long-term relationship derived is as follows:

$$C\_HN = \underset{(2.64)}{3.29} + \underset{(7.81)}{0.49}DLI + \underset{(4.34)}{0.18}A2 \qquad (3.6)$$

the error correction coefficients are significant in all the three equations. The additional tests for weak exogeneity of some of the three variables in (3.6) to the model variables have been rejected too (Appendix 4, table 4). The inclusion of the relative price in the vector error correction model has introduced important changes to the consumption model estimates. The cointegrating vector (3.6) is maintained in all the three equations of consumption, labour income and wealth and should therefore be considered together.

The relative price has significant coefficients of elasticity in all the three equations and expected signs. In the consumption equation, a 1% increase in the relative prices of durables to non-durables results in a total consumption rise of 0.14%.[24] In the other equations, the increase in relative prices leads to a decrease in both disposable labour income (-0.14%) and wealth (-0.20%).

The elasticity coefficients of credit change are very close to the estimates derived from the model specified in Appendix 3. For example, an increase in household loans of 1% in the consumption equation triggers a rise in consumption of 0.28%, whereas in the wealth equation credit increase affects wealth growth by 0.33%. Both elasticities have an economic meaning from an economic point of view. Consumption and wealth step up in the short term with the

[24] The impact of relative prices has been also tested in a model where consumption data include non-durable consumption alone. The elasticity of the relative price is positive too, and the coefficient – considerably higher (0.33). It follows that any faster-paced increase in durable prices vis-à-vis non-durables promotes non-durable consumption, hence total consumption.

increase in credit. It can therefore be assumed that the effect on wealth will manifest itself in an increase in housing assets. Households borrow loans to purchase new homes, prompting a physical rise in assets, or to buy homes that are not newly-constructed. Credit demand then leads to higher house prices, which in turn raise the value of housing assets. When a loan is borrowed to meet home repair or maintenance costs, again it raises the price of the assets.

Apart from the seasonal dummies, wealth change (ΔA_2) is the other variable with a significant t-statistic in the consumption equation. The sign of the coefficient, however, is negative, which makes it difficult to find an economic explanation that an increase in wealth in the preceding quarter leads to a negative change in consumption in the current period.

Conclusion

The present study is aimed at explaining the factors affecting household consumption by using various techniques of statistical analysis (e.g. dynamics of the variables examined, graphic visualization and cointegration tests) to estimate the different vector error correction models. It should be also noted that the period of observation is comparatively short and that some of the indicators have been additionally estimated. It can be concluded that the key factors shaping the dynamics of household consumption are income and wealth.

Of all factors herein estimated total disposable income and disposable labour income prove to have the strongest effect on household consumption in both a short- and long-term perspective. The models specified in sections 3.2.3 and 3.2.4 are taken to explain household consumption in relation to income.

In the long term an increase in disposable household income of 1% results in a 1.008% rise in total household consumption. The estimated elasticity satisfies economic theories where the *consumption/income* ratio remains stable in the long run. In a short-run perspective, a 1% rise in total disposable income triggers a consumption increase of 0.84%.

Disposable labour income affects consumption, with the elasticity coefficient amounting to 0.72 in the long term and 0.76 in the short term.

Adjustment to long-term equilibrium between consumption and income in both models takes place via changes in consumption. In the short term, consumption change is highly sensitive to current changes in income in both models.

The inclusion of wealth as a third endogenous variable in the estimated vector error correction models supports the hypothesis of one cointegrating vector. The findings satisfy economic theory that there is a long-term relationship between consumption, income and wealth. Of all the three models specified in sections 3.2.5., 3.2.6. and 3.2.7., the model in 3.2.7. can be said to be the one summarizing the factors affecting consumption. We also think that there is ample empirical evidence of the role of liquid restraints as well as the significance of relative prices to consumption estimations.

Credit growth leads to higher household consumption. Our conclusion about loans is that they can produce a favourable effect on consumption only in the short term. The coefficient of elasticity is 0.28. Despite the stable cointegration relationship between credit and consumption in the long term, we adopt a more cautious approach to the interpretation of the results not mentioned in section 3.2.6. In our view, robust credit growth in the long run results in higher household liabilities. It follows that if net financial assets happen to turn negative, this will have an adverse effect on consumption in the long run.

In addition to the seasonal dummy variables, the relative price of durables to non-durables is the second exogenous factor affecting consumption in the short term. Its coefficient of elasticity is 0.14. A faster increase in the prices of durables compared to non-durables boosts non-durable consumption, hence total consumption. In the period surveyed, non-durable consumption enjoyed a relative share of about 80% in the total, as calculated at constant prices.

The long-term impact of disposable labour income on household consumption has a coefficient of elasticity of 0.49, and that of wealth, represented as the sum of financial assets plus the value of housing assets - 0.18.

In the mid term, the strong growth in household consumption is expected to be further sustained. Current household income has been steadily growing giving rise to stronger expectations of a future increase with the country's accession to EU. Household loan demand is expected to carry on rising, with mortgage credit reporting a larger contribution as the mortgage credit market gains further momentum. At the same time, mortgage loan interest rates, as well as credit interest as a whole, will decline as a result of stiffer bank competition. The demand for durables is expected to go on the increase as household income and their confidence and ability to meet financial liabilities grow. Furthermore, real estate prices are expected to continue their upward trend.

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Appendices

Appendix 1.1
Impact of total disposable income on consumption

Endogenous variables: C_HN DTI
Exogenous variables: C SEAS(1) SEAS(2) SEAS(3)

Table 1: Determining the optimal lag length

(based on the Schwarz criterion)

Number of lags	LogL	LR	FPE	AIC	SC	HQ
0	83.97	NA	0.00	-4.90	-4.53	-4.78
1	132.40	78.12	0.00	-7.77	**-7.21***	-7.59
2	135.83	5.09	0.00	-7.73	-6.99	-7.49
3	145.15	12.62*	1.12E-06*	-8.07*	-7.15	-7.77*

Table 2: Determining the number of cointegrating equations

(Intercept (no trend) in cointegrating equation)

Number of equations hypothesis	Eigenvalue	Trace Statistic	5%	1%
			Critical Value	
None*	0.52	**24.36**	19.96	24.60
At most one	0.03	1.04	9.24	12.97

1 equation at the 5% significance (trace test).

Not a single equation at the 1% significance level (trace test).

Number of equations hypothesis	Eigen value	Max-Eigen Statistic	5%	1%
			Critical Value	
None**	0.52	**23.32**	15.67	20.20
One at the most/At least one	0.03	1.04	9.24	12.97

**(**) Rejection of the hypothesis at the 5% (1%) levels of significance.*

1 equation at the 5 and 1% significance levels (max-eigenvalue test).

Table 3: Estimates based on a vector error correction models

$$C\_HN = \underset{(0.12)}{0.20} + \underset{(9.04)}{1.008}DTI$$

Dependent variable	Equation	
	ΔC_HN	ΔDTI
Error correction coefficient	**-0.33** (-3.32)	0.12 (1.14)
ΔC_HN(-1)	-0.20 (-1.13)	0.01 (0.04)
ΔDTI(-1)	-0.18 (-1.14)	-0.05 (-0.27)
SEAS(1)	**-0.22** (-9.40)	**-0.19** (-7.52)
SEAS(2)	-0.03 (-0.98)	0.11 (2.79)
SEAS(3)	**0.12** (8.56)	**0.22** (13.62)
Adj. R-squared	0.93	0.95
SEE	0.032	0.035
$X^2_{sc}(1) = 2.09\,[0.72]$, $X^2_n(4) = 7.81\,[0.10]$, $X^2_{hs}(27) = 35.75\,[0.12]$		

***Note**: The t-statistics are given in brackets. The last row of the table contains the results of the residual tests, with the F-statistics being given first, and probability in square brackets.*

Table 4: LR-test for a cointegration limitation on the α coefficients

Null hypothesis	LR- statistic, probability
$\alpha_{c\_hn} = 0$	0.00
$\alpha_{dti} = 0$	**0.22**

Appendix 1.2
Impact of disposable labour income on consumption

Endogenous variables: C_HN DLI
Exogenous variables: C SEAS(1) SEAS(2) SEAS(3)

Table 1: Determining the optimal lag length

(based on the Schwarz criterion)

Number of lags	LogL	LR	FPE	AIC	SC	HQ
0	82.30	NA	0.00	-4.79	-4.42	-4.67
1	134.45	84.11*	1.28E-06*	-7.90*	**-7.34***	-7.72*
2	137.12	3.96	0.00	-7.81	-7.07	-7.57
3	141.02	5.28	0.00	-7.81	-6.88	-7.51

Table 2: Determining the number of cointegrating equations

(Intercept (no trend) in cointegrating equation)

Number of equations hypothesis	Eigenvalue	Trace	5%	1%
		Statistic	Critical value	
None**	0.48	**27.32**	19.96	24.60
At most 1	0.18	6.20	9.24	12.97

1 equation at the 5 and 1% significance (trace test).

Number of equations hypothesis	Eigenvalue	Max-Eigen Statistic	5%	1%
			Critical value	
None**	0.48	**21.13**	15.67	20.20
At most 1	0.18	6.20	9.24	12.97

**(**) Rejection of the hypothesis at the 5% (1%) levels of significance.*

1 equation at the 5 and 1% significance levels (max-eigenvalue test)

Table 3: Estimates based on a vector error correction model

$C\_HN = \underset{(7.23)}{4.71} + \underset{(16.48)}{0.72} DLI$		
Dependent variable	Equation	
	ΔC_HN	ΔDLI
Error correction coefficient	**-0.51** (-2.86)	0.24 (1.19)
ΔC_HN(-1)	0.09 (0.69)	0.15 (1.06)
ΔDLI(-1)	-0.17 (-0.92)	-0.14 (-0.69)
SEAS(1)	**-0.16** (-12.92)	**-0.11** (-7.79)
SEAS(2)	0.02 (1.14)	**0.10** (4.08)
SEAS(3)	**0.11** (5.34)	**0.10** (4.55)
Adj. R-squared	0.92	0.81
SEE	0.033	0.038
$X^2_{sc}(1) = 6.65[0.16]$, $X^2_{n}(4) = 5.12[0.27]$, $X^2_{hs}(27) = 25.69[0.54]$		

***Note**: The t-statistics are given in brackets. The last row of the table contains the results of the residual tests, with the F-statistics being given first, and probability in square brackets.*

Table 4: LR-test for a cointegration limitation on the α coefficients

Null hypothesis	LR-statistic, probability
$\alpha_{c\_hn} = 0$	0.01
$\alpha_{dti} = 0$	**0.25**

Appendix 2
Disposable labour income, wealth and consumption

Endogenous variables: C_HN DLI A
Exogenous variables: C SEAS(1) SEAS(2) SEAS(3)

Table 1: Determining the optimal lag length

(based on the Schwarz criterion)

Number of lags	LogL	LR	FPE	AIC	SC	HQ
0	103.77	NA	0.00	-5.92	-5.37	-5.74
1	198.11	146.07	0.00	-11.43	**-10.45***	-11.11
2	212.62	19.66*	1.65E-09*	-11.78*	-10.39	-11.33*
3	220.55	9.20	0.00	-11.71	-9.91	-11.12

Table 2: Determining the number of cointegrating equations

(Intercept (no trend) in cointegrating equation)

Number of equations hypothesis	Eigenvalue	Trace	5%	1%
		Statistic	Critical value	
None**	0.76	**64.48**	34.91	41.07
At most 1	0.40	18.25	19.96	24.60
At most 2	0.05	1.71	9.24	12.97

1 equation at the 5 and 1% level of significance (trace test)

Number of equations hypothesis	Eigenvalue	Max-Eigen Statistic	5%	1%
			Critical value	
None*	0.76	**46.23**	22.00	26.81
At most 1	0.40	**16.54**	15.67	20.20
At most 2	0.05	1.71	9.24	12.97

**(**) Rejection of the hypothesis at the 5% (1%) levels of significance.*

2 equations at the 5% significance level (max-eigenvalue test.)

1 equation at the 1% significance level (max-eigenvalue test).

Table 3: Estimates based on a vector error correction model

$C\_HN = \underset{(10.37)}{5.50} + \underset{(8.91)}{0.50}DLI + \underset{(4.84)}{0.15}A$			
Dependent variable	Equation		
	ΔC_HN	ΔDLI	ΔA
Error correction coefficient	**-0.52** (-4.20)	0.04 (0.25)	**0.59** (3.49)
ΔC_HN(-1)	-0.17 (-1.39)	0.19 (1.19)	0.16 (0.96)
ΔDLI(-1)	-0.06 (-0.32)	-0.19 (-0.84)	-0.34 (-1.40)
ΔA(-1)	-0.10 (-0.84)	0.05 (0.36)	**0.46** (2.89)
SEAS(1)	**-0.20** (-12.83)	**-0.10** (-5.14)	**0.06** (3.02)
SEAS(2)	-0.05 (-1.60)	**0.09** (2.04)	**0.15** (3.33)
SEAS(3)	**0.08** (3.53)	**0.09** (3.10)	**0.15** (4.80)
Adj. R-squared	0.94	0.80	0.54
SEE	0.030	0.039	0.041
$X^2_{sc}(1) = 14.38[0.11]$, $X^2_n(6) = 13.65[0.03]$, $X^2_{hs}(66) = 83.66[0.07]$			

Note: *The t-statistics are given in brackets. The last row of the table contains the results of the residual tests, with the F-statistics being given first, and probability in square brackets.*

Table 4: LR-test for a cointegration limitation on the α coefficients

Null hypothesis	LR statistic, probability
$\alpha_{c\_hn} = 0$	0.00
$\alpha_{dli} = 0$	**0.79**
$\alpha_A = 0$	0.00
$\alpha_{dli} = 0$, $\alpha_A = 0$	0.00

Appendix 3
Disposable labour income, wealth, credit change and consumption

Endogenous variable: C_HN DLI A2
Exogenous variables: C SEAS(1) SEAS(2) SEAS(3)

Table 1: Determining the optimal lag length

(based on the Schwarz criterion)

Number of lags	LogL	LR	FPE	AIC	SC	HQ
0	112.25	NA	0.00	-6.27	-5.58	-6.05
1	214.41	151.58*	0.00	-12.28	**-11.17***	-11.92
2	226.37	15.44	8.44E-10*	-12.47 *	-10.95	-11.97*
3	230.87	4.94	0.00	-12.19	-10.24	-11.55

Table 2: Determining the number of cointegrating equations

(Intercept (no trend) in cointegrating equation)

Number of equations hypothesis	Eigenvalue	Trace	5%	1%
		Statistic	Critical values	
None**	0.77	**65.34**	34.91	41.07
At most 1	0.40	18.55	19.96	24.60
At most 2	0.07	2.29	9.24	12.97

1 equation at the 5 and 1% level of significance (trace test)

Number of equations hypothesis	Eigenvalue	Max-Eigen Statistic	5%	1%
			Critical value	
None**	0.77	**46.79**	22.00	26.81
At most 1	0.40	**16.26**	15.67	20.20
At most 2	0.07	2.29	9.24	12.97

**(**) Rejection of the hypothesis at the 5% (1%) levels of significance.*

2 equations at the 5% significance level (max-eigenvalue test).

1 equation at the 1% significance level (max-eigenvalue test).

Table 3: Estimates based on a vector error correction model

$$C\_HN = \underset{(8.82)}{5.78} + \underset{(5.53)}{0.41}DLI + \underset{(4.77)}{0.21}A2$$

Dependent variable	Equation		
	ΔC_HN	ΔDLI	ΔA2
Error correction coefficient	**-0.42** (-4.79)	0.00 (0.02)	**0.54** (4.21)
ΔC_HN(-1)	**-0.26** (-2.41)	0.16 (0.96)	0.21 (1.33)
ΔDLI(-1)	0.09 (0.58)	-0.15 (-0.60)	-0.25 (-1.12)
ΔA2(-1)	**-0.28** (-2.49)	-0.01 (-0.08)	0.29 (1.79)
ΔCR(-1)	**0.31** (3.52)	0.11 (0.78)	**0.28** (2.14)
SEAS(1)	**-0.22** (-14.93)	**-0.11** (-4.89)	**0.06** (2.70)
SEAS(2)	**-0.09** (-3.03)	0.07 (1.38)	**0.14** (3.00)
SEAS(3)	0.04 (1.76)	0.07 (1.38)	**0.11** (3.48)
Adj. R-squared	0.96	0.79	0.62
SEE	0.025	0.040	0.037
$X^2_{sc}(1) = 15.46[0.08]$ $X^2_n(6) = 8.18[0.23]$, $X^2_{hs}(78) = 105.87[0.02]$			

Note: *The t-statistics are given in brackets. The last row of the table contains the results of the residual tests, with the F-statistics being given first, and probability in square brackets.*

Table 4: LR-test for a cointegration limitation on the α coefficients

Null hypothesis	LR-statistic, likelihood
$\alpha_{c\_hn} = 0$	0.00
$\alpha_{dli} = 0$	**0.98**
$\alpha_{A2} = 0$	0.00
$\alpha_{dli} = 0$, $\alpha_{A2} = 0$	0.00

Appendix 4
Disposable labor income, wealth, credit change, relative prices, consumption

Endogenous variables: C_HN DLI A2
Exogenous variables: C ΔCR RELP SEAS(1) SEAS(2) SEAS(3)

Table 1: Determining the optimal lag length

(based on the Schwarz criterion)

Number of lags	LogL	LR	FPE	AIC	SC	HQ
0	120.20	NA	0.00	-6.59	-5.76	-6.32
1	217.99	138.79*	0.00	-12.32	**-11.07***	-11.91
2	230.51	15.34	8.09E-10*	-12.55*	-10.88	-12.01*
3	238.22	7.96	0.00	-12.47	-10.38	-11.79

Table 2: Obtaining/identifying/determining the number of cointegration equations

(Intercept (no trend) in cointegrating equation)

Number of equations hypothesis	Eigenvalue	Trace Statistic	5%	1%
			Critical value	
None**	0.70	**54.23**	34.91	41.07
At most 1	0.37	15.87	19.96	24.60
At most 2	0.03	1.10	9.24	12.97

1 equation at the 5 and 1% level of significance (trace test).

Number of equations hypothesis	Eigenvalue	Max-Eigen Statistic	5%	1%
			Critical value	
None**	0.70	**38.36**	22.00	26.81
At most 1	0.37	14.77	15.67	20.20
At most 2	0.03	1.10	9.24	12.97

**(**) Rejection of the hypothesis at the 5% (1%) levels of significance.*

2 equations at the 5% significance level (max-eigenvalue test).

1 equation at the 1% significance level (max-eigenvalue test).

Table 3: Estimates based on vector error correction models

$$C\_HN = \underset{(2.64)}{3.29} + \underset{(7.81)}{0.49}DLI + \underset{(4.34)}{0.18}A2$$

Dependent variable	Equation		
	ΔC_HN	ΔDLI	ΔA2
Error correction coefficient	**-0.37** (-2.50)	**0.45** (2.45)	**0.53** (2.66)
ΔC_HN(-1)	-0.30 (-1.84)	-0.21 (-1.03)	0.28 (1.29)
ΔDLI(-1)	0.03 (0.17)	-0.21 (-1.03)	-0.18 (-0.77)
ΔA2(-1)	**-0.27** (-2.20)	-0.12 (-0.79)	0.29 (1.72)
ΔCR	**0.28** (2.81)	0.17 (1.37)	**0.33** (2.48)
RELP	**0.14** (2.82)	**-0.14** (-2.25)	**-0.20** (-2.99)
SEAS(1)	**-0.23** (-8.17)	**-0.19** (-5.53)	**0.07** (1.91)
SEAS(2)	**-0.10** (-2.17)	-0.04 (-0.65)	**0.16** (2.52)
SEAS(3)	0.04 (1.88)	**0.06** (2.12)	**0.11** (3.47)
Adj. R-squared	0.95	0.84	0.62

$$X^2_{sc}(1) = 6.56[0.68] \quad X^2_{n}(6) = 10.43[0.11], \quad X^2_{hs}(90) = 90.00[0.04]$$

Note: *The t-statistics are given in brackets. The last row of the table contains the results of the residual tests, with the F-statistics being given first, and probability in square brackets.*

Table 4: LR-test for a cointegration limitation on the α coefficients

Null hypothesis	LR- statistic, likelihood
$\alpha_{c\_hn} = 0$	0.01
$\alpha_{dli} = 0$	0.02
$\alpha_{A_2} = 0$	0.00
$\alpha_{dli} = 0$, $\alpha_{A2} = 0$	0.00