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# WEALTH EFFECTS ON CONSUMPTION

## HOUSING WEALTH VERSUS FINANCIAL WEALTH

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### ABSTRACT

The purpose of this thesis is to investigate and compare the effects of changes in financial wealth and housing wealth on private consumption in Sweden. On the basis of theory and previous research, a base-case error-correction model containing consumption, income, financial wealth, and housing wealth is estimated on quarterly data over the period 1980-2004. The base-case model is then altered by using different measures of consumption as well as by including additional explanatory variables. The main findings are that, in contrast to previous research, the long run elasticity of consumption with respect to financial wealth is higher than the corresponding elasticity for housing wealth. On the contrary, in the short run, the elasticity of consumption with respect to housing wealth is substantially greater than the elasticity with respect to financial wealth. The income elasticity of consumption is noticeably lower than expected in both the long run and the short run.

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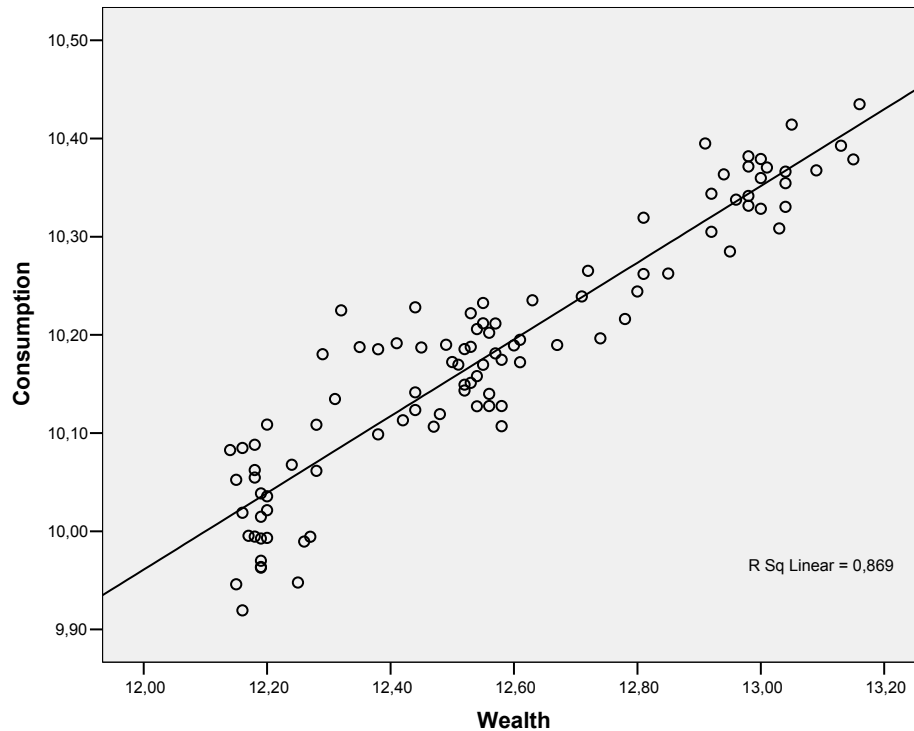
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# 1. Introduction

## 1.1 Background

When estimating a regression equation relating private consumption to wealth, the estimated coefficient on the wealth variable is usually interpreted as a measure of the wealth effect; the causal effect from exogenous changes in wealth upon consumption.<sup>1</sup> In figure 1.1.1 below the logarithm of private consumption is regressed against the logarithm of aggregate wealth.

**Figure 1.1.1** The “wealth effect”



In recent years the link between changes in asset prices and consumption behavior has attracted the attention of scholars as well as the general public. The reason for this is probably the puzzling behavior of private consumption in the wake of the stock market crash in the beginning of the century. Given the widely accepted notion that changes in wealth are correlated with changes in private consumption, tumbling share prices would be

<sup>1</sup> Case, Quigley and Shiller, 2005 p. 1.

expected to result in a contraction of consumer expenditure through a negative wealth effect. However, to the surprise of scholars, politicians, and investors there was only a weak effect on private consumption in the year's immediately following the stock market crash. On the contrary, private consumer expenditure actually continued to grow at decent rate, although not at the same high rate as during the years preceding the crash.<sup>2</sup>

In order to explain the surprisingly weak effect of changes in wealth upon consumption, a number of theories have been put forward. For instance, some economists argue that the wealth effect upon consumption from stock markets is small since financial wealth is unevenly distributed across the population. Share ownership tends to be concentrated in the hands of a wealthy minority whose consumption is relatively unaffected by changes in wealth, i.e. inelastic. Since the part of aggregate consumption that can be attributed this wealthy minority is small, the magnitude of the wealth effect on aggregate consumption becomes limited. Another explanation that gained popularity in the years following the stock market crash was that wealth effects on consumption are lagged, i.e. they will only have a gradual, long-term effect on the economy. However, considering the fact that half a decade has now passed since the bursting of the equity bubble without any marked effect on consumption, the validity of this theory must be seriously doubted.<sup>3</sup>

Previous research on wealth effects has mainly focused on financial wealth. However, as mentioned above, financial wealth tends to be concentrated in the hands of a small minority and may thus have no discernible effect on aggregate consumption. Housing wealth (residential real estate) on the other hand, is an asset class that tends to be more evenly distributed. Few individuals have large stock portfolios but many own their home. Although financial and housing wealth are in many ways different, it is plausible to believe that changes in housing wealth are related to changes in consumption in ways similar to those of financial wealth.<sup>4</sup> This belief is further supported by recent institutional innovations which have made it as easy to extract cash from housing equity as realizing capital gains on shares.<sup>5</sup> Given the upward trend in house prices in both Sweden and the US in recent years, the continued

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<sup>2</sup> The Economist, 2001 p. 70.

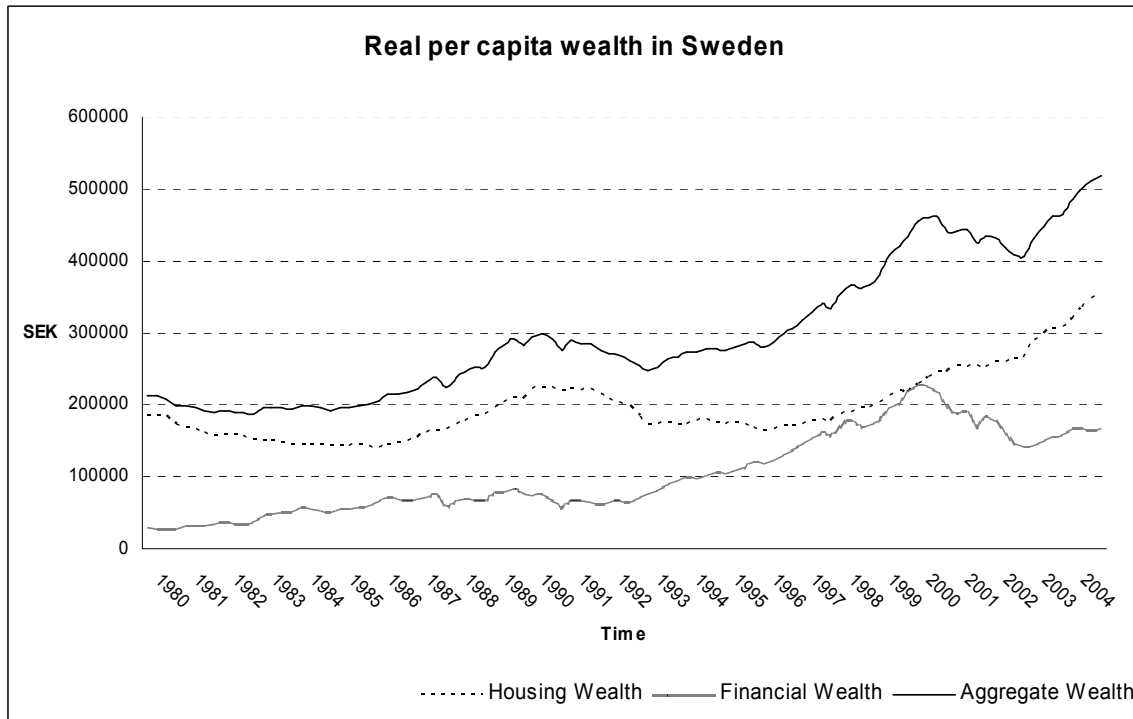
<sup>3</sup> The Economist, 2001 p. 70.

<sup>4</sup> Case, Quigley and Shiller, 2005 p. 1.

<sup>5</sup> Case, Quigley and Shiller, 2005 p. 1.

growth of consumer expenditure in these countries could perhaps be explained by a wealth effect from increasingly higher prices of residential real estate. In figure 1.1.2, financial wealth, housing wealth and aggregate wealth for Swedish households are shown for the period 1980-2004. It is interesting to note that increasing house prices to some extent mitigates the fall in total wealth resulting from the stock market crash in the beginning of the century.

**Figure 1.1.2** Real per capita wealth in Sweden 1980-2004



## 1.2 Purpose

The purpose of this thesis is to investigate and compare the effects of changes in financial wealth and housing wealth on private consumption in Sweden. Given the development of the Swedish stock and housing markets in recent years, we find previous research on this topic either outdated or inconclusive and thus believe it would be interesting to reexamine the impact of changes in financial wealth and housing wealth on private consumption. Albeit there are a few studies on private consumption in Sweden as well as abroad that have included wealth in disaggregated form, the purpose of these studies has generally not been to

examine wealth effects from housing and financial assets in isolation, but rather to investigate some related issue. As a consequence, we believe that a more thorough investigation and comparison of wealth effects in the Swedish stock and housing markets would constitute an important contribution for better understanding the mechanisms that governs the relationship between consumption and wealth.

### 1.3 Outline

Following the introduction and the purpose, relevant economic theory and previous research on wealth effects are presented in section two. In section three, an econometrical model is developed and explained. The data set is presented and described in section four. Statistical tests and empirical results are presented and compared to previous findings in section five. Finally, conclusions are drawn in section six and suggestions for further research are given in section seven. Statistical tests are explained in the appendix.

## 2. Theory

### 2.1 Consumption, income and wealth

When investigating the relationship between consumption, income and wealth, a common starting point is the permanent income hypothesis formulated by Ando & Modigliani (1963).<sup>6</sup> The long run relationship between consumption, income and wealth proposed by Ando & Modigliani can be formulated in terms of the optimization problem presented in equation (2.1.1) below:<sup>7</sup>

$$Max U = \sum_t \beta^t U_t(C_t) \quad (2.1.1)$$

$$w.r.t. \sum_t C_t / (1+r)^t \leq W_0 + \sum_t Y_t / (1+r_t)^t$$

According to the permanent income hypothesis, each agent choose a consumption path that maximizes her utility (U) function (weighted by a time discount rate  $\beta^t$ ) with respect to a budget constraint which is governed by a discounted stream of future income ( $\sum_t Y_t / (1+r_t)^t$ ) and the initial physical wealth that the individual is endowed with ( $W_0$ ). In order to empirically test this relationship, Ando & Modigliani proposed the following equation:<sup>8</sup>

$$C_t = c_Y Y_t + c_W W_t \quad (2.1.2)$$

In equation (2.1.2) above, consumption at time t is expressed as a linear function of current income ( $Y_t$ ) and current physical wealth ( $W_t$ ). Since the purpose of our thesis is to investigate the effects of changes in financial and housing wealth on private consumption,

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<sup>6</sup> Ando & Modigliani, 1963 pp. 56-57.

<sup>7</sup> Chen, 2005 p. 6.

<sup>8</sup> Ando & Modigliani, 1963 p. 58, and Chen, 2005 p. 7.

we augment equation (2.1.2) by disaggregating current physical wealth into financial net wealth and housing wealth.

$$C_t = c_Y Y_t + c_{FW} FW_t + c_{HW} HW_t \quad (2.1.3)$$

In equation (2.1.3) above, consumption at time  $t$  is a linear function of current income, financial net wealth ( $FW_t$ ) and housing wealth ( $HW_t$ ). Since income is a flow variable and wealth is a stock variable, we anticipate the marginal propensity to consume out of income to be close to unity, whereas we expect the corresponding number for wealth to be substantially lower. Moreover, given the fact that financial wealth and housing wealth are two rather distinct asset classes, there is a possibility that the marginal propensity to consume out of housing wealth ( $c_{HW}$ ) is different from the marginal propensity to consume out of financial wealth ( $c_{FW}$ ).

First, increases in some kinds of wealth may be viewed as more uncertain than others. Second, households may have a bequest motive, often reinforced by asymmetric tax laws favouring the holding of unrealized capital gains until death. Third, households may view the accumulation of some kinds of wealth as an end in it self. Fourth, households may find it difficult to measure their wealth and may not even know what it is from time to time. Fifth, a relative shift in the price of some kinds of assets may have an asymmetric effect on the savings patterns of current and prospective owners. Finally, some people may separate different kinds of wealth into separate mental accounts which may say that some assets are more appropriate to use for current consumption while others may only be used for future consumption.<sup>9</sup>

Despite the above mentioned differences, the reason why Ando & Modigliani did not include wealth in disaggregated form may simply be that the housing market was rather

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<sup>9</sup> Case, Quigley and Shiller, 2005 p. 3.



undeveloped at this point in time, implying that it was more difficult for individual homeowners to consume out of housing equity on the margin. Financial innovations facilitating the extraction of cash from housing equity were not as developed at that time as they are nowadays.<sup>10</sup>

## 2.2 Previous research

Previous research on the effect of housing wealth on consumption is rather limited. In a study based on aggregate data on consumer spending, financial wealth and non-financial wealth in the US, Elliot (1980) examines the marginal effect of changes in wealth on consumption. He finds that, in contrast to financial wealth, non-financial wealth has no effect on consumption and therefore concludes that non-financial wealth is not treated as a part of realizable purchasing power by households.<sup>11</sup> However, Elliot's conclusions regarding the importance of non-financial wealth are questioned in Bhatia (1987). In essence, Bhatia questions Elliot's method of estimating the value of residential property.<sup>12</sup> Whereas Elliot uses accumulated construction costs as a value measure for residential property, Bhatia uses estimates of market values from the US Census of Housing in order to approximate the value of residential property. By using the latter specification, Bhatia shows that non-financial wealth (real assets) has a significant impact on consumption.<sup>13</sup>

Using US micro data on individual households from the Panel Study of Income Dynamics, Skinner (1989) investigates the impact of housing wealth on consumption. Skinner found the effect of a marginal change in housing wealth to have a small but significant effect on consumption. However, when correcting his equations for heterogeneity (individual differences across cross sectional observations), the significant influence of housing wealth on consumption disappears.<sup>14</sup> Skinner argues that since a shift in the relative price of housing implies that sellers gain and buyers lose, the aggregate wealth effect of housing on

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<sup>10</sup> Case, Quigley and Shiller, 2005 p. 1.

<sup>11</sup> Elliot 1980, p. 528.

<sup>12</sup> Bhatia 1987, pp. 437-438.

<sup>13</sup> Bhatia 1987, p. 438.

<sup>14</sup> Skinner 1989, p. 24.

consumption may be close to neutral.<sup>15</sup> Furthermore, Case (1992) found evidence of a significant consumption effect during the real estate price boom in the late 1980's using data for New England.<sup>16</sup>

Previous studies investigating wealth effects in consumption functions have mainly been carried out on a single country basis. However, in a relatively new study, Byrne & Davis (2003) investigate disaggregated wealth in various consumption functions for the G7 nations. Using quarterly data from 1972Q2 to 1998Q4, Byrne & Davis formulate error-correction models including real disposable income and disaggregated financial net wealth in the long run and lagged consumption and disposable income in the short run.<sup>17</sup> Financial net wealth is disaggregated into liquid assets (net cash) and illiquid assets (bonds, shares, and life and pension funds net of mortgage debt).<sup>18</sup> The authors conclude that illiquid financial wealth tends to be a more significant determinant of consumption in most G7 nations than liquid financial wealth. Unfortunately, due to data reasons housing wealth is not included in the consumption functions estimated by Byrne & Davis.<sup>19</sup>

In a recently published study Case, Quigley & Shiller (2005) examines wealth effects using both US and international data. In contrast to Byrne & Davis (2003), wealth is disaggregated into financial wealth and housing wealth. The purpose of the study is to examine the link between increases in financial wealth, housing wealth, and consumer spending.<sup>20</sup> Case, Quigley & Shiller address this link using two different data sets; a panel of annual observations on 14 developed countries during the period 1975-1999, and a panel of quarterly observations on US states from 1982 through 1999. When describing the data the authors point out a number of shortcomings. For instance, the international panel is likely to suffer from substantial institutional differences among countries such as variations in taxation of wealth and capital gains as well as in credit availability. A likely problem with the US state data set is that the stock market has trended upwards during most of the sample period. On the other hand, the US panel has an advantage in that data definitions and

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<sup>15</sup> Skinner 1989, p. 1.

<sup>16</sup> Case 1992, pp. 172-173.

<sup>17</sup> Byrne and Davis, 2003 p. 12.

<sup>18</sup> Byrne and Davis, 2003 p. 14.

<sup>19</sup> Byrne and Davis, 2003 p. 11.

<sup>20</sup> Case, Quigley and Shiller, 2005 p. 1.

institutions are uniform across cross-sectional units.<sup>21</sup> Estimates of housing market wealth are constructed from repeat sales price indexes and mean home prices (base year 1990 and 1990Q1, respectively). Case, Quigley & Shiller construct their aggregate housing wealth panel for the US in the following way<sup>22</sup>:

$$V_{it} = R_{it} N_{it} I_{it} V_{io} \quad (2.2.1)$$

$V_{it}$  = aggregate value of owner occupied housing in state  $i$  in quarter  $t$

$R_{it}$  = home ownership rate in state  $i$  in quarter  $t$

$N_{it}$  = number of households in state  $i$  in quarter  $t$

$I_{it}$  = weighted repeat sales price index for state  $i$  in quarter  $t$

$V_{io}$  = mean home price for state  $i$  in the base year

The international aggregate housing wealth panel is computed in a similar fashion as equation (2.2.1). The definition of housing wealth in Case, Quigley & Shiller takes no account of the size or quality of new construction or of improvements in existing homes, i.e. their housing wealth measure can be described as the wealth of house owners assuming they own a standard unchanging home.<sup>23</sup> In essence, housing wealth is defined in this manner in order to make sure that the causality between changes in the market price of housing and consumption goes in the correct direction, i.e. from housing wealth to consumption and not the other way around. If the total value of the housing stock was used as a measure of housing wealth, there would most likely be a relation between housing wealth and consumption only because housing consumption is a part of aggregate consumption.<sup>24</sup> A different approach to solve the above mentioned causality problem would be to subtract the imputed value of owner occupied housing services usually included in total private consumption. However, due to data issues this has not been done in Case, Quigley & Shiller. This method of adjusting total private consumption will be further explored later on in this thesis. Moreover, data on aggregate consumption, housing values and stock market

<sup>21</sup> Case, Quigley and Shiller, 2005 p. 8.

<sup>22</sup> Case, Quigley and Shiller, 2005 p. 14.

<sup>23</sup> Case, Quigley and Shiller, 2005 p. 10.

<sup>24</sup> Case, Quigley and Shiller, 2005 p. 10.

valuations, by country and year, were expressed per capita in real terms using UN population data and the GNP deflator for each country.

Using a variety of different model specifications (base-case, fixed effects, and error-correction) Case, Quigley & Shiller estimate ordinary and least squares relationships between real per capita consumption, disposable income, financial and housing wealth. For the US state data, the resulting coefficient estimates are 0.660, 0.019 and 0.131 for income, financial and housing wealth, respectively. For the international data the corresponding elasticities are 0.567, 0.056 and 0.047.

Over the previous decade, a few Swedish studies have touched upon the relationship between increases in housing and financial wealth and increases in private consumption. Berg & Bergström (1995) investigate wealth effects in the consumption function using data over the period 1970-1992.<sup>25</sup> Wealth is disaggregated into financial wealth and housing wealth. Using various model specifications in an error-correction framework, the authors examine the long and short run impact of changes in different variables on total consumption. In the long run the resulting elasticities for income, financial and housing wealth are 0.642, 0.126 and 0.221, respectively. When including an error-correction term in their model Berg & Bergström are also able to establish a significant short term relationship between housing wealth, financial wealth, and consumption.<sup>26</sup> Another author who has examined the effects of disaggregated wealth on private consumption in Sweden is Barot (1995). Using semi-annual data over the period 1973-1993, Barot estimates consumption functions of different specifications in an error-correction framework. In conclusion, Barot argues that disaggregated wealth is an important parameter in the Swedish consumption function.<sup>27</sup>

With the purpose of developing a better understanding of the factors determining private consumption, Johnsson & Kaplan (1999) estimate an error-correction model using a single equation approach, i.e. the long run variables (in level form) are regressed together with the

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<sup>25</sup> Berg & Bergström, 1995 p. 421.

<sup>26</sup> Berg & Bergström, 1995 p. 435.

<sup>27</sup> Barot, 1995 p. 38.

variables that describe the short run dynamics (in differences form) of the model.<sup>28</sup> In the short run they argue that financial assets and the relative house price are significant and important explanatory variables. The long run elasticities for disposable income, financial and housing wealth are 0.8, 0.04 and 0.16, respectively.<sup>29</sup> Moreover, Lyhagen (2001) investigates the existence of precautionary saving using Swedish data for the years 1973 to 1992. Using an error-correction model Lyhagen estimates a long run consumption function that includes income, financial wealth, housing wealth, and a variable measuring consumer expectations. His model also includes various autoregressive components. The resulting long run elasticities for income, financial and housing wealth are 0.34, 0.15 and 0.18, respectively.<sup>30</sup>

Using Swedish data from 1980 to 2004, Chen (2005) investigates the relationship between consumption, disposable income and wealth.<sup>31</sup> In contrast to recent research on the same topic, which predominantly uses some specification of the standard error-correction model (c.f. Berg & Bergström (1995) or Case, Quigley & Shiller 2005); Chen uses a vector error-correction model. Referring to the work of Lettau & Ludvigson (2004), Chen argues that the properties of the vector error-correction model are more suitable when investigating the consumption-income-wealth relationship compared to the standard error-correction model.<sup>32</sup> Consequently, using a vector error-correction model Chen estimates the long run elasticities of income, financial and housing wealth to 0.258, 0.052 and 0.19, respectively.<sup>33</sup> However, since Chen uses a different model specification than previous researchers it is somewhat difficult to evaluate and compare his results against preceding studies on Swedish data.

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<sup>28</sup> Johnsson & Kaplan, 1999 p. 4.

<sup>29</sup> Johnsson & Kaplan, 1999 p. 18.

<sup>30</sup> Lyhagen, 2001 p. 677.

<sup>31</sup> Chen, 2005 p. 38.

<sup>32</sup> Chen, 2005 p. 4.

<sup>33</sup> Chen, 2005 p. 26.

### 3. Method

#### 3.1 Econometric modeling

Most macroeconomic time series are non-stationary and vary substantially over time, often without any obvious mean-reverting features or tendencies to move towards a linear trend. Prior to the 1970s, economic models containing non-stationary variables were usually estimated on data in levels using standard OLS techniques.<sup>34</sup> This is exemplified in equation (3.1.1) below where consumption is regressed on aggregate wealth.

$$\ln C_t = \alpha + \beta \ln W_t + \varepsilon_t \quad (3.1.1)$$

In a widely cited study, Granger & Newbold (1974) coined the term spurious regression and showed that standard OLS techniques could result in statistically significant relationships between theoretically unrelated non-stationary time series. They concluded that it is important to consider the dynamic aspects of time series variables when estimating econometrical models.<sup>35</sup> Granger & Newbold argued that spurious regressions could be avoided simply by estimating time series models in differences rather than in levels. This is due to the fact that even if most macroeconomic time series are non-stationary in levels, they are usually stationary in difference form. However, since economic theory typically predicts long run relationships between economic variables, a regression model only including variables in difference form will usually not be able to capture the long run implications of the theory.<sup>36</sup>

In the 1980s, Granger developed the concept of cointegration which essentially says that a linear combination of non-stationary time series variables can be stationary. If this is the case, the variables in question are said to be cointegrated which implies that deviations from the long run cointegration relationship are stationary. This is often true for linear combinations of macroeconomic series such as consumption, income and wealth.<sup>37</sup>

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<sup>34</sup> Englund, Persson & Teräsvirta, 2003 pp. 6-7.

<sup>35</sup> Granger & Newbold, 1974 pp. 117-119.

<sup>36</sup> Englund, Persson & Teräsvirta, 2003 p. 7.

<sup>37</sup> Englund, Persson & Teräsvirta, 2003 p. 8.

Granger demonstrated that relationships between cointegrated variables can be expressed in a statistically meaningful way in terms of an error-correction model. In this type of model, changes in the dependent variable depends on two sets of variables; variables in difference form that measures the short term dynamics of the system and an error correction term in level form that measures the deviation from the cointegration relationship. In terms of economic theory, the error-correction model has a natural interpretation. The model basically says that the dynamics of the dependent variable is governed by two forces; one that acts to level out any deviation from the long term cointegration relationship (for instance equilibrium consumption), and one that governs the short term dynamics of the adjustment path towards long run equilibrium.<sup>38</sup>

Engle & Granger (1987) develops a test for cointegration and shows how an error-correction model can be estimated.<sup>39</sup> To illustrate this method, an error-correction model for the consumption-wealth relationship described in equation (3.1.1) above is estimated below:

$$\text{Long run model} \quad \ln C_t = \alpha + \beta \ln W_t + u_t \quad (3.1.2)$$

$$\text{Short run model} \quad \Delta \ln C_t = \alpha + \beta_0 \Delta \ln W_t + \beta_1 u_{t-1} + \varepsilon_t \quad (3.1.3)$$

In equation (3.1.2), the long run (cointegration) consumption-wealth relationship is estimated in level form. In equation (3.1.3), the short run dynamics of the relationship between consumption and wealth is estimated in difference form. To tie the short run behavior of consumption to its long run equilibrium, the residuals from the long run model are lagged one period and included in the short run model. The lagged residual from the long run model is called an error-correction term. The absolute value of the coefficient on the error correction term measures the speed at which consumption adjusts the system back to the long-run equilibrium between consumption and wealth estimated in stage one.<sup>40</sup>

<sup>38</sup> Englund, Persson & Teräsvirta, 2003 p. 8, and Gujarati, 2003 pp. 822-823.

<sup>39</sup> Engle & Granger, 1987 pp. 264-270.

<sup>40</sup> Chen, 2005 p. 13, and Gujarati, 2003 p. 825.

## 4. Data

### 4.1 Time series data

In this thesis we investigate and compare the effects of changes in financial wealth and housing wealth on private consumption in Sweden using quarterly data over the period 1980Q1 to 2004Q4. The variables are transformed into real per capita terms using the consumer price index (CPI) as deflator, with 2004Q1 as base year. The CPI and population statistics have been obtained from the International Financial Statistics database. In order to allow for a more economics oriented interpretation of estimated regression coefficients (elasticities), we take the natural logarithm of all variables.

### 4.2 Consumption

The different consumption variables used in this thesis are computed from quarterly data on total aggregate consumption provided by Statistics Sweden. Given the purpose of this thesis, we only want to include household consumption in our definition of consumption. As a consequence, consumption expenditure in Sweden by foreign citizens is not included in our definition of total consumption. This is also true for the consumption of non-profit organisations. Moreover, we choose to include consumption by Swedish households abroad since we find it appropriate to study the effect of changes in our wealth variables on consumption regardless of where the consumption takes place. Total consumption ( $C$ ) can then be divided into four different subcategories: Consumption of durables ( $CD$ ), consumption of non-durables ( $CND$ ), consumption of housing services ( $CHS$ ) and consumption of non-housing services ( $CNHS$ ). This is illustrated in equation (4.2.1) below:

$$C_t = CD_t + CND_t + CHS_t + CNHS_t \quad (4.2.1)$$

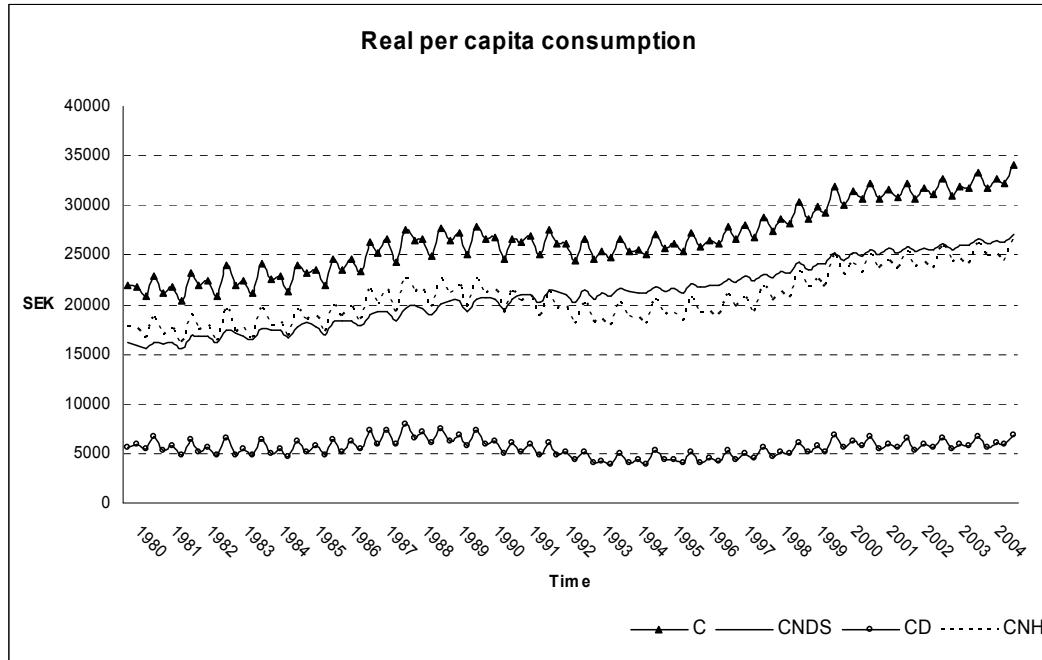
Dividing total consumption into these subcategories enables us to analyze whether changes in our disaggregated wealth variables have different effects on different categories of consumption. Consumption of housing services ( $CHS$ ) reflects how much Swedish



households pay in rent for their home. For coop shares and dwellings for permanent use rental costs for an equivalent rental apartment are imputed. The change in the consumption of housing services is thus highly correlated with the development of the rent level in Sweden. On the other hand, rental costs for dwellings for seasonal and secondary use are based on the capital cost of owning the property.

By subtracting consumption of housing services from total consumption we arrive at a measure of consumption that we label non-housing consumption (CNH). Since the part of consumption directly affected by housing is left out, we believe that this definition is well suited for our purpose. By using non-housing consumption we hence control for potential feedback effects between housing expenditures and housing wealth. Compared to total consumption, we expect the use of non-housing consumption to reduce the impact of changes in housing wealth on consumption expenditure

Adding together consumption of non-durables, consumption of housing services, and consumption of non-housing services we arrive at a variable that we label consumption of non-durables and services (CNDS). To our knowledge there is no previous study on Swedish data where the relationship between disaggregated wealth and non-housing consumption, consumption of durables and consumption of non-durables and services are investigated. We find it likely that the relationship between consumption and disaggregated wealth will differ depending on how consumption is measured. The different measures of consumption used are visualised in figure 4.2.1. We think it is interesting to note that there are quarterly trends in all four series.

**Figure 4.2.1** Real per capita consumption (SEK, quarterly)

### 4.3 Housing wealth including coop share apartments

In estimating the value of the wealth that Swedish households have tied up in housing we use quarterly data provided by Statistics Sweden. We have made estimations for three different types of housing: dwellings for permanent use, dwellings for seasonal and secondary use, and coop shares. Although financial and housing wealth are in many ways different, it is plausible to believe that changes in housing wealth are related to changes in consumption in ways similar to those of financial wealth.<sup>41</sup> We consequently believe that an increase in housing wealth will have a positive effect on private consumption.

#### 4.3.1 Dwellings for permanent, seasonal and secondary use

The values of dwellings for permanent use and dwellings for seasonal and secondary use are computed using tax assessed values (I) and purchase price coefficients (PPC) according to equation (4.3.1.1) below:

<sup>41</sup> Case, Quigley and Shiller, 2005 p. 1.

$$V_t = T_t \times PPC_t \quad (4.3.1.1)$$

The purchase price coefficient is the ratio of the average purchase price in each quarter to the tax assessed value. Since only sold properties are taken into account when constructing the purchase price coefficients, there is a possibility that these are not representative for the population as a whole. For instance, it is more likely that smaller houses are sold more frequently than larger ones. It may also be difficult to classify dwelling units into permanent or seasonal use; a problem which is common in areas with a mix of permanent and seasonal dwellings surrounding larger cities. During our sample period, new tax assessments have been made in 1981, 1989, 1996 and 2003. In between these years, tax assessed values have been increased when new housing has been added or when modernisation of the existing housing stock has taken place.

#### 4.3.2 Coop share apartments

Coop share apartments are regarded as financial wealth by Statistics Sweden. However, since we are interested in studying the effects of changes in housing and financial wealth on consumption separately, we believe that it better serves our purpose to regard coop shares as a part of the housing stock rather than as financial wealth. Since Statistics Sweden only publish figures for the aggregate value of coop shares on an annual basis, assumptions regarding quarterly figures have had to be made. In years when the total value of coop shares have moved in the same direction as the total value of dwellings for permanent use, the relative quarterly change in the value of dwellings for permanent use is used as a proxy for the relative quarterly change in the value of coop shares. However, in years when the value of these two housing categories move in opposite directions, quarterly figures for the value of coop shares are linearly interpolated from annual figures.<sup>42</sup>

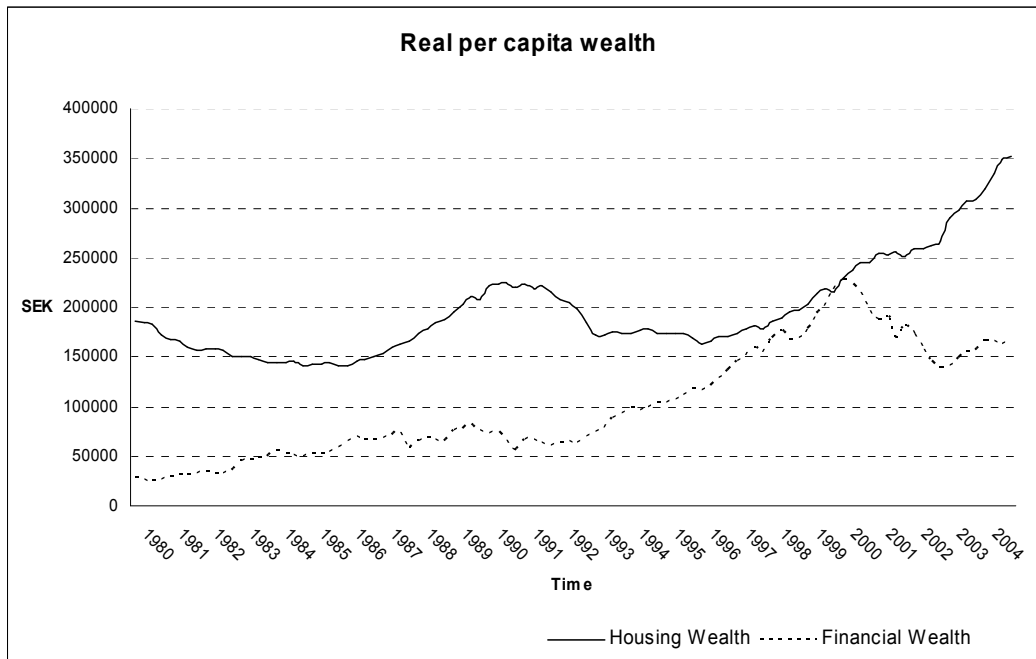
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<sup>42</sup> The prices of coop shares and dwellings for permanent use move in opposite directions in seven out of twenty five years.

#### 4.4 Financial net wealth

Quarterly data on Swedish households' financial net wealth (FW) has been provided by Associate Professor Lennart Berg of Uppsala University. The data is congruent with yearly figures provided by Statistics Sweden. Financial net wealth consists of deposits, shares, assets in pension funds and other financial assets net of household debt.<sup>43</sup> Coop shares are not included in our measure although they are usually defined as financial wealth. As previously mentioned, we find it more appropriate to classify coop shares as housing wealth. According to economic theory, an increase in financial net wealth should lead to an increase in consumption expenditure. Figure 4.4.1 visualizes the developments of financial wealth and housing wealth over time. It is interesting to note that financial wealth has increased at a substantially higher pace than housing wealth over the sample period. The ration of financial wealth to housing wealth peaked during the IT-boom in the late 1990s, exceeding unity in the last quarter of 1999.

**Figure 4.4.1** Real per capita wealth

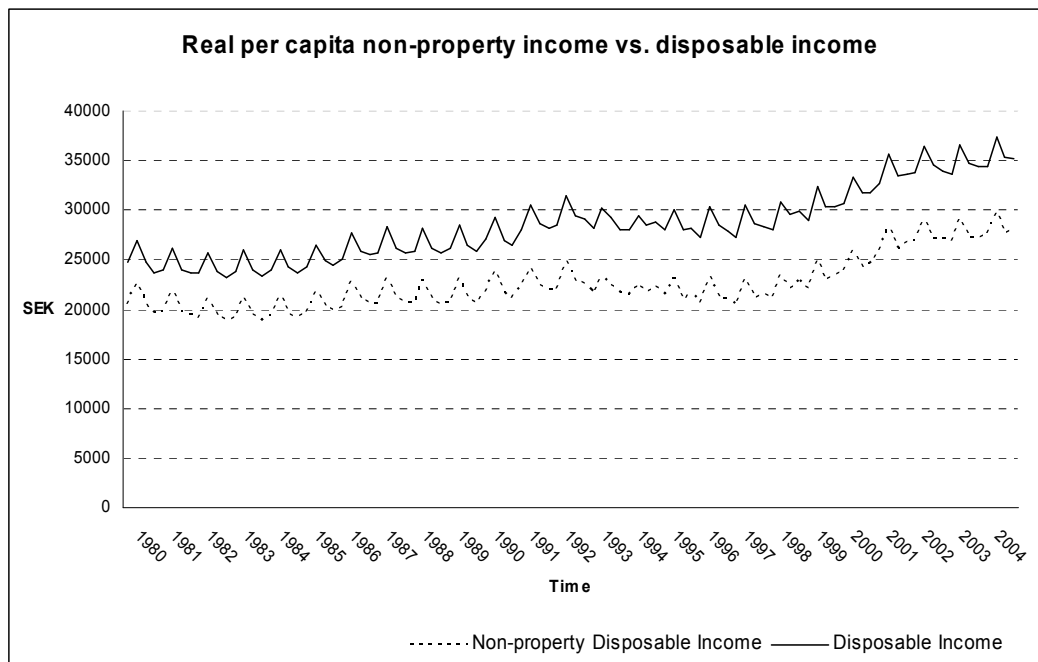


<sup>43</sup> See Berg & Bergström (1995) p. 425 for a more detailed description.

## 4.5 Non-property disposable income

Quarterly data on non-property disposable income (NPY) has been provided by Associate Professor Lennart Berg of Uppsala University. The variable has been computed by subtracting households' capital gains as well as the operating surplus for real estate from disposable income.<sup>44</sup> Raw data was collected from the National and Financial Accounts of Statistics Sweden. We expect a strong positive correlation between consumption and non-property disposable income. In figure 4.5.1 below, non-property disposable income is compared to disposable income. As can be seen in figure 4.5.1, the spread between disposable income and non-property income is rather constant over time.

**Figure 4.5.1** Real per capita income



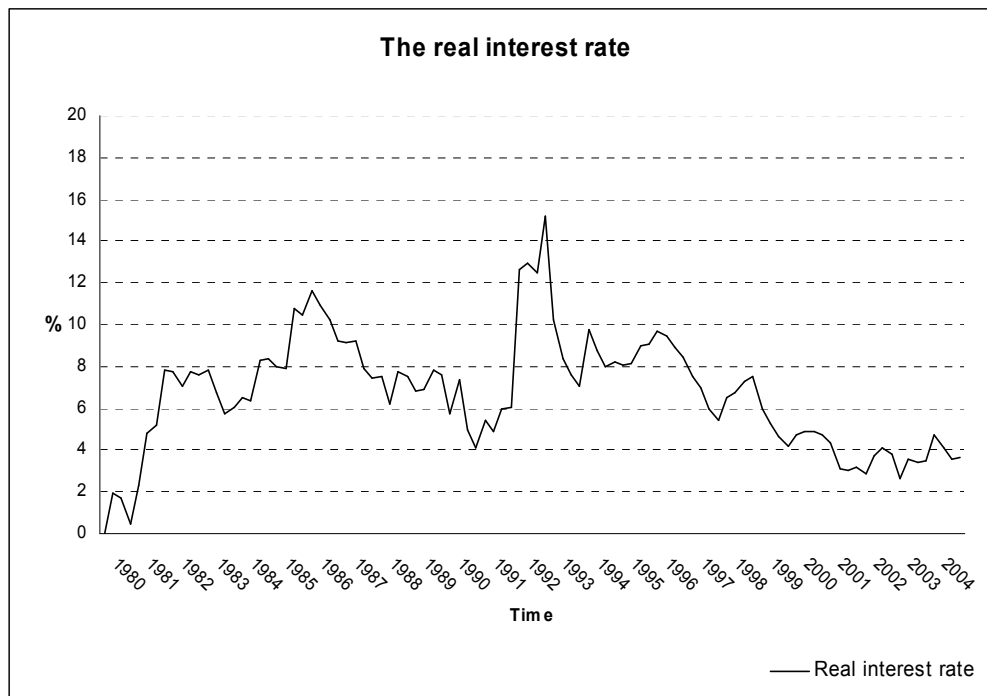
## 4.6 Real interest rate

As a measure of the interest rate we use quarterly figures from the International Financial Statistics database. The interest rate is in nominal terms and defined as the average short

<sup>44</sup> Agell & Berg, 1996 p. 600.

term rate of the six largest Swedish banks' loans to households, at quarter end. We find it more suitable to use this interest rate rather than to use an interest rate not available to households such as the repurchase rate or a government bond yield. To compute the real interest rate ( $R$ ) we deflate the nominal interest rate by the inflation rate. We define the inflation rate as the quarterly change in the Swedish CPI, assuming that current inflation is an adequate approximation for households' inflation expectations. By lagging the real interest rate two quarters we control for possible delays between a change in the real interest rate and its effect on consumption. We expect an increase in the real interest rate to have a dampening effect on consumption. As can be seen in figure 4.6.1 below the real interest rate peaked during the financial crisis in 1991-1993.

**Figure 4.6.1** The real interest rate

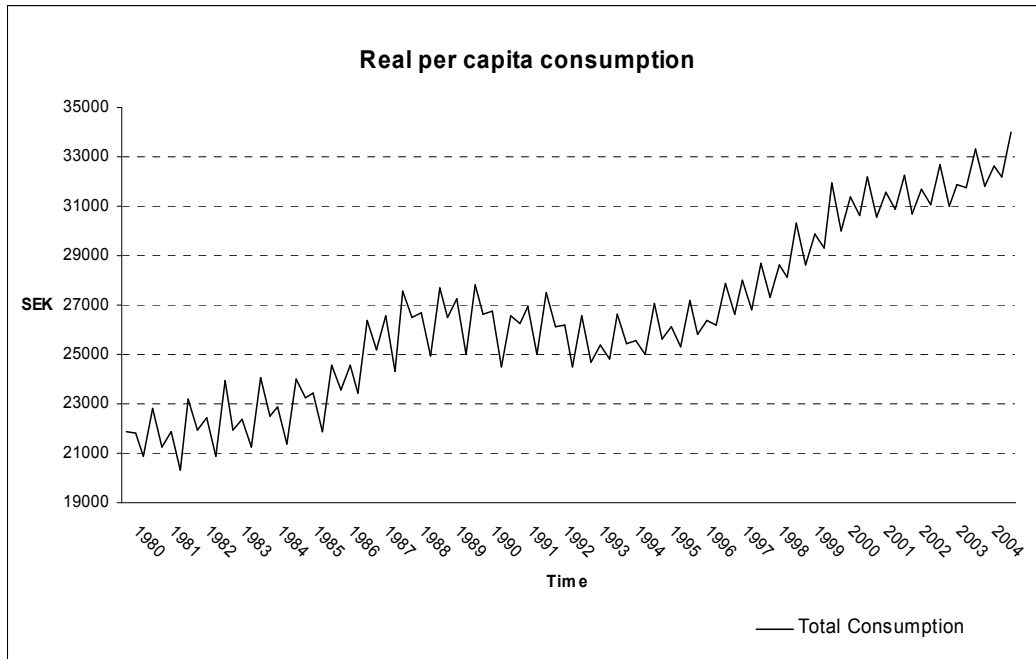


## 4.7 Dummy Variables

In order to control for seasonality in consumption we choose to include quarterly dummy variables in our regression. The existence of a quarterly pattern in consumption which justifies the use of quarterly dummy variables is shown in figure (4.7.1) below. In addition,

there are several episodes during our sample period when the Swedish economy was hit by different exogenous events affecting our variables in one way or another. As can be seen in figure 4.7.1, the most dramatic event influencing consumption was the financial crisis that took place in 1991-1993. To control for this extraordinary event we include a dummy variable for this time period.<sup>45</sup>

**Figure 4.7.1** Total consumption (absolute levels)



<sup>45</sup> Berg & Bergström (1995) include a dummy for 1991-1992. However, according to the Riksbank the financial crisis occurred in between 1992-1993, hence we also include the year 1993 in our dummy variable.

## 5. Empirical Results

### 5.1 Stationarity

The decision to use an error-correction model is based on the assumption that our variables are non-stationary on an individual basis. Given that most macroeconomic variables usually are non-stationary, we believe that this is a reasonable conjecture.<sup>46</sup> Nevertheless, to make sure that our variables are non-stationary in level form and stationary in difference form, we perform standard Dickey-Fuller tests on all variables. A more detailed explanation of the test, together with the test results, can be found in the appendix. In line with our expectations, we cannot reject the null hypothesis of non-stationarity on a five percent level for any of our variables. As a consequence, we compute the first difference of the variables and then once again perform Dickey-Fuller tests. This time we are able to reject the null hypothesis of non-stationarity on a five percent level for all variables. We have thus established that all our variables are stationary in first difference form (integrated of order one); a necessary assumption in our modeling strategy.

### 5.2 Long-run model

Estimated coefficients and corresponding standard errors from various specifications of our long-run model can be seen in table 5.2.1 below. In model (1.1) we regress total consumption against income. In line with economic theory, the coefficient estimate on income is positive, close to unity, and highly significant. In model (2.1), aggregate wealth is included to examine the effect of changes in aggregate wealth on consumption, i.e. the wealth effect. As can be seen in table 5.2.1, the inclusion of aggregate wealth substantially reduces the magnitude of the estimated income coefficient. Nevertheless, both coefficients are still significant at the five percent level, implying a robust relationship with consumption.

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<sup>46</sup> Englund, Persson & Teräsvirta, 2003 pp. 6-7.



**Tabel 5.2.1** Unstandardized coefficient estimates from the long run model

Long run									
Dep. variable:	C						CNH	CNDS	CD
Model (#):	(1.1)	(2.1)	(3.1)	(4.1)	(5.1)	(6.1)	(7.1)	(8.1)	(9.1)
Constant	<b>1,138**</b> <i>0,395</i>	<b>4,174**</b> <i>0,355</i>	<b>4,997**</b> <i>0,335</i>	<b>4,999**</b> <i>0,334</i>	<b>4,997**</b> <i>0,332</i>	<b>4,622**</b> <i>0,407</i>	<b>6,193**</b> <i>0,558</i>	<b>2,399**</b> <i>0,229</i>	<b>12,141**</b> <i>1,448</i>
NPY	<b>0,906**</b> <i>0,039</i>	<b>0,216**</b> <i>0,063</i>	<b>0,158**</b> <i>0,066</i>	<b>0,141**</b> <i>0,068</i>	<b>0,131*</b> <i>0,068</i>	<b>0,235**</b> <i>0,082</i>	<b>-0,163</b> <i>0,111</i>	<b>0,552**</b> <i>0,046</i>	<b>-1,360**</b> <i>0,288</i>
W		<b>0,310**</b> <i>0,026</i>							
FW			<b>0,189**</b> <i>0,007</i>	<b>0,117**</b> <i>0,007</i>	<b>0,113**</b> <i>0,008</i>	<b>0,110**</b> <i>0,009</i>	<b>0,354**</b> <i>0,012</i>	<b>0,146**</b> <i>0,005</i>	<b>0,019</b> <i>0,032</i>
HWCO			<b>0,118**</b> <i>0,029</i>	<b>0,204**</b> <i>0,032</i>	<b>0,216**</b> <i>0,032</i>	<b>0,164**</b> <i>0,033</i>	<b>0,099**</b> <i>0,049</i>	<b>0,030</b> <i>0,020</i>	<b>0,826**</b> <i>0,126</i>
R				<b>0,004</b> <i>0,004</i>					
R <sub>2</sub>					<b>0,006</b> <i>0,004</i>				
Q1	<b>-0,059**</b> <i>0,014</i>	<b>-0,062**</b> <i>0,009</i>	<b>-0,062**</b> <i>0,007</i>	<b>** -0,062</b> <i>0,007</i>	<b>-0,062**</b> <i>0,007</i>	<b>-0,062**</b> <i>0,007</i>	<b>-0,081**</b> <i>0,012</i>	<b>-0,023**</b> <i>0,005</i>	<b>-0,208**</b> <i>0,031</i>
Q2	<b>-0,053**</b> <i>0,014</i>	<b>-0,046**</b> <i>0,009</i>	<b>-0,045**</b> <i>0,007</i>	<b>-0,045**</b> <i>0,007</i>	<b>-0,042**</b> <i>0,007</i>	<b>-0,045**</b> <i>0,007</i>	<b>-0,061**</b> <i>0,012</i>	<b>-0,033**</b> <i>0,005</i>	<b>-0,090**</b> <i>0,032</i>
Q3	<b>-0,106**</b> <i>0,014</i>	<b>-0,095**</b> <i>0,009</i>	<b>-0,093**</b> <i>0,007</i>	<b>-0,093**</b> <i>0,007</i>	<b>-0,092**</b> <i>0,007</i>	<b>-0,094**</b> <i>0,007</i>	<b>-0,124**</b> <i>0,012</i>	<b>-0,061**</b> <i>0,005</i>	<b>-0,210**</b> <i>0,032</i>
D9192						<b>-0,016</b> <i>0,010</i>			
R <sup>2</sup>	<b>0,858</b>	<b>0,944</b>	<b>0,962</b>	<b>0,963</b>	<b>0,962</b>	<b>0,962</b>	<b>0,886</b>	<b>0,988</b>	<b>0,550</b>
σ	<b>0,049</b>	<b>0,031</b>	<b>0,026</b>	<b>0,026</b>	<b>0,025</b>	<b>0,026</b>	<b>0,043</b>	<b>0,018</b>	<b>0,111</b>
DW	<b>0,282</b>	<b>0,566</b>	<b>0,833</b>	<b>0,867</b>	<b>0,869</b>	<b>0,835</b>	<b>0,343</b>	<b>1,286</b>	<b>0,230</b>

Note: standard errors in *italics*.

\*\* and \* denote significance at the 5 % and 10% level, respectively.

Since the purpose of this thesis is to investigate and compare the effects of changes in financial and housing wealth on private consumption, aggregate wealth is disaggregated into financial wealth and housing wealth in model (3.1). This model specification is consistent with the economic theory presented in section 2.1 above, as well as similar to model specifications used in previous research, and is therefore used as our base-case model.<sup>47</sup> The estimated long run relationship described by model (3.1) is illustrated in equation (5.2.1) below:

$$\ln C = 4.997 - 0.062Q1 - 0.045Q2 - 0.093Q3 + 0.158 \ln NPY + 0.189 \ln FW + 0.118 \ln HWCO \quad (5.2.1)$$

Equation (5.2.1) suggests that one percentage point's growth in disposable income will result in a 0.158 percentage point's increase in total consumption, one percentage point's growth in

<sup>47</sup> See for instance Case, Quigley and Shiller (2005), Berg & Bergström (1995), Lyhagen (2001), and Chen (2005).

financial wealth will follow with a 0.189 percentage point's increase in total consumption, and one percentage point's growth in housing wealth will result in a 0.118 percentage point's increase in total consumption. Our results differ somewhat from the long run elasticity parameters  $[\beta_Y; \beta_{FW}; \beta_{HW}]$  estimated by Lyhagen (2001) [0.34; 0.15; 0.18], Chen (2005) [0.258; 0.052; 0.197], Berg & Bergström (1995) [0.642; 0.126; 0.221], Johnsson & Kaplan (1999) [0.8; 0.04; 0.16] and Case et al. (2005) [0.660; 0.019; 0.131]. However, all studies except Chen (2005) estimate their models over different time periods. In addition, the above authors also use slightly different model specifications compared to our base case model. For instance, Lyhagen includes a variable that measures consumer expectations; Berg & Bergström includes a dummy controlling for the financial crisis in 1991-1992; and Case et al. uses gross financial wealth instead of net financial wealth. Moreover, most previous studies use yearly data (aggregated quarterly observations in some cases), and does hence not include quarterly dummies in their models. The fact the previous studies use different time periods and different model specifications imply that their results are not entirely comparable to our results, although we still believe that a comparison constitutes a good reality check.

Regarding our results, it is interesting to note that the effect of a change in income on consumption is not as strong as the effect found by other authors. Also in contrast to previous research, we find that variations in financial wealth have a stronger impact on consumption compared to changes in housing wealth. The long run elasticity for financial wealth is about two-thirds higher than the long run elasticity for housing wealth. To sum up, we find our estimates for financial wealth to be higher and our estimates for income to be lower than found in previous research. Our estimates for housing wealth are however in line with preceding findings.

Since the variables in our model are of varying absolute magnitude, the percentage change in consumption as a result of a one percentage point change in one of our explanatory variables is not equal to the absolute monetary change in consumption. Hence, in order to be able to compare the absolute monetary effect on consumption from an absolute monetary change in one of our explanatory variables (the marginal propensity to consume) we transform our coefficient estimates using a weight illustrated in equation (5.2.2) below:

$$w_X = \frac{\sum_{t=1}^{t=100} C_t}{\sum_{t=1}^{t=100} X_t} \quad (5.2.2)$$

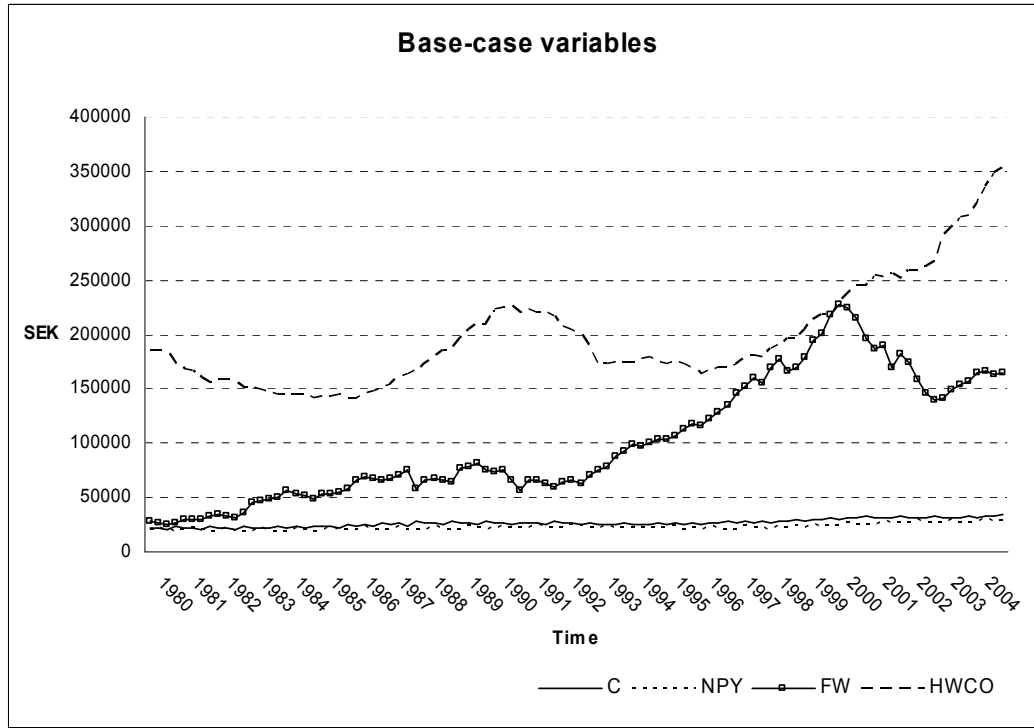
In equation (5.2.2) the sum of total consumption for our sample period (N=100) is divided by the sum of all explanatory variables, respectively. However, since the difference in magnitude between the variables is not constant over time, this correction is not entirely accurate but is nonetheless a satisfactory approximation. The resulting coefficient estimates ( $\hat{\beta}_X^w$ ) are then computed using equation (5.2.3) below<sup>48</sup>:

$$\hat{\beta}_X^w = \hat{\beta}_X \times w_X \quad (5.2.3)$$

Applying this procedure, the marginal propensities to consume out of income, financial and housing wealth are 0.186, 0.049 and 0.016, respectively. In other words, if for example income increases by one monetary unit, total consumption grows by approximately 0.186 monetary units. Hence in absolute terms the effect on consumption from a change in income is substantially stronger than the wealth effects arising from changes financial and housing wealth, respectively. Moreover, the wealth effect from changes in financial wealth is approximately three times larger than the corresponding effect from changes in housing wealth. The difference between the variables in absolute levels is illustrated in figure (5.2.1) below.

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<sup>48</sup> The weights for income, financial and housing wealth are 1.18, 0.26 and 0.13, respectively.

**Figure 5.2.1** Variables in absolute levels over time (real terms per capita)

In model (4.1) the real interest rate is included as an explanatory variable, and in model (5.1) the same variable is lagged two periods. Economic theory predicts a negative relationship between the real interest rate and consumption. However, the coefficient estimates on the interest rate variables in models (4.1) and (5.1) are positive and statistically insignificant. We hence believe that they can be excluded from our model without any loss of explanatory power. Model (6.1) differs from model (3.1) in that it includes a dummy variable for the financial crisis in 1991-1993. The estimated coefficient on the dummy variable turns out to be small and insignificant and can hence, in similarity with the real interest rate, be left out of the model. Moreover, it is also interesting to note that the estimated coefficients for all models with total consumption as dependent variable are relatively stable.

Models (7.1) to (9.1) include the same explanatory variables as the base-case model, but different measures of consumption. To our knowledge, this has not been investigated before using the same setup as in our base case model. However, when using non-housing consumption and durables consumption as in models (7.1) and (9.1), the sign of the

estimated coefficient on income turns negative. Regarding model (9.1) it should be noted that the estimated coefficient on housing wealth is statistically significant and close to unity (0.826), whilst the coefficient on financial wealth is small and insignificant. When using non-durables consumption including services as dependent variable, the estimated coefficient on income has the correct sign and is large (0.552) compared to the base-case model (0.158). It should also be noted that coefficient on housing wealth is small (0.03) and insignificant, whilst the coefficient on financial wealth (0.146) is in line with the base-case model (0.189).

### 5.3 Cointegration

In section 5.1 we showed that all our variables are integrated of order one. However, the error-correction model also requires the variables to be cointegrated, i.e. that there is a long run equilibrium relationship among them. If no such long run relationship exists, the results obtained from our long run model might be spurious. Consequently, to make sure our variables are cointegrated; we perform Engle-Granger tests on all models presented in section 5.2. A more detailed explanation of the test, together with the test results, can be found in the appendix. Regarding the test results, we are able to reject the null hypothesis of nonstationarity of the residuals for all models except (1.1), (7.1) and (9.1). Since the tests are based on critical values obtained from the same tau-distribution used for the standard Dickey-Fuller test discussed in section 5.1, the test results may only be characterised as indicative. Despite the fact that the critical values are not entirely appropriate, we believe that they can be used as a satisfactory simplifying approximation.<sup>49</sup>

### 5.4 Short run model

Estimated coefficients and standard errors from various specifications of our short run model can be seen in table 5.4.1 below. Concerning the short run dynamics of the consumption, income and wealth relationship, it should be noted that the error-correction terms in all model specifications are negative and significant. This indicates that consumption reverts rather quickly to its long-run path, which is in line with our expectations.

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<sup>49</sup> Gujarati, 2003 p. 823.

Regarding our short run coefficient estimates it is interesting to note that the estimates for housing wealth are large and significant in comparison to the estimates for financial wealth. In other words, changes in financial wealth do not seem to have any discernable impact on consumption in the short run. This is in contrast to the long run where we show that changes in financial wealth have a stronger effect on consumption relative housing wealth. It is also interesting to note that all models with total consumption as dependent variable have similar coefficient estimates.

**Table 5.4.1** Unstandardized coefficient estimates from the short run model

Short run								
Dep. variable:	C					CNH	CNDS	CD
Model (#):	(2.2)	(3.2)	(4.2)	(5.2)	(6.2)	(7.2)	(8.2)	(9.2)
Constant	<b>0,094**</b> <i>0,005</i>	<b>0,096**</b> <i>0,005</i>	<b>0,095**</b> <i>0,005</i>	<b>0,095**</b> <i>0,005</i>	<b>0,095**</b> <i>0,005</i>	<b>0,130**</b> <i>0,005</i>	<b>0,056**</b> <i>0,004</i>	<b>0,236**</b> <i>0,011</i>
Q1	<b>-0,151**</b> <i>0,008</i>	<b>-0,155**</b> <i>0,007</i>	<b>-0,154**</b> <i>0,007</i>	<b>-0,154**</b> <i>0,007</i>	<b>-0,155**</b> <i>0,007</i>	<b>-0,207**</b> <i>0,008</i>	<b>-0,072**</b> <i>0,005</i>	<b>-0,454**</b> <i>0,016</i>
Q2	<b>-0,076**</b> <i>0,008</i>	<b>-0,079**</b> <i>0,008</i>	<b>-0,078**</b> <i>0,008</i>	<b>-0,078**</b> <i>0,008</i>	<b>-0,080**</b> <i>0,008</i>	<b>-0,114**</b> <i>0,009</i>	<b>-0,060**</b> <i>0,006</i>	<b>-0,145**</b> <i>0,017</i>
Q3	<b>-0,143**</b> <i>0,007</i>	<b>-0,146**</b> <i>0,007</i>	<b>-0,146**</b> <i>0,007</i>	<b>-0,147**</b> <i>0,007</i>	<b>-0,146**</b> <i>0,007</i>	<b>-0,195**</b> <i>0,008</i>	<b>-0,084**</b> <i>0,005</i>	<b>-0,366**</b> <i>0,015</i>
D9192					<b>0,004</b> <i>0,007</i>			
ΔNPY	<b>0,238*</b> <i>0,125</i>	<b>0,200*</b> <i>0,120</i>	<b>0,215*</b> <i>0,120</i>	<b>0,201*</b> <i>0,121</i>	<b>0,216*</b> <i>0,122</i>	<b>0,138</b> <i>0,136</i>	<b>0,359**</b> <i>0,095</i>	<b>-0,016</b> <i>0,273</i>
ΔW	<b>0,177*</b> <i>0,095</i>							
ΔFW		<b>0,040</b> <i>0,032</i>	<b>0,038</b> <i>0,032</i>	<b>0,036</b> <i>0,033</i>	<b>0,039</b> <i>0,032</i>	<b>0,017</b> <i>0,037</i>	<b>0,077**</b> <i>0,026</i>	<b>0,030</b> <i>0,074</i>
ΔHWCO		<b>0,288**</b> <i>0,095</i>	<b>0,276**</b> <i>0,095</i>	<b>0,300**</b> <i>0,099</i>	<b>0,288**</b> <i>0,102</i>	<b>0,337**</b> <i>0,111</i>	<b>0,009</b> <i>0,068</i>	<b>0,696**</b> <i>0,221</i>
ΔR			<b>-0,004</b> <i>0,003</i>					
ΔR <sub>-2</sub>				<b>0,003</b> <i>0,004</i>				
RES <sub>-1</sub>	<b>-0,258**</b> <i>0,081</i>	<b>-0,448**</b> <i>0,091</i>	<b>-0,456**</b> <i>0,091</i>	<b>-0,465**</b> <i>0,094</i>	<b>-0,459**</b> <i>0,092</i>	<b>-0,199**</b> <i>0,062</i>	<b>-0,466**</b> <i>0,102</i>	<b>-0,118**</b> <i>0,048</i>
R <sup>2</sup>	<b>0,885</b>	<b>0,900</b>	<b>0,903</b>	<b>0,902</b>	<b>0,901</b>	<b>0,926</b>	<b>0,791</b>	<b>0,939</b>
σ	<b>0,022</b>	<b>0,020</b>	<b>0,020</b>	<b>0,020</b>	<b>0,020</b>	<b>0,023</b>	<b>0,015</b>	<b>0,046</b>
DW	<b>2,318</b>	<b>2,153</b>	<b>2,155</b>	<b>2,150</b>	<b>2,162</b>	<b>2,543</b>	<b>1,910</b>	<b>2,616</b>

Note: standard errors in *italics*.

\*\* and \* denote significance at the 5 % and 10% level, respectively.

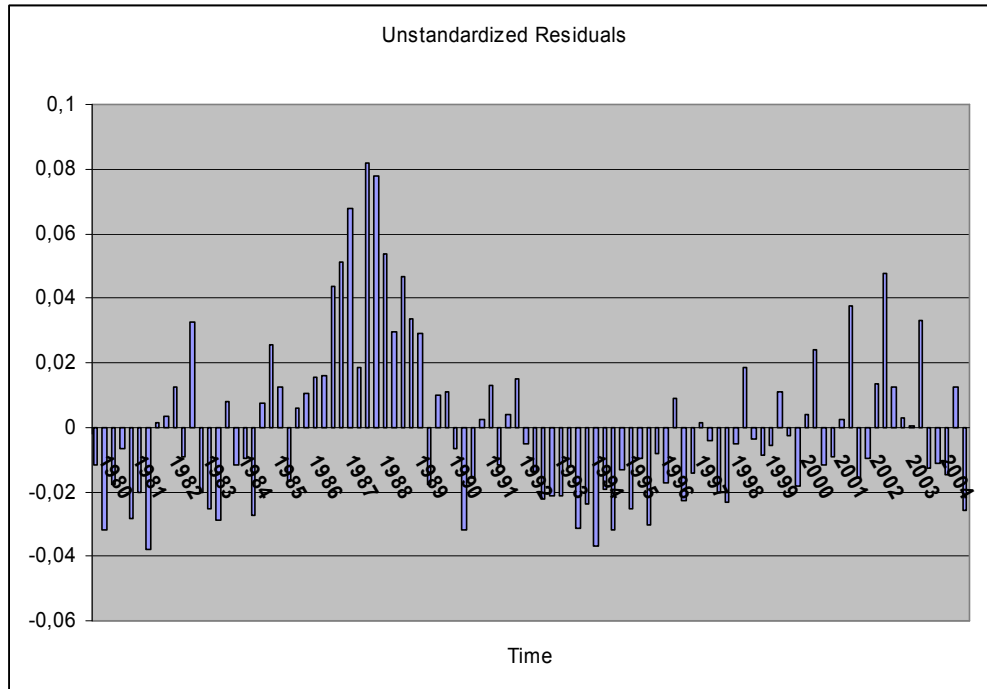
As regards the model with non-housing consumption as dependent variable, the estimated coefficient on income now has the expected sign. In line with our long run results, changes in financial wealth seem to have a stronger effect on consumption of non-durables goods and services compared to changes in housing wealth. The contrary is true for the model

containing durables consumption, where the estimated coefficient on housing wealth is large and significant in the short and long run whilst the coefficient on financial wealth is small and insignificant.

## 5.5 Unusual events

As can be seen in residual plot of our base-case model in figure 5.5.1 below, our model is rather good at predicting the development of private consumption in Sweden in between 1980 and 2004.

**Figure 5.5.1** Unstandardized residuals (base-case model)



There are however certain time periods when the model over or underestimates actual consumption. For instance, our model overestimates consumption by two to three percentage points during the financial crisis in 1991-1993. Moreover, in the years following the financial deregulation in 1985, our model underestimates private consumption by around eight percentage points at the most. Given these results, it seems reasonable to investigate whether it is possible to improve the model specification in some way. A natural starting

point would be to include dummy variables for years when extraordinary events in some way influenced the Swedish economy. However, including dummy variables for various time periods do not improve our model. The existence of large residuals in some years may also be due to model misspecification, i.e. that one or more explanatory variables have been left out of the model. For instance, Agell & Berg (1996) suggests that the consumption boom in the mid 1980s can be explained along other lines than financial deregulation, and point out a pickup in real wage growth during the same period as an alternative explanation.<sup>50</sup>

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<sup>50</sup> Agell & Berg, 1996 p. 596.



## 6. Conclusion

The purpose of this thesis was to investigate and compare the effects of changes in financial and housing wealth on private consumption in Sweden. The main findings are that, in contrast to previous research, the long run elasticity of consumption with respect to financial wealth is higher than the corresponding elasticity for housing wealth. In contrast, in the short run the elasticity of consumption with respect to housing wealth is substantially greater than the elasticity with respect to financial wealth. The income elasticity of consumption is noticeably lower than expected in both the long run and the short run.

It is interesting to note that the long run elasticity for financial wealth is about two-thirds higher than the long run elasticity for housing wealth. When computing the marginal propensities to consume out of financial and housing wealth, the wealth effect from changes in financial wealth is approximately three times larger than the corresponding effect from changes in housing wealth. Regarding the short term model, it should be noted that the error-correction term is negative and significant in all tested specifications. This implies that short run shocks affecting the explanatory variables are counteracted, i.e. consumption reverts back to its long run equilibrium path.

Since total consumption includes housing related expenditures, we control for potential feedback effects between housing expenditures and housing wealth using non-housing consumption instead of total consumption as dependent variable. In line with our expectations, this model setup reduces the impact of changes in housing wealth on consumption. However, the credibility of this setup must be seriously questioned since the resulting coefficient on income is negative and insignificant. Substituting total consumption for durables-only consumption affects the income variable in the same fashion and yields a very strong housing wealth effect but only a weak effect from financial wealth. On the contrary, using non-durables consumption results in a strong effect from income and financial wealth but reduces the importance of changes in housing wealth.

## 7. Suggestions for Further Research

The purpose of this thesis was to investigate and compare the effects of changes in financial and housing wealth on private consumption in Sweden. However, as in all empirical investigations, the results obtained are highly sensitive to the quality and definition of the data. For instance, using more accurate estimates of housing and financial wealth would most likely result in more stable results. Nevertheless, accurately measuring the value of, for instance, the aggregate housing stock is very difficult due to the large number of unique objects.

Moreover, in order to capture the dynamic behavior of economic agents one could further elaborate with lagged variables. Also, to control for differences in consumption patterns between different geographical regions, the effects of changes in financial and housing wealth could be investigated using regional data. We also believe that it would be interesting to examine the effects of changes in further disaggregated components of financial and housing wealth.

## 8. References

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### **Websites**

[www.imfstatistics.org](http://www.imfstatistics.org)

[www.riksbanken.se](http://www.riksbanken.se)

[www.scb.se](http://www.scb.se)

## 9. Appendix

### 9.1 Stationarity

All Dickey-Fuller tests are based on the equation:

$$\Delta \ln C_t = \alpha + \beta_1 Q1 + \beta_2 Q2 + \beta_3 Q3 + \beta_4 T + \beta_5 \ln C_{t-1} + u_t \quad (9.1.1)$$

In equation (9.1.1) above,  $\Delta \ln C_t$  is the first difference of  $\ln C_t$  at time  $t$ ,  $T$  is time trend and  $\ln C_{t-1}$  is the value of  $\ln C_t$  at time  $t-1$ .  $Q1$ ,  $Q2$  and  $Q3$  are quarterly time dummy variables. The null hypothesis tested for in all Dickey-Fuller tests is  $H_0 : \beta_5 = 0$  (i.e. the series contain a unit root) and the alternative hypothesis used is  $H_1 : \beta_5 < 0$ . The t-value of the estimated coefficient of  $\ln C_{t-1}$  ( $\beta_5$ ) follows the  $\tau$  (tau) distribution.

**Table 9.1.1** Dickey-Fuller tests (levels)

Variable	$\tau_{observed}$	$\tau_{critical}$	Decision
ln(C)	-2,850	-3,455	may not reject $H_0$
ln(CD)	-1,708	-3,455	may not reject $H_0$
ln(CNH)	-1,890	-3,455	may not reject $H_0$
ln(CNDS)	-2,166	-3,455	may not reject $H_0$
ln(YNP)	-1,892	-3,455	may not reject $H_0$
ln(FW)	-1,446	-3,455	may not reject $H_0$
ln(HWCO)	-0,345	-3,455	may not reject $H_0$
ln(R)	-1,387	-3,455	may not reject $H_0$
ln(R-2)	-2,547	-3,455	may not reject $H_0$

Note:  $N=100$  and  $\tau_{critical}$  correspond to a 5% sig. level.

In table 9.1.1 the  $\tau$  values presented in column two represents the estimated t values obtained from the SPSS output, and the  $\tau$  values in the third column are the critical values from the  $\tau$  distribution corresponding to the number of observations ( $N=100$ ) for each variable. The null hypothesis is rejected if the observed  $\tau$ -value is more negative than the critical  $\tau$  value, i.e.  $\tau_{observed} < \tau_{critical}$ . A significance level of five percent was used in all tests. As can be inferred from table 9.1.1 we cannot reject the null hypothesis of non-stationarity

for any of the variables. As a consequence, we compute the first difference of the variables and then once again perform Dickey-Fuller tests. The results from these tests can be seen in table 9.1.2 below.

**Table 9.1.2** Dickey-Fuller tests (differences)

Variable	$\tau_{observed}$	$\tau_{critical}$	Decision
$\Delta \ln(C)$	-12,845	-3,455	reject
$\Delta \ln(CD)$	-13,746	-3,455	reject
$\Delta \ln(CNH)$	-14,171	-3,455	reject
$\Delta \ln(CNDS)$	-12,717	-3,455	reject
$\Delta \ln(YNP)$	-4,814	-3,455	reject
$\Delta \ln(FW)$	-8,962	-3,455	reject
$\Delta \ln(HWCO)$	-5,319	-3,455	reject
$\Delta \ln(R)$	-21,268	-3,455	reject
$\Delta \ln(R_2)$	-21,048	-3,455	reject

Note:  $N=100$  and  $\tau_{critical}$  corresponds to a 5% sig. level.

This time we are able to reject the null hypothesis of non-stationarity on a five percent level for all variables. We have thus established that all our variables are stationary in first difference form (integrated of order one); a necessary assumption in our modeling strategy.

## 9.2 Cointegration

Given that our variables are integrated of order one, it is essential to make sure that there is a long run, cointegration relationship among them to avoid spurious regression results.<sup>51</sup> Hence, in order to make sure that such a long run, or equilibrium, relationship exists among our variables, we perform Engle-Granger tests on our base-case model, as well as on models using different consumption specifications. In the Engle-Granger test, the residuals from the model under consideration are tested for stationarity using a standard Dickey-Fuller test.

The test procedure is visualised in equations (9.2.1) and (9.2.2) below:

<sup>51</sup> Gujarati, 2003 p. 822.

$$\ln C_t = \alpha + \beta_1 Q1 + \beta_2 Q2 + \beta_3 Q3 + \beta_4 \ln NPY_t + \beta_5 \ln FW_t + \beta_6 \ln HWCO_t + \varepsilon_t \quad (9.2.1)$$

$$\Delta \hat{\varepsilon}_t = \alpha + \gamma \hat{\varepsilon}_{t-1} + u_t \quad (9.2.2)$$

Equation (9.2.1) represents a long run regression model in where all variables are integrated of order one, and equation (9.2.2) illustrates a standard Dickey-Fuller test of the estimated residuals from equation (9.2.1), i.e. an Engle-Granger test. The null hypothesis and decision rule are the same as those used in section 9.1 above. As can be inferred from table 9.2.1, we are able to reject the null hypothesis of nonstationarity of the residuals for all models except (1.1), (7.1) and (9.1).

**Table 9.2.1** Results from the Engle-Granger tests

Model	$\tau_{observed}$	$\tau_{critical}$	Decision
1.1	-2,829	-3,455	may not reject $H_0$
2.1	-4,150	-3,455	reject $H_0$
3.1	-4,937	-3,455	reject $H_0$
4.1	-5,051	-3,455	reject $H_0$
5.1	-4,997	-3,455	reject $H_0$
6.1	-4,986	-3,455	reject $H_0$
7.1	-2,925	-3,455	may not reject $H_0$
8.1	-6,496	-3,455	reject $H_0$
9.1	-2,508	-3,455	may not reject $H_0$

Note: N=100 and  $\tau_{critical}$  corresponds to a 5% sig. level.