The forecasting ability of consumer confidence on consumption expenditures for Sweden

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Abstract

The purpose of the thesis is to investigate the forecasting ability of consumer confidence on real household consumption expenditures for Sweden, using data between 1996Q1 and 2021Q3. The Micro index and the Macro index are used for analysis, in addition to the consumer confidence indicator to separately capture different aspects of Swedish consumer confidence. The main empirical evaluation criteria is to compare the root mean square forecast errors (RMSE) of VAR-models augmented by the consumer confidence indices against reference VAR-models with different compositions of fundamental variables. Furthermore, the RMSEs of the models are compared against the RMSEs of the random walk. The estimated models outperform the random walk in most cases for the 8 and 12 step-ahead forecasts. When comparing the RMSE for the models augmented by the confidence indices against the baseline specifications, significant improvements in forecast accuracy are rare. However, in specific cases the confidence indices do improve the forecast accuracy of the growth in consumption expenditures implying that confidence indices should be considered by policy makers, economic agents and professional forecasters when trying to predict consumption expenditures.

Keywords: consumer confidence, consumption expenditures, pseudo out-of-sample forecasts.

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Contents

1 Introduction

The empirical evidence of the forecasting ability and performance of consumer confidence on consumption expenditures for the Swedish economy is scarce. One potential explanation could be that accurately forecasting consumption expenditures has proven to be a difficult task. However, economic agents and policy makers do pay attention to and use leading economic indicators, such as consumer confidence, for decision making. Since consumption expenditures constitute a major part of aggregate demand it is of relevance to evaluate the usefulness and performance of consumer confidence in predicting consumption expenditures.

The purpose of the thesis is to investigate the forecasting ability of consumer confidence on real household consumption expenditures for Sweden, using data between 1996Q1 and 2021Q3. The Micro index and the Macro index will be used for analysis, in addition to the consumer confidence indicator to separately capture different aspects of Swedish consumer confidence. To evaluate and compare the forecasting ability of the consumer confidence indices on consumption expenditures beyond the information provided by other fundamental variables, recursive and rolling pseudo out-of-sample forecasting analysis will be performed. The main empirical evaluation criteria is to compare the root mean square forecast error (RMSE) of VAR-models augmented by the consumer confidence indices against reference VAR-models with different compositions of fundamental variables. Furthermore, the RMSEs of the models are compared against the RMSEs of the random walk.

The role of consumer confidence in explaining consumption expenditures in Sweden has been investigated in previous studies, see e.g., Assarsson & Österholm (2015) and Berg & Bergström (1996). Assarsson & Österholm (2015) evaluated and compared the nowcasting ability of the confidence indices. Berg & Bergström (1996) compared the explanatory power of two forward-looking indices, corresponding to the Macro and Micro indices, for 1975-1994. There seems to be a gap in the empirical research literature

when it comes to studying the forecasting ability of consumer confidence on consumption expenditures using data for Sweden. The value added of the thesis is to empirically evaluate and compare the performance in terms of the forecasting ability of the consumer confidence indicator, the Macro index and the Micro index on consumption expenditures for Sweden, using data up to 2021Q3. Furthermore, several reference models and models augmented by the confidence indices are estimated and used for analysis to be able to evaluate and compare the forecasting performance of the confidence indices beyond the information provided by different sets of fundamentals, chosen according to theory and empirical findings in the literature.

The rest of the thesis is structured as follows. Section 2 presents the theoretical background, findings and conclusions in the empirical research literature and information regarding the methodology of the Consumer Tendency Survey. Section 3 describes the data. Section 4 consists of Granger causality and correlation tests, stationarity and cointegration tests, model selection and pseudo out-of-sample forecasting analysis. Section 5 presents the conclusions.

2 Related literature

In the section of related literature the Permanent Income Hypothesis, an established theoretical concept explaining consumption decisions is presented. Also, previous studies examining the explanatory power of consumer confidence on consumption expenditures and empirical findings regarding the relationship between the variables are discussed. Subsequently, key aspects of the survey methodology of the Consumer Tendency Survey conducted by the National Institute of Economic Research (NIER) are presented.

2.1 Theoretical perspective

On the basis of empirical findings such as that consumption was smoother and less volatile compared to income, Friedman developed the Permanent Income Hypothesis. The Permanent Income Hypothesis was the first conceptualization of consumption smoothing and states that consumption decisions of individuals should be consistent with the permanent income, i.e. the expected long term income (Meghir 2004). For example, if applying the life cycle-Permanent Income Hypothesis, today's consumption should equal a fraction of lifetime income, while meeting the condition that total lifetime consumption is consistent with the permanent income. From the life cycle-Permanent Income Hypothesis framework, Hall (1978) derived that the marginal utility of consumption follows a random walk. That result suggests that only one-period lagged values of marginal utility of consumption should have explanatory power on the marginal utility of consumption today. Assuming that the marginal utility of consumption is a linear function of consumption, the theoretical conclusions are applicable to consumption too, meaning that income and other fundamental variables are of no use for predicting future consumption. However, uncertainty regarding future earnings could affect the average propensity to consume (Meghir 2004). Therefore, if viewing consumer confidence as a proxy for uncertainty it could be argued from a theoretical standpoint that confidence should be included as an explanatory variable when trying to predict consumption expenditures (Dees & Soares Brinca 2013).

2.2 Previous studies

The empirical research literature targeting the forecasting ability and explanatory power of consumer confidence on consumption expenditures is extensive in terms of evidence from various countries and time periods. As described by Bram & Ludvigson (1998) one of the major objectives within

this field of empirical macroeconomic research is to investigate whether consumer confidence contains any information, i.e. improves forecast accuracy, regarding future consumption expenditures beyond the information provided by fundamental variables. This research question has also been addressed by e.g. Dees & Soares Brinca (2013), Carroll et al. (1994), Desroches & Gosselin (2004), Throop (1992) and Assarsson & Österholm (2015).

The empirical results in the existing literature regarding the predictive power of consumer confidence on consumption expenditures are partly inconsistent. However, a variety of researchers have come to the conclusion that modelling consumer confidence improves forecast accuracy of consumption expenditures. Dees & Soares Brinca (2013) performed out-of-sample forecasts using confidence indicators for the United States and the euro area. They estimated a threshold model with censored values of consumer confidence, which is in line with the methodology used by Desroches & Gosselin (2004), to capture that consumer confidence has been shown to have greater predictive power during periods characterized by high volatility of indicator values (Throop 1992, Carroll et al. 1994). Dees & Soares Brinca (2013) find that the threshold models deliver increased forecast precision of consumption expenditures that is statistically significant compared with standard OLS-models excluding consumer confidence for both the U.S. and euro area. Furthermore, the RMSEs for the threshold models is smaller in comparison to the RMSEs for OLS-models with uncensored confidence with respect to OLS-models excluding confidence. Desroches & Gosselin (2004) find similar results for the U.S. employing the same threshold methodology, providing additional support to the claim that consumer confidence proves particularly useful for forecasting purposes during periods with high swings in consumer confidence.

Previous studies investigating the role of Swedish consumer confidence in explaining consumption expenditures include Assarsson & Österholm (2015) and Berg & Bergström (1996). In the context of an out-of-sample nowcast-

ing excercise, Assarsson & Österholm (2015) find that the smallest RMSE is related to the specification relying on the consumer confidence indicator provided by the NIER, outperforming a model containing the consumer confidence indicator developed by the European Commission, an AR(1) and AR(2) benchmark model. However an MA(3) reference model gives the best nowcast accuracy. Furthermore, out-of-sample nowcasting is also conducted employing models comprising the Micro index and Macro index respectively, where the former performs better than the latter. This result seems reasonable with the structure of the questions of the indicator measures in mind, i.e., that the Micro index captures household's assessment of the present and expected private financial situation and the present and expected willingness to make major purchases. Berg & Bergström (1996) also find that the index capturing the assessment of the personal financial situation is to a greater extent linked to the growth rate of consumption.

2.3 The consumer confidence indicator

The Consumer Tendency Survey conducted by the National Institute of Economic Research (NIER), comprises the consumer confidence indicator, the Micro index and Macro index.

The Consumer Tendency Survey conducted by NIER was first introduced on a quarterly basis in 1973, but has been performed on a monthly basis since 1993. The indicators contained in the Consumer Tendency Survey are computed based on answers from 1500 randomly assigned households and respondents between 18-84 years of age. The data is collected between the first and and the fifteenth each month through both an online questionnaire and telephone interviews. The survey questions[1], which are listed in the

[1]The answer option used in the appendix for survey questions $5a - b$, $6a - b$ and $18a - c$, which is "___ %", does not correspond to the answer options for those specific questions listed in the English version of the "User guide to the Economic Tendency Survey" (NIER 2022), since they are presented with a typo. The design of the answer option for those questions as listed in the appendix, instead follows the formulation found

appendix, are qualitative multiple choice questions. The confidence indicator values are computed as "the difference between the percentages of respondents responding positively and negatively to a question"(NIER 2022). Furthermore, the Consumer Tendency Survey time series are deseasonalised using X-12-Arima and from 1996 onwards the series are standardised with a mean value of 100 and a standard deviation of 10. The interpretation of an indicator value above (below) 100 is that the majority of respondents replied positively (negatively) (NIER 2022).

The consumer confidence indicator captures household's assessment of their present and expected (within the next 12 months) personal financial situation, the present and expected (within the next 12 months) situation of the Swedish economy and whether it is a good time to buy consumer durables at the moment. The Micro index and the Macro index capture different aspects of Swedish consumer confidence. The Micro index captures household's assessment of the present and expected private financial situation and the present and expected willingness to make major purchases. The Macro index captures household's view of the present and expected situation of the Swedish economy and their expectations regarding unemployment (NIER 2022).

The Economic Tendency Survey is included in the DG ECFIN's Joint Harmonised EU Programme of Business and Consumer Surveys. The programme principles are designed to achieve harmonised survey methodology across EU member states regarding in particular data collection timing and questionnaires. The harmonisation is important since it enables for better cross-country comparisons of indicator values for EU member states participating in the programme (NIER 2022, European Commission 2016).

in the corresponding Swedish user guide.

3 Data

The dataset used spans from the first quarter of 1996 to the third quarter of 2021, which yields 103 observations[2]. All variables are retrieved as quarterly data beside the consumer confidence indicator, the consumer Micro index, the consumer Macro index and the stock market index. The confidence indices and the stock market index are computed and provided on a monthly basis and have been converted into quarterly data by taking averages of the monthly data.

The consumer confidence indicator, (CCI), the consumer Micro index, ($Micro$), and the consumer Macro index, ($Macro$), are collected from the Consumer Tendency Survey conducted by the National Institute of Economic Research (NIER). The real private final consumption expenditures, (CON), is retrieved from FRED. In terms of data collection of the fundamental variables; the net real disposable income of households, (INC), measured in millions of SEK and the net financial wealth of households, (W^{fin}), are collected from Statistics Sweden, the unemployment rate, (u), is retrieved from FRED, the short-term interest rate, which is the money market rate, (MMR), and inflation, (π) are collected from the OECD database, the stock market index, ($Stock$), proxied by OMXS30, is retrieved from "ekonomifakta".

There is some consensus in the literature concerning the inclusion of fundamental variables. Labor income, in some cases proxied by disposable income, short-term interest rates and real stock prices are variables consistently used in the context of forecasting consumption expenditures (Dees & Soares Brinca 2013, Bram & Ludvigson 1998, Desroches & Gosselin 2004). The reason for including labor income is based on the empirical finding that there appears to be a relationship between lagged income growth and consumption expenditures growth (Bram & Ludvigson 1998). Other frequently used explanatory variables in this setting are inflation, the unemployment rate

[2]The time span is chosen to maximize the number of observations, starting in 1996 since that is from when confidence indices are available.

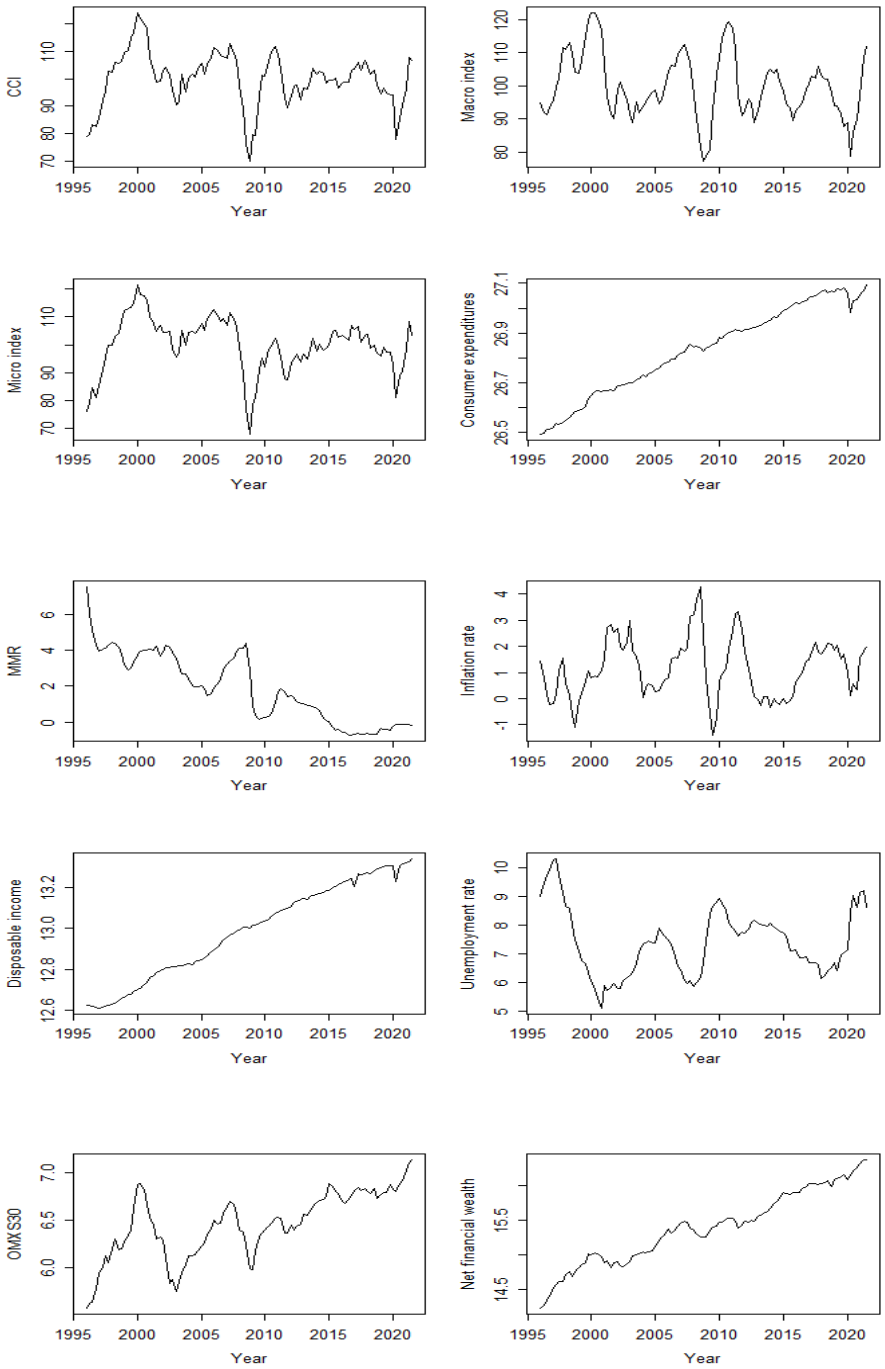
and wealth measures. Berg & Bergström (1996) used net financial wealth and housing wealth as proxies for household wealth and housing wealth is excluded from the set of fundamentals based on their finding that financial net wealth is more relevant than housing wealth in determining consumption expenditures. The confidence indicators and the real private final consumption expenditures variable are seasonally adjusted upon collection. It is not explicitly stated whether the fundamental variables are seasonally adjusted. Upon collection, the real disposable income data seems to exhibit heavy seasonal patterns, with peaks every second quarter each year[3]. Also, there is some evidence for seasonal patterns for the short-term interest rate. In an attempt to remove the seasonal component the disposable income data and the short-term interest rate are deseasonalised using the X-13-ARIMA-SEATS algorithm. The stock market index and the net financial wealth of households are transformed into real terms using the Swedish CPI. The private final consumption expenditures, real disposable income, the stock market index and the net financial wealth of households are transformed into logarithms. The time series in levels with the transformations mentioned above are plotted in Figure 1.

Consumption expenditures follows a positive trend during the sample period and exhibits two major declines during the financial crisis and the last three quarters of 2020 due to the Covid-19 pandemic. Similarly, the disposable income and net financial wealth follow a positive trend. In particular, consumption expenditures appears to co-move with the disposable income. The confidence indices are similar, which is reasonable considering the Micro index and Macro index are based on subsets of the questions underlying the consumer confidence indicator. However, from a closer inspection, the Macro index deviates a bit from the pattern of the other two indices. The confidence indices are peaking in the first quarter of 2000, with a value of 124 for the consumer confidence indicator, and severely decrease during the

[3]See figure 2 in the appendix

financial crisis and the outbreak of the Covid-19 crisis. The stock market index (positive trend), the inflation rate, the unemployment rate and the short-term interest rate (negative trend) have been quite volatile during the period under study.

Figure 1: Time series in levels



4 Empirical analysis

4.1 Augmented Dickey Fuller and KPSS-tests

First, in line with standard time series analysis procedure, the time series are tested separately for a unit root. This is done by using the Augmented Dickey-Fuller (ADF) test and the KPSS-test. In the presence of a unit root, a time series is non-stationary. The objective of testing the time series for a unit root is to achieve stationary processes. The test procedure using the ADF-test is structured as follows, estimating three equations; one with drift and trend, one with drift and one without drift and trend. The equations are estimated and evaluated in consecutive order as presented above. The null hypothesis of the estimated test equations for the ADF-test is that the process comprises a unit root. If the test statistic is less than the critical value for τ_3, which is -3.43, the null of a unit root is rejected, i.e,. the process is trend-stationary, and if $\Phi_3 > 6.49$ the model comprises a drift and trend. If the test statistic is not less than the critical value for τ_3, the next model to test is the one with drift. If the test statistic is less than the critical value for τ_2, which is -2.88, the null of a unit root is rejected and if $\Phi_1 > 4.63$ the equation comprises a drift term. If the test statistic is not less than the critical value for τ_2, the model without drift and trend is evaluated. If the test statistic is less than the critical value for τ_1 of -1.95, the null of a unit root is rejected. If the null of a unit root is not rejected in any of the three cases, the time series is non-stationary in levels and the ADF-test procedure is repeated on the first difference. For the KPSS-test, if the test statistic exceeds the critical value of 0.146 with trend or 0.463 with drift, the null hypothesis of stationarity is rejected.

The full ADF and KPSS-tests results on the data in levels are presented in Tables 13-22 in the Appendix. The results from the tests when performed on differenced data are not included, but can be provided if requested. All variables concluded to be non-stationary in levels are integrated of order one

according to ADF and KPSS-tests results, i.e., no variables are integrated of order 2 or higher. In Table 1, the summary of the order of integration for the variables according to the test results and the conclusion about the order of integration to use for analysis are presented. The consumer confidence indicator, Macro index, short-term interest rate and unemployment are trend-stationary in levels according to the ADF-test results. The KPSS-test results for these variables support that conclusion, since the null of stationarity is not rejected. For inflation, τ_2 is rejected and the KPSS-test result supports stationarity in levels with drift. Consumption expenditures and disposable income are difference stationary, i.e,. integrated of order one, according to ADF and KPSS-test results. For the Micro index, the stock market index and the net financial wealth, the null of a unit root is not rejected using the ADF-test. However, the KPSS-test results are contradicting, indicating stationarity in levels with trend. In particular, the KPSS-test is useful when the estimated AR(1)-parameter in the ADF-test is close to unity. For these variables, the AR(1)-parameter is not very close to unity and therefore the series are considered difference stationary, relying on the ADF-test results.

Table 1: ADF-test and KPSS-test results

Variable	ADF-test	KPSS-test	Order of integration
ln CON	I(1)	I(1)	I(1)
ln INC	I(1)	I(1)	I(1)
ln W^{fin}	I(1)	I(0)	I(1)
CCI	I(0)	I(0)	I(0)
Macro	I(0)	I(0)	I(0)
Micro	I(1)	I(0)	I(1)
MMR	I(0)	I(0)	I(0)
ln Stock	I(1)	I(0)	I(1)
π	I(0)	I(0)	I(0)
u	I(0)	I(0)	I(0)

Notes: In the table, the results for the ADF and KPSS-tests are displayed for all variables. In the fourth column, the order of integration used for analysis is presented.

4.2 Correlation and Granger causality

In order to evaluate and get an understanding of the relationship between the variables, correlation and Granger causality tests are conducted. The variables are implemented in accordance with the ADF and KPSS-tests results presented in the previous section, to ensure stationarity. The results are presented in Table 2 and Table 3 respectively, where the "Δ" notation indicates that the first difference of a series has been taken. In particular, for the purpose of this thesis, the most important results are the ones related to the change in consumption expenditures. In terms of correlation results, all variables apart from inflation are positively correlated with the change in consumption expenditures (column 1), although with varying magnitude. The strongest correlation of 0.58 is found for the change in real disposable income, which does not come as a surprise due to the similar patterns of the series in levels, seen in Figure 1. Furthermore, the correlation coefficients for the confidence indices are higher than for the rest of the fundamentals.

Table 2: Correlation matrix

	Δ ln CON	CCI	Macro	Δ Micro	Δ ln INC	Δ ln Stock	Δ ln W^{fin}	π	MMR	u
Δ ln CON	1.00	0.31	0.32	0.43	0.58	0.29	0.16	-0.11	0.03	0.10
CCI	0.31	1.00	0.87	0.16	0.25	0.11	-0.11	-0.02	0.06	-0.37
Macro	0.32	0.87	1.00	0.12	0.20	0.14	-0.06	-0.00	0.19	-0.10
Δ Micro	0.43	0.16	0.12	1.00	0.29	0.50	0.37	-0.45	-0.10	0.38
Δ ln INC	0.58	0.25	0.20	0.29	1.00	0.02	-0.09	0.06	0.02	-0.08
Δ ln Stock	0.29	0.11	0.14	0.50	0.02	1.00	0.72	-0.44	-0.14	0.42
Δ ln W^{fin}	0.16	-0.11	-0.06	0.37	-0.09	0.72	1.00	-0.43	-0.08	0.40
π	-0.11	-0.02	-0.00	-0.45	0.06	-0.44	-0.43	1.00	0.18	-0.52
MMR	0.03	0.06	0.19	-0.10	0.02	-0.14	-0.08	0.18	1.00	-0.12
u	0.10	-0.37	-0.10	0.38	-0.08	0.42	0.40	-0.52	-0.12	1.00

Notes: In the table, Pearson correlation coefficients for the combination of all variables in the data set are reported. The Pearson correlation coefficient always takes a value in the range -1 to 1, where a negative value indicates a negative reationship (a value of -1 means perfectly negatively correlated), 0 implies no correlation, a positive value indicates a positive relationship (a value of 1 means perfectly positively correlated).

The Granger causality test shows that consumption expenditures is Granger caused by the Micro index, the stock market index, the net financial wealth, inflation and unemployment. This implies that the Micro index could prove more relevant in forecasting consumption expenditures than the consumer

confidence indicator and the Macro index. However, as discussed by Dees & Soares Brinca (2013), it is of importance to keep in mind that the structure of the pairwise Granger causality test is unconditional on control variables.

Table 3: Pairwise Granger causality

	Δ ln CON
Δ ln CON	-
CCI	0.36
Macro	0.10
Δ Micro	0.01
Δ ln INC	0.26
Δ ln Stock	0.01
Δ ln W^{fin}	0.00
π	0.01
MMR	0.69
u	0.04

Notes: In the table, p-values are presented. The null hypothesis of the test is that there is no Granger causality, i.e., a rejection of the null (p-value < 0.05) implies Granger causality.

4.3 Model specifications

The purpose of the thesis is to analyse and compare the forecasting ability of the consumer confidence indices on consumption expenditures beyond the information provided by fundamentals, i.e,. the focus is on predictability rather than inference. To be able to identify the predictive power of the confidence indices beyond the information provided by fundamentals model specifications both including and excluding the confidence indices will be used for analysis for comparative purposes. In Table 4, baseline model 1, 2

and 3 do not include any of the consumer confidence indices. Models 4 to 12 are extensions of the three baseline specifications augmented by each of the consumer confidence indices respectively.

The dependent variable is the log change in consumption expenditures. In line with previous research, (see e.g., Bram & Ludvigson (1998)) lags of the dependent variable are included in all specifications. In terms of the fundamental variable composition of the models, lags of the real disposable income and the real financial wealth are included in all specifications. The inclusion is theoretically motivated based on the Permanent Income Hypothesis, described in section 2.1, which states that consumer spending should be consistent with the expected long term income. The real disposable income and the real financial wealth are both components of the expected long term income, thus they are included in all specifications. The real disposable income and the real financial wealth are the only fundamentals included in the first baseline specification. In baseline model 2, the set of fundamentals is expanded by the inclusion of financial indicators, namely the short-term interest rate and the stock market index. Adding financial indicators make baseline model 2 correspond to the baseline model analysed by Bram & Ludvigson (1998), apart from that I also include real financial wealth in order to capture potential wealth effects. In baseline model 3, inflation and unemployment are added to baseline model 1. The choice of combination of sets of fundamentals, which in turn determine the model specifications used for analysis, to some extent follow the methodology in the literature. The variables regarded relevant for predicting consumption expenditures and are anchored in economic theory are included in a consistent manner across all specifications, as discussed above. Dees & Soares Brinca (2013) argue that stock prices, short-term interest rates, the unemployment rate and real oil prices are variables included due to their relevance for predicting consumption expenditures based on empirical evidence rather than having established positions as fundamentals according to economic theory.

4.4 Cointegration

Based on the ADF and KPSS-tests results there is a mixture of I(0) and I(1) variables in the data set. Variables integrated of different order can't share stochastic trend, which implies that there is no cointegration. However, the possibility of cointegration is checked for all of the models, since they include two or more variables integrated of order one, which is a structure that allows for potential cointegration. In accordance with the Pantula principle, Johansen's trace test and the Johansen-Juselius' maximum eigenvalue test are used to identify the cointegration rank r, i.e., the number of cointegrated vectors. The test procedure is similar to the ADF-test for which the simplest model with no deterministic variables is tested first. The null hypothesis is that there is no evidence of cointegration. The test procedure is structured as follows, estimating three models; the first model has no deterministic variables, the second model has an intercept and the third model comprises a deterministic trend. The models are checked in consecutive order as presented above for each r, until the null of no cointegration is not rejected for which the test procedure is completed. The lag order is selected according to Akaike's information criteria (AIC). The model specifications tested for cointegration and the Johansen's trace test and the Johansen-Juselius' maximum eigenvalue test results in terms of the suggested cointegration rank r and lag order p, are presented in table 3.[4]

The Johansen's trace test and the Johansen-Juselius' maximum eigenvalue test results indicate existence of cointegrating vectors for the majority of the specifications. For some model specifications the test results are conflicting. On the basis of simulations for small samples, Lütkepohl et al. (2001) concluded that the trace tests had greater power performance com-

[4] A baseline model specification including all fundamentals and three models augmented by the consumer indices were also tested for cointegration. However, for those models the greatest possible number of cointegrating vectors were suggested by the trace and eigenvalue tests, which can not be economically motivated due to the structure of the data. Therefore, those models are discarded.

pared to the eigenvalue tests. Therefore, in the case of conflicting results, the cointegration rank is determined according to the trace test results. This implies that cointegration is rejected for baseline model 1 and baseline model 2. Baseline model 1 comprises variables that are all I(1) according to the ADF-test results. For baseline model 3 the trace test suggests one cointegrating vector. However, since the model is an extension of baseline model 1 augmented by inflation and unemployment, which are both I(0) according to ADF-test and KPSS-test results, the cointegration rank should be the same as for baseline model 1. Following the same reasoning, since the consumer confidence indicator and the Macro index are stationary in levels, model 4, model 5, model 7, model 8, model 10 and model 11 should have no cointegrating vectors since they are extensions of baseline model 1 and baseline model 3. Model 6 comprises I(1) variables exclusively and according to both the trace and eigenvalue tests, $r = 0$. Stock & Watson (2015) state that if erroneously modelling cointegrating relationships using a VECM when variables are not actually cointegrated, a trend will be introduced into the forecast which could potentially reduce the performance of the out-of-sample forecasts. As a complement, the Engle Granger test for cointegration has been performed on all models and the results are that there is no cointegration in any of the models. Since there is no evidence of cointegration in the models comprising only I(1) variables following the Pantula principle and the Engle Granger test results indicate no cointegration, the analysis is performed assuming no cointegration and VAR-models are estimated.

Table 4: Johansen's trace test and the Johansen-Juselius' maximum eigenvalue test results

Model		Variables	Trace test	Eigenvalue test	Lags
Baseline model 1	Model 1	ln CON, ln INC, ln W^{fin}	0	0	2
Baseline model 2	Model 2	ln CON, ln INC, ln W^{fin}, MMR, ln Stock	0	1	2
Baseline model 3	Model 3	ln CON, ln INC, ln W^{fin}, π, u	1	1	4
Model 4	Model 1 + CCI	ln CON, ln INC, ln W^{fin}, CCI	1	1	2
Model 5	Model 1 + Macro	ln CON, ln INC, ln W^{fin}, Macro	1	1	2
Model 6	Model 1 + Micro	ln CON, ln INC, ln W^{fin}, Micro	0	0	2
Model 7	Model 2 + CCI	ln CON, ln INC, ln W^{fin}, MMR, ln Stock, CCI	1	2	2
Model 8	Model 2 + Macro	ln CON, ln INC, ln W^{fin}, MMR, ln Stock, Macro	1	1	2
Model 9	Model 2 + Micro	ln CON, ln INC, ln W^{fin}, MMR, ln Stock, Micro	1	1	2
Model 10	Model 3 + CCI	ln CON, ln INC, ln W^{fin}, π, u, CCI	1	1	2
Model 11	Model 3 + Macro	ln CON, ln INC, ln W^{fin}, π, u, Macro	1	1	2
Model 12	Model 3 + Micro	ln CON, ln INC, ln W^{fin}, π, u, Micro	1	0	4

Notes: In the table, the cointegration rank suggested by the Johansen's trace test and the Johansen-Juselius' maximum eigenvalue test for the 12 models used for analysis are listed. Also, the number of lags selected by Akaike's information criteria are presented.

4.5 Rolling and recursive pseudo out-of-sample forecasts

The objective of the forecasting analysis is to assess and rank the models with regard to their forecasting ability of the growth in consumption expenditures, estimating both recursive and rolling forecasts. To evaluate the predictive power of the models the root mean square prediction error (RMSE) is estimated for each model and compared against the random walk. The same procedure is performed to compare the baseline specifications with their counterpart models augmented by the confidence indices. The Diebold-Mariano test is conducted to assess whether there is a statistically significant difference in forecasting accuracy between the models. Also, the forecast bias is computed in order to evaluate the forecasting precision of the models.

The training set ranges from 1996:Q2 to 2005:Q4. The forecasts are conducted on 1, 4, 8 and 12 quarter horizons, which gives 63, 60, 56 and 52 observations for forecast evaluation respectively. The forecast horizons used are chosen in order to evaluate and compare the predictive power on a short (1 step-ahead), medium (4 and 8 step-ahead) and long term (12 step-ahead)

basis.

In Table 5 and Table 6 the forecast bias for the recursive and rolling forecasts is presented. The null hypothesis is that there is no bias. The forecast bias is calculated as the difference between the actual values of the changes in consumption expenditures and the predicted values. The presented values are p-values calculated using the Newey-West estimator and the null hypothesis is not rejected in any case indicating no forecasting bias.

Table 5: Bias test - Recursive forecasts

Model	h=1	h=4	h=8	h=12
Model 1	0.79	0.86	0.93	0.75
Model 2	0.85	0.88	0.90	0.53
Model 3	0.85	0.77	0.57	0.70
Model 4	0.77	0.73	0.87	0.52
Model 5	0.92	0.82	0.99	0.67
Model 6	0.94	0.90	0.90	0.79
Model 7	0.86	0.86	0.98	0.79
Model 8	0.89	0.70	0.60	0.48
Model 9	0.90	0.89	0.90	0.53
Model 10	0.99	0.80	0.74	0.94
Model 11	0.73	0.71	0.75	0.84
Model 12	0.88	0.77	0.56	0.69
Random walk	0.85	0.81	0.63	0.70

Notes: Bias test for recursive forecasts for all models. The reported values are p-values. The null hypothesis is no bias.

Table 6: Bias test - Rolling forecasts

Model	h=1	h=4	h=8	h=12
Model 1	0.55	0.61	0.64	0.80
Model 2	0.50	0.65	0.72	0.94
Model 3	0.39	0.51	0.33	0.43
Model 4	0.50	0.61	0.66	0.82
Model 5	0.64	0.62	0.61	0.76
Model 6	0.58	0.60	0.61	0.77
Model 7	0.51	0.68	0.70	0.83
Model 8	0.59	0.61	0.88	0.99
Model 9	0.53	0.65	0.72	0.93
Model 10	0.47	0.49	0.29	0.45
Model 11	0.54	0.50	0.39	0.53
Model 12	0.41	0.51	0.32	0.41
Random walk	0.85	0.81	0.63	0.70

Notes: Bias test for rolling forecasts for all models. The reported values are p-values. The null hypothesis is no bias.

As derived by Hall (1978), consumption follows a random walk under the life cycle-Permanent Income Hypothesis. Therefore, the forecasting accuracy of the models is partly evaluated by comparing the RMSE of the models against the RMSE of the random walk. In Table 7 and Table 8, the RMSE for each model and for the random walk at every horizon are presented. For the recursive forecasts the RMSE is lower than the RMSE of the random walk at every horizon. However, the random walk provides better prediction accuracy compared to some of the models when rolling forecasts are computed. To

allow for easier interpretation and comparisons, the relative RMSE of the models against the random walk are presented in Table 9 and Table 11. For the recursive forecasts all of the models perform better than the random walk at all horizons since the value of the relative RMSEs are less than unity. By using the Diebold-Mariano test, it is possible to conclude that the difference in forecasting accuracy is statistically significant for all models for the 8 and 12 step-ahead forecasts. In terms of the relative RMSEs for the rolling forecasts, the results are more diverse. All models beat the random walk for the 8 step-ahead forecasts and the null of equal precision is rejected in all cases. Model 7 is the only model that significantly outperforms the random walk for the 4 step-ahead forecasts. Model 1, 4, 5, 6, 7 and 8 perform significantly better than the random walk for the 12 step-ahead forecasts.

Table 7: Root mean square error - Recursive forecasts

Model	h=1	h=4	h=8	h=12
Model 1	0.0157	0.0149	0.0151	0.0152
Model 2	0.0160	0.0148	0.0153	0.0154
Model 3	0.0158	0.0145	0.0151	0.0153
Model 4	0.0155	0.0151	0.0152	0.0152
Model 5	0.0153	0.0151	0.0152	0.0152
Model 6	0.0156	0.0149	0.0151	0.0152
Model 7	0.0158	0.0147	0.0150	0.0153
Model 8	0.0155	0.0148	0.0150	0.0153
Model 9	0.0160	0.0148	0.0153	0.0154
Model 10	0.0156	0.0144	0.0151	0.0153
Model 11	0.0154	0.0145	0.0150	0.0154
Model 12	0.0158	0.0145	0.0151	0.0153
Random walk	0.0210	0.0213	0.0182	0.0164

Table 8: Root mean square error - Rolling forecasts

Model	h=1	h=4	h=8	h=12
Model 1	0.0220	0.0236	0.0155	0.0150
Model 2	0.0206	0.0197	0.0159	0.0155
Model 3	0.0249	0.0401	0.0155	0.0159
Model 4	0.0222	0.0242	0.0156	0.0152
Model 5	0.0218	0.0236	0.0156	0.0151
Model 6	0.0220	0.0251	0.0155	0.0156
Model 7	0.0209	0.0195	0.0154	0.0154
Model 8	0.0204	0.0198	0.0155	0.0153
Model 9	0.0205	0.0200	0.0159	0.0157
Model 10	0.0251	0.0401	0.0155	0.0169
Model 11	0.0248	0.0387	0.0154	0.0165
Model 12	0.0248	0.0414	0.0155	0.0162
Random walk	0.0210	0.0213	0.0181	0.0164

In Table 10 and Table 12, the relative RMSE for the baseline specifications and their counterpart models augmented by the confidence indices are presented. The augmented models perform better than the baseline specifications for the 1 step ahead forecasts, but the null of equal precision is not rejected. Model 7 and model 8, including the consumer confidence indicator and the Macro index respectively, significantly outperform baseline model 2 for the 8 step-ahead forecasts. Model 5, including the Macro index, performs

significantly worse than model 1 for the 4 and 8 step-ahead forecasts. For the rolling forecasts, none of the augmented models improve the forecasting accuracy compared to the baseline models at the 5 percent significance level according to the Diebold-Mariano test results. However, model 7 and model 8 outperform model 2 for the 8 step-ahead forecasts at the 10 percent level.

In general, the models outperform the random walk in terms of prediction accuracy for the 8 and 12 step-ahead forecasts and this is especially true for the recursive forecasts. When comparing the baseline specifications with their counterpart models augmented by the confidence indices, significant improvements in forecast accuracy are rare. For the recursive forecasts the relative RMSE is less than unity for all models for the 1 step-ahead forecasts although the difference in forecast accuracy is not significant. The performance of model 7 and model 8 having significant improvements in forecast precision for the 8 step-ahead forecasts, implies that the consumer confidence indicator and the Macro index prove useful for predicting consumption expenditures beyond the information contained in the disposable income, financial wealth, the stock market index and the money market rate variables.

Table 9: Relative RMSE of models against random walk - Recursive forecasts

Model	h=1	h=4	h=8	h=12
Model 1	0.74	0.70	0.82**	0.92***
Model 2	0.76	0.69	0.84**	0.93**
Model 3	0.75	0.68	0.83**	0.93***
Model 4	0.73	0.70	0.83**	0.92***
Model 5	0.72	0.71	0.83**	0.92***
Model 6	0.74	0.70	0.82**	0.92***
Model 7	0.75	0.68	0.82**	0.93***
Model 8	0.73	0.69	0.82**	0.93***
Model 9	0.75	0.69	0.84**	0.93**
Model 10	0.74	0.67	0.82**	0.93***
Model 11	0.73	0.68	0.82**	0.93***
Model 12	0.75	0.68	0.83**	0.93***

Significance levels for the Diebold-Mariano test: ***p<0.01, **p<0.05, *p<0.10.

Table 10: Relative RMSE of augmented models against baseline specifications - Recursive forecasts

Model		h=1	h=4	h=8	h=12
Model 4	Model 1 + CCI	0.988	1.008	1.009	1.001
Model 5	Model 1 + Macro	0.973	1.012**	1.006**	0.998
Model 6	Model 1 + Micro	0.992	0.999	0.999	0.999
Model 7	Model 2 + CCI	0.989	0.991	0.979**	0.993
Model 8	Model 2 + Macro	0.970	1.000	0.981**	0.994
Model 9	Model 2 + Micro	0.996	1.000	0.999	0.999*
Model 10	Model 3 + CCI	0.984	0.996	0.995	1.002
Model 11	Model 3 + Macro	0.971	1.000	0.994	1.006
Model 12	Model 3 + Micro	0.998	1.001	1.000	0.999

Significance levels for the Diebold-Mariano test: ***p<0.01, **p<0.05, *p<0.10.

Table 11: Relative RMSE of models against random walk - Rolling forecasts

Model	h=1	h=4	h=8	h=12
Model 1	1.04	1.10	0.85**	0.91**
Model 2	0.97	0.92*	0.87**	0.94
Model 3	1.18	1.88	0.85**	0.96
Model 4	1.05	1.13	0.85**	0.92***
Model 5	1.03	1.10	0.85**	0.91***
Model 6	1.04	1.17	0.85**	0.94***
Model 7	0.99	0.91**	0.84**	0.93**
Model 8	0.96	0.92	0.85**	0.93**
Model 9	0.97	0.94	0.87**	0.95
Model 10	1.19	1.88	0.85**	1.03
Model 11	1.18	1.81	0.84**	1.00
Model 12	1.18	1.94	0.85**	0.98

Significance levels for the Diebold-Mariano test: ***p<0.01, **p<0.05, *p<0.10.

Table 12: Relative RMSE of augmented models against baseline specifications - Rolling forecasts

Model		h=1	h=4	h=8	h=12
Model 4	Model 1 + CCI	1.007	1.026	1.004	1.014
Model 5	Model 1 + Macro	0.992	0.998	1.004	1.008
Model 6	Model 1 + Micro	0.998	1.062	0.997	1.038
Model 7	Model 2 + CCI	1.016	0.987*	0.968*	0.997
Model 8	Model 2 + Macro	0.990	1.004	0.974*	0.989
Model 9	Model 2 + Micro	0.994	1.016	0.999	1.012
Model 10	Model 3 + CCI	1.010	1.000	0.997	1.066
Model 11	Model 3 + Macro	0.998	0.963	0.993	1.036
Model 12	Model 3 + Micro	0.998	1.031	1.000	1.017

Significance levels for the Diebold-Mariano test: ***p<0.01, **p<0.05, *p<0.10.

5 Conclusion

The purpose of the thesis has been to investigate the forecasting ability of consumer confidence on real household consumption expenditures for Sweden. The results from the out-of-sample forecasts show that all of the estimated VAR-models outperform the random walk for the 8 and 12 step-ahead forecasts using the recursive forecast approach. For the rolling forecasts all models outperform the random walk for the 8 step-ahead forecasts and half of the models beat the random walk for the 12 step-ahead forecasts. In terms of the performance of the consumer confidence indicator, the Macro index and the Micro index respectively, the following are the main results; i) when computing the relative RMSE for the models augmented by the confidence indices against the baseline specifications, significant improvements in forecast accuracy are rare, ii) model 7, model 8 and model 9 significantly outperform model 2 at the medium and long forecast horizons suggesting that the confidence indices improves forecast accuracy of the growth in consumption expenditures beyond the information provided by the disposable income, financial wealth, the stock market index and the money market rate, iii) model 5, which comprises the Macro index, performs significantly worse than the reference model (model 1) for the 4 and 8 step-ahead recursive forecasts.

The conclusion drawn from the result that the confidence indices in specific cases do improve the forecast accuracy of the growth in consumption expenditures is that confidence indices should be considered by policy makers, economic agents and professional forecasters when trying to predict consumption expenditures. Based on the results it is not possible to rank the confidence indices in terms of their individual performance. Furthermore, it is of importance to keep in mind that the results follow from the specific data used and the structure of the models. Using other estimation techniques or studying other time periods could lead to different results.

For future research, a valuable extension would be to compare and evalu-

ate the performance of the confidence indices by implementing other methodological frameworks previously used within this field of empirical macroeconomic research, such as the threshold methodology. Another extension could be to evaluate their performance in relation to other set of fundamentals than the ones used in this thesis. Finally, another way to provide valuable insights to the existing literature could be to conduct similar research for other countries for which there is a lack of empirical evidence.

6 References

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7 Appendix

7.1 Consumer Tendency Survey questionnaire

1. **How does the financial situation of your household now compare with what it was 12 months ago? Has it...?**
   Got a lot better
   Got a little better
   Stayed the same
   Got a little worse
   Got a lot worse
   Don't know
2. **How do you think the financial position of your household will change over the next 12 months? Will it...?**
   Get a lot better
   Get a little better
   Stay the same
   Get a little worse
   Get a lot worse
   Don't know

21. **The future financial situation of your household is currently**
    Easy to predict
    Moderately easy to predict
    Moderately difficult to predict
    Difficult to predict
    Don't know

3. **How do you think the general economic situation in this country has changed over the last 12 months? Has it...?**
   Got a lot better
   Got a little better
   Stayed the same
   Got a little worse

Got a lot worse
Don't know

4. **How do you think the general economic situation in this country will develop over the next 12 months? Will it. . . ?**
   Get a lot better
   Get a little better
   Stay the same
   Get a little worse
   Get a lot worse
   Don't know
5. **Compared with 12 months ago, do you find that prices in general are . . . ?**
   Very much higher
   Quit a bit higher
   A little higher
   About the same
   Lower
   Don't know

5a-b. **Compared with 12 months ago, how much higher in percent do you think that prices are now? (Average)**
   ___ %

6. **Compared to the situation today, do you think that at in the next 12 months prices in general will . . . ?**
   Increase faster
   Increase at the same rate
   Increase at a slower rate
   Stay about the same
   Fall slightly
   Don't know

6a-b. **Compared with today, how much in percent do you think that prices will go up (i.e. the rate of inflation 12 months from now)?**

___ %

7. **How do you think the level of unemployment in the country will change over the next 12 months? Will it. . . ?**
   Increase sharply
   Increase slightly
   Remain the same
   Fall slightly
   Fall sharply
   Don't know
8. **Do you think there is an advantage for people to make major purchases (furniture, washing machines, TV sets etc.) at the present time?**
   Yes, now is the right time
   It is neither the right time or the wrong time
   No, it is the wrong time, purchase should be postponed
   Don't know
9. **Over the next 12 months, how do you think the amount of money you will spend on major purchases will compare with what you spent over the last 12 months? Will it be. . . ?**
   Much more
   A little more
   About the same
   A little less
   Much less
   Don't know
10. **In the view of the general economic situation, do you think this is:. . . ?**
    A very good time to save
    Quite a good time to save
    Neither a good, nor an unfavourable time to save
    Rather an unfavourable time to save
    A very unfavourable time to save

Don't know

11. **Over the next 12 months, how likely are you to be able to save any money?**
    Very likely
    Fairly likely
    Fairly unlikely
    Very unlikely
    Don't know
12. **Which of these statements best describe the present financial situation of your household?**
    We are saving a lot
    We are saving a little
    We are just managing to make ends meet on our income
    We have to draw on our savings
    We are running into debt
    Don't know
13. **How likely are you to buy a car within the next 12 months?**
    Very likely
    Fairly likely
    Fairly unlikely
    Very unlikely
    Don't know
14. **Are you planning to purchase or build a home within the next 12 months (to live in yourself, for a member of your family, as a holiday home, to let etc.)?**
    Yes, definitely
    Possibly
    Probably not
    Definitely not
    Don't know

15. **Over the next 12 months, how likely are you to spend any large sums of money on home improvements such as central heating, sanitary ware etc.?**
    Very likely
    Fairly likely
    Fairly unlikely
    Very unlikely
    Don't know
16. **Compared with 12 months ago, is the risk that You will become unemployed. . . ?**
    A lot greater
    A little greater
    About the same
    A little less
    A lot less
    No opinion

18a-c. **The variable rate for mortgages is currently X per cent. How high do you expect it to be in one year/two years/five years?**
    ___ %

7.2 ADF and KPSS-tests

The AR(1) in Table 13 to 22 represents the autoregressive parameter in the ADF-test equation. The number of lags are determined by AIC.

Table 13: ADF-test on CCI

Type:	Trend	Drift	None	
AR(1):	0.6	0.72	1	
Lags:	9	9	8	
	statistic	1pct	5pct	10pct
τ_3	-3.77	-3.99	-3.43	-3.13
Φ_3	7.12	8.43	6.49	5.47
τ_2	-3.12	-3.46	-2.88	-2.57
Φ_1	4.88	6.52	4.63	3.81
τ_1	-0.24	-2.58	-1.95	-1.62

Table 14: ADF-test on $Macro$

Type:	Trend	Drift	None	
AR(1):	0.65	0.78	1	
Lags:	9	2	12	
	statistic	1pct	5pct	10pct
τ_3	-3.84	-3.99	-3.43	-3.13
Φ_3	7.42	8.43	6.49	5.47
τ_2	-5.02	-3.46	-2.88	-2.57
Φ_1	12.64	6.52	4.63	3.81
τ_1	-0.28	-2.58	-1.95	-1.62

Table 15: ADF-test on $Micro$

Type:	Trend	Drift	None	
AR(1):	0.78	0.84	1	
Lags:	8	8	8	
	statistic	1pct	5pct	10pct
τ_3	-2.69	-3.99	-3.43	-3.13
Φ_3	3.63	8.43	6.49	5.47
τ_2	-2.34	-3.46	-2.88	-2.57
Φ_1	2.77	6.52	4.63	3.81
τ_1	-0.35	-2.58	-1.95	-1.62

Table 16: ADF-test on CON

Type:	Trend	Drift	None	
AR(1):	0.83	0.99	1	
Lags:	1	1	1	
	statistic	1pct	5pct	10pct
τ_3	-2.73	-3.99	-3.43	-3.13
Φ_3	4.25	8.43	6.49	5.47
τ_2	-1.38	-3.46	-2.88	-2.57
Φ_1	9.65	6.52	4.63	3.81
τ_1	4.14	-2.58	-1.95	-1.62

Table 17: ADF-test on INC

Type:	Trend	Drift	None	
AR(1):	1.01	0.99	1	
Lags:	12	12	12	
	statistic	1pct	5pct	10pct
τ_3	0.11	-3.99	-3.43	-3.13
Φ_3	1.49	8.43	6.49	5.47
τ_2	-1.72	-3.46	-2.88	-2.57
Φ_1	14.31	6.52	4.63	3.81
τ_1	4.90	-2.58	-1.95	-1.62

Table 18: ADF-test on MMR

Type:	Trend	Drift	None	
AR(1):	0.82	0.98	0.98	
Lags:	3	4	4	
	statistic	1pct	5pct	10pct
τ_3	-4.41	-3.99	-3.43	-3.13
Φ_3	9.75	8.43	6.49	5.47
τ_2	-1.28	-3.46	-2.88	-2.57
Φ_1	1.05	6.52	4.63	3.81
τ_1	-1.41	-2.58	-1.95	-1.62

Table 19: ADF-test on u

Type:	Trend	Drift	None	
AR(1):	0.85	0.88	1	
Lags:	3	3	4	
	statistic	1pct	5pct	10pct
τ_3	-4.11	-3.99	-3.43	-3.13
Φ_3	8.45	8.43	6.49	5.47
τ_2	-3.76	-3.46	-2.88	-2.57
Φ_1	7.14	6.52	4.63	3.81
τ_1	0.08	-2.58	-1.95	-1.62

Table 20: ADF-test on π

Type:	Trend	Drift	None	
AR(1):	0.74	0.74	0.96	
Lags:	9	9	8	
	statistic	1pct	5pct	10pct
τ_3	-3.22	-3.99	-3.43	-3.13
Φ_3	5.23	8.43	6.49	5.47
τ_2	-3.24	-3.46	-2.88	-2.57
Φ_1	5.31	6.52	4.63	3.81
τ_1	-0.98	-2.58	-1.95	-1.62

Table 21: ADF-test on *Stock*

Type:	Trend	Drift	None	
AR(1):	0.88	0.94	1	
Lags:	1	1	1	
	statistic	1pct	5pct	10pct
τ_3	-3.04	-3.99	-3.43	-3.13
Φ_3	4.80	8.43	6.49	5.47
τ_2	-1.88	-3.46	-2.88	-2.57
Φ_1	1.96	6.52	4.63	3.81
τ_1	0.52	-2.58	-1.95	-1.62

Table 22: ADF-test on W^{fin}

Type:	Trend	Drift	None	
AR(1):	0.84	1	1	
Lags:	2	2	2	
	statistic	1pct	5pct	10pct
τ_3	-3.06	-3.99	-3.43	-3.13
Φ_3	4.92	8.43	6.49	5.47
τ_2	0.03	-3.46	-2.88	-2.57
Φ_1	2.82	6.52	4.63	3.81
τ_1	2.39	-2.58	-1.95	-1.62

Table 23: KPSS-test in levels

	5 pct	CCI	$Macro$	$Micro$	CON	INC
Trend	0.146	0.0619	0.0345	0.102	-	-
Drift	0.463	-	-	-	2.1303	2.1502

Table 24: KPSS-test in levels

	5 pct	MMR	u	π	$Stock$	W^{fin}
Trend	0.146	0.0469	0.1356	-	0.0808	0.092
Drift	0.463	-	-	0.088	-	-

7.3 Real disposable income

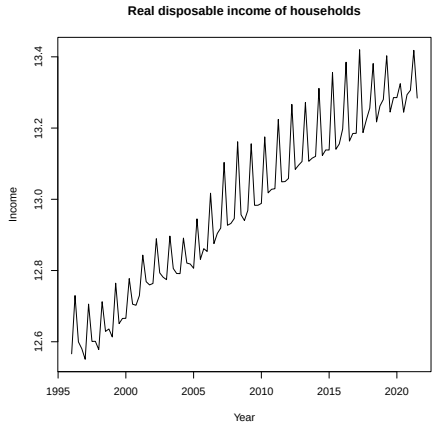

Figure 2: (ln) real disposable income of households, not seasonally adjusted