LUND UNIVERSITY

DEPARTMENT OF ECONOMICS

Household debt in Sweden

an empirical investigation of the determinants of the debt increase from 1980 - 2009

Bachelor Thesis

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Author

Sanja Panić

Supervisor

Klas Fregert

Abstract

The Swedish household debt has been quite high and increasing for the past 30 years. In this thesis I tried to find the underlying reasons for the development in the long-run by using the Engle-Granger two-step model for co-integration but found that there was no co-integration between the household debt to disposable income ratio and the chosen variables. In the short-run analysis I de-trended all the variables and proceeded with an OLS regression and found that the debt to disposable income ratio was determined by all the variables but especially by debt to assets, the demographic variable and the real estate prices.

Keywords: Household debt, Sweden, Engle-Granger, Life-cycle hypothesis, co-integration

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1. Introduction

Household debt in Sweden has been quite high for the past 30 years, in 1981 it was approximately 88% of disposable income and has since increased, in 2009 it reached the highest level yet of 156% of disposable income. Three factors that theoretically have been important for this development are the deregulation of the financial market, the low interest rates and the demographic pressure, and these factors could probably explain a big part of the increased household debt levels. But Sweden is not alone with the problem of high and increasing household debt, countries like Australia and the Unites States of America have seen the same development in the past. Although the Swedish real estate market has not collapsed like the US market did, high dependency on household debt can have devastating effects on the private economy, like what we saw happen in the US. But this has not scared the general public and the real estate prices are continuing to rise as well as the household debt. One of the most alarming things about this development is the low interest rate which people are using and borrowing more, this could leave the general public in big financial trouble when the interest rates start to increase to normal levels, many may even be forced to private bankruptcy.

Research in this area is mostly theoretical and does not use as recent figures as the ones which will be used in this thesis. The data is often compared to other countries and with different variables. But one theoretical paper that was very helpful with the theory was "Household Debt and the Macroeconomy".[1] There is another paper that has been interesting for this thesis that compares Sweden to the United Kingdom, "House Prices and Housing Investment in Sweden and the United Kingdom".[2] It is a study that focuses more on the dynamic housing demand and investment supply of Sweden and the UK but it has been helpful in getting some insight on the subject. There is however one paper written on the same subject but for Australia, "Australian Household Debt – an empirical investigation into the determinants of the rise in the debt-to-income ratio"[3] which was very helpful and used as an inspiration for this thesis.

The purpose of this thesis is to empirically study what the main reasons for the growth in the household debt to disposable income ratio in Sweden are in the short- and long-run. This will

[1] Debelle, G. (2004)
[2] Barot, B. & Yang, Z. (2002)
[3] Philbrick, P. & Gustafsson, L. (2010)

be conducted through Engle-Granger two-step technique for testing co-integration. The main reasons for the increase in household debt to disposable income in the short-run will be shown to be debt to assets, the demographic variable and real estate price index and in the long-run no co-integration was found between debt to disposable income and the chosen variables.

The thesis will start of with some background information in section 2. Section 3 will introduce the theory that will be used throughout the thesis and discuss possible variables; section 4 will introduce the econometric specification and data. Section 5 presents the econometric models that will be used. In section 6 the results will be presented, section 7 will discuss the results and in section 8 the conclusion is presented.

2. Background

In this section the measurements of household debt that will be used throughout the thesis will be introduced, followed by some important events in the Swedish economy, which have contributed to the increase in household debt. This section will be concluded by a discussion about the consequences of increasing household debt.

2.1 Household Debt Ratios

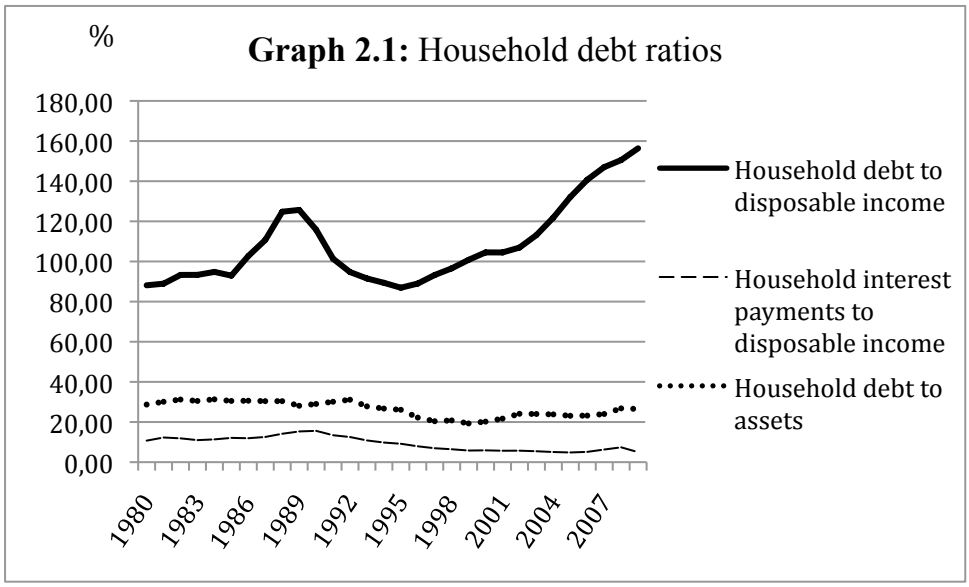
There are many ways to measure household debt, everything from raw data to different ratios. Some of the most relevant ones to this thesis are the ones that will be presented and which other papers also used.[4] To be able to compare the obtained data I have chosen to use different ratios in this thesis and the main measurement will be the household debt to disposable income ratio, which is the total household debt, divided by total household disposable income. This will give us some sense of how high the debt level is and will also give us a ratio to compare to the household assets to household debt ratio and the household interest payment to household disposable income ratio.

Household debt to asset ratio is calculated by dividing total household debt with total household assets. This ratio is very sensitive to changes in real estate prices and/or other assets, for example an increase in real estate prices would mean increase in debt and the ratio could fluctuate as prices fluctuate. But at the same time when real estate prices increase so does the value of the assets so the effect of the fluctuation depends on how much of the assets are real estate and how much are different types of assets such as financial assets, for example shares or bonds, or other assets for example art work.

The household interest payment to disposable income ratio is total household interest payments divided by total household disposable income. As it is today in Sweden the repo rate is very low and has continually decreased since September 2008 from 4.75% and reached its ultimate low of 0.25% in July 2009, it has since stayed at this level.[5] The repo rate is the rate at which the banks get to borrow from the Swedish Riksbank. This ratio is directly affected by changes in the interest rate, thus it will fluctuate in the same direction as the interest rate.

[4] See for example Debelle, G. (2004), p 52-54
[5] Ekonomifakta (2010)

Below we have the three ratios in a graph so that it will be easier to compare them to each other.

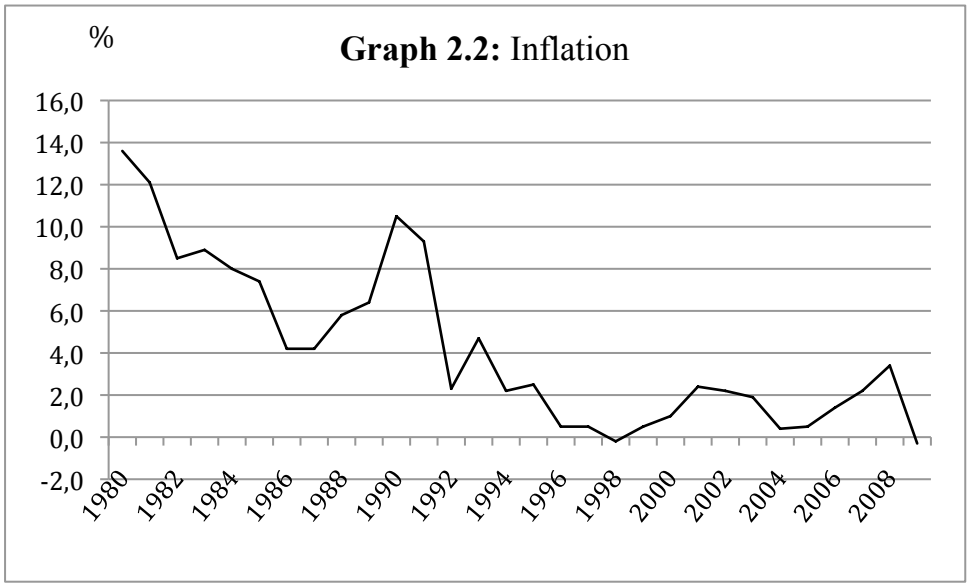


2.2 The Swedish Economy And The Development Of The Households Debt

Household debt in Sweden has been high and increasing for the past 30 years. As we can see in Graph 2.1 the household debt to disposable income ratio has increased from approximately 88% in 1981 to 156% in 2009. Some events in the Swedish economy have contributed to this development and will be discussed in this section.

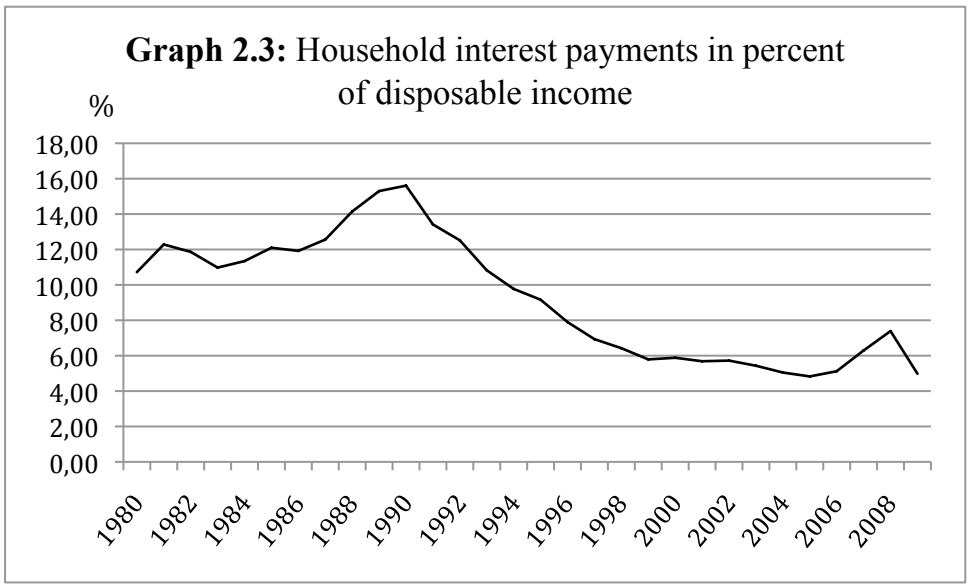
In the 1980's the fixed exchange rate became a problem for Sweden when the Swedish Riksbank did not have the power to change the interest rate freely and the goal instead became low inflation, later defined as a 2% increase of consumer price index (CPI).[6] The decision of the Swedish government to deregulate the Swedish credit market in November of 1985 meant that the banks could give unlimited loans without the interference of the Swedish Riksbank. As we can see in Graph 2.1, there was an increase in the debt to income ratio from 93% to 125% of disposable income in the three years that followed. Not only did the household debt increase, the real estate prices also increased from indexed prices of 130 in 1985 to 217 in 1991. In addition to the deregulation of the credit market the inflation started to increase in 1987 from 4.2% to its peak of 10.5% in 1990 (as we can se in Graph 2.2), consumption became higher than income and the debt continued to increase.

[6] Riksbanken (1993), Pressrelease Nummer 5



Graph 2.2: Inflation

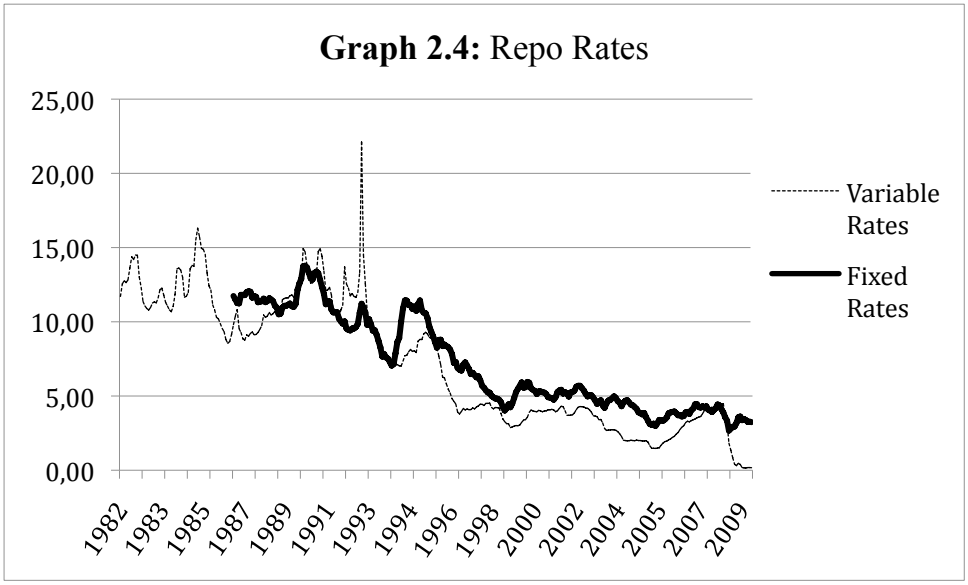
Between 1990 and 1991 there was a reform on the tax deduction of interest payment, from 50% to 30%, which increased the interest costs. As we can see in Graph 2.3 the interest payments in percent of disposable income started to decrease (due to the decrease of debt in the same year as we saw in Graph 2.1) and the real estate prices had seen a 9% decrease in 1992.



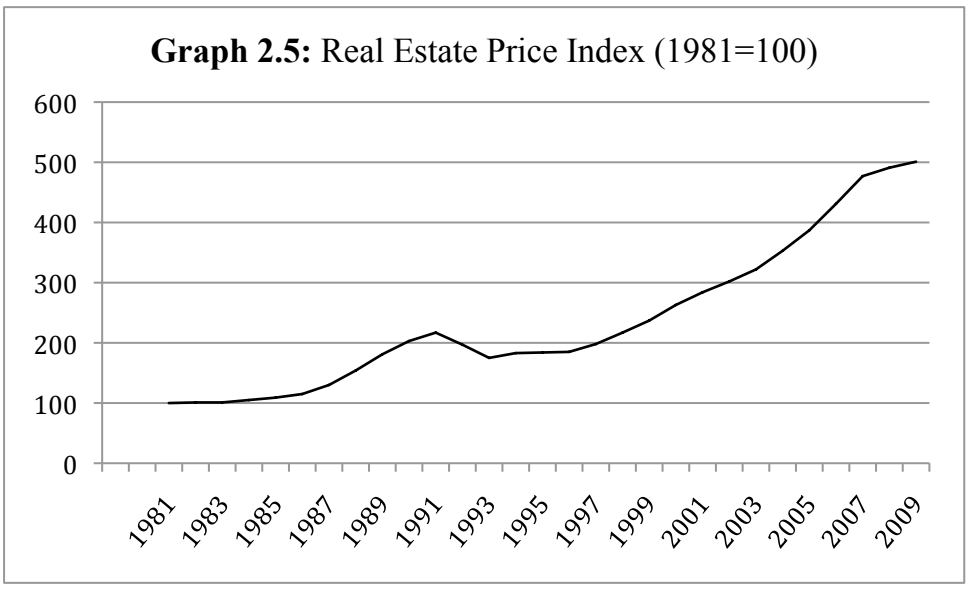
Graph 2.3: Household interest payments in percent of disposable income

The same year the fixed exchange rate became too much and too expensive, for the Swedish government, because of speculation and the Swedish krona was left to float freely. By then a full-blown financial crisis had hit Sweden and the interest rates had devastating effects on the Swedish household economy. As we can see in Graph 2.4 variable repo rates went from

13.3% in August of 1993 to 22.1% in September and then down again to 14.5 in October. From that point the interest rates started to decrease and by October of 1996 the repo rates were down to a normal level[7] of 4.83%.



But the real estate prices had increased from indexed prices of 197 in 1992 to the level of 237 in 1999. Since then the real estate prices have only increased and in 2009 it was recorded to be indexed price of 501, the highest level yet.



[7] Sveriges Riksbank (2006)

2.3 Consequences Of Increasing Household Debt And Shocks

One of the major problems with a high level of household debt combined with low interest rate is that many people take on debt which they can have a problem repaying if the interest rate increases to a normal level. The average interest rate on newly acquired debt in Sweden was 2.39% in June 2010[8], which is quite low; a normal level in Sweden (taking what is considered the normal repo rate in to consideration) should be between 5-7%.[9] This means at least 2-4 percentage points below average and as we can see in Graph 2.3 the percent of interest payments to disposable income has decreased. Considering the increase of household debt and the decrease of interest payments there could be big financial problems for many households when the economy goes in to a boom and the interest rate starts to increase to what is considered a normal level.

High dependency on debt can leave households very sensitive to different kinds of economic shocks like interest rate changes, changes in real estate prices and unemployment.[10] Although these shocks can be related the discussion of the consequences will focus at one shock at the time and assume ceteribus paritus.

A high dependency on household debt makes households more sensitive to an interest rate shock, which will mostly affect households that have variable rate loans. In Sweden many households fix the interest rate of loans on different periods of time, everything from 1 year to 10 years, but households in Sweden predominantly have loans with variable rates.[11] This means that not all households will be affected by an increase in the interest rate, but the portion of households that have variable rate loans will be affected. Many households also fix the interest rates on some part of the loans and have another part of loans at variable rates. If there is a shock on interest rates it will not be as sizable as if the whole loan was on a variable rate, but at the same time they get the benefit of lower interest rates if there is a negative shock on the interest rate, on the portion of debt that has variable rates.

A real estate price decrease or increase will not have a direct effect on the household economy like an interest rate shock but it will affect the equity of a household. If real estate prices

[8] Sveriges Statistiska Centralbyrå (2010), Press release June
[9] Sveriges Riksbank (2006)
[10] Debelle, G. (2004), p57-60
[11] Debelle, G. (2004), p58

decrease, the loan that a household might have will be more than what the house is worth. This can be analyzed from a wealth point of view, if ones wealth decreases one will start to consume less to be able to save more which in turn would affect the rest of the economy, such as future unemployment.

An income shock like unemployment will not affect as many households as a shock on interest rate, but it will affect some households. Depending on how large the unemployment benefits are the effect of the income shock will vary, as well as how much debt the households that face unemployment have. A problem for the households that have both sizable debt and are faced with unemployment is how to pay the mortgage payments. Even if the job opportunities are in another city they cannot just leave their homes and afford to pay housing at another location as well as for the home that they already have. They must probably first sell their house or their apartment so that they can pay off the debt and then move.

3. Theory

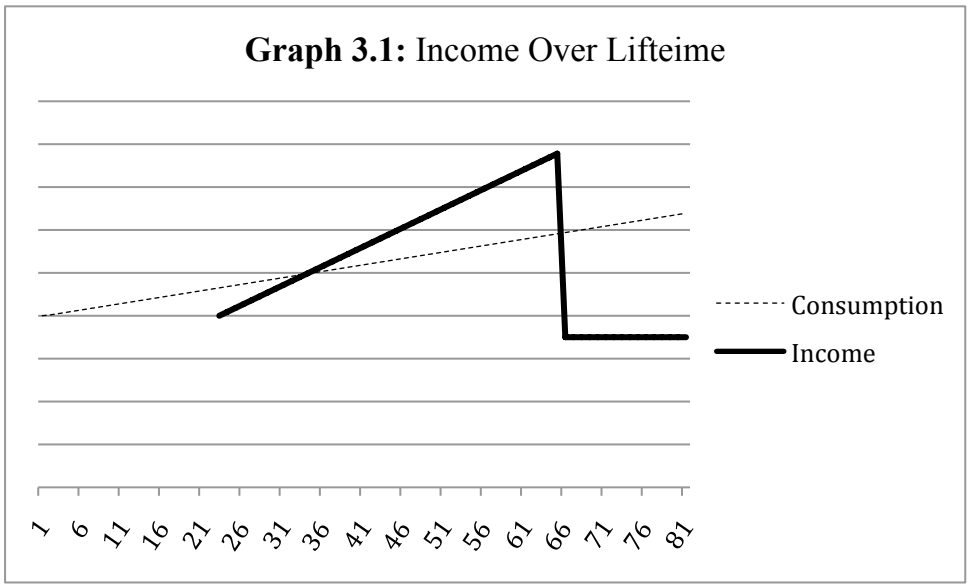
The purpose of this section is to identify which variables that could be relevant in explaining the development of debt to disposable income through the theory presented. It will start off with the Life Cycle Hypothesis and then present the Ando-Modigliani mathematical part of the Life Cycle Hypothesis. It will continue with a discussion about changes in interest rates, demographics and real estate prices. This is followed by a discussion about the inflation rate and what happens to household debt. It ends with a presentation of the random walk hypothesis.

3.1 Life Cycle Hypothesis

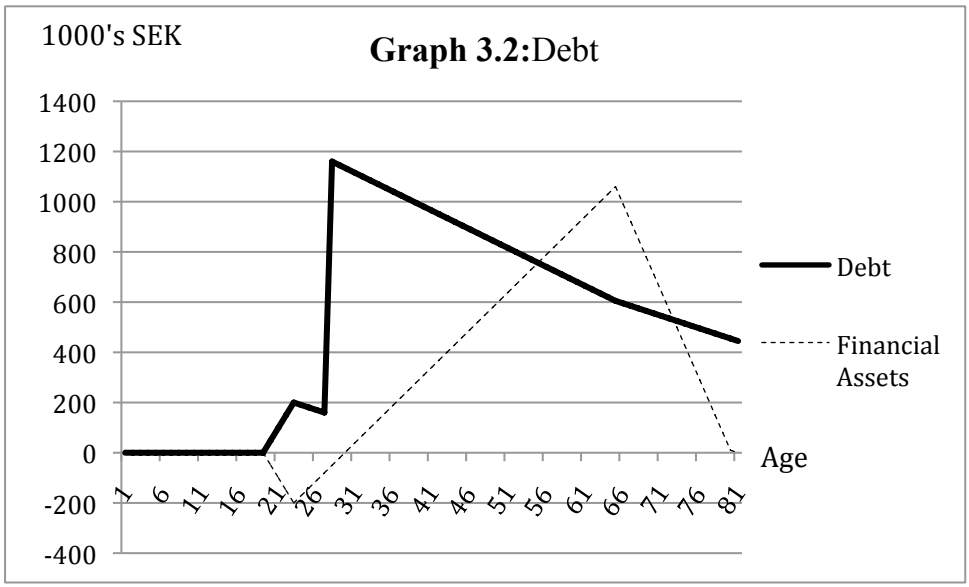
The Life Cycle hypothesis states that one will have different levels of income during different periods of time in life. One will thus want to smooth out the income to sustain a relatively steady consumption. Which means that during the early years in life one will borrow, for example to be able to study at the university they will have to take student loans. Then during the later years of life one will repay those student loans and start to save for retirement, which will smoothen the life-cycle consumption.[12] One will do this to maximize ones utility. This explains why households take on debt if for no other reason than to be able to smooth their income out over the different periods of life. In this thesis we will use the life cycle hypothesis and add financial wealth, assets and interest rate instead of just using income. The mathematical part of the Ando-Modigliani model of the life cycle hypothesis will end this section.

Ones consumption increases with age due to many reasons. When one is young not much is needed, but as one grows older one buys things like cars, computers, more expensive clothes, in short more luxury goods. In Graph 3.1 wee can see this through the dotted line named consumption. The other part of the graph shows how income increases and decreases during ones lifetime. It starts off low and increases throughout time but at the age of pension the income decreases. To finance the drop in income one needs to have savings that one can now spend to smooth the consumption.

[12] Branson, W. (1989), p. 253



So as one start to grow older one needs to invest in their future; some invest in their education, some buy real estate, some save in savings accounts, some buy shares and some save in funds for their pensions. All this is done to get some kind of return on their money either in form of interest or in form of profit when one sells. As one reaches the age of pension they use these savings, as we can see in Graph 3.2 below the financial assets start to decrease. But one also accumulates debt, some through student loans and some through acquisition of property, and throughout life they then pay back the accumulated debt. As we can see in the graph below this example shows this person first studied four years and accumulated student loans, started to pay back those loans and at the age of 28 bought some kind of real estate which increased the debt with one million Swedish Kronor (SEK) and then continued to make mortgage payments throughout life. As we can see from the example some people do not even pay back the debt that they have before they die, but might leave some kind of property that can be sold and then the debt will be repaid.



The mathematical part of the Ando-Modigliani model of Life cycle hypothesis is presented below.[13]

The first equation is and aggregate consumption function when we assume that income is relatively constant and tastes between present and future consumption is stable over time.

$$c_t = k(PV_t) \qquad (3.1.1)$$

C represents the consumption at any given time, k is the fraction of a consumer's present value that he or she wants to consume and PV is present value. To develop a consumption function we need to rewrite the present value to economic variables. Since future expected income cannot be measured, the Ando-Modigliani model divides income to income from labor y^L and income from property y^p, which gives us equation 3.1.2.

$$PV_0 = \sum_0^T \frac{y_t^L}{(1+r)^t} + \sum_0^T \frac{y_t^P}{(1+r)^t} \qquad (3.1.2)$$

From this we need to define the future property income, which is the real household net worth at the beginning of the period, a_0.

$$\sum_0^T \frac{y_t^P}{(1+r)^t} = a_0 \qquad (3.1.3)$$

[13] Branson, W. (1989), p. 254-256

To separate current labor income from expected future labor income we have the next equation:

$$PV_0 = y_0^L + \sum_1^T \frac{y_1^L}{(1+r)_t} + a_0 \qquad (3.1.4)$$

To see how expected future labor income is related to current variables we assume that there is an average expected labor income:

$$y_0^e = \frac{1}{T-1} \sum_1^T \frac{y_1^T}{(1+r)^t} \qquad (3.1.5)$$

Where 1/(T-1) is the average of the present value of future labor income.

$$\sum_1^T \frac{y_t^L}{(1+r)^t} = (T-1)y_0^e \qquad (3.1.6)$$

This gives us a present value of the income stream:

$$PV_0 = y_0^L + (T-1)y_0^e + a_0 \qquad (3.1.7)$$

Equation 3.1.7 leaves us with another term to find a measurement for, which is the average expected labor income y^e. The average expected labor income is assumed to be a multiple of present labor income as presented:

$$y_0^e = \beta y_0^L : \qquad \beta > 0 \qquad (3.1.8)$$

This means that people will adjust their expectations of future income if y^e changes by the fraction of β of the increase in y^L. By combining equation (3.1.7), (3.1.8) with equation (3.1.1) we get a statistically measurable form of the Ando-Modigliani consumption function that is presented below:

$$c_0 = k[1 + \beta(T-1)]y_0^L + ka_0 \qquad (3.1.9)$$

3.1.1 Changes In Interest Rates

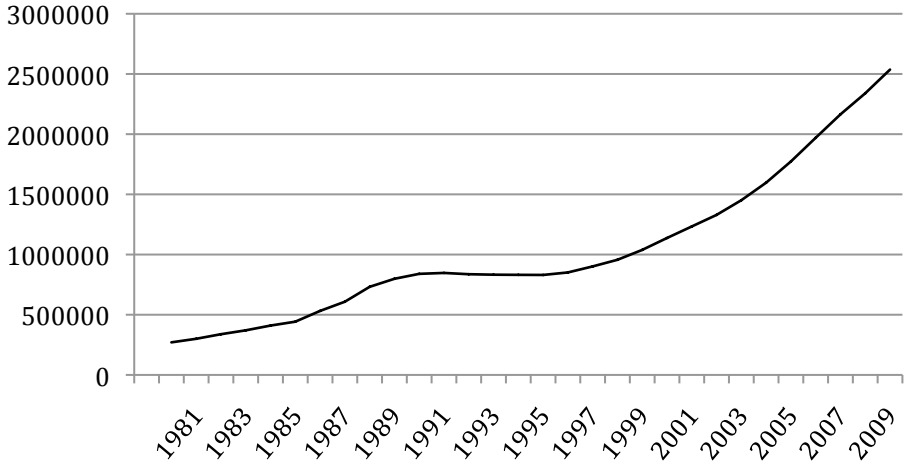
In the life cycle hypothesis changes in interest rates are not discussed specifically, it is incorporated in the term of k but not defined by it. Changes in interest rate can be analyzed through the two-period-model of consumption. In this model we have two effects, the

substitution effect and the income effect. A low interest rate will mean that the cost of taking on debt will decrease. One will substitute future consumption for current consumption and take on more debt, thus the savings rate will decrease; this is the substitution effect. But we also have the income effect, decreased interest rates means a decrease in future expected income thus savings rate will increase, thus the income effect. The net effect of the substitution effect and the income effect depends on the size of the two effects.[14]

3.1.2 Changes In Real Estate Prices And Equity

As mentioned earlier in the thesis the real estate prices in Sweden have increased quite substantially over the last 30 years. This means that the household debt level has been increasing, as we can see in Graph 3.3 below. Households that took on loans before the real estate prices increased and those that took on loans after the prices increased have very different debt levels, which we will not include in this thesis.

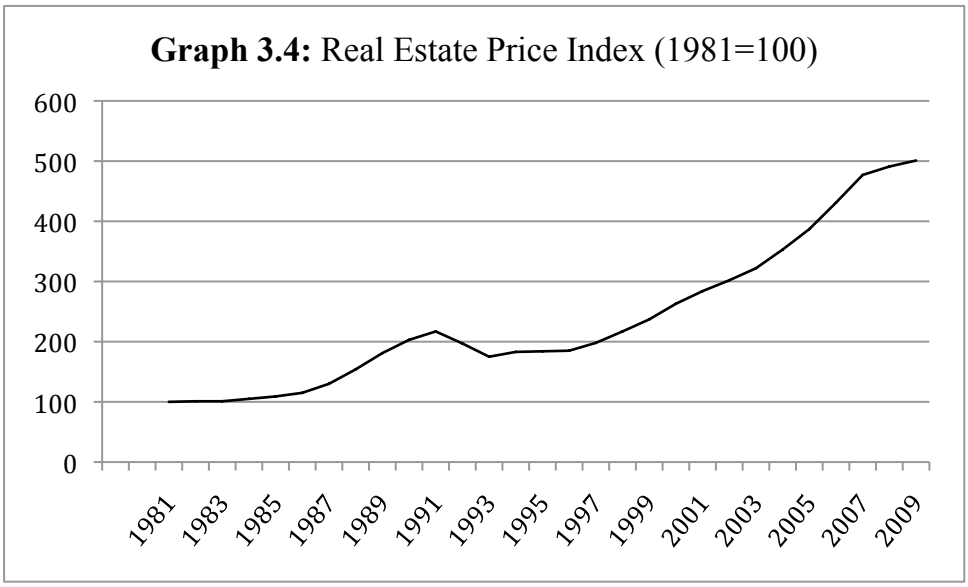
Graph 3.3: Total household debt in SEK



The older generation in Sweden also see differently on taking on debt because they have seen the crisis of 1990's when many households could not afford to pay the interest rates and the mortgage payments and were forced to sell their homes. Thus they are a little bit more careful on taking on debt. But if they bought real estate in the early 90's or even earlier than that they have accumulated a substantial amount of wealth due to the real estate price increase. Analyzed through the life cycle hypothesis this is a form of saving, so when they decide to

[14] Burda, M. & Wyplosz, C. (2005), p. 351-352

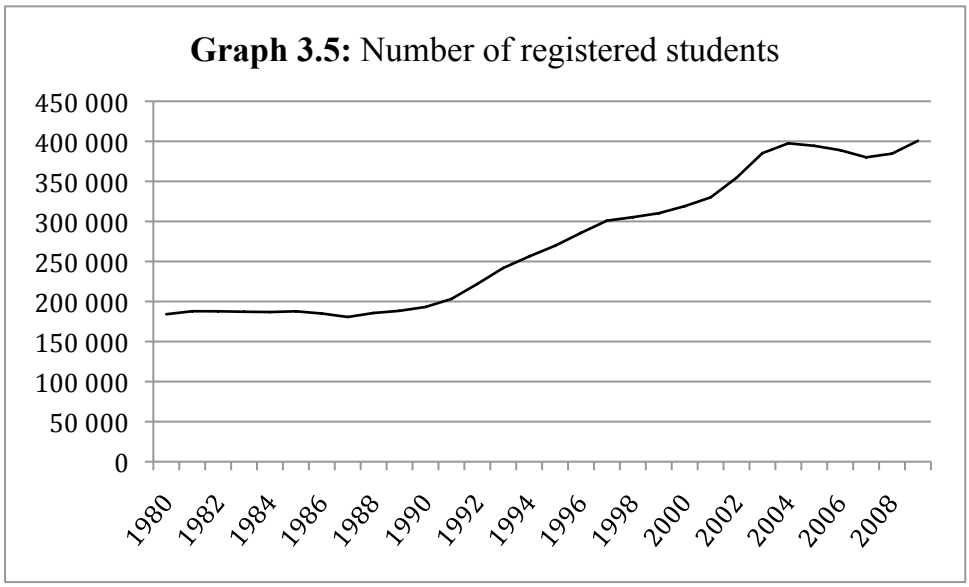
sell their homes their financial wealth will increase substantially but their non-financial assets will decrease.



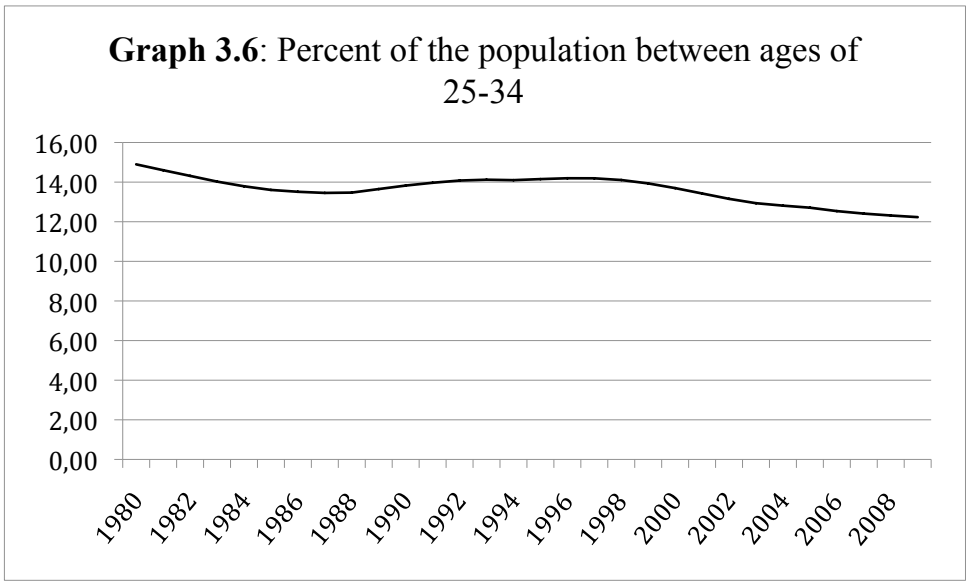
3.1.3 Demographics

The age of the population also plays a big role in this analysis. One would expect that the younger the population is the higher the debt, since young people have to take on more debt to sustain a smooth consumption according to the life cycle hypothesis than when talking about the same portion of an older generation. At the same time it has become easier to take on debt in Sweden which has also helped the development of higher debt levels.

Another variable when looking at demographics is how the portion of individuals that study at the university has changed throughout the years. Since many students have to take on student loans to finance books and the living expenses that come with studying on different location, if one assumes that the portion of students has increased (which we can see in Graph 3.5 below) then the debt should theoretically also increase. The other important aspect is that if more individuals' invest in a higher education, fewer individuals' work and income becomes less now than if these individuals would be working. But with a higher education they will later earn a higher income than what could be expected without this higher education.



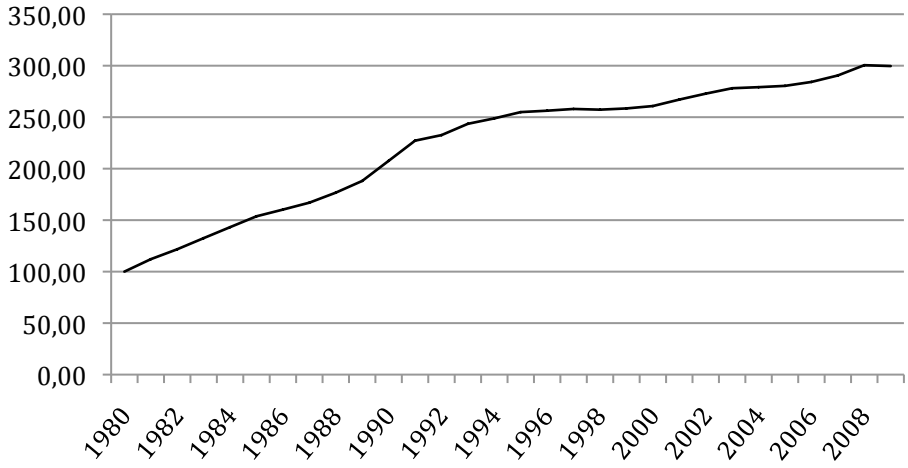
If we take a closer look at the population between the ages of 25-34 we can see (in the graph below) that it has decreased from the beginning of the 1980's to 2009 with about 2.6 percentage points. To draw this back to the life cycle hypothesis this means that the increase in debt cannot only be because of the population growth or the fact that more young people study at the university, even though the number of students has increased and the percent of the population in the age group of 25-34 has decreased.



3.2 Inflation Rate

In 1993 the Swedish Riksbank decided that the monetary policy was to be focused on price stability with the start of 1995, the delay was due to the inflation tendencies that followed with the decision to let the Swedish krona float freely and some changes in indirect taxes. The goal was that inflation should be 2% per year.[15] As we can see in Graph 3.7 the CPI started to increase more slowly from 1993. The decreased inflation has contributed to the increase in household debt for two reasons. First because interest rates are partly determined by how high the inflation is, which means that decreased inflation will lead to decreased interest rates. In order to take loans in a bank in Sweden the bank requires one to have an income which is enough to cover the interest rate costs and to make some mortgage payments without compromising the quality of life. So if the inflation decreases and thus the interest rate decreases, the nominal cost to repay the loans and the interest costs decreases and one can take on more debt. The second reason is that low inflation rates eats up less of the debt than high inflation, or if you will low inflation gives lower nominal income growth so the level of debt in relation to disposable income stays the same.

Graph 3.7: Consumer Price Index (1980=100)



[15] Riksbanken (1993), Pressrelease Nummer 5

3.3 Random Walk Hypothesis

The random walk hypothesis is originally an investment theory that states that the past movement of the prices in the stock market cannot be used to predict the future movement in the stock market but that prices maintain an overall upward trend. The prices are instead determined by today's expectations about the future price. So if we expect prices to increase tomorrow we will buy stocks today, the demand increases and as a result the stock price increases, so it is a self-fulfilling prophecy.[16] If there is no co-integration between the debt to disposable income ratio and the variables, which will be chosen, then the debt to disposable income ratio follows a random walk and will not be affected by the variables but only by its own previous value.

[16] Westerlund, J. (2005), p 203

4. Econometric Specification And Data

In the previous section some possible variables to explain the increase in the debt to household ratio were discussed. This section starts off with explaining which variables that have been chosen and that will be included in the model. It then continues to discuss important aspects of the data and ends with a presentation of how the data is measured and where it was obtained.

4.1 Choice Of Variables

The dependent variable will be the debt to disposable income ratio (DDY). Interest payments to disposable income ratio (RPDY) will be included to see if the cost of taking on debt affects the decision to accumulate more debt. We will include the inflation (INF) so that we can see how much of the debt increase is real, the real income increase and to observe the real estate price increase. The real estate price index (REPI) will be included so that we may capture the increase in debt as the price increase and to capture the wealth effect, from the change in asset prices. Household debt to assets ratio (DA) was chosen to be included to see if how much the assets were worth in relation to how much debt was accumulated affected how much debt households are willing to accumulate or if that does not affect their debt decisions. A demographic (DEMO) variable will be included in the model in the form of the percent of the population between ages 25 and 34 as it was assumed to be the age when most debt is accumulated. The econometric specification is as follows:

$$DDY = \int(REPI, RPDY, INF, DEMO, DA) \qquad (4.1.1)$$

4.2 Time Series And Co-integration

When using time-series data in regressions it is important to know if the time-series are stationary or not. To have stationary data means that the mean and variance does not change over time or position.[17] If the data is non-stationary we have a unit root problem. In the case that the variables have unit root problems they should not be included in a regression analysis since this could give us misleading results. But there is an exception to the rule, which is when variables are co-integrated, this means that they have the same unit root or stochastic trends. They are not independent of each other even if they in the short run do not follow each

[17] Westerlund, J. (2005), p 202

other there is long-run co-integration between them.[18] Another thing that can be done is to de-trend the data so that it becomes stationary instead of using the raw data and have problems with unit roots[19] but by doing this we then only get a short-run relationship between the dependent variable and the other variables. It this thesis I will conduct both tests.

4.3 Data

All the data used in this thesis was obtained from the Swedish Statistical Central Bureau (SCB) with the exception of the asset to disposable income, which was obtained from Ekonomifakta. The data was mainly yearly, some of it was available per quarter but was chosen as a yearly average, already calculated, to have the same type of data for all the variables.

Table 4.1 Data Measurements And Sources

Variable	Measurement	Source
Debt to disposable income	Yearly	SCB
Real Estate Price Index	Yearly Index	SCB, subject area of Housing, construction and building
Interest payments to disposable income	Yearly	SCB
Inflation	Yearly	SCB, subject area Prices and consumption
Demographic variable	Yearly	SCB, subject area Population
Debt to assets	Yearly	Ekonomifakta

Tables are available at www.scb.se and www.ekonomifakta.se

4.3.1 Debt And Interest Payments To Disposable Income

The household debt to disposable income data and interest payments to disposable income data was obtained from SCB and already calculated on a yearly basis. The debt to disposable income data is only for the household debt and it does not include corporate debt, it is calculated in current prices. The interest payments to disposable income are the interest payments for that specific debt. This variable was chosen to be included because I wanted to

[18] Westerlund, J. (2005), p 209-210
[19] McCallum, T. Bennett (1993)

be able to see the cost of taking on debt and if this cost affects households' propensity to accumulate more debt. The interest rate could have been included instead of this variable but there was only data for the fixed interest from 1987 and not the whole time period that will be investigated so taking an average of the variable- and fixed interest rate would have been somewhat misleading.

4.3.2 Real Estate Prices Index

To have some kind of measurement of the changes in real estate prices the only data available, that I could find, was the real estate price index, which was obtained from SCB. The only negative aspect of the real estate price index is that it starts in 1981, thus we only have 29 observations instead of 30 observations like with the rest of the variables.

4.3.3 Inflation

The inflation data was obtained from SCB and was originally calculated by them. The data is calculated by dividing the value of CPI this year by the value of CPI the year before and the multiplying it with 100, which is the most common way of calculating inflation.[20]

4.3.4 Demographic Variable

The demographic variable that was chosen is the age group between 25 to 34 and was obtained from SCB, but it was only available in total population so I had to divide the total number of people in the age group with the total population and multiply it by 100 for every year. This age group was chosen because it was assumed to be the age group where the first home is bought and most debt is accumulated, and at the same time including many of the students that take student loans in order to get educated.

4.3.5 Debt To Assets

Debt to assets was obtained from Ekonomifakta and was already calculated as a ratio. This is a measurement to see how much debt the population has in relation to the value of their assets.

[20] Sveriges Riksbank (2010)

5. Econometric Method

In this section the econometric theory and methods that will be used in the thesis is presented. Engle-Granger two-step technique for testing co-integration will be used to see if there is a long-run co-integration and to see if the variables have a short-run relationship we will de-trend the variables, and conduct an OLS regression on the generated de-trended time series.

5.1 Testing For Unit Roots And Long-run Co-integration

The Augmented Dickey-Fuller integration test (ADF) is used to test if the variables are stationary or non-stationary. When doing the ADF tests one can choose to do it with deterministic components (equation 5.1.1), an intercept (equation 5.1.2) or with an intercept and trend (equation 5.1.3). One can also choose to use a number of lags or the first and second difference.

$$\Delta Y_t = \delta Y_{t-1} + u_t \qquad (5.1.1)$$

$$\Delta Y_t = \alpha + \delta Y_{t-1} + u_t \qquad (5.1.2)$$

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + u_t \qquad (5.1.3)$$

The null hypothesis is that H_0: $\delta = 0$, the series has unit root and is non-stationary. The alternative hypothesis is H_1: $\delta < 0$, which means that the series is stationary.

A problem with the ADF test is that the t-statistic no longer has the ordinary t-distribution with M degrees of freedom and instead has a Dickey-Fuller distribution.

The problem with non-stationary time series data is that the mean and variance no longer are constant over time. And when included in a co-integration test both the R^2 value and the t-statistic could be large even though there is no long-run co-integration between the variables. In this case the Durbin-Watson statistic will be small which is an indication that there is an autocorrelation problem. A regression with these three properties can lead to an incorrect conclusion that is called a spurious regression.[21]

[21] Westerlund, J. (2005), p 205

Step 1: After establishing if the data is non-stationary or stationary an OLS regression on the original data will be done to see if there is a long-run co-integration between the debt to disposable income ratio and the variables. The OLS regression will be done by using equation (5.1.4) below on the original data.

$$Y_t = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon_t \quad (5.1.4)$$

Step 2: To be able to eliminate the possibility of a spurious regression we need to test the error correction term, ε_t (from equation 5.1.4) by doing an ADF test on it using the equation (5.1.5). If the error correction term is stationary the OLS regression results will be accurate and we can eliminate the possibility of spurious regression.

$$\Delta\varepsilon_t = \alpha + \beta T + \delta\varepsilon_{t-1} + u_t \quad (5.1.5)$$

The hypothesis will be: H_0: $\delta = 0$, the error correction term is non-stationary thus there is no co-integration; the variables follow a random walk. H_1: $\delta < 0$, the error correction term is stationary thus there is co-integration.

5.2 Testing For Short-run Relationship

The objective of this part of the analysis is to see if there is a short-run relationship between different variables that have been chosen and the debt to disposable income ratio, which is the dependent variable.

First we will start by doing an Ordinary Least Squares (OLS) regression on the first difference generated variables, which means that they no longer have a trend, to see if there is a short-run relationship between the dependent variable debt to disposable income and the chosen variables. To get the first difference equation (5.2.1) is used and equation (5.2.2) for the OLS regression with the first difference generated variables.

$$\Delta(\Delta Y_t) = \alpha + \delta\Delta Y_{t-1} + e_t \quad (5.2.1)$$

$$\Delta Y_t = Y_t - Y_{t-1} = \alpha + \beta_1\Delta X_1 + \beta_2\Delta X_2 + \beta_3\Delta X_3 + \beta_4\Delta X_4 + \beta_5\Delta X_5 + \varepsilon_t \quad (5.2.2)$$

6. Results

In this section the results of the estimation are presented, starting of with unit root tests on all the variables, the short-run relationship test and then the co-integrations test.

6.1 Unit Root Tests And The Long-run Co-integration Test

The first step in the testing of the different variables is to do a unit root test to see if they are stationery or non-stationary using the Augmented Dickey-Fuller test. This was done in EViews 7. Table 6.1 below will present the results and followed by an interpretation. It was tested with both a trend and intercept, thus using the equation below.

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + u_t \qquad (6.1.1)$$

Table 6.1: Unit Root Test Results (Intercept and Trend)

Variables	t-statistic	First difference
Debt to disposable income	-0.211774	-2.358833
Inflation	-3.169405	-5.842404
Debt to assets	-1.075845	-4.239701
Demographic	-0.709458	-1.649107
Interest payments to disposable income	-1.912368	-3.291638
Real estate price Index	-0.258037	-2.253318

I found that almost all the variables except inflation had unit root problems when testing them. We proceeded to try Difference-stationary process to get a stationary time series. When conducting unit root test on the first difference we found that the absolute computed ADF t-statistic was smaller than the critical value and we were able to reject the H_0 for all variables on 1% significance level except for the demographic variable, which on a 5% significance level was borderline but we were able to reject the H_0 at 10% significance level. After testing the variables for unit roots we generated the first difference series to get stationary data.

The first step of Engle-Granger: After establishing that most of the time series are non-stationary the long-run co-integration needed to be established. To do this I had to run an OLS estimation on the original data. The results are presented below:

Table 6.2: Long-run Co-integration Results

Variable	t-statistic	Probability
Constant	5.795541	0.0000
Inflation	-0.455185	0.6532
Debt to assets	-1.887035	0.0718
Demographic	-5.508805	0.0000
Interest payments to disposable income	4.478142	0.0002
Real estate price index	3.700198	0.0012

In the long-run all the variables seem to be co-integrated except for inflation with the debt to disposable income ratio. But since the R^2 value is 0.931363, which is quite high and the Durbin-Watson value is 0.840537, which is quite low we need to do an ADF test on the error correction term to make sure we do not have a spurious regression.

The second step of Engle-Granger: When doing the ADF test on the error correction term I found that the t-statistic was -2.287083 and the probability was 0.4268. As the error correction term is not observed data but estimated we can no longer use the same critical values as with the ordinary ADF values. This means that even though the error correction term has a t-statistic of -2.287083 it is non-stationary and we can thus not reject the null hypothesis of no co-integration.

6.2 The Short-run Relationship Tests

With the generated first difference series we run an OLS regression to see if there was a short-run relationship between household debt to disposable income and the different variables. The results are presented in Table 6.2.

Table 6.3: Short-run Results First Difference

Variables	t-statistic	Probability
Constant	-1.117525	0.2758
Inflation	-2.123792	0.0452
Debt to assets	-2.835509	0.0096
Demographic	-3.005092	0.0065
Interest Payments to disposable income	2.411579	0.0247
Real estate price index	2.537653	0.0188

From these results it can be concluded that debt to disposable income is determined by debt to assets, the demographic variable and real estate price index in the short-run at a 1% significance level, and that debt to disposable income is determined by inflation and interest payments on a 5% significance level. The R^2 = 0.573684 is low and the Durbin-Watson = 1.740359 is high so there is no indication of a spurious regression.

7. Discussion

In this section I will discuss the results that I obtained through the different tests and how they fit the economic theory both in the short- and long-run. The purpose of this thesis was to see if I could find the underlying reasons for the high and increasing household debt to disposable income ratio in Sweden and what they were.

The first part of the econometric method was to see if the variables were stationary or non-stationary. I found that inflation was stationary which was expected[22] and that all other variables were non-stationary. To have non-stationary data means that the data has some kind of trend. Household debt to disposable income ratio and real estate price index both have an increasing trend while household interest payments, debt to assets and the demographic variable all have a decreasing trend, so the fact that these variables were non-stationary was not surprising.

The results indicate that there is no long-run co-integration between the household debt to disposable income ratio and the explanatory variables. The debt to disposable income ratio thus follows a random walk. This was very surprising since there theoretically should be some relationship between the dependent and some of the independent variables. It has been found that there is a relationship between debt to disposable income and interest rates and real estate prices in Australia[23], which is why the decreasing interest rate should increase the price of real estate and in turn should increase the debt level. This is what has been observed in the data used. Both interest payments and the real estate price index should be co-integrated with the debt to disposable income ratio but it was not. I did not expect the debt to assets, inflation or the demographic variable to be big determinants but I wanted to see if it affects the debt level. But, as already mentioned I found that there was no co-integration. The reasons that there was no co-integration could be because of the time period that was investigated was not long enough to find a long-run relationship. It could also be because of the economic shocks that have occurred in Sweden during this time period. There might have been too many or happened too frequently for the time series to return to its long-run trend, which consequently would give no co-integration when tested. Another possibility would be to investigate a shorter time period that excludes some of the economic shocks observed in the Swedish

[22] Basher, S. A. & Westerlund, J. (2006)
[23] Philbrick, P. & Gustafsson, L. (2010), p 55

economy. But this time period might be too short to reach a conclusion about the long-run relationship between the dependent and the independent variables.

In the short-run I found that the debt to disposable income ratio is determined by debt to assets, the demographic variable, real estate price index, inflation and interest payments. I was a little surprised by the fact that all the variables were determinants in the short-run. The fact that real estate price index and interest payments were determinants was not surprising since in theory these should be the most important variables. However what was surprising was the sign of the interest rate payments, which was positive. It would be expected that real estate prices determine how much debt needs to be accumulated to be able to buy a home and that interest payments measure the cost of accumulating debt respectively. But that higher interest payments would mean higher debt is very contradictory to what theory suggests.[24] For inflation to be co-integrated in the short-run was not that surprising because it is something that I expected to affect debt to disposable income. Since inflation affects the interest rate and as theory suggests lower inflation would mean lower interest rates, which would mean more debt. Therefore to have a negative sign for inflation was expected. That the demographic variable was a determinant was somewhat surprising since the percent of the population of the age group 25-34 years old has decreased. As the negative sign in the co-integration test suggests the lower the population of the age group of 25-34 the more debt to disposable income. Perhaps my assumption that this is the age group that accumulates the most debt was wrong. I could have included a wider age group, for instance the age group between 25-44 or perhaps the age group should have been older, for instance 35-44. That debt to assets was a determinant with the debt to disposable income was not so surprising due to the fact that I believe that people do not take on more debt than what their assets are worth.

[24] Debelle, G. (2004), p 59-60

8. Conclusion

From the conducted econometric test in this thesis I found that there in the long-run was no co-integration between the debt to disposable income ratio and the other variables. I could thus not find the underlying reasons for the increased debt to disposable income in the long-run, which was surprising. However, it showed that there was a short-run relationship between the debt to disposable income and all the variables. So are people's decisions to take on debt in the long-run not motivated by any of the variables that have been included in the thesis? Probably not! But there is no evidence to show the contrary for Sweden, from my investigation. Perhaps there were some variables that should have been included and some that should have been excluded in this thesis but this is something that could be investigated in the future. One example of a variable that could have been included is some kind of confidence indicator about the economy. Or maybe there should have been a longer time series, which could represent the development better.

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