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The nub of the household indebtedness, and its association to the housing market, from a Swedish point of view

An empirical investigation of the household indebtedness with a focus
on the housing market



LUND UNIVERSITY

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Abstract

The debt to disposable income ratio of Swedish households has the past thirty years increased radically and mortgages cover eighty percent of household's financial liabilities. According to the Life-cycle hypothesis, households maintain a steady consumption throughout their lifetime by accumulating mortgages in early ages with the aim to repay their debts when their economy becomes stronger as they become older. This paper aims to investigate what factors drive Swedish households to borrow and increase their debts and debt ratios, and whether the main impact on household debts is the house prices that have increased radically as well.

This is done by estimating several econometric regressions and analysing variables such as; housing price index (*HPI*), interest rate (*IR*), debt to assets (*DA*), and squared mean age (*AGE*²) to see how the variables affect the dependent variable - debt to disposable income (*DDI*). The results show that housing prices have a strong positive impact on the dependent variable in the long-run. In fact, all variables are significant in the long-run except for interest rate (*IR*) which is a short-run coefficient. Thus, affecting household debt and the housing market in the short-run.

Key words: Household debt, housing price, interest rate, debt to disposable income, debt to assets, demographics, debt ratio

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1. Introduction

In today's society, it is no longer an uncommon thing for households to have high debts. In fact, household's debt ratio has almost doubled since the mid-1990s and it keeps increasing even further which has led to both rising house prices and rising household debt (Andersson & Jonung 2016). This would not be a problem if household wages would increase at the same pace as the household debt ratio, but in this case wages remain unchanged while the debt ratio keeps increasing (Dagens industri, 2020). Furthermore, today's consumption behaviour of individuals aims to spend and consume more than one actually needs. Even more alarming is that most of the individuals do not actually afford such a lifestyle but, along with the increasingly easier access for loans, they accumulate more and more debt (Riksbanken, 2019). Consumption loans make up 18 percent of household debt, while the remaining part mostly consists of mortgages. A reason for the debt ratio having increased markedly is the low interest rates in Sweden. Even if the households can manage the amount of debt and a high debt ratio today, this might not be the case if the interest rates increase in the future.

Stefan Ingves, the governor of the Swedish Riksbank, argued in an interview that an increase in household debt is the biggest threat to the financial stability. The higher debt ratio a household has, the more sensitive it is considered to be against unexpected changes in the real economy. A negative economic shock that implies unemployment can as a consequence lead to loss of income that in turn results in even further problems. Households face economic difficulties and risks of being unable to pay their debts which leads to changed consumption behaviour in the meaning that households limit their consumption. If a majority of a country's population change their consumption behaviour due to economic difficulties, this can have major macroeconomic effects. Debelle (2004) discusses the macroeconomic implication of the increasing household debt and concludes that household indebtedness is not likely to be the source of a negative shock to the economy on its own but will amplify shocks coming from other sources. This would especially be the case for sources that affect household income such as increased unemployment.

Finocchiaro et al. (2011) states that the main reason to increased household debt in Sweden is the increase of mortgages that compose 80 percent of household debts. Dynan and Kohn (2007) also argue that demographics are important aspects when looking at debt ratios. The younger the households are, the more likely it is for them to have a high debt ratio due to that, in many cases, youths have gained student loans during their time when attending higher education. Furthermore, recent graduates expect to receive higher wages in the future which motivates them to borrow even more. Another argument for increased indebtedness is increased house prices, which forces households to borrow more so they can afford their estates.

According to the Swedish Financial Supervisory Authority, Sweden still faces a problem with new household borrowers taking on mortgages since their volume of debts exceeds either their assets, or in relation to the value of their estate. Furthermore, new mortgage borrowers from 2019 have increased the average debt ratio even further compared to earlier years (Finansinspektionen, 2020). On the other hand, the report reveals that new mortgage borrowers are in general better prepared to manage mortgage payments if they would face economic difficulties than what households were in 2018 (Finansinspektionen, 2018). However, even if households in 2020 are predicted to manage an increase in interest rates better than earlier years, the risk of not being able to manage mortgage payments during economic difficulties is still a majority among households with high debt ratio. (Finansinspektionen, 2020)

In order to analyse what causes Swedish households to increase their debts and debt ratio, one must include and consider several variables in the analysis. Having established the two-way interaction of housing prices and household debt, we decided to include studies examining the subject of house prices' effect on the economy in order to get the whole picture behind the driving factors of increased real estate prices. It has been an important subject to study since the development of the housing market affects the macroeconomy, the government budget and the financial stability of a country.

1.1 Research Question

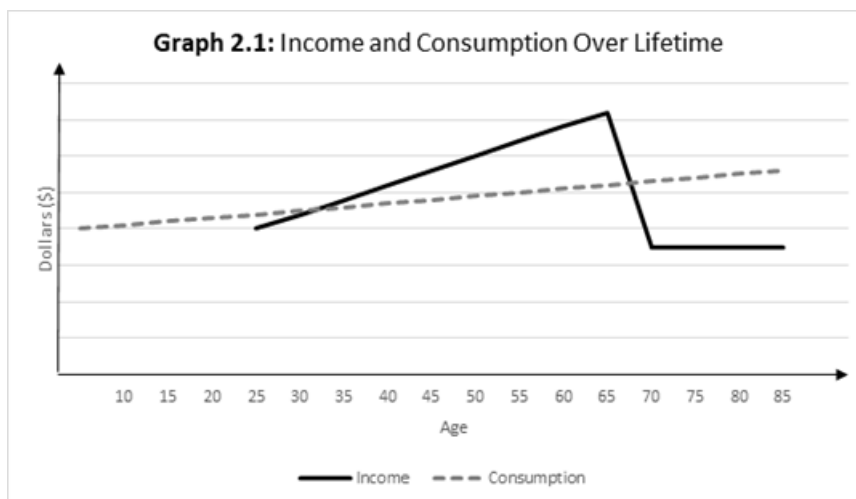
What factors impact the radical increase of the Swedish household debt? Is there a stronger correlation between the dependent variable and increased housing prices compared to the other variables?

2. Theoretical Framework

The purpose of this section is to identify what set of variables that may explain, theoretically, the increase in the household debt level. We will especially focus on how the housing market prices are related to the upsurge in leveraged households. The aim is to distinguish the various factors that could conceivably be relevant in explaining the development of household debt to disposable income in relation to the housing market. There are several driving forces behind household debt making it hard to acknowledge the actual cause, since a complex chain of events occur and reinforce themselves into a vicious circle. Thus, stressing the importance of this section.

2.1 Traditional theory

Modigliani's life cycle theory or Friedman's theory of permanent income are general frameworks commonly used to explain the relationship between variables when analysing household indebtedness (Finocchiaro *et al.*, 2011). The theories are based on the hypotheses that households seek to smooth their saving, borrowing and consumption over the course of a lifetime, which usually increase as one gets older (see Graph 2.1 down below). Individuals will allocate their money at a level consistent with their expected long-term average income and lifetime resources. Considering well-functioning financial markets, the aim of the households' is to smooth out consumption, even though incomes coming from wages and assets usually vary over the life cycle.



Source: Own illustrations

Keeping this in mind, one might find it helpful when searching for factors that affect household borrowing decisions and their ability to accumulate debt. However, the permanent income and life cycle model is, though a suitable foundation, only a simplified paradigm when it comes to evaluating the relationship between housing market prices and household debt. It is thus not uncommon to look at departures from that model to possibly find out why Swedish households do not necessarily find their optimal and most efficient borrowing levels and instead have a rising level of indebtedness. Potential factors behind household indebtedness and housing prices are most likely to influence one another, making it difficult to separate cause and effect. Decreasing housing prices generate a decline in consumption and growth. Yet, a decrease in spending and recession will stimulate decreasing housing prices as well. (Debelle, 2004)

2.2 General factors behind the housing prices and household debt

One may describe the factors driving household debt with a simplified version. To begin with, consumption is important for the overall economy. The demand drives the consumption of goods and services, and if something is demanded it is also needed to be supplied. This allows for employment opportunities for the working population. They earn the money and they spend it, keeping the economy alive. But most importantly - they invest. Investments ensure financial security and stable incomes. Financially secured households mean that less households rely on economic welfare which, as a matter of course, makes the government more financially stable too. Following these lines, investments are important for the economy at an individual level but also for the broader economy. Namely, because households place the money in financial institutions as they invest. This enhances production, employment, and the overall economic progress, generating a stable economic growth. (Claussen et al., 2011)

That being said, financial institutions rely on household investments and spending. The government or the central bank may lower interest rates in order to increase consumption and thus inject more money into the economy. On one hand, the low interest rates stimulate economic growth with the easier access to loans. Thus, financing investments in both physical and financial assets, but also driving debt. On the other hand, we have future income, demographics and uncertainty that also influence the household's level of borrowing. If an individual expects future income to rise, the expectations will drive

consumption up, boosting the level of debt. The income is closely related to age because income profiles tend to substantially vary with age, increasing as we age and then slowly starts to decrease as we retire. However, one cannot always rely on such expectations, hence the variable uncertainty. The degree of uncertainty may differ since it depends on a specific household's attitude towards risk. Households can choose precautionary measures and save instead of consume and borrow. If, for some reason, the uncertainty is reduced, the household will instead choose to reduce the precautionary measures, consume more and thus accumulate debt.

2.3 The real estate market and its impact on household debt

In more detail, there are certain variables that are important to shed light on when analysing the link between household debt and housing prices. Future household expectations on income, spending and saving, as well as age, are factors already mentioned above. Those are variables commonly used when explaining household debt, together with interest rates and the price of housing of course. Besides, households' economic situation is also affected by the amount and value of assets owned since it in turn influences the extent of debt the household might accumulate.

2.3.1 How do house prices influence household debt?

The increased housing prices have been the most significant driver of the rising indebtedness in Sweden, where house prices have more than doubled since the mid-2000s (Emanuelsson *et al.*, 2018; FI *et al.*, 2015). The demand for housing in Sweden has increased during a long period of time, increasing pressure on the housing market prices. The increased demand is argued to be driven by the so-called user cost, where Englund *et al.* (2015) state that the factor that has affected the user cost the most is the real interest rate after tax. The real interest rate on mortgages in Sweden has decreased tremendously since the mid-1990s. Furthermore, this has reduced the user cost which consequently has made it possible for households to afford buying more expensive homes, causing demand and prices to increase. Keeping all other components of the user cost constant, the decline in mortgages has still kept the user cost at the same level, due to the degree of the decline, despite the fact that housing prices and household indebtedness has increased. The fall in real interest rate is hence one of the main reasons why there has been an upsurge in housing prices in the last few decades. (Claussen *et al.*, 2011; FI *et al.*, 2015)

Housing purchases are largely financed by mortgages and this results in higher household debt. Moreover, since the mid-1990s, the pile of credits of Swedish households have been growing twice as fast as incomes resulting in both growing house prices and rising household debt (Andersson & Jonung, 2015). Along with the financial deregulations that took place in the mid-1980s in Sweden the granting of credits was untied from the real economic development, leading to a rapid and prolonged credit expansion among Swedish households. Andersson and Jonung (2015) state that after the deregulations, a clear long-term credit cycle developed in Sweden, where the amount of credit and property prices followed a similar pattern. Furthermore, a boom-bust pattern is reflected by the overheating in the Swedish economy in the late 1980s and the crisis in the early 1990s. Following this, the index for one- and two-dwelling houses for permanent living showed a rapid, and almost constant, upturn. Besides, clear declines are found after the burst of the dotcom bubble, as well as after the global financial crisis in 2008. As the authors analyse in what way the level of credit has affected real house prices, the results show that the growing credit stock has contributed to the increased housing prices. An indication, though weaker, is found that rising housing prices lead to a rising demand for credits. Andersson & Jonung (2015) argue that even though the upsurge of housing prices is not directly fueled by growing supply and easier access of credits, the availability of financial liabilities has contributed to a larger boost in house prices. At least increasing more than they would have done.

2.3.2 Supply and demand - what are the basics behind price movements?

Broadly speaking, a good or service has to be demanded and supplied in order for a price of it to arise. The size of the demand and supply determines the price of a certain commodity. The price is set where demand meets supply, forming an equilibrium. When either one of these parameters change, the price increases or decreases depending on the situation. (Lundmark, 2017)

In this case, the commodities of interest are houses. Demand and supply do not only differ depending on the commodity of interest but also the period of time. In more detail, the demand and supply, and thus the prices in a housing market, differ in the short- and long-run as well. When it comes to demand, housing is yielding utility and is a necessity in life for most households. Therefore, houses are durable goods that have a longer lifespan and one should be able to go by long periods between the purchases. The price

elasticity of demand for durable goods is generally more elastic in the short-run than in the long-run. For the housing market, this means that a home purchase is an asset for the household, expected to be used during a long period ahead of time.

Economic theory also tells us that in the short-run, the demand is the only thing driving house prices since the supply for the housing market in the short-run is not very responsive. The building and production of houses take time and cannot be done overnight. This implies that supply will stay constant in the short-run and that demand will be the only thing determining and setting prices in that period. In turn, factors driving demand will thus have an impact on house prices (Lundmark, 2017). The supply in the Swedish housing market has for a long period of time been limited. This has contributed to increased demand and a rise in housing prices. It is hence important to note that supply for housing is less elastic and that the prices are “sticky” in comparison to other markets in the economy. The increased prices have also increased the household's net wealth. However, this in combination with a high debt ratio can be problematic in the case of a price change. (Riksgälden, 2015)

2.4 Assumptions

With the information mentioned above one can conclude that it is indeed difficult to find the actual epicentrum of the growing debt and the increased housing prices. To discover whether the overindebtedness is driving housing prices, or vice versa, one can apply the two assumptions presented below. Both channels help explain how house price changes influence household debt, but with alternative starting points.

2.4.1 Assumption 1: Direct Wealth Effect

Assumption 1 implies that changes in the housing market influence household debt through a direct wealth effect. Simply put, unexpected increases in house prices make homeowners wealthier. This, in turn, can affect the marginal propensity to consume out of wealth, reflected by the borrowing responses (Case *et al.* 2013). The wealth effect works however in two ways. The effect varies depending on the age of the homeowner. Older homeowners might for example plan to downsize or exit the housing market when they retire. In this case, the growing house price trend would result in an increased net wealth. On the contrary, for a younger aged household, a wealth effect due to increasing

house prices will be offset. One can explain this with the housing needs being increasing, or at least constant, for the younger homeowners and their foreseeable future. This would imply a larger wealth effect for older homeowners and a smaller effect for the younger ones (Atalay *et al.* 2016).

2.4.2 Assumption 2: Indirect Collateral Effect

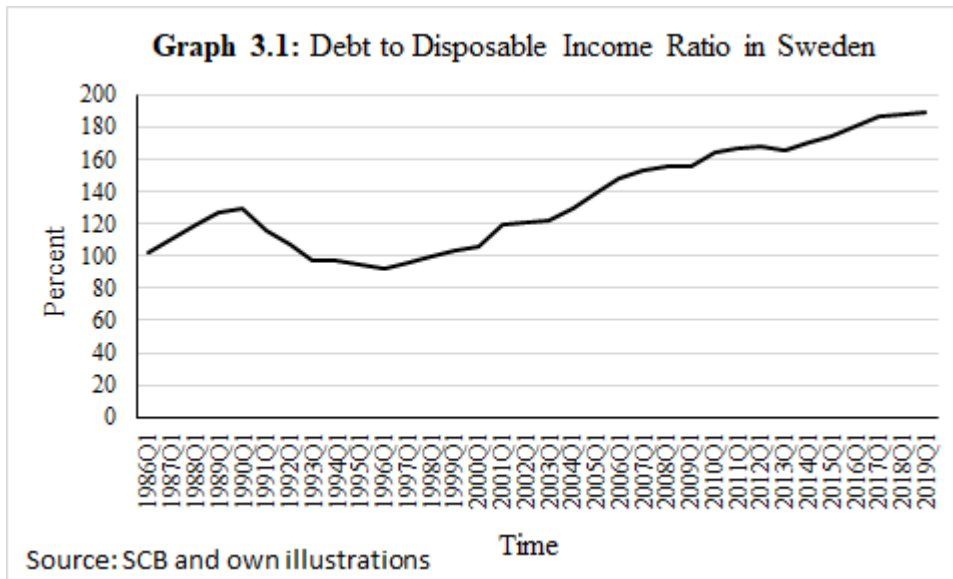
Assumption 2 implies that housing prices influence household debt through an indirect collateral effect via the household's borrowing capacity. Put differently, a rise in housing prices might increase the value of a household's property since housing wealth is the largest form of housing collateral. A household that faces borrowing constraints, prior to the price increase, will now be able to loosen their borrowing constraints. Simply due to the value of the property rising, and thus being able to serve as a security for a loan. A rise in house prices for high leveraged households is likely to relax collateral constraints to a wider extent than for lower leveraged households, due to the higher leveraged households being more collateral constrained. (Atalay *et al.* 2016; Aoki *et al.* 2004)

3. Background Information and Policy Actions

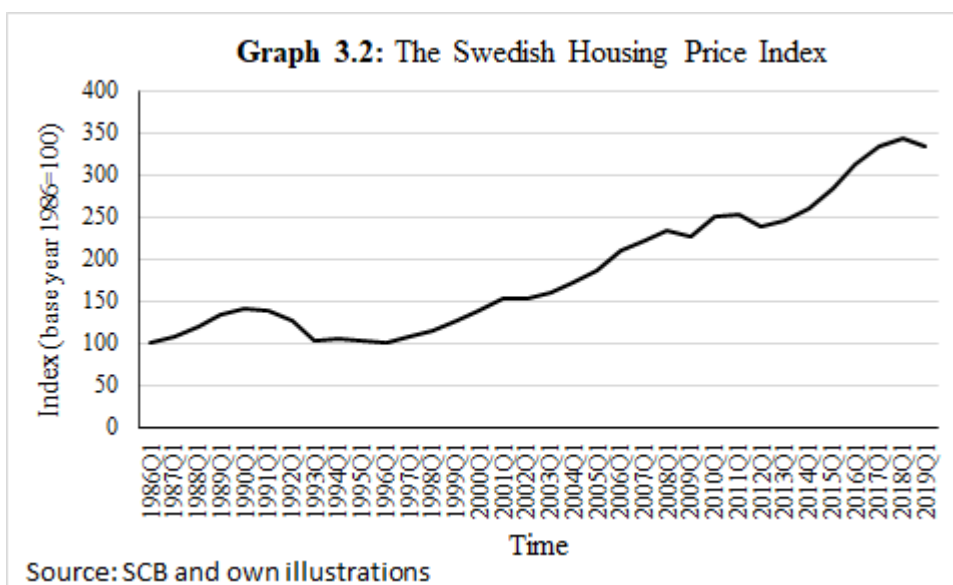
3.1 Historical events behind the Swedish debt ratio and housing prices

For the purpose of understanding the subject in hand it is necessary to get a grasp of the historical events and background information behind household indebtedness, housing prices and policy actions in Sweden. Even though it would have been desirable to observe trends further back in time than the mid-1980s, there is a reason for the data being chosen for this specific period.

Namely, the so-called November Revolution. It would turn out to have a profoundly large impact on the Swedish economy. During the 1970s and 1980s an increasing number of countries relaxed their financial market regulations as a result of the internalisation taking place at the time. Sweden did not follow immediately, but after a longer period of resistance the Riksbank started to dismantle regulations in 1985. What brought about this change was the new technology allowing for international transactions being conducted both faster and to a larger extent than what had been possible before. Broadly speaking, the Swedish economy was influenced by the rest of the world entitling ideas that markets should be free from regulations. Governments desired capital markets that were unregulated, however this came with a cost. Deregulation in combination with a favorable macroeconomic environment in general suddenly made the accumulation of debt to increase sharply in Sweden. The Riksbank tried to slow down the rapid development through a contractionary monetary policy, but unfortunately without any further results (The Riksbank, 2020). The rapid and sharp increase in debt to disposable income following the November Revolution in 1985 is visible in Graph 3.1 down below:



The debt ratio increased from 100 percent to 130 percent the following years after the deregulation. Independent of the interest rate level, the real cost of borrowing was at the time extremely low due to the high inflation in combination with the high interest deduction (Debelle, 2004). A growing number of borrowers and a growing amount of loans taken emerged from the optimistic Swedish households. The easier access for credits boosted consumption and the demand for housing flourished. However, the supply of housing fell behind. The outcome is visible in Graph 3.2 - housing prices grew tremendously.



It is inevitable not to mention the price development and supply of housing in the discussion about Swedish household indebtedness. From Graph 3.2 we can also see that housing prices have mainly experienced an upward trend which has recently accelerated even further. As previously mentioned, the supply of housing was not able to meet the increased demand and this has turned out to be the case during the past thirty years, since the deregulations. As households had easier access to credits, their net wealth increased. However, the debt ratio did too. It was not only problematic for the households but for the financial institutions as well. Liquidity problems started to arise within banks and so actions needed to be taken. An extensive tax reform was thus introduced in 1990. It included, among other things, a cutback of the interest deduction. Part of the motivation for the reduction was to promote savings and reduce borrowing (Government Offices of Sweden, 1997).

Households became more sensitive to changes in interest rates, as well as more cautious concerning decisions on whether or not to take on debt. The financial and economic situation in Sweden had taken a turn. Economic growth was no longer expanding but was instead replaced with an incoming recession during the first couple of years of the 1990s. The changes in behaviour of the Swedish households affected their consumption patterns and habits, leading to a decrease in consumption. In turn, aggregate demand fell causing the prices of the housing market to drop. In Graph 3.1 we can see that the recession led to a fall in the Swedish household's debt ratio, which reached the lowest value measured since 1987 (Wetterberg, 2018). The Financial Crisis in 2008 did too affect the Swedish economy, however not as much as the 1990s crisis. The drop in the debt ratio during the Financial Crisis is barely visible when compared to the drop taking place during the Swedish Financial Crisis. The crisis in 2008 was more extensive in a global and international perspective. A possible explanation behind how the Swedish economy managed to endure the Financial Crisis could partly be explained by the fact that the Riksbank carried out a cutback on the interest rate with 4.5 percentage points. The Swedish economy did indeed recover, and the low interest rate may have dampened the crisis. However, it still caused the debt ratio to continuously ascend, to today's just below 190 percent (Elmér, et al., 2012).

3.2 The Swedish Policy Actions

The Swedish government has taken various measures in the attempt to reduce the household indebtedness that is rising in Sweden. After the Global Financial Crisis, specifically in 2010 - the Financial Supervisory Authority (FI) introduced a limit on the loan-to-value ratios (LTV) of homes, a so-called mortgage cap. The mortgage cap in turn generated the loan-to-value ratios in Sweden to decline. A couple of years later, in 2016, yet another measure was taken. This time the Swedish government, together with FI, decided upon introducing regulations regarding amortisation requirements (Finansinspektionen, 2016). The new regulations entered into force on 1 June 2016.

Since buying a house is expensive for most individuals, it would take time before being able to buy a home if loans did not exist. Households would have to save the entire expense of a home in order to acquire it. The purpose of mortgages is for households to skip this step and be able to buy a home with borrowed money. Thus, mortgages serve an important function from an economic point of view as they enable households to obtain a house and use future income to pay off the debt. Though it may seem simple and beneficial for households it is nevertheless important to approach with caution. Household indebtedness is largely compromised by mortgages, creating a risk for the economy. From a global aspect, previous experience suggests that households with a high LTV are more likely to be sensitive to changes in events caused by economic shocks. This causes households to change their consumption habits, provoking economic downturns (Finansinspektionen, 2016). Economic shocks may include higher interest rates, falling house prices or loss of household income.

Consequently, the Swedish government and FI wanted to reduce such forthcoming risks as household indebtedness was escalating. They argued that the increased mortgage amortisation would ensure lower macroeconomic risks by making highly leveraged households reduce their leverage over time. The motivation behind this was the fact that the higher the leverage a household holds, the more sensitivity the household is towards economic implications (Finansinspektionen, 2016). Even stricter rules were introduced in 2017 regarding the amortisation requirements, especially aiming for highly leveraged households. The new tightened amortisation requirement would mean that households taking on new mortgages that exceed 4.5 times their net income should be forced to

repay an additional 1 percent of the debts in addition to the old amortisation requirement (Finansinspektionen, 2018).

Due to the high indebtedness of Swedish households, the discussion about the interest deduction in 1990 has once again become relevant. According to the Riksbank (2019), the development of the real interest rate in Sweden is largely due to the structural factors since monetary policy is only assumed to affect the real interest rate in the short-term. The expansionary monetary policy by the Swedish central bank has contributed to increased risks in the housing market through rising household debt. In order to restrain this from further developing monetary policies need to be taken, however, that would mean deviations from the inflation target. The inflation would thus be stuck at a level well below two percent.

To conclude, there is evidence that the undertaken policy measures have indeed worked towards reducing the household indebtedness in Sweden, at least when taking the short-term into consideration. However, there are still questions arising as several previous studies have established a two-way interaction behind variables affecting household indebtedness. Which is why this is an important subject to study since the development of the housing market, household debt and policy actions affect the macroeconomy, the government budget and the financial stability of a country.

4. Literature Review

It is difficult to distinguish whether house prices drive borrowing or if borrowing is driving house prices. Or perhaps there are other factors to take into consideration that might drive both? From previous studies on household debt and its driving factors, including house prices, we have learned that there is indeed a correlation between the two. Despite this, it does not imply a causal relationship between house prices and borrowing. Little is known about which one is causing the other (Cloyne *et al.* 2018).

However, numerous studies have been performed in an attempt to find the cause. Dynan and Kohn (2007) used macro data from the US and found a strong correlation between increased house prices and household debt during the 2000s. The authors suggest that demographics have contributed to a greater indebtedness and that debt use is higher partly due to an increase in educational attainment. They also find that a fall in longer-term interest rates, as well as, increased expected household incomes could have contributed to the increased debt. Financial innovation and housing prices have however boosted debt the most. Furthermore, there are several previous studies that have shown that there is a two-way connection between the housing market and mortgages (see for example Oikarinen (2009) and Anundsen & Jansen (2013), examining Finland and Norway respectively, as well as Disney *et al.* (2010) examining the housing market in the UK).

The two-way interaction between housing prices and credit, in the long-run, explains that increased housing prices lead to credit expansions which in turn increases pressure on prices of the housing market (Anundsen & Jansen 2013). The authors also find that interest rates influence housing prices indirectly through the credit channel. Similar studies have been conducted in Sweden where the above-mentioned relationship and corresponding results were found too. Turk (2015) uses a three-equation model that captures housing price, household debt and residential investment. The model aims to separate the properties of household debt and housing prices over the long-run and simultaneously enable the short-run dynamics to remain flexible for self-reinforcing effects. It is thus mortgages that affect house prices in the short term, however it is the housing prices in the long term that affect households' total debt (Turk, 2015).

According to the aforementioned studies, household debt depends, amongst other things, on housing prices, the real mortgage rate, real GDP, and housing supply.

When describing household debt, collateral value of housing and housing wealth seems to be of great importance too. The two studies by Oikarinen (2009) and Disney *et al.* (2010) find that household borrowing is affected by both a wealth effect and collateral constraints. Iacoviello (2004) studies the impact of a rise in housing wealth on the household borrowing capacity through the collateral effect. The collateral constraints on housing wealth create an asymmetry in the relationship between housing prices and economic activity. The asymmetry is described as follows - when housing wealth is high, the collateral constraints are relaxed. If this is the case, house price changes barely affect the sensitivity of borrowing and spending. On the contrary, it is found that when housing wealth is low, collateral constraints are tight. This leads to a borrowing and spending moving along with house price changes in a much more noticeable trend (Iacoviello, 2004). Taking wealth effect and collateral constraints into consideration, Oikarinen (2009) concludes that the two-way interaction between housing prices and housing loan stock is likely to increase the fragility of the financial sector. Furthermore, macroeconomic cycles are found to be affected by housing price movements, generating a positive impact on consumption loans.

Disney *et al.* (2010) finds similar results. However, the authors argue that the impact of housing prices on household indebtedness is greater for households which are borrowing-constrained by a lack of housing equity as collateral. Since these households tend to use unsecured debt to a greater extent, they are also more likely to refinance when the borrowing constraints are relaxed, due to a rise in house prices. As a result, they are also more likely to increase their indebtedness relative to unconstrained households.

Claussen *et al.* (2011) believes that the main reason for the price increase that has taken place in housing in Sweden since the 1990s has been mainly due to increased income, lower real interest rates and an increased preference for housing consumption. Based on previous research and studies, the authors conclude that households' financial liabilities also had an impact on price developments. The same goes for Bjellerup and Majtorp (2019) who analyse both the long-term and short-term trends in Swedish housing prices

in an attempt to explain the historical development and to make forecasts for future house prices. They make use of a supply and demand approach, concluding that both the increased supply of housing and the tightening of the amortization requirement had an impact in the price fall in 2017. Furthermore, the authors find yet another factor affecting house prices, namely household expectations.

Hofmann (2004) conducts a study with the aim of examining several driving factors behind bank credits. The study was conducted in 16 industrialized countries between the years of 1980 to 1998 and included bank loans, real GDP, a short-term real interest rate and house prices as variables. The real interest rate was added to the model acting as a measure of the cost of a loan. House prices were added as they were believed to explain household borrowing. Hofmann argued that borrowing should increase if house prices increase in order to maintain an even and balanced consumption. Increased house prices also stimulate the opportunities to borrow in such a way that household collateral, in many cases the house itself, increases in value. The regression was at first runned without including the variable house prices.

Hofmann was able to determine that real GDP and the real interest rate had no long-term effect on bank loans or household credit. However, when house prices were included in the analysis it could be established that GDP and house prices had a positive relationship with bank loans and that the real interest rate had a negative relationship with bank loans. Hofmann concluded that the results indicated that house prices play a central role in the way lending in the private sector looks like (Hofmann, 2004).

5. Empirical Analysis

The following part will present the methodology, which the empirical analysis is based upon. It will also include a description of the data and the variables chosen as well as the results. We will be dealing with time series data and run the regressions in the statistical program named Eviews. The aim is to examine why there is a growing household debt in Sweden and how it could be related to the increasing prices of the housing market. To achieve this we will test for unit roots and cointegration, along with deriving an error correction model (ECM).

5.1 Methodology

One of the important data used for empirical analysis is time series data, which will be used and explained in this part of the paper. Since we want to study and measure the correlation between different variables over time our data consists of a series of numerical data points indexed in time order, otherwise known as time series data. This sort of data allows us to measure how, for example, a pattern changing over time. Thus, time series data is collected at regular time intervals such as monthly or quarterly, as in this case. In spite of time series data being heavily used in econometric studies, the data is not always entirely accurate as it presents special problems for econometricians, namely non-stationarity. This means that the variables violate at least one out of three conditions of stationarity. The conditions are as follows: 1) the mean value must be constant over time, 2) the variance must be constant over time and 3) a constant autocorrelation structure over time. If two independent non-stationary variables are included in a regression model that is estimated with an OLS estimator they would not only generate misleading results but a spurious regression as well. To solve an issue of that kind, the majority of empirical work based on time series data will assume that the underlying time series is stationary. (Gujarati & Porter 2009)

There are methods to be used in order to measure the stability of the time series. When testing the data for stationarity, one can test for a unit root problem with, amongst others, the Augmented Dickey-Fuller (ADF) integration test. The ADF is an extended test that includes extra lagged terms of the dependent variables with the aim to eliminate autocorrelation, as the error term is unlikely to be white noise. The length of the extra

lagged terms is determined after each test as we check if the residuals of the ADF regression are autocorrelated. (Asteriou & Hall 2007, 295-297) The test can be done by deterministic components such as including an intercept, or an intercept with a trend or none of them.

If the data is non-stationary, it indicates that the data has a problem with unit root and is thus unstable. A problem with the ADF test is that it has a Dickey-Fuller distribution. This means that the t-statistics do not have the usual t-distribution with M degrees. There is a possibility that the R-square value and the t-value turn out to be high even though there is no long-run cointegration between the variables. If this is the case, there will be an indication of a small statistical value of the Durbin-Watson d statistic. Furthermore, a small Durbin-Watson value may be an indication of autocorrelation in the data which is another problem. (Hyndman. RJ & Athanasipoulos. G, 2018)

Variables with a unit root problem should not be included in the regressions because they could lead to misleading results and might therefore not be valid for forecasting and prediction. To solve the problem of non-stationarity one should apply the method of differencing. Furthermore, there exists another exception for when the OLS estimator is still consistent, though not efficient, even though the regression contains non-stationary variables. If a variable with a unit root problem is co-integrated, they have the same unit root or stochastic trends. This means that even if they do not follow each other in the short-run, there is a long-run cointegration since they are not independent of each other. If it would have turned out to be the case it would mean that the sets are cointegrated, which would imply that the regression analysis can be proceeded without generating spurious results (Westerlund, 2005). Another solution for the unit root problem is to detrend the data until it becomes stationary. However, the consequence of this is that there will only be a short-run correlation between the dependent variable and the independent variables. (Hyndman. RJ & Athanasipoulos. G, 2018)

5.2 Data - the regression model and the choice of variables

The regression data is collected on a quarterly basis, from the first quarter of 1986 until the fourth quarter in 2019. This gives us 136 observations, which should be sufficient enough to demonstrate the long-term equilibrium relationships. The data is collected

from the Financial Stability Report, where Statistics Sweden (SCB) and the Riksbank is responsible for the data sources (The Riksbank, 2019).

5.2.1 Our Regression Model

Five variables are chosen to be included in the data regression. The regression analysis will depart from the following model:

$$\begin{aligned}
 \text{Debt to Disposable Income}_t &= \alpha + \beta_1 \text{Debt to Assets}_1 + \beta_2 \text{Housing Price Index}_2 + \\
 &\beta_3 \text{Interest Rate}_3 + \beta_4 \text{Age}^2_4 + \delta_5 \text{DummyVariable Financial Crisis}_5 + \varepsilon_t \\
 &\text{(Simplified: } DDI_t = \{\alpha + \beta_1 DA_1 + \beta_2 HPI_2 + \beta_3 IR_3 + \beta_4 Age^2_4 + \delta_5 DVCrisis_5 + \varepsilon_t\})
 \end{aligned}
 \tag{5.2.1}$$

The dependent variable is debt to disposable income (*DDI*), followed by four independent variables. The first independent variable is the household debt to assets ratio (*DA*). It is included to see the value of the assets in relation to the amount of debt accumulated, and if there is any effect on the household's decision making regarding taking on more loans or not. The second independent variable is the logarithmic form of housing price index (*HPI*), where 1986 is the base year. The statistics present price level, price trends and turnover in the real estate market with a focus on one- or two-dwelling buildings for permanent living. The data is deflated with CPIF (CPI with fixed interest rate). *HPI* is included with the aim to see whether there is a correlation between the increase in household debt and the increase in housing prices, as well as the effect on wealth caused by a change in asset prices. The third independent variable is the interest rate (*IR*), included with the purpose to see the effect of individuals' propensity to lend as the interest rate changes over time. Since 80 percent of household debt consists of mortgages, it would have been desirable to use an average mortgage rate as a measure of household borrowing costs. However, we were not able to achieve this, as it has not been a requirement for the banks in Sweden to report the average mortgage rates for years earlier than 2015. We instead chose to include a t-bill (three months maturity), which was adjusted for inflation in order to get a real interest rate similar to the one Hoffman (2004) used in his model. Although statistics of the interest rate existed further back than 1986, it would not have been desirable to start the period before 1985 due to the regulated credit market that prevailed before November the same year. Lastly, the fourth independent variable is the squared mean of age (*AGE*²) which is included in the

regression to control for age as debt and income varies with this specific demographic variable. The variables are seasonally adjusted, as well as adjusted for inflation. Furthermore, we chose to include dummy variables (*DVCrisis*) for the years of 1992/1993 and 2008/2009 in order to control for the financial crises taking place at those points in time.

According to Hoffman (2004) we should not expect the housing prices and interest rates to have the same amount of effect on disposable income as on household debt. Hence, these variables should affect the debt ratio towards a similar direction as previous studies, i.e. house prices should have a positive impact on debt to disposable income and the interest rate a negative one.

6. Results

To test for non-stationarity, we conducted the Augmented Dickey-Fuller integration test (ADF) which was carried out on all variables included in the regression. Testing for non-stationary corresponds to testing for the existence of a unit root. The null hypothesis (H_0) is non-stationary which means that the series has a problem with unit root while the alternative hypothesis H_1 states that the series is stationary. The null hypothesis is rejected when the t-value is less than the test critical value. After running the test we failed to reject the null hypothesis. This indicated that none of our variables were stationary at level, with the exception for the variable AGE^2 , which was stationary at level using both trend and intercept. Moving on, we performed another ADF test but this time by first differencing and thus securing the second condition of cointegration. This time around we were able to reject the null hypothesis for all variables of order one - hence stationary. After performing the unit root test, we concluded that all variables (except for AGE^2) are stationary at 1% significance level except DDI which is stationary at 10% when integrated of order one (see **Appendix: 1. Unit Root Test ADF**). The results from the Augmented Dickey-Fuller test, testing for unit root, are presented down below:

Variables	Level	First Difference
Debt to disposable income	- (0.8820)	* (0.0630)
Debt to Assets	- (0.3870)	*** (0.0000)
HPI	- (0.9297)	*** (0.0045)
Interest Rate	- (0.6103)	*** (0.0000)
Age^2	** (0.0204)	

Table 1: Results from the Augmented Dickey-Fuller test for unit root

***, **, * reject the null hypothesis at 1%, 5% and 10% significance level respectively

MacKinnon (1996) one-sided p-values within parenthesis

We carried on with an Engle-Granger test to test for cointegration, consequently keeping in mind that we must treat the variables as non-stationary. The result showed us that all variables were significant except for *IR*. This would imply that all variables are long-run coefficients, except for *IR* which is a short-run coefficient. However, the R^2 -value turned out to be bigger than the Durbin-Watson value meaning that the regression is spurious (see **Appendix: 2. Engle-Granger**). However, if the residuals of the regression model are significant then it corrects the equilibrium of the system and thus, we can interpret the coefficients as we like.

In order to apply this approach and use this method to decide whether cointegration exists, we did yet another ADF integration test, but this time it was based on the residuals. After running the ADF test on the residuals we compared the t-statistic value with the Engle-Granger critical values, these are -3.34 at 5% significance level and -3.04 at 10% significance level. The t-statistic value of the residuals turned out to be 3.44 in absolute value (see **Appendix: 3. ADF on Residuals of EQ.1**), and thus bigger than the Engle-Granger critical value of 3.04 in absolute value at 5% significance level. We can thus reject the null hypothesis that the residuals have unit root. We can accept the alternative hypothesis, meaning that our residuals are stationary. This way we can tell that our estimated model (EQ.1) is not spurious. In turn, this indicates that cointegration is present. The results from the estimated regression (EQ.1) are presented down below:

Variables	Coefficients	Standard Errors
Debt to Assets	1.808***	(0.154)
HPI	0.755***	(0.030)
Interest Rate	-0.077	(0.238)
<i>Age</i> ²	0.06177**	(0.031)
Constant	-4.061368***	(0.402)
Observations: 136		
Determination coefficient, R^2 : 0.985		
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$		
Table 2: Estimated results from the regression model		

In a cointegration analysis, it is the cointegration parameter, i.e. the long-term equilibrium relationship, that is examined instead of the marginal effects. Since some of the variables in the regression model are logarithmic, the result will be interpreted as an elasticity. When housing prices increase by 1 percent, the debt to income ratio will increase by 0,75 percent, in the long-run. This implies that housing prices have a long-term effect on the household debt. Furthermore, the results show that the relationship between the real interest rate and the debt ratio is negative. Since the real interest rate is not logarithmic, the coefficient will be interpreted differently. If the real interest rate increases by one unit, the debt ratio will fall by approximately 8 percent in the long-run ($0.077 \times 100 = 7.7\%$). However, as mentioned earlier, all variables except for the real interest rate are significant meaning that the variable *IR* is a short-run coefficient. Thus, affecting household debt and the housing market in the short-run. Age and assets of the household turn out to have a positive relationship with the debt ratio in the long-run.

After having established that most of the variables have a long-run equilibrium relationship, and hence are cointegrated, we can proceed by running the Error Correction Model (ECM).

6.1 Our Error Correction Model:

$d(ddi) = c + d(\log_hpi) + d(da) + d(ir) + age^2 + dv_crisis + u(-1)$, where, $u(-1)$ is our error correction term.

We run the ECM in Eviews, and this time around our R^2 -value is less than the Durbin-Watson statistics (see **Appendix: 4. Error Correction Model**). This would indicate that our Error Correction Model is not a spurious model. However, one may not totally rely on this process. Therefore, we proceed by testing whether the residuals of the equation (EQ2) suffer from serial correlation, also known as autocorrelation. To do this we use the Breush-Godfrey test. We look at the observed R^2 -value and its corresponding p-value (see **Appendix: 5. Breush-Godfrey Serial Correlation LM Test**). Since the p-value is bigger than 5% we cannot reject the null hypothesis, meaning that the ECM is not serially correlated.

To further investigate whether the regression suffered from any problems we included a normal distribution test on the residuals. Unfortunately, we were not able to accept our null hypothesis. The H_0 tells us that the residuals are normally distributed since the p-value is less than 5% (see **Appendix: 6. Normal Distribution Test of Residuals**). This

means we have a problem because the residuals are not normally distributed, which is not desirable. In order to avoid such an issue, we would have to differently design our ECM so that the problems do not show up.

7. Discussion

The regressions are estimated in the attempt to understand which underlying variables that are driving household indebtedness. Moreover, if any of the variables is the main driver behind. Estimated results by Dynan and Kohn (2007) show that rising house prices can justify one fifth of the total increase in household debt. In other words, the housing market prices do in fact influence debt to a large extent. This goes hand in hand with the results in this thesis too, where the independent variable *HPI* has the most impact on our dependent variable. According to Dynan and Kohn (2007) changes in interest rates and preferences can only partially explain the run-up of debt while rising house prices are crucial.

Comparing this to earlier studies, several authors have come to similar conclusions. Hoffmann (2004), for example, argued that the main impact on the increase in household debt is that the housing prices have increased markedly the past 30 years. As it has become more expensive to buy real estate, many households are in need of taking more loans which leads to higher household debts. Furthermore, the results also show that other variables have an impact as well, such as demographics for example which is also argued in the study by Dynan and Kohn (2007). Demographics have an impact on the dependent variable since many youths educate themselves in early ages. Higher education might often imply study loans which cannot be repaid until after graduation. By the time the students have graduated and are ready to buy their first home, they already have debts which increase even more when they finance their first homes through mortgages.

In relation to the life-cycle hypothesis, our results show that the desire to have an even consumption over the lifetime is impacted by the distribution of demographics debt ratio which evens out later in life. This can be explained by the fact that people today enter the labour market later in life compared to earlier years due to that more people decide to attend higher education. As a result, this delays life-processes such as buying real estates and the increase in housing prices has made it possible for households to increase their mortgage on an already mortgaged asset. Furthermore, as mentioned in section 2, the life-cycle theory assumptions regarding real interest rate and household debts correspond to our results as well. This means that the real interest rate has a negative impact on a

household's debt ratio. Therefore, the life-cycle hypothesis is an important theory in order to understand human behaviour in relation to economic decisions and changes in society.

Housing purchases are largely financed by mortgages and this results in higher household debt. Moreover, since the mid-1990s, the pile of credits of Swedish households have been growing twice as fast as incomes resulting in both increased house prices and rising household debt (Andersson & Jonung, 2015). This leads us to another explanation to the increased debt ratio which is the value of the real estates. As the housing prices rise, the value of the real estate's increase as well. This argument is also strengthened by assumption 1: Direct wealth effect, that was mentioned in section 2. Assumption 1 implies that changes in the housing market influence household debt through a direct wealth effect. Simply put, unexpected increases in house prices make homeowners wealthier. This, in turn, can affect the marginal propensity to consume out of wealth, reflected by the borrowing responses (Case *et al.* 2013). As a result, the value of household's security for mortgage also increases leading to increased opportunities for borrowing. Furthermore, as mentioned earlier, there is a negative correlation between household debt ratio and the interest rate, meaning that the costs of borrowing decreases. As a result, incentives to borrow increase which in turn leads to higher household debts and debt ratio.

To slow down the rise of the debt ratio and prevent it from increasing, there are several actions that can be considered. One action is to implement reforms that forces individuals to behave in a certain way such as how the fiscal system is designed regarding house sales and purchases. Another action is a requirement for instalment that in turn leads to higher requirements for having mortgages granted. According to the Swedish Financial Supervisory Authority, the requirements for instalment have resulted in a reduction in mortgages and debt ratio since it limits the possibility to have mortgages granted. According to the theory of demand and supply, this should lead to a decrease in housing prices in the short-run. If the housing prices decrease, the result of this should be a decrease in debt ratio since the lower the price is, the less mortgage households are in need of. This corresponds to the second assumption discussed in section 2. Assumption 2 implies that housing prices influence household debt through an indirect collateral effect through households borrowing capacity. Put differently, a rise in housing prices might increase the value of a household's property since housing wealth is the largest form of housing collateral. A household that faces borrowing constraints, prior to the price

increase, will now be able to loosen their borrowing constraints. As a result, the less households need to borrow, the more the household debt ratio will decrease.

This is however a contributing factor behind households increased debt ratio since a removal of the instalment requirements would in the long-run lead to an increased demand for housing as the mortgage opportunities increase which in the long-run might lead to an increased supply. In turn resulting in a housing market where prices should adjust and come to an equilibrium. The problem with this is that a high debt ratio would remain since it increases as it becomes easier to borrow which is still detrimental to financial stability. (*Claussen et al. 2011*)

A solution to increased debt ratio could be an improvement in the rental market. By simplifying the possibility to rent a housing instead of buying it, this would reduce the pressure on the housing market and decrease the housing prices as well as the volume of mortgages. One way to do this is to review the fiscal system. The current fiscal system does not create incentives to change from a condominium to a rented housing due to capital gains tax. This may not reduce high debt ratios and indebtedness completely, but it would result in a decrease for both of them which would also reduce the threat to financial stability.

As mentioned before, our results show that there is a negative correlation between household debt ratio and the interest rate, meaning that the costs of borrowing decreases. Another solution to reduce the household debt ratio in relation to our results could be to increase the repo rate. An increased interest rate would lead to higher borrowing costs that in turn should result in reduced consumption for many households. The interest rates in Sweden have been low for a long period of time and many households have been taking advantage of it. Instead of saving their money for economically difficult times in case the interest rate would increase, many households have either consumed their money or invested their money by increasing their mortgages on their already mortgaged homes. As a result of expanding the interest rates, the borrowing opportunities would reduce as well, and more households would decrease their indebtedness and debt ratio.

8. Conclusion

The time series analysis our study is based upon confirms previous research and economic theory. After running several tests to see whether there is a correlation between the dependent variable *DDI* and the independent variables, with a main focus on the *HPI*, we found that there is indeed a correlation between the variables and that *HPI* has a strong correlation to the debt to disposable income. Besides, we know from previous literature and theory, that a low interest rate lowers the households borrowing costs. This in turn will make the households change their consumption behaviour and hence accumulate more and more debt. Thus, it was primarily housing market prices, as well as interest rates, that had the biggest impact on the Swedish's debt ratio during the past 30 years.

The assumptions presented in the theoretical framework are perhaps of most interest when it comes to future studies regarding this subject. The effects of wealth and collateral of the households are interesting since it touches upon the behaviour of individuals. The household debt ratio is, according to this theory, influenced by the marginal propensity to consume when individual households increase their wealth through indirect or direct effects.

Our aim and purpose of our thesis was to apply an econometric analysis and to empirically study the driving factors behind the increasing household debt to disposable income ratio in Sweden, with a focus on the housing market. The research question presented in the introduction was: "What factors impact the radical increase of the Swedish household debt? Is there a stronger correlation between the dependent variable and increased housing prices compared to the other variables?" We can conclude that we found that all factors influenced the debt ratio, some more than others. Especially housing prices. However, we can also conclude there is no simple, nor one single answer to why and how the debt ratio has increased this much during the last couple of decades. It is an incredibly complex subject that requires a great deal of attention. Our thesis is examining only a couple variables out of many that may possibly affect the household debt to disposable income ratio. It is therefore important for policy makers to concern issues that are of great macroeconomic implications, such as household debt

- and for those policies to be formulated as accurate as possible in order to either avoid or meet future economic crises with vast confidence.

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Appendix

1. Unit Root Test ADF

DDI LEVEL

Null Hypothesis: DDI has a unit root

Exogenous: Constant

Lag Length: 4 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.522767	0.8820
Test critical values:		
1% level	-3.480818	
5% level	-2.883579	
10% level	-2.578601	

*MacKinnon (1996) one-sided p-values.

DDI FIRST DIFFERENCE

Null Hypothesis: D(DDI) has a unit root

Exogenous: Constant

Lag Length: 3 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.786397	0.0630
Test critical values:		
1% level	-3.480818	
5% level	-2.883579	
10% level	-2.578601	

*MacKinnon (1996) one-sided p-values.

HPI LEVEL

Null Hypothesis: HPI has a unit root

Exogenous: Constant

Lag Length: 5 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.236051	0.9297
Test critical values:		
1% level	-3.481217	
5% level	-2.883753	
10% level	-2.578694	

*MacKinnon (1996) one-sided p-values.

HPI FIRST DIFFERENCE

Null Hypothesis: D(HPI) has a unit root

Exogenous: Constant

Lag Length: 4 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.741881	0.0045
Test critical values:		
1% level	-3.481217	
5% level	-2.883753	
10% level	-2.578694	

*MacKinnon (1996) one-sided p-values.

DA LEVEL

Null Hypothesis: DA has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.784179	0.3870
Test critical values:		
1% level	-3.479656	
5% level	-2.883073	
10% level	-2.578331	

*MacKinnon (1996) one-sided p-values.

DA FIRST DIFFERENCE

Null Hypothesis: D(DA) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.611032	0.0000
Test critical values:		
1% level	-3.479656	
5% level	-2.883073	
10% level	-2.578331	

*MacKinnon (1996) one-sided p-values.

IR LEVEL

Null Hypothesis: IR has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.338542	0.6103
Test critical values:		
1% level	-3.479281	
5% level	-2.882910	
10% level	-2.578244	

*MacKinnon (1996) one-sided p-values.

IR FIRST DIFFERENCE

Null Hypothesis: D(IR) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-10.69745	0.0000
Test critical values:		
1% level	-3.479656	
5% level	-2.883073	
10% level	-2.578331	

*MacKinnon (1996) one-sided p-values.

AGE LEVEL

Null Hypothesis: AGE has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 2 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.782816	0.0204
Test critical values:		
1% level	-4.028496	
5% level	-3.443961	
10% level	-3.146755	

*MacKinnon (1996) one-sided p-values.

2. Engle-Granger

EQ. 1

Dependent Variable: DDI

Method: Least Squares

Date: 06/29/20 Time: 13:06

Sample: 1986Q1 2019Q4

Included observations: 136

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.061368	0.402192	-0.101006	0.0000
HPI	0.752513	0.030217	0.249039	0.0000
DA	1.807628	0.153563	11.77123	0.0000
IR	-0.077370	0.238066	-0.324995	0.7457
AGE	0.061771	0.030841	2.002889	0.0473
DUMMY	-4.028963	1.102098	-3.655722	0.0004

R-squared	0.984795	Mean dependent var	136.3944
Adjusted R-squared	0.984210	S.D. dependent var	31.81487
S.E. of regression	3.997755	Akaike info criterion	5.652458
Sum squared resid	2077.665	Schwarz criterion	5.780957
Log likelihood	-378.3671	Hannan-Quinn criter.	5.704677
F-statistic	1683.983	Durbin-Watson stat	0.333212
Prob(F-statistic)	0.000000		

3. ADF on Residuals of EQ.1

Null Hypothesis: U has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.447643	0.0110
Test critical values:		
1% level	-3.479281	
5% level	-2.882910	
10% level	-2.578244	

*MacKinnon (1996) one-sided p-values.

4. Error Correction Model

EQ.2

Dependent Variable: D(DDI)

Method: Least Squares

Date: 06/29/20 Time: 13:55

Sample (adjusted): 1986Q2 2019Q4

Included observations: 135 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.795576	4.723735	-1.226905	0.2221
D(HPI)	0.404196	9.448087	4.276907	0.0000
D(DA)	1.081139	0.221709	4.876398	0.0000
D(IR)	-0.051020	0.225337	-0.226415	0.8212
AGE	0.003769	0.002894	1.302381	0.1951
DUMMY	-0.111269	0.576824	-0.192900	0.8473
U(-1)	-0.070047	0.047659	-1.469753	0.1441

R-squared	0.273374	Mean dependent var	0.645259
Adjusted R-squared	0.239313	S.D. dependent var	2.230290
S.E. of regression	1.945201	Akaike info criterion	4.219067
Sum squared resid	484.3272	Schwarz criterion	4.369711
Log likelihood	-277.7870	Hannan-Quinn criter.	4.280284
F-statistic	8.026090	Durbin-Watson stat	1.914934
Prob(F-statistic)	0.000000		

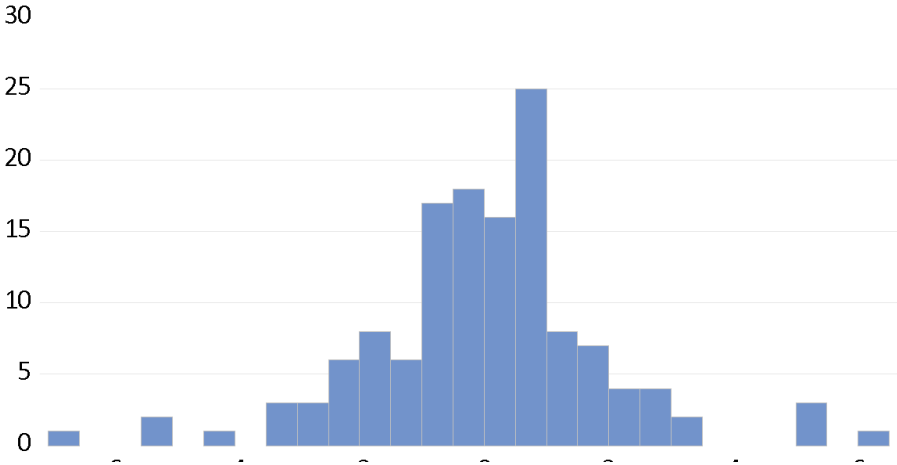
5. Breush-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.007501	Prob. F(2,126)	0.3681
Obs*R-squared	2.124949	Prob. Chi-Square(2)	0.3456

6. Normal Distribution Test of Residuals



Series: Residuals	
Sample 1986Q2 20:	
Observations 135	
Mean	-6.78
Median	0.08
Maximum	6.23
Minimum	-6.50
Std. Dev.	1.90
Skewness	0.02
Kurtosis	5.05
Jarque-Bera	23.7