



JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL
JÖNKÖPING UNIVERSITY

The small house market in the Stockholm region

A study of the impact of macroeconomic factors

Bachelor thesis within Economics

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Title: The House Market in Stockholm- A study of the impact of macro-economic factors

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Abstract

Buying a house is for most people the biggest investment they will ever make. A lot of factors are taken in to consideration when looking for the perfect house; location, size, what state it is in and so forth. But since most people's budgets are limited, the price is probably the most important aspect in the decision making process of buying a house. It is therefore highly interesting to note that since 1981, house prices in Sweden have increased with almost 400 percent.

This thesis examines the relationship between small house prices and macroeconomic factors in the Stockholm region during the period 1991 to 2007. By using macro economic theories complemented by data for all Stockholm's municipalities in a OLS regression, the thesis will explain how the variables affects the small house prices in a boom, recession and over time.

The results and analysis reveals that as house prices rises, people tend to increase their spending on interest costs and vice versa if the prices falls. Furthermore, results show that in a boom, an existence of speculation is contributing to the rise while convergence is an important factor in a recession. The most important conclusion from this thesis is the fact that the influence of macroeconomic variables on house prices differs significantly, depending on if the economy is in a recession or a boom. Finally, the influence on the economy that the house- and real estate market possesses cannot be underestimated with its important effect on the credit market, inflation and asset market.

Kandidatuppsats inom Nationalekonomi

Titel:	Stockholms hus marknad - en studie av makroekonomiska faktorer påverkan
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Sammanfattning

Husköp är för de flesta människor deras livs största investering och det är därför många faktorer som först måste vägas in varav den viktigaste förmodligen är priset. Huspriserna i Sverige har sedan 1981 nästan fyrdubblats, en utveckling som är mycket kraftigare än inflationen samma tid.

Den här kandidatuppsatsen avser att undersöka Stockholmregionens småhuspriser åren 1981-2007 och dess relation till makroekonomiska faktorer. Genom att använda en OLS regression med insamlad data för Stockholms alla kommuner och makroekonomiska teorier, visar vi hur utvalda makroekonomiska variabler påverkar småhuspriserna generellt, i hög- samt lågkonjunktur.

Resultat och analys visar att om småhuspriserna går upp är tenderar Stockholms befolkning att lägga en större del av deras inkomst på räntekostnader och tvärtom när priserna går ner. En psykologisk aspekt har en viktig del i dessa upp och nedgångar, i en uppgång startar en spekulationsperiod då människor vill vara en del ägandet i den uppåtgående husmarknad medans i en nergång skapas en sorts konvergens och en rad faktorer påverkar varandra i en spiralliknande nedåt trend. Denna trend kan förklaras i DiPasquales och Wheatons assets market model där det positiva förhållandet mellan marknader som hyresmarknaden, kreditmarknaden, byggmarknaden och tillgångsmarknaden står i fokus. Den viktigaste slutsatsen i uppsatsen är att makroekonomiska faktorer påverkar småhuspriserna helt olika beroende på om ekonomin är i en hög eller lågkonjunktur. Slutligen bör nämnas hur viktigt hus- och fastighetsmarknaden är för en ekonomi genom dess påverkan på kreditmarknaden och inflationen.

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1 Introduction

Buying a house is for most people the biggest investment they will ever make. A lot of factors are taken in to consideration when looking for the perfect house; location, size, what state it is in and so forth. But since most people's budgets are limited, the price is probably the most important aspect in the decision making process of buying a house. It is therefore highly interesting to note that since 1981, house prices in Sweden have increased with almost 400 percent (see graph 6).

The run up in house prices is not unique for Sweden. In recent decades house prices have risen faster than growth in many countries. (Persson, 2005)

The house market is today a highly debated subject in all sorts of media due to the effects of the sub-prime mortgage crisis in the U.S. The financial markets all over the world are deeply affected, and Sweden is not an exception. There has been a large fall on the Swedish stock market due to these events and we can already see a trend in house prices falling. Göran Lind, advisor for the Swedish central bank describes the situation as the first global financial crisis ever. He compares this crisis with the Swedish real estate crisis in the beginning of 1990 when lenders based the loans on the value of the real estate rather than the borrower's ability to pay back the loan. He also states that, through the years, most of the economic crisis around the world has arisen from a real estate bubble. (Dagens Nyheter, 2008)

The purpose of this thesis is to analyze the relationship between previous mentioned house price fluctuations and macroeconomic variables.

We will try to answer the question;

To what extent are house prices in Stockholm determined by macroeconomic variables such as interest rate, income, demography, location, employment and number of newly developed houses, and to what extent are they affected by the state of the economy?

It focuses on the interest cost but also highlights other influential factors so that a comprehensive picture can be drawn. Other explanatory variables we will include are: employment, business cycle fluctuation, net migration and the stock of houses.

We will, with the help of a regression and graphs, try to analyse what factors that have been influential and what factors that have not. With the regression we will also try to catch the effect on house prices when the economy is in a recession and when it is in a boom.

The methodology employed is a standard OLS regression followed by an analysis. To limit the scope of research the thesis only concern one- and two dwelling houses during a specific time period of 1991-2007. The time period chosen covers some significant rises and falls in house prices such as the real estate bubble and the removal of the favourable tax deduction policies. We have limited the area investigated to the twenty five municipalities in Stockholm¹.

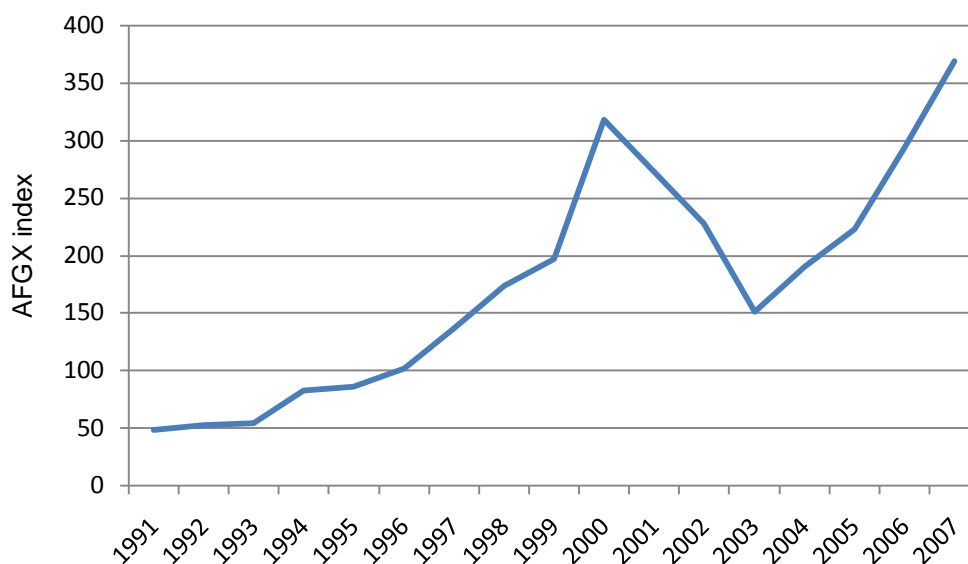
The paper is structured as following; Chapter 1 gives a short description of the Swedish economy and presents some major policy decisions affecting the house market during the chosen period. Chapter 2 presents a brief overview of what research that has been done about house prices. It also provides some theories and discusses which macroeconomic variables are the most influential when explaining house prices. Chapter 3 describes the variables, how the data has been collected and the method used in our study. Chapter 4 provides the results from the regression and an analysis of the results. Chapter 5 summarises the main conclusions and chapter 6 gives some suggestions for further research.

Some additional information can be found in the appendices.

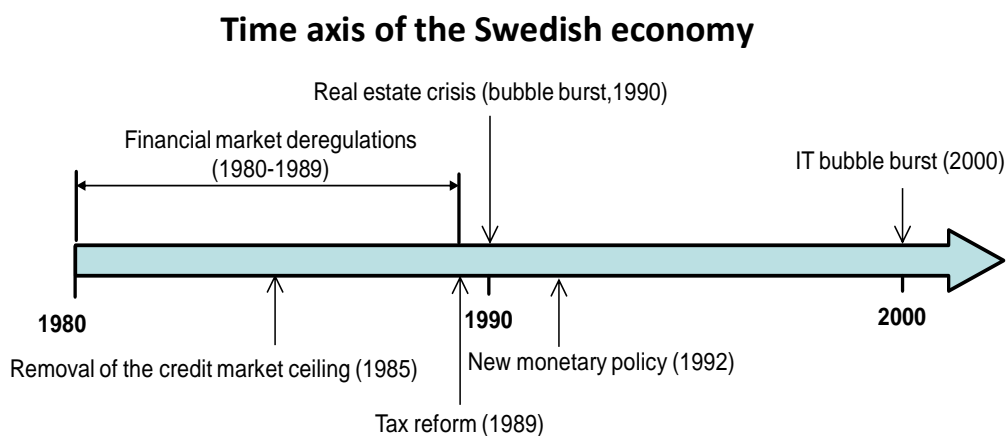
¹ Municipalities within Stockholm County; Upplands Väsby, Vallentuna, Österåker, Värmdö, Järfälla, Ekerö, Huddinge, Botkyrka, Salem, Haninge, Tyresö, Upplands-Bro, Täby, Danderyd, Sollentuna, Stockholm, Södertälje, Nacka, Sundbyberg, Solna, Lidingö, Vaxholm, Norrtälje, Sigtuna and Nynäshamn. Heby is excluded due to the fact that it changed from being a part of Stockholm region to Uppsala region during the chosen period.

1.1 Swedish Economy

This chapter will highlight some important events taking place that affected the Swedish economy, and more importantly, affected the house prices. The first graph shows the financial economy's development which is a rather good indicator for the Swedish economy in total. Graph two is a time axis with the major events and policy changes affecting the house market.



Graph 1, Affärsvärldens General Index (Source: Affärsvärlden)



Graph 2, Time axis over important events in the Swedish economy

When summarising the Swedish economic development from a real estate point of view during the period, the first that comes to mind is the Swedish housing bubble that kept growing until it finally burst 1990. Behind the bubble lied, according to Jaffee (1994), several factors such as: real estate subsidies, tax deduction legislation, removal of the mortgage ceiling, deregulation of the financial market, low interest rates.

During the first half of the 1980's, Swedish economy worsened due to lower productivity, low GDP growth, growing budget deficit and negative imbalances in the net export. During this period of harsh economical conditions, the Swedish crown experienced a devaluation that improved the economical climate in which many corporations survived. Export increased while import decreased. (Giertz, 2008)

Deregulations of the financial market

During the 80's, the Swedish financial market was gradually deregulated, a decision that was in line the development for international financial markets with new liberal, deregulated and more competitive conditions as result. This led to significant changes for the banks that now could solely form their own strategies for volume, pricing and positioning (Frisell, L and Noréus, M, 2002.)

The goal that many advocators of the new policy such as Erik Åsbrink and Michael Sohlman, claimed we would achieve was a growth supported market (Nilsson, 2008.) A part of these financial deregulations was deregulations of the credit market, described below.

Deregulations of the credit market

The economy recovered in the middle of the 80's thanks to decreasing real interest rates. This development had it explanations in higher inflation and lower nominal interest rates. Moreover, the political decision in 1985, to remove all regulations in the credit market including the lending ceiling made it possible for people and companies to get larger loans at this lower interest. Most of the new real estate investments were in the office market in which the value of buildings and rents increased significantly.(Jaffee, 1994)

From 1985 to 1986, Stadshypotek's real estate lending increased from 5 Billion to 30 Billion crowns, a development that was similar to the rest of the market (Wohlin, 1998)

With the financial market situation that became internationalised, politicians had no choice but to make deregulations (Schön, 2007).

Tax reform

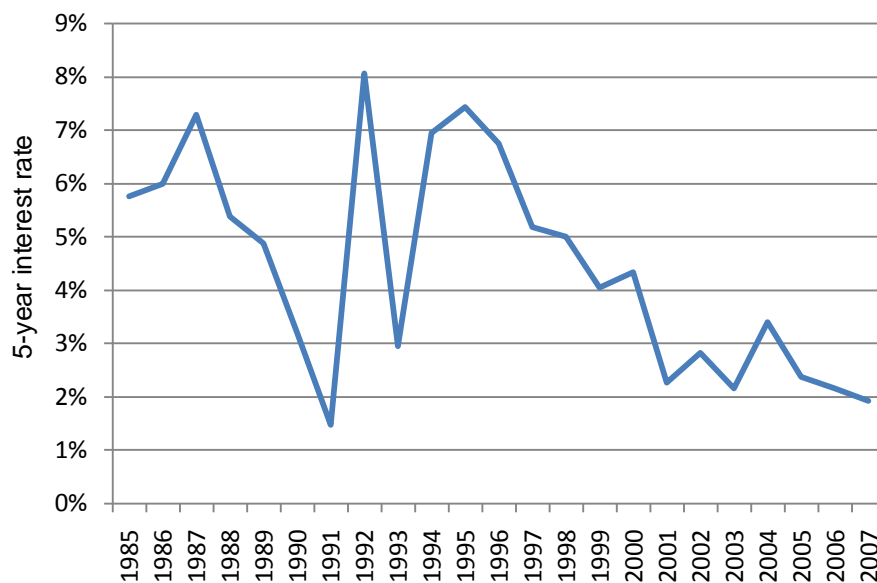
The tax legislation which had been generous was gradually tightened during the 90's and it became less profitable to own real estate. Earlier, it had been advantageous to own real estate due to a tax deduction that made it possible for investors to almost borrow at no real interest cost.

Deregulations of subsidies

Around 1990, the market expected a decrease of real estate subsidies which led to an incentive to build even more before the actual decrease would take place (Jaffee, 1994.) The decrease in real estate subsidies also came with the tax reform. In addition, the VAT (value added tax) for building real estates was increased from 13% to 25%. These two changes led to as mentioned above, a decrease in incentive to build new real estate. It also became more expensive to own real estate and the demand for houses decreased. (Srejber, 2001)

Real estate crisis

The fact that the credit/GDP ratio increased made the situation unsustainable in the early 90's. With rising interest rates, real estate prices plunged; many people could not pay their mortgages and Sweden experienced a deep recession with a rapidly increasing unemployment. (Jafee 1994)



Graph 3, 5-year interest rate (Source: SCB)

1995, Sweden joined the European Union and a new market conditions were on its way to take form. With the globalisation that still today is growing came more competition and at the same several deregulations happened in Sweden. The politicians realised during the 90's that a new focus on economic growth was necessary, earlier the biggest industrial companies were seen as crucial for Sweden's GDP but now the spotlight moved more towards medium or small regional entrepreneurial companies. (Giertz, 2008)

New monetary policy

In the end of the 80's, the economic situation in Sweden reached a point when it was unsustainable to continue the previous monetary policy. After several devaluations, everyone was expecting the crown to undergo another one as the prices and salaries were to continue increasing at the fast rate. During a time of lacking incentive to hold down the prices and salaries, a speculation against the crown started which finally led to heavy increases of the interest rate as a defense. However, the rise was not sufficient and Sweden had no other choice but to let the crown float in the autumn 1992. Science and experience within the field showed that a long term and solid monetary policy should be obtained by keeping the inflation low and having responsible government finances. (Rosenberg, 2007)

The Swedish government decided it was necessary to form a new monetary policy, built on these two goals. An inflation target was set to 2% but since it is a hard task to keep it at exactly one level, a (+/-) 1% was set as a tolerant spread. However, the central bank sometimes has to overlook the inflation rate if they consider other factors as more important, often the unemployment rate. Then a target is instead set at when they should reach the inflation goal again. The Central bank calls this a flexible inflation focused policy. (Rosenberg, 2007)

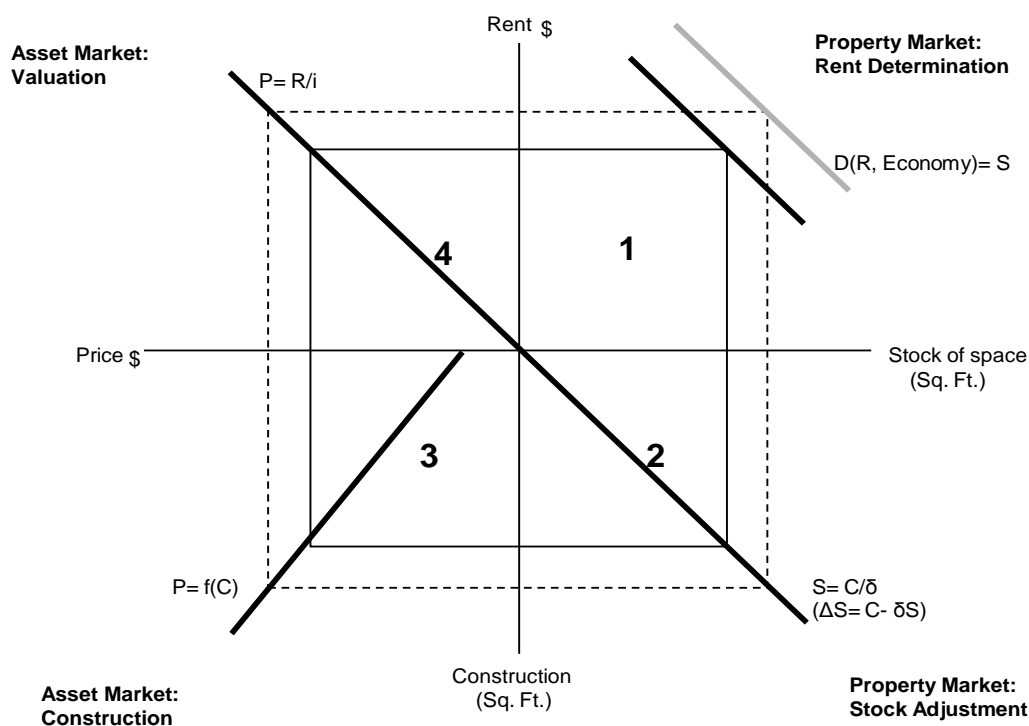
The previous described development is similar to the ones in many other countries, all a necessary change of path to adapt to deregulations in the international financial market. In the end of the 90's, possibilities in the new information technologies caught the politicians' attention that changed policy to stimulate this new growth. (Bergström 1999)

The IT bubble

The IT sector was growing extraordinary in the whole west of the world and at last, the bubble that many critics predicted would not hold burst at the end of 1999/beginning of 2000. This bubble was built on the new standard way of valuating a company from a growth, expansion and expected future profit perspective and not from realistic aspects as present and real data such as cash flows and profits today. Sweden was of course affected by other countries but was also set back by the domestic IT crash and experienced a recession. Since 2001, the Swedish economy has stabilized and had an upswing the rest of the chosen period. (Johansson-Stenman, 2002).

2 Theory and Previous studies

DiPasquale and Wheaton (1996) discusses the link between the property- and asset market. House prices are determined in the asset market hence the demand for houses must equal the supply. If the supply would decrease, prices would go up and vice versa. Another aspect influencing the demand for housing is the rent of space, property market. For house owners the rent is referred to the *use* of the property i.e. the annual share of income that is spent on ownership of the property. When the number of households increases, demand rises and with fixed supply, rents will rise as well. The asset market links with the property market in two aspects. First, rent levels determined in the property market are strongly correlated with demand in the asset market. The second link is through the construction and development sector. If more houses are built, prices will be driven down in the asset market and rents will decline in the property market. An illustration of the model is shown in this four-quadrant diagram.



Graph 4, Property and assets market (Source: DiPasquale and Wheaton, 1996)

The left hand side's two quadrants represents the asset market and ownership of houses, the quadrants on the right hand side are representing the property market for the use of space. When the combined property market and asset market are in equilibrium, the starting and ending levels of stock are the same. Quadrant number one shows the relationship between rent cost and space. Demand is a function of rent and conditions in the economy. In equilibrium, rent must be determined so that demand is exactly equal to stock ($D(R, \text{Economy}) = S$). Quadrant number two shows the annual flow of new construction. Change in stock is equal to new construction minus depreciation (removal) of stock ($\Delta S = C - \delta S$). When depreciation equals new construction, stock of space is constant ($S = C / \delta$). In quadrant three, the creation of new assets is determined. The curve $P = f(C)$ represents asset price equal to replacement cost of new buildings. If new construction is below equilibrium it would lead to excess profits whereas a level above would be unprofitable. Finally, quadrant four represents the rent-to-price ratio. The capitalization rate (i) is the current yield of holding real estate assets and is primarily based on the long-term interest rate, expected growth in rents, risk associated with rental income stream, and level of real estate taxes.

Suppose that the economy would expand and the rent-stock curve would shift out (grey line). In order to meet this new demand for space, new construction will take place. The new construction generate asset prices to go up which is translated in to higher rents. The new market equilibrium is now the dashed line outside the original equilibrium.

2.1 Monetary policies, expectations and speculative behaviour

To what extent monetary policies have an impact on asset prices has been widely discussed. The Swedish central bank sets the instrumental interest rate, the repo rate. The central bank is working independently from the government and its main objective is to keep the inflation stable at approximately 2 %. According to Persson (2005), when making monetary decision, it is taken into consideration how debt and house prices will affect demand and inflation. When the central bank changes the repo rate it has a direct effect on the short term interest rate. How much it is affecting house prices are highly uncertain but since buying a house is a long term investment their reasoning is that it should only have a marginal influence of people's willingness to buy houses.

Another important aspect with the repo rate is that it influences ability to lend and the level of the interest rate set by the commercial banks and mortgage loan issuers and consequently affecting house prices. The central bank believes that fundamental factors such as income, interest rates and construction of new houses explain the development of house prices. Further they think that speculative behaviour has a rather small impact In Sweden. In difference to many other countries, people in Sweden buy houses to actually live in and not to sell them one year later to make a profit.

Iacoviello (2005) studies the interaction between house prices and the business cycle and whether or not the central bank should respond to fluctuations in asset prices. He concludes that responding to changes in asset prices does not yield any significant gains in stabilizing inflation rate or welfare gains. This theory supports the one of Bernanke and Gertler (2001) who claims that the central bank should not respond to asset prices.

It is important to distinguish market bubbles from fundamental-driven price changes when investigating market behaviour, Abraham and Hendershott (1996). When appreciating house price changes two factor are of importance; first are fundamentals such as real income, construction costs and after-tax interest rates explaining changes in the equilibrium price. Second is forecasts of initial gaps between actual- and equilibrium prices. The latter is referred to the gap arising when houses are overvalued (above equilibrium price) or undervalued (below equilibrium price). Himmelberg et al. (2005) also discusses how one tells if rapid growth of house prices is caused by macroeconomic factors or if it is due to speculative behavior leading to an unsustainable house bubble. It is stated that house bubbles arise when house buyers are willing to pay inflated prices today because they believe their house will appreciate even more in the future. Hort (1998) states that speculative behaviour by economic actors may have an impact on fluctuations in short-term house prices, but one should be careful referring to it without any qualitative survey data.

The results of the previous studies indicate that movements in house prices can mainly be explained by three different aspects; Changes in macroeconomic variables, monetary policies and speculative behaviour. Which macroeconomic variables proven to be the most influential is somewhat unclear but what we can expect is that interest rate and inflation have a negative relationship to house prices and a positive relationship to house rents, income and the stock market. With a regression later in the paper, we intend to show which variables are most influential and possibly rule out those who shows no relationship.

2.2 Previous studies

According to Hort (1998), movements in income, user costs (including property tax, interest rate and inflation) and construction costs were found to have a significant long-run effect on house prices in Sweden. She uses a restricted error correction model with a two-step procedure. In the first step, long-run equilibrium is estimated with an OLS regression. In the second step the short-run dynamics are explored including the residuals from the first step.

Iacoviello (2000) has studied the main macro economic factors behind fluctuations in house prices in six European countries; France, Spain, Italy, Germany, UK and Sweden. He has used a structural vector autoregressive (SVAR) approach to find how house prices respond to the main shocks behind economic fluctuations. Quarterly time series data for GDP, house prices, inflation and interest rates are used to see how they react to supply, demand and monetary and inflation shocks. A SVAR analysis describes the evolution of a number of variables over a time period with uncorrelated structural shocks. The results from the analysis is that adverse monetary shocks generally have a negative impact on house prices and that demand and monetary shocks play an important role in driving house price fluctuations over the short run.

Girouard and Blöndal (2001), claim that the movements in real house prices are strongly correlated with the business cycle. However, the annual growth in house prices have varied considerably among different OECD countries; Sweden is among those who have increased the least. Further he discusses the impact of the cost of constructing additional units, the so called Tobin's q . If the cost of building a new house is below market price of already existing houses, it is more profitable for consumers to build a new house and later sell them at market price. Tobin's q is calculated as house prices divided by construction cost. In long-run equilibrium, the ratio between them should be equal to one.

The Central bank (2005) explains, with the help of a regression model, how a number of explanatory variables have contributed to the development of the Swedish house prices. The model shows that the low interest rate, low construction activity and increasing disposable income have been the main contributing factors to the price development.

They also discuss how rents can be a good comparative measurement to tell us how reasonable the price development of houses has been. If houses were correctly valued they should follow the same track as rents. However, in Sweden where the rental market is regulated it is not a relevant measurement.

The article highlights another interesting aspect that may have positively influenced the mortgage market; improvements in information technology. Internet, improvements in data- and statistical computation programs and financial innovations are just some examples of the improvements. These more advanced tools have created higher efficiency and together with more competition, it has helped to squeeze the credit institutions into better mortgage rates.

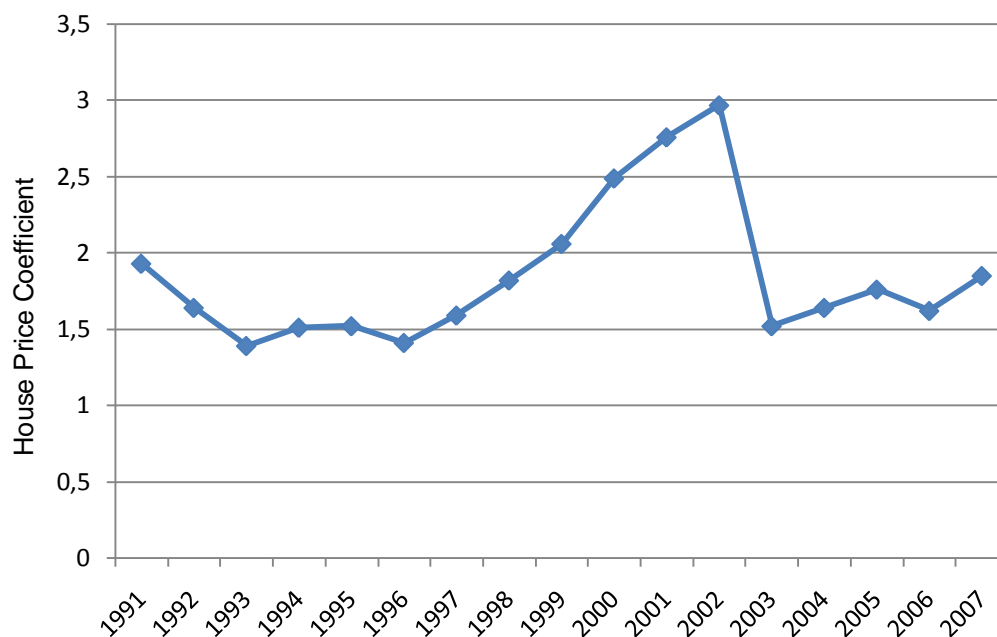
Gregory D Sutton (2002) has made a study of house price fluctuations in six advanced economies; the United States, Australia, the United Kingdom, Canada, Ireland and the Netherlands. The results emerging from the analysis was that shocks to national income, stock market and interest rates have had a large impact on the recent house price gains. Other variables also included in the analysis were household income and wealth since they are positively related to the demand for housing.

Himmelberg et al. (2005) claim that when comparing house prices over a time period one cannot compare the real house prices as the annual cost of owning. Instead there are five factors one should take in consideration when calculating annual home ownership, also called "imputed rent". The six components are; the foregone interest rate the home owner could have got if he/she invested the money in something else instead, the cost of one-year property tax, tax benefits from owner-occupancy, maintenance costs, anticipated gains from owning the house and the additional risk of buying instead of renting a home. In equilibrium, the expected annual cost of owning a house should not exceed the annual cost of renting. If it does exceed annual cost of renting it could be a sign of an overvalued house market.

Mikhed and Zemčík (2007) used a cointegration procedure with panel data when testing if the previous years' fast rise in house prices in the U.S. were due to changes in fundamental variables. The fundamentals used in the test were house rent, personal income, interest rate, population, building costs, CPI and stock market wealth.

The results showed that house rent were the only fundamental that could potentially be cointegrated with house prices. Since the other variables were not reflecting the house prices the conclusion was drawn that a house bubble existed in the U.S. Gallin (2006) uses a similar method and finds no co integration when testing the relationship of per capita income and house prices. He argues that using standard tests for cointegration have low power, especially in low samples, and that panel data is therefore better suited since the tests are more powerful.

3 Data and Empirical method



Graph 5, House price coefficient (House price as a share of taxation value, Source: SCB)

Stockholm is divided into 25 municipalities. The data used for house prices, income, births, deaths, net migration, employment, house stock and distance from the city are all collected on a municipality level.

Interest rate and CPI do not change between regions hence, are collected on a national level. The time period chosen includes seventeen years, 1991-2007 which we divided into smaller periods according to how the house price coefficient graph fluctuates (graph 5). The house price coefficient is calculated as house price divided by taxation cost.

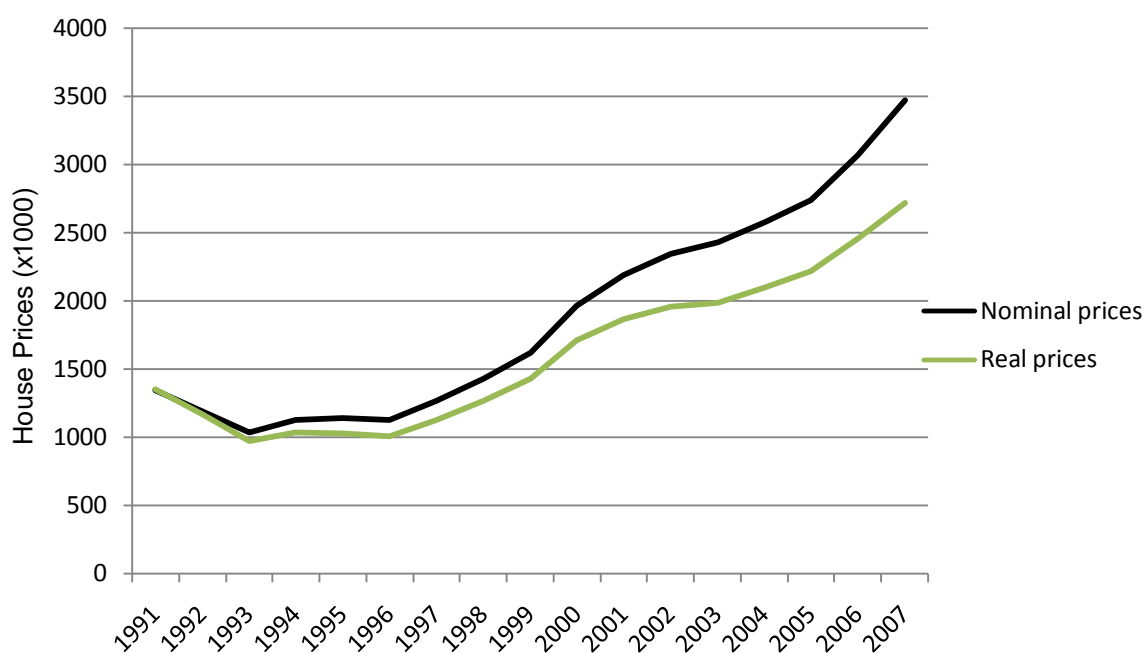
Periods -91 to -93 and -02 to -03 had large downfalls in the price coefficient while periods -96 to -02 and -03 to -07 the coefficient where increasing. The period in between, -93 to -96, the level of the coefficient was almost constant. By dividing it this way we hope to find some patterns in the variables' explanatory power, that we would not have done otherwise. To observe the change in each period and variable, a differential equation is made between the first and the last year. The result is the percentage of how each variable has changed during the period.

3.1 Description of variables and data collection

Regression Variables

House prices

The data for house prices are collected from *Statistics Sweden (SCB)*. It has been collected for every municipality and year individually. The statistics regards all, privately owned, small houses within the municipality that has been sold during the year in question. An average price has been calculated for each year. The data does not take factors such as building year, condition or location in to consideration but clearly indicate the price level development between years and municipalities. The houses are defined as one-and two dwelling buildings.



Graph 6, House prices in Stockholm region (Source SCB)

Interest cost

This variable shows inhabitants willingness to invest in houses relative to their income. The variable is the share of income people spend on interest costs for a house. By including this factor, we hope to draw conclusions about how the willingness in the market affects the house prices and vice versa. Remember though, that this variable is calculated per person and house owners usually are two adults with one income each.

Since one- and two dwelling houses often are regarded as a significant and long term investment we have chosen to use 5-year rate and not any shorter rate. The 5 year bond will in this paper be referred to as the “long” rate. The data has been retrieved from The Swedish Central bank.

Employment

The people are sorted by where they live and not by where their workplace is situated and includes all labour force between the ages of twenty to sixty-four. The data is collected by SCB. The method of collecting the data has been modified twice during our time period; -93 and -03. These adjustments may affect the result slightly and should be taken in to consideration but the data is still credible enough to include in the regression. Employment is an important factor since it is an indicator of the state of the market.

Net Migration

Since statistics in solely migration between municipalities has not been collected we solved it by taking population for each municipality and adjusted the data for deaths and births. The result is migration minus emigration and this is the number used. The data gives us a measure of how popular each municipality are and thereby were we can expect higher house prices. The data for population, deaths and births were found on SCB.

House stock

Change in the stock of houses gives us an indication of demand of houses in each municipality. If the quantity of newly developed houses is large it may affect house prices negatively. However, if these new house were built to substitute old houses that were torn down, the effect on prices would instead be positive since the standard of houses in the market has increased. Even though we do not believe that there has been a large quantity of newly produced houses, we want to capture the contingent effect it might have had. The

data is calculated as number of newly produced houses minus number of removed houses and is collected from SCB.

Regional Characteristics

Two regional characteristics are used separately as dummies. This is due to relative low degrees of freedom in the model. However, since this is a thesis in economics with theories behind the research, the degrees of freedom are acceptable.

Distance

Location is an influential factor when buying a house. Therefore, we find it relevant to test the distance from each municipality to the city centre and its effects on prices.

The best indicator would have been to use the travelling time but a lack of data availability made it impossible. The distance is measured in kilo meters from the central station in Stockholm city. The data is collected from Eniro's direction service.

Average income

People's average income within the municipality is important because it gives us an indication of how much money people can afford to spend on houses; people's spending budget for houses has a positive relation to their income. This will further allow us to compare high income and low income municipalities and house prices. The data used are collected by SCB and are defined as the average yearly income within each municipality.

Table 1, Table of variables

Variable name ²	Definition	Expected effect
Dependent variable:		
Δ Real house price (Hpreal)	Δ Nominal House Price/ (1+CPI) (%)	
Independent variables:		
Δ Interest cost (longintcost)	Δ (Real House Price*Interest rate)/Real Income (%)	Pos. effect
Reference price (Hpreal-91/93/-96/-02/-03)	Real House Price for the first year of the period (%)	Pos. effect in boom Neg. effect in recession
Δ Employment (emp)	Δ Employment/Population within the age of 20-64 (%)	Pos. effect
Δ Net migration (mig_pop)	Δ Net migration/Population (%)	Pos. effect
Δ House stock (new_prod_houses)	Δ ((New Prod. houses-Torn down)/# of houses) (%)	Pos. effect in boom Neg. effect in recession

Unavailable data and data excluded in the model

There are some variables that according to previous studies have shown to have an impact on house prices but there are no data to be found. One of these variables is *Construction cost*. If market price for houses are high and construction cost lower, people will build their houses instead of buying those already existing on the market. *Rent* is also an influential factor according to previous research but no data was collected on this in Sweden before 1997. However, according to the Central bank (2005), the rental market in Sweden is regulated thus, is not a good measurement to tell whether or not houses are overvalued.

AFGX

Previous studies have often concluded a related impact of the stock market and house prices. When people earn high returns on investments, they are willing to spend more on their accommodation. Therefore, when the stock market rises, real estate prices should go in the same direction. AFGX is a shortening for *Affärsvärldens General Index*, an index calculated by the Swedish business magazine Affärsvärlden.

² (Real house price-93 – Real house price -91)/Real house price -91

(Interest cost -93 – Interest cost -91)/Interest cost -91

(Employment-93 – Employment-91)/Employment-91

(Net migration-93 – Net migration-91)/Net migration-91

(House stock-93 – House stock-91)/House stock-91

The same calculations have been made for all periods but with the appropriate data for the respective period.

3.2 Econometric model

Following the work of DiPasquale and Wheaton (1996) we have included house prices, employment rate, interest cost and house stock in our model. We have used it as a guideline when creating our model although we had to modify it slightly due to lack of data. Net migration and distance are added to give an indication of the demand for houses in suburban areas compared to central areas.

In order to investigate the relationship between house prices and the macroeconomic variables we have chosen to use a standard OLS regression. Real house price is the dependent variable and the model's independent variables are: *interest cost, net migration, reference price, employment and house stock.*

According to DiPasquale and Wheaton (1996), if the house market is in equilibrium an increase in e.g. number of new build houses would be followed by an increase in house price and in the share of income spent on ownership until a new equilibrium is reached.

Model:

$$\begin{aligned} \Delta Real\ House\ price_i = & \beta_1 + \beta_2 Reference\ price_i + \beta_3 \Delta Interest\ cost_i + \\ & \beta_4 \Delta Employment_i + \beta_5 \Delta Net\ migration_i + \beta_6 \Delta House\ stock_i + \\ & \beta_7 D_{High\ income_i} + \beta_8 D_{Low\ income_i} + \varepsilon \end{aligned} \quad (1)$$

The original model is divided into two different specifications, where the dummy variables are the only factors separating them. Gujarati, D. (2003, p.298) explains the existence of dummy variables as "Such variables are thus essentially a device to classify data into mutually exclusive categories such as male or female"

In *specification 1*, two dummies are added, $D_{High\ income}$ and $D_{Low\ income}$, in order to find a pattern in people's different income. $D_{High\ income}$ takes the value one for the third of the municipalities with the highest average household income and zero for the rest (see appendix A). $D_{Low\ income}$ takes the value one for the third of the municipalities with lowest average household income. In *specification 2*, dummies are used to detect any influence of the municipalities' distance from the city on the dependent variable. $D_{periphery}$ takes the value one for the third situated furthest away from the municipality of Stockholm. The rest of

them take the value zero. For D_{centre} the same process has been made except, the third situated closest to the municipality of Stockholm has taken the value one. (see appendix A) In order to avoid perfect collinearity, we have excluded the dummies for the municipalities within the “middle range”.

The reference price is included in each regression to give a starting position. It is basically the real house price level for each period’s starting year.

Heteroskedasticity occurs when the conditional variances of u (disturbance terms) are not constant. Taking an example from Gujarati, D. (2003) about income; as people’s income increases, so does the alternatives on what to spend it on. Therefore, it is not likely that the disturbance terms are kept constant. Heteroskedasticity can also arise due to the presence of outliers. An outlier is an observation that differs significantly from the other observations.

When using variables such as income and interest rate it is likely that heteroskedasticity arises. We have therefore chosen to use the *White Heteroskedasticity-Consistent Standard Errors & Covariance* when running the regression.

4 Results and Analysis

In this chapter we will present the results from the OLS regressions with robust errors we did in E-views. Moreover, after having presented the results for each period and regional specifications, we will discuss and analyze the results. Later on, in the analysis, we hope to reach deeper conclusions by comparing periods with the same economic trends.

Table 2 1991-1993, macroeconomic variables' influence on house prices (OLS with robust errors, 25 observations)

Variables	Specification 1 Adjusted R-Squared= 0.409434		Specification 2 Adjusted R-Squared= 0.238416	
	Beta Value	P-Value	Beta Value	P-Value
C	-0.468676	0.4438	-0.172120	0.7394
HPREAL91	-0.000156	0.0687	-3.49E-05	0.7162
LONGINTCOST	-0.619797	0.4755	0.472230	0.5826
EMP	-0.331865	0.8643	-1.634217	0.3240
MIG_POP	2.213373	0.0078	1.494821	0.1857
NEW_PROD_HOUSES	-0.739929	0.6660	-0.745179	0.6282
DHIGH_INCOME	0.131766	0.1124	Not included	Not included
DLOW_INCOME	0.179850	0.0081	Not included	Not included
DCENTRE	Not included	Not included	0.148021	0.0230
DPERIPHERY	Not included	Not included	-0.010201	0.7776

Specification 1

The adjusted R-squared indicates that the fitness of the model for this period is less efficient but still acceptable while net migration is significant at a 1% level. Employment, interest cost and house stock are all insignificant or highly insignificant.

The Beta coefficients for all independent variables except employment are as expected. Keep in mind that our expectation for the Beta of interest cost is completely different, depending on the real estate cycles for each period.

Specification 2

R-squared is even lower in this model and all independent variables are insignificant.

Although limitations in analyzing the Beta values exist due to the relatively low fitness of the model, interest cost and employment interferes with the expectations while net migration and house stock are in line with them.

This period, right after the real estate bubble, had burst hence it was a turbulent time for the Swedish economy. The new tax legislation, which made it less profitable to carry big loans, resulted in fewer investments which led to lower house prices. This occurred even though the long interest rate also went down.

The result from the regression shows that there are not many significant variables. The high- and low income municipalities, net migration, reference price, and the periphery municipalities are the only influential and significant factors in this period. As we expected, net migration had a positive correlation to house prices, and since net migration was decreasing, house prices fell. We can also see that average income had an effect on house prices. The AFGX- index was pretty much constant during the whole period hence it is hard to say to what extent it influenced the house prices.

Table 3 1993-1996, macroeconomic variables' influence on house prices (OLS with robust errors, 25 observations)

Variables	Specification 1 Adjusted R-Squared= 0.570379		Specification 2 Adjusted R-Squared= 0.549160	
	Beta Value	P-Value	Beta Value	P-Value
C	-0.029081	0.6617	-0.027829	0.6230
HPREAL93	0.000102	0.2266	8.03E-05	0.4293
LONGINTCOST	0.398350	0.0379	0.302178	0.1837
EMP	1.857686	0.0984	1.731378	0.1057
MIG_POP	0.560497	0.0945	0.481724	0.2317
NEW_PROD_HOUSES	-1.078695	0.1054	-0.559491	0.4623
DHIGH_INCOME	0.038445	0.2259	Not included	Not included
DLOW_INCOME	0.021564	0.5139	Not included	Not included
DCENTRE	Not included	Not included	0.005939	0.8222
DPERIPHERY	Not included	Not included	0.041082	0.4763

Specification 1

The coefficient of determination has for this period a relatively high and fully acceptable level; approximately 54.9% of the variance in the dependent variable is explained by the independent variables in Specification 1.

With a significance level of 10%, employment, net migration and interest cost are all significant and change in stock is slightly significant. All of these variables have the sign that can be expected. Among the significant variables, employment has the largest impact on house prices. Further, we can see that change in stock of houses has a larger effect than net migration.

Specification 2

R-squared is almost as strong as with Income Dummies but the significance for the independent variables are weaker, hence Specification 1 is to prefer. Employment is the only variable that slightly holds under a level of confidence at 10%.

This was a period when house prices were stable and relatively low. We can see that almost all variables are significant; interest cost, employment, net migration and newly produced houses. No major events or policy changes took place in Sweden during this time that could have affected the house market. The AFGX-index was increasing slightly during these years but that does not seem to have affected the house prices. The variables in our regression seem to have been the most influential factors on house prices during these years.

Table 4 1996-2002, macroeconomic variables' influence on house prices (OLS with robust errors, 25 observations)

Variables	Specification 1 Adjusted R-Squared= 0.932182		Specification 2 Adjusted R-Squared= 0.927337	
	Beta Value	P-Value	Beta Value	P-Value
C	0.679673	0.0000	0.674477	0.0000
HPREAL96	9.64E-05	0.0038	0.000117	0.0034
LONGINTCOST	1.788046	0.0000	1.748973	0.0000
EMP	0.373064	0.4043	-0.015412	0.9697
MIG_POP	0.391793	0.0020	0.532269	0.0003
NEW_PROD_HOUSES	-0.176239	0.3795	-0.058203	0.7840
DHIGH_INCOME	0.018333	0.2522	Not included	Not included
DLOW_INCOME	-0.024710	0.1462	Not included	Not included
DCENTRE	Not included	Not included	-0.028935	0.0830
DPERIPHERY	Not included	Not included	-0.028935	0.0830

Specification 1

R-squared for this period is significantly higher and close to 1 which implies that the model almost works perfectly. More than 95% of the variance in house prices are explained by the

independent variables. Moreover, interest cost and net migration stands under confidence level of 1% so we can claim that these variables almost explain all of the variance in the dependent variable.

As we expected, interest cost, employment and net migration all have a positive relationship to house prices and interest cost has the largest beta. Also, change in stock has a negative coefficient which was expected.

Specification 2

The R-squared is very similar to the one in Specification 1 which shows that specification 2 is strong as well.

When it comes to the significance among the independent variables, specification 2 do not differ much from Specification 1. Interest costs and net migration are highly significant and have positive Beta's and interest costs have a large impact on house prices. This is something one could expect and we will explain this relationship more deeply in the analysis and conclusion.

During this six year period, house prices were steadily increasing to be doubled at the end of 2002. Interest cost and net migration were strongly affecting the house market. During most of this period the IT business was blooming and the interest rate was relatively low thus, people had more money to spend on housing. When the economy is going well people dare to make investments, e.g. in real estates. This could be an explanation for the net migration increase. Surprisingly, the crash of the IT business, in 1999-2000, does not seem to have affected the house prices. Even though the AFGX-index (see graph 1) shows a drop of one hundred and fifty percentage units, house prices were still increasing.

Table 5 2002-2003, macroeconomic variables' influence on house prices (OLS with robust errors, 25 observations)

Variables	Specification 1 Adjusted R-Squared= 0.989106		Specification 2 Adjusted R-Squared= 0.991105	
	Beta Value	P-Value	Beta Value	P-Value
C	0.243176	0.0000	0.243995	0.0000
HPREAL02	-5.78E-06	0.0342	-8.85E-06	0.0094
LONGINTCOST	1.287907	0.0000	1.281186	0.0000
EMP	0.090841	0.5766	0.027743	0.8457
MIG_POP	0.131966	0.3215	0.023861	0.8445
NEW_PROD_HOUSES	0.017619	0.8131	0.082987	0.4138
DHIGH_INCOME	-0.001785	0.4687	Not included	Not included
DLOW_INCOME	0.002263	0.2775	Not included	Not included
DCENTRE	Not included	Not included	0.005021	0.0309
DPERIPHERY	Not included	Not included	0.005980	0.1779

Specification 1

The adjusted R-squared is evidence for the strengths in the model with a value very close to 1. Interest cost is the only significant variable and the beta illustrates the relationship to house prices. If the interest cost increases by 100%, house prices rises by 128, 8%. Change in stock, net migration and employment are insignificant even at a 10% confidence level.

Specification 2

Like previous periods, the probabilities tell us that Specification 1 is better fit. The adjusted R-squared and interest cost are very close to Specification 1 but the other independent variables are less significant. The graphs for average house prices and house price coefficient, respectively, show very different tendencies for this period. The sharp turn in the house price coefficient curve in 2002 had to a large extent to do with the taxation increase for houses, implemented in 2003.

The rapid average house price rise slowed its pace during this period, however prices were still moving upwards. This stagnation was probably caused by a lagged reaction to the IT bubble bursting and the previous mentioned taxation rise. Since the IT-crash only had an indirect effect on the house market, it is reasonable to believe that the reaction was lagged. The fall in employment indicates that the state of the market was worsened. The financial market recovered and started rising again in the end of this period. Interest cost and 2002's base price were the only significant variables during these two years. Our regression results

shows, once again, a few numbers of significant variables when the Swedish economy is unstable.

Table 6 2003-2007, macroeconomic variables' influence on house prices (OLS with robust errors, 25 observations)

Variables	Specification 1 Adjusted R-Squared= 0.957326		Specification 2 Adjusted R-Squared= 0.934529	
	Beta Value	P-Value	Beta Value	P-Value
C	0.114995	0.0003	0.076109	0.0068
HPREAL03	1.37E-05	0.2859	3.42E-05	0.0552
LONGINTCOST	1.077586	0.0000	1.146527	0.0000
EMP	0.722567	0.0629	1.344038	0.0082
MIG_POP	0.276792	0.1145	0.248509	0.4783
NEW_PROD_HOUSES	0.004894	0.9775	-0.017754	0.9525
DHIGH_INCOME	0.036576	0.0030	Not included	Not included
DLOW_INCOME	-0.008797	0.3583	Not included	Not included
DCENTRE	Not included	Not included	-0.005529	0.5171
DPERIPHERY	Not included	Not included	-0.029219	0.3147

Specification 1

For our last period, the coefficient of determination remains high, indicating that we have a strong model. Interest cost is significant at 1%, employment at 10% and net migration is slightly significant. Change in stock of houses is on the other hand highly insignificant.

Interest cost, employment and net migration all have positive impact on the dependent variable, all according our expectations. Change in stock however, has a small positive Beta that conflicts with its expected effect.

Specification 2

The coefficient of determination keep following the trend, being very similar to the one in Specification 1.

Interest cost remains highly significant while employment is significant at 1% and net migration gets less significant, compared to Specification 1. The Beta of employment is in this model much higher, indicating an almost double positive impact on house prices. Besides that, interest cost has a vaguely stronger effect and change in stock now has a small but expected influence on the dependent variable.

The economy in Sweden during this period was stable and did not have any major events that rocked the house market. The AFGX-index shows that the financial market was blooming. This is reflected well in our regression results for this period, where a lot of the macro economic variables are significant. The fact that newly produced houses are significant in this case is most likely a lagged effect of the previous years' rise in house prices. At this point it was probably in many cases more profitable to build new houses than to move into already existing ones. Net migration also goes hand in hand with building new houses thus; more demand leads to more supply.

Recession

Starting with the periods 1991-1993 and 2002-2003 there are not many similarities to find. The only independent variables that show an influence on house prices in both periods are the reference price and the group of periphery municipalities. These two periods are also the only time when the AFGX-index is not increasing. However, it is an interesting observation that when an economy is in a recession or unstable, as in both periods, house prices are no longer as influenced of macroeconomic variables as otherwise.

Boom

When comparing the time periods 1996-2002 and 2003-2007, when house prices were rising, we expected interest cost to have a positive relation to the dependent variable. This is clearly confirmed in our results. Net migration is the second independent variable, which is significant in both periods. The increase in population seems to have had, as expected, a rather large influence on the house price rise in every municipality.

The period with the highest number of significant independent variables was 1993-1996, the period in which the house price level was rather constant. Except interest cost and net migration, also employment and house stock were affecting the house prices.

4.1 Econometric analysis over time

The variable we were most certain to have a strong influence was the interest cost. Since for most people it is a necessity to take a loan to be able to finance their house buying, it is rather likely that the price of the house is dependent on the cost of borrowing money. This

variable also showed in the regression to have a quite strong relationship. Employment was a factor that we expected to have larger impact than what it shows in our regression model. Employment is an indicator of the state of the economy and should relatively well follow the fluctuations in the market. If employment is low, the buying power of the people is weakened, and this we expected should be reflected in decreased house prices. However, a graphical analysis of employment shows that it follows the fluctuations in house prices rather well. The variable house stock was less anticipated to show significance in our results, when splitting up the time series into periods. According to DiPasquale and Wheaton (1996), in the short run, construction may diverge significantly from demand because of lags and delays in the construction business. If demand for housing first rise, price will rise as well. Eventually, when prices are above construction cost, then new houses will be built. The financial market corresponded rather well with the fluctuations in house prices however, as stated earlier; we expected the IT crash to have hit harder on the house market.

One issue with our method in this thesis is the way the data is gathered and the fact that we use a differential equation model. In practice, all our municipalities together functions as one labour market solely. Labour can freely move within this labour market and therefore, our data which is based on where people live can sometimes be misleading. Some regions have, by most certainty, more commuters while others have less. In other words, central parts of Stockholm have more offices and people going there to work but have their housing in other regions and vice versa.

Furthermore, even if income is included in one variable in our model, some less wealthy municipalities contains mostly apartments and not houses. Inhabitants in the municipalities with lower income often live in rental apartments, have lower education and are more likely to lose their jobs when the economy is in a recession. They are also among the employed that lose their jobs fast when the economy turns down. Since we use cross sectional data, all these factors are not fully taken into account.

We can finally state that our adjusted R-squared were significantly lower during the first two periods, 1991-1996 when the economy was less stable. The rest of our time period, 1996-2007 when the economy was more stable, adjusted R-squared was very high.

5 Conclusion

Our aim with this thesis is to examine to what extent house prices in Stockholm region where affected by macro economic variables and to what extent they were influenced by the state of the economy.

The most important conclusion in this paper is the fact that the house market in Sweden works differently in booms and recession. How the house prices are influenced by macro economic variables completely differs depending on if the economy is experiencing a boom or a recession. In our opinion, this can be explained by a human psychological aspect. When the economy turns up into a boom, people's willingness to invest in house rises and as we mentioned earlier the Swedish real estate market is more investment oriented than others. This leads to a period of speculation and the attitude "if others make money on their housing, why should not I be a part of this upswing market as well?" The speculation solely, contributes to increasing house prices which further leads to an increase in construction of new houses. Since from the decision to start building new property to it is actually ready to sell is a long period, a lagging effect in the market is present.

The speculation will continue until the market peaks and turns down. Historically and recently, there have arisen situations in which house owners with too high mortgage loans and too expensive houses cannot consequently afford to keep their houses but have to sell to a lower market price without being able to fully repay their loans.

In a recession however, a kind of convergence can explain our results. This convergence is created by a pessimistic and worrying view upon the house market. Like in the case of speculation above, the distrustful view on the house market contributes to a period with prices going down instead of up.

The development in booms and recessions described above can be confirmed in DiPasquale and Wheaton's Property and assets market model, in which a "spiral" way of thinking market creates a spinoff effect. The rental market, construction market, asset market and also credit market all affect each other. We have clearly seen that the elasticity in e.g. interests cost has gone from very high during the turbulent years to lower and more stable when reaching a new equilibrium. This could be explained by interest rate expectations in the market.

How large the distance between the municipalities and Stockholm's city centre did not seem to influence the house price fluctuations. However, the wealth within the municipalities had an impact on the prices during the years 1991 to 2007. This impact differed depending on if the economy was in a boom or recession.

Finally, we have to stress how important the real estate market is for an economy. Its close relationship to the credit market and affect on inflation should not be underestimated; this is something the world badly has experienced from the recent sub-prime crisis.

6 Suggestions for further research

The conclusion that the house market and its factors vary depending on the business cycle is something that could be used as a foundation in the future. By investigating this relationship one might be able to further conclude how the market forces affects house prices in different stages of the business cycle.

Another suggestion is to do regressions and analysis over other urban regions to confirm or disconfirm our standing point in house prices in booms and recessions.

Another angle that could be relevant to investigate is the market forces that lie behind the current market development and the recent sub-prime crisis. How do the credit institutions policies affect the mortgage lending, people's interest costs and prices? This further leads to questions about how the deregulations in the credit market have influenced the market, its actors and their policies. Perhaps, a regulation of credit institutions is to prefer when weighting advantages and disadvantages of the choice between more competition or more control and responsibility in the market.

This implies that the central bank, real estate brokerage firms and mortgage credit institutes should use two different models for market predictions; one for booms and another one for recessions in order to come up with a good and relevant prediction. Since these predictions controls many important decisions, this is an issue market actors may want to take into consideration.

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Appendicies

Income dummies

High income municipalities:

Ekerö
 Tyresö
 Täby
 Danderyd
 Sollentuna
 Nacka
 Lidingö
 Vaxholm

Medium income municipalities

Upplands Väsby
 Vallentuna
 Österåker
 Värmdö
 Järfälla
 Huddinge
 Salem
 Stockholm
 Solna

Low income municipalities

Botkyrka
 Haninge
 Upplands-Bro
 Södertälje
 Sundbyberg
 Norrtälje
 Sigtuna
 Nynäshamn

Distance dummies

Municipalities furthest from the city

Vallentuna
 Värmdö
 Upplands-Bro
 Södertälje
 Vaxholm
 Norrtälje
 Sigtuna
 Nynäshamn

Municipalities with medium distance from the city

Upplands Väsby
 Österåker
 Järfälla
 Ekerö
 Botkyrka
 Salem
 Haninge
 Tyresö
 Sollentuna

Municipalities closest to the city

Huddinge
 Täby
 Danderyd
 Stockholm
 Nacka
 Sundbyberg
 Solna
 Lidingö