



UNIVERSITY OF GOTHENBURG  
SCHOOL OF BUSINESS, ECONOMICS AND LAW

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## **Bubble Trouble**

An inquiry into the theories of housing bubbles, modestly applied on Sweden

Magnus Landergren

Supervisor: Hans Bjurek  
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# BUBBLE TROUBLE

## AN INQUIRY INTO THE THEORIES OF HOUSING BUBBLES, MODESTLY APPLIED ON SWEDEN

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MAGNUS LANDERGREN

*Abstract: How do we spot a housing bubble? Swedish house prices and household debt have in recent decades risen faster than ever before. This thesis discusses different models for assessing housing bubbles, including neoclassical, econometric and behavioral models. The models are applied to Swedish data, finding no conclusive results but enough evidence to recommend that policy-makers proceed under the assumption that there is indeed a housing bubble.*

SUPERVISOR: HANS BJUREK

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## INTRODUCTION

*“We reach a condition where there is a shortage of houses, but where nevertheless no one can afford to live in the houses that there are.” John Maynard Keynes (1936)*

Whether or not Sweden is currently in a housing bubble is a widely debated issue in the popular economic debate. Some argue that we are in a bubble, other claim the opposite. But how can well-informed and smart economists reach completely different conclusions? Part of the answer lies in what model is used to analyze the issue. In the best of worlds it should not matter which model you choose since every single one should lead you to the same conclusion, namely the truth. Unfortunately, this is not the case. The choice of model affects which results are reached. This thesis attempts to analyze and discuss some of the models which can be applied to bubbles. For each model there will either be a review of existing research which uses Swedish data or there will be rudimentary analyzes applied to the Swedish case. Knowledge about the models’ weaknesses and underlying assumptions is necessary to understand that the results are not objective but in fact is a product of the models’ characteristics. Hopefully this thesis will result in a higher knowledge of the available models and guide in the model selection in future research.

The thesis is split into six chapters: the first chapter is a short overview of the Swedish housing market and relevant parts of the financial market. The second chapter deals with simple models and indicators. The third chapter is about neoclassical models and dynamic stochastic general equilibrium (DSGE) models. The fourth chapter deals with econometric models. The fifth chapter discusses concepts based on behavioral economic and lastly there are some concluding remarks in the sixth chapter.

What exactly is meant by a *bubble*? There is no generally accepted definition, The Riksbank (2011, p. 81) mentions three possible definitions for *overvalued* house prices:

- I. House prices are above their long-term trend;
- II. House prices cannot be explained by fundamental factors;
- III. Predictions by the models indicate falling house prices.”

Using the first definition it is clear that Swedish houses are overpriced which is shown in chapter 2. This thesis uses a definition of house bubbles which states that there is a bubble if there is a major increase in house prices which *will* be followed by a sharp and sudden decline

in house prices. Whether the boom or bust can be explained by fundamental factors or can be predicted in advanced are of course interesting questions but do not really belong in the definition of a bubble. A boom-bust pattern which with hindsight looks like a bubble is a bubble, regardless of whether or not it could have been predicted or explained with fundamentals.

For the purpose of this thesis there is no reason to make a distinction between houses and co-op apartments, since both are bought, sold and subject to the same kind of speculation. Both houses and co-ops are referred to simply as *houses*. *Apartments* refers to rental apartments.

## CHAPTER 1 - THE SWEDISH HOUSING MARKET

At the core of this thesis lies the fact that Swedish house prices has increased by 140% in real terms since the mid-90s (SCB). But in what institutional framework has this increase taken place? What characterize the housing market in general and Swedish housing market in particular? What regulations affect the market? How much is being built? Why is there a housing shortage and how does it affect prices? How does the situation in the rental market affect the housing market? Not all these question can be answered but this introductory section will attempt to provide sufficient background information for the reader to understand the most fundamental determinants of the housing market before looking at more specific models.

### THE CHARACTERISTICS OF HOUSES AS A GOOD

When analyzing the housing market one must bear in mind that houses are different from other financial assets and consumer goods. Houses are mainly bought and sold by individuals and not by institutions. Since the main dividend of a house is the *housing service* they provide, houses are unsuitable to be traded directly by institutions. Since transaction costs are high the housing market is also unsuitable for short-term speculation. In order to speculate in the price of a house one must first buy the house, then either live in it or rent it out to someone else for a couple of years until the value hopefully has appreciated and the house can be sold at a profit. The possibility to buy-to-let has been severely restricted in Sweden, the regulations have been liberalized in 2013, but some restrictions still remain. There is no short-market for houses in Sweden. These facts are relevant because it makes it exceedingly hard for arbitrageurs to participate in the market. In the financial markets these forces usually, at least theoretically, conspire to bring prices towards their equilibrium value. In the housing market

this equalizing force is much weaker and consequently the housing market can stay mispriced for a longer time.

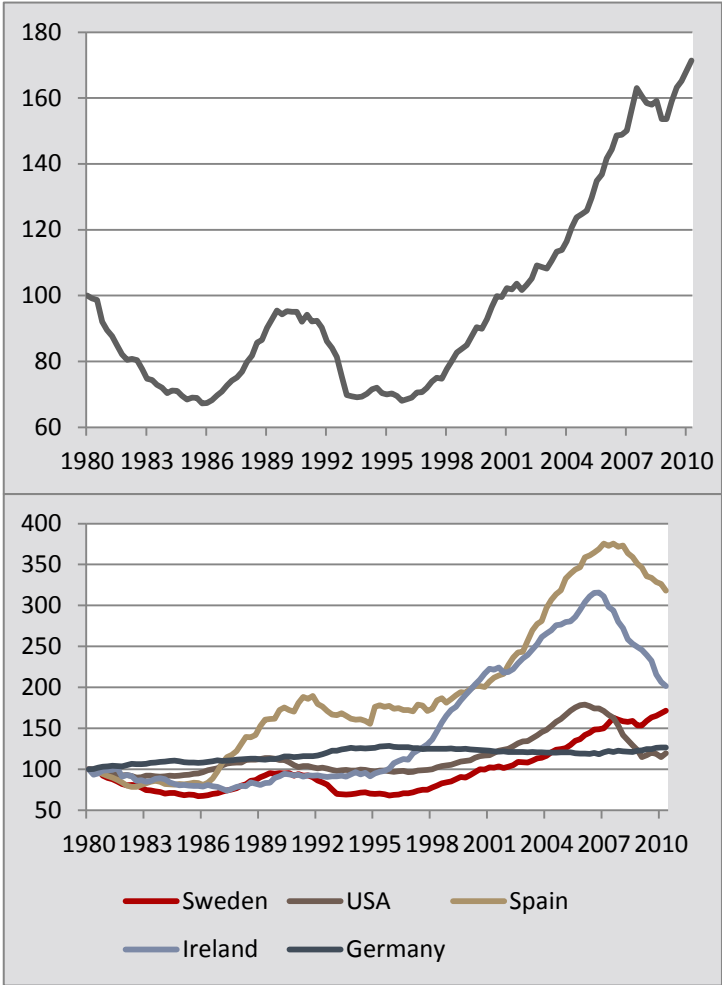
Houses are often perceived as a safe investment, Shiller and Akerlof (2009) illustrates this by the increased usage of the term “safe as a house” which was originally used to describe boats but which has now come to be used to describe houses as investment objects. Houses are in fact not safe investments. House prices are cyclical but with a longer wavelength than a normal business cycle; a house price cycle could last up to two decades (Boverket, 2013 p.3). The problem with these long cycles is that people forget the downturns, and disregard the risk in their behavior. This process is described by Minsky (1992, 1996) in his Financial Instability Hypothesis which states that financial institutes will become more liberal with giving credit when continuous asset value increases can cover the cost of the loans, thereby slowly increasing the risk taking.

**HOUSE PRICES – HOME AND ABROAD**

Sweden had a real estate crash and a financial crisis in the early 1990s. Figure 1 shows that the development since 1996 completely dwarfs the previous boom. Since 1996 real house prices has increased by 140 percent, which is equivalent to average real increase of 6.5 percent per year. This number can be compared to the average house price increase between 1978 and 2008 which was a mere 1.2 percent per year (Riksbanken, 2011 p.26). While many countries which have seen a similar price increase as Sweden saw their house prices collapse after 2007, Sweden only experienced a

**FIGURE 1 - REAL HOUSE PRICES, INDEX 1980 = 100**

**TOP: SWEDEN - BELOW: INTERNATIONAL COMPARISON**



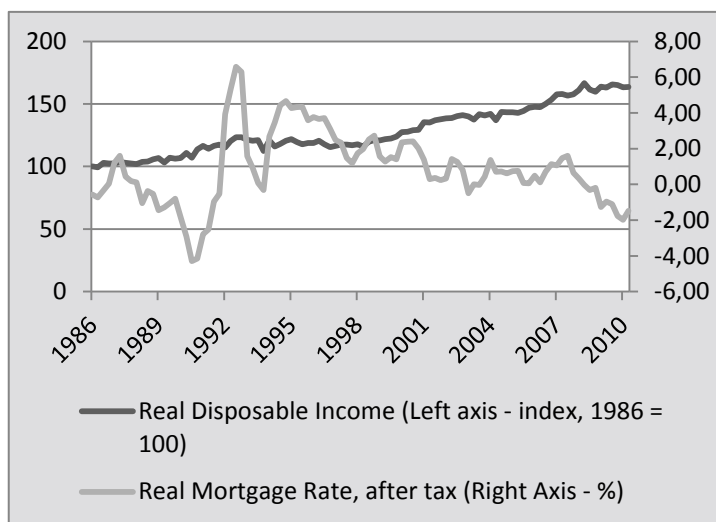
minor 6 percent decrease before house prices started to increase again. At the time of writing this, Swedish house prices are once again at an all-time high. The regional differences are large; the average house now cost 26,000 SEK/m<sup>2</sup> while a house in central Stockholm has an average price of 62,000 SEK/m<sup>2</sup> (Mäklarstatistik – Bostadsrätter 2013).

Compared to the house prices in Spain and Ireland the Swedish boom has been rather modest, as Figure 2 shows. However the Swedish boom is quite similar to the one in the USA which started the great recession. Germany is often used as an example of a country which does not have a bubble due to their stable house prices.

## INCOME AND MORTGAGE RATES

Real disposable income has increased by roughly 60 percent since 1986, which Figure 2 shows. This can affect house prices through two different channels. The first one is that when income increases household can afford to pay more for the house they want, thus driving up prices. Secondly, with higher income households can afford to buy more luxurious houses, thus increasing the quality of houses sold. It is hard to quantify the effect of the quality increase,

FIGURE 2 – REAL DISPOSABLE INCOME AND REAL MORTGAGE RATE



but if we do not take it into account we are likely to overestimate the house price increase.

One key factor behind the house price increase is the falling mortgage rate. The mortgage rates are at their lowest rate for two decades. As mortgage rates fall it becomes cheaper for household to borrow which means they can borrow more at a given income, thus driving up demand and hence also prices. Figure 2 shows that the real mortgage rate after tax has been trending downwards since 1995. Unlike real income, where one can expect a long-run upward trend, interest rates are cyclical. Even if there is no normal or natural rate for interest rates the current low rates are an historical anomaly and it will eventually start increasing again. The share of households with adjustable mortgage rates has increased rapidly, from 8 percent in 1996 to 47 percent in 2012 (SCB, 2013). This implies that a change in the repo rate affects the households' economy quicker than it used to do.

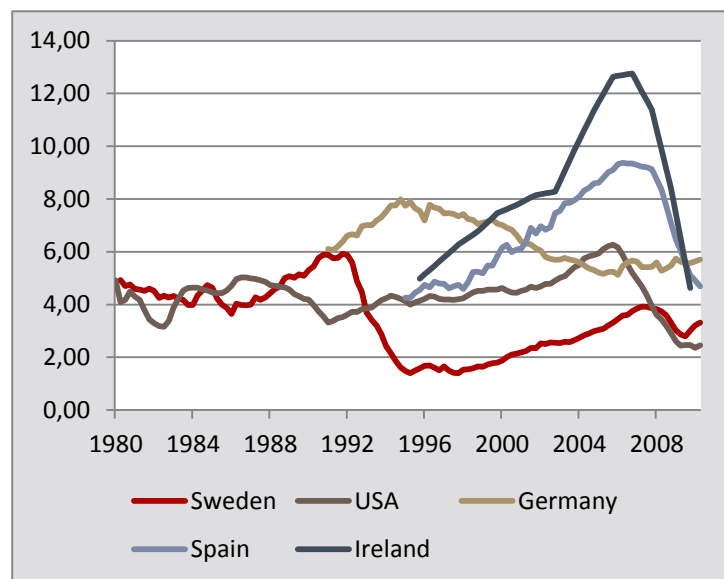
## CONSTRUCTION, INVESTMENT, ZONING LAWS AND BUILDING REGULATION

Why are not more houses and apartments being built when real prices has more than doubled? In a normal supply and demand analysis, higher prices would induce firms to increase their supply until prices returned to their equilibrium value. The number of newly constructed apartments and houses in Sweden is equivalent to just half a percent of the total stock of houses and apartments which indicates that the market is inefficient (Boverket, 2012 p.16).

Figure 3 shows that housing investment as a share of GDP has increased since the recession in the mid-90s, but the current

investment rate of 3.3 percent is still below the average investment rate of 3.4 percent since 1980. The Swedish housing investment rate is far below the rate that the US, Spain and Ireland experienced before their busts. The USA, Spain and Ireland did not only face falling house prices, large part of the downturn in the real economy was caused by the collapsing construction sector. There is no

FIGURE 3 - HOUSING INVESTMENT (% GDP)



reason to believe that Sweden face any risk of a serious downturn in construction. Quite the opposite, the problem in Sweden appears to be that too little is being built. Even Germany with their low and stable house prices invests more in housing than Sweden do.

There are some possible explanations why Swedish housing investments remain so low. The Swedish Competition Authority has suggested that competition might be weak in the construction sector and statistics shows that construction cost has been increasing faster than the inflation rate (Riksbanken, 2011 p.72; SCB, 2012). Claussen (2012, p. 8) finds that house prices Granger-cause construction costs which indicate a poorly functioning market. A second explanation could be rigid construction regulations and restrictive zoning laws. Building a new house or apartment building often includes rather cumbersome legal processes and time consuming appeals. Explaining how these regulations work and what effect they have is however beyond the scope of this paper and will not be discussed further.



## THE RENTAL MARKET

Why is the rental market important when analyzing house prices? Everyone needs somewhere to live. In a well-functioning market, homeowners who consider their properties to be overvalued would sell them to make a profit. But they would still need somewhere to live. As it is exceedingly difficult to get a rental apartment (and much harder to get one which one actually likes) the possibility of realizing the profits of an overvalued house is small. People who would rather rent the apartment are forced into buying, thus driving demand and prices up.

The prominent Swedish economist Assar Lindbeck (2012) has denounced the Swedish housing policy as a “70 years long disaster”. This is no new insight for Lindbeck; already in 1963 Lindbeck et al criticized the Swedish system of rent regulations, which was originally introduced during World War II as a temporary measure for keeping inflation at bay, as the prime cause of the housing shortage. Lindbeck (2012 and 1972) has gone so far as to say that rent regulation appears to be “the most efficient, currently known, method to destroy a city, with the exception of bombing”<sup>1</sup>. Lindbeck is not alone in his opinion that rent regulations should be abolished, the OECD, the IMF, the EU-commission and the latest government report by Bergendahl (2012, p.37) all agree.

The exact mechanics of the rent regulations has changed over the years. Originally the rent regulation was introduced in 1942 but the system used today is mainly based on a reform from 1968. There are two main components of the current rent regulation; firstly the *utility-value-system*<sup>2</sup> which implies that an apartment’s rent should be in line with the rent level in similar apartments. Secondly, changes in rents should be determined in collective bargains between the landlords and their central organization on the one side and *The Swedish Union of Tenants* on the other side (Bergendahl 2012). Until 2011 the rent level in public housing was used as the norm for the entire market. The consequence, in terms of price, has been that rents have been kept artificially low and that the location of an apartment has had very little impact on the rent.

During the same period when real house prices increased by 144 percent, real rents only increased by 13 percent (Riksbanken, 2011 p.51) Since it has generally not been profitable to

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<sup>1</sup> My translation

<sup>2</sup> Bruksvärdessystemet in Swedish

build rental apartments the construction rate has been abysmal. According to the report by Bergendahl (2012, p.29) the number of privately owned co-op apartments has increased by more than 50 percent since 1990 while the number of rental apartments has increased by less than 5 percent. The shortage of rental apartments is especially large in the major cities. In Stockholm the waiting period for getting a normal sized apartment legally is approximately 6 years (11 years in the inner city) which can be compared to 0 weeks queue in Oslo, Copenhagen, Helsinki, Brussels and Berlin and 1-5 weeks queue in Amsterdam and Madrid, according to Bergendahl (p.67).

## THE SWEDISH FINANCIAL INSTITUTIONAL FRAMEWORK

Since the mid-80s the Swedish credit market has been deregulated, meaning that credit is no longer rationed. Household debt increased sharply after the liberalization, and in combination with the bankers' inexperience is often claimed to have led to the Swedish financial crisis in the early 90s.

Buying a house is often the largest investment people carry out during their lifetime. Therefore fluctuations in house prices have a unique effect on the households' economy. Unlike other assets such as stocks and bonds, houses are generally highly leveraged. New mortgages on average have a loan-to-value ratio of 69 percent with large variance; in the stock of existing mortgages 5.2 percent of the households had a loan-to-value ratio over 91 percent according to the Swedish Financial Supervisory Authority (FSA, 2012). Despite the high debt levels, 57 percent of all new mortgages do not require any amortization. In 2010 the FSA introduced a legal requirement that all new loans must have a loan-to-value of 85 percent or lower. 30 percent of the cost of a mortgage is deductible, up to a limit of a total deduction of SEK 100,000. A fall in house prices could potentially have a devastating effect on the real economy as households are forced to spend a large share of their income on deleveraging their debt instead of spending it on consumption, as has been argued by Irving Fisher (1933), Koo (2008) and Eggertsson and Krugman (2012) among others. The house prices also have a direct effect on the stability of the financial system, the IMF (2011 p.5) concludes that two thirds of all systemic bank crisis, where there is available data, were preceded by a collapsing housing bubble. The same study finds that the more prices and debt increased during the boom the harder the bust will be.

*Mortgage Backed Securities* (MBS) played an important part of the US housing bubble. A MBS is a financial instrument based on the cash-flows from the underlying mortgages. In the

subprime crisis individual mortgages were packed into MBS and sold on from the original lender to larger financial institutes. These institutes merged MBS into *Collateralized Debt Obligations* (CDO) which were then sold to even larger financial institutes. As the instruments were sold the risk transferred from the seller to the buyer, thus the sellers had no incentive to maintain the quality of the underlying mortgages. It was because of the transferring of risk that mortgage lenders started giving mortgages to individuals with subprime creditworthiness.

In Sweden and most of Europe; covered bonds, a financial instrument which is similar to MBS, are used. In Sweden the total value of covered bonds amounts to SEK 1 600 billion which is equivalent to fifty percent of Swedish GDP, which makes it a market larger than that for Swedish government bonds (Riksbanken, 2011 p.156). Unlike MBS the original lender maintains the risk when issuing a covered bond. If a mortgage in a covered bond fails the original issuer is required to replace the failed mortgage with some other collateral. This implies that the issuer has a large incentive to keep a high quality on their mortgages. Therefore the Swedish market does not appear to have the moral hazard problem which plagued the US subprime market.

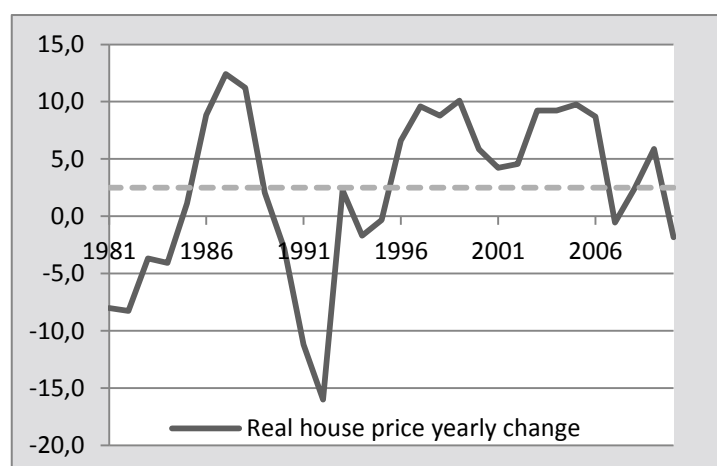
## CHAPTER 2 - SIMPLE MODELS AND INDICATORS

Before trying to assess the housing markets using complex econometric models and abstract theoretical models, there is the possibility of using much simpler methods. The simple models are able to give important information about the state of the housing market at a glance. These simple models cannot claim to give the full picture of the market. All of them have theoretical problems; important variables are omitted and too much weight is put into a few explanatory variables. But because the models are so scaled down it is very easy to notice their limits. While it is easy to miss important theoretical weaknesses in an econometric model it is almost impossible to miss the drawbacks in the simple models. All models have their drawbacks, and being aware of these drawbacks is the first step to resolving them or avoiding drawing the wrong conclusions.

### THE LONG-RUN TREND

Probably the simplest model for assessing a house price bubble is by looking at house prices in a long perspective to see if house price increases has been considerably higher during recent years than the long-run average increase. If house prices have increased unusually fast it could be an indication of a bubble. There are however several

FIGURE 4 REAL HOUSE PRICE, YEARLY CHANGE AND AVERAGE



factors, other than a bubble, which could explain the fast price increase. Firstly, there could be an increasing discrepancy between the supply and demand of houses which drives up prices quickly. Secondly, changes in regulation can cause quicker prices changes when the market adjusts to the new equilibrium, for example after a financial deregulation. Thirdly, the quality of houses could increase unusually fast. Fourthly, housing might become a relatively more important consumption good due to trends or due to changes in income levels. As can be seen in Figure 4, the period from 1996 until 2007 was characterized by price increases over the average rate which is a worrying sign, 7.9 percent per year compared to the average of 2.5 percent since 1981. Just looking at the long-run trend is a crude indicator and the Swedish data does not provide any clear understanding of the market. The long-run trend weakly indicates that there could be a bubble but offers no substantial evidence.

### PRICE TO RENTS (P/R)

One way of assessing real estate bubbles is to compare the price of buying a home with the cost of renting a home. As has been pointed out earlier, houses are different from most other assets in that they serve several functions. Houses are both a major financial asset and a place to live. Just as stocks and bonds pay monetary dividends one could say that houses provides a non-monetary benefit by giving the owner or tenant a place to live. This *housing service* is provided by both owned homes and rented homes. One can reasonably assume that two otherwise identical houses will provide the same non-monetary benefit regardless of whether they are owned or rented.

If there is equilibrium in the market the alternative cost of buying a house should roughly be equal to the rental cost. Owned and rented houses are close substitutes to each other, if for

example house prices were overvalued a rational individual would try to sell their houses and move to a rental apartment. This would decrease the demand for houses and increase the demand for apartments which would cause the price to align. If the relation between prices and rents were to change it could be an indication of under- or overvaluation. There are some other factors which could explain changes in the relationship between prices and rents. If the quality - such as size, location and interior standard - of houses were to increase faster than apartments the ratio should change and it would not be because of a bubble.

How well has *Price-to-rent* worked in the latest crisis as an indicator of housing bubbles? *The Economist* (2011) uses, among other things, *Price-to-Rent* in their analysis of the housing market in several countries. When examining the results for countries where we know there was a bubble, such as the US, Ireland, Spain, the P/R-ratio increased sharply up until the time of the crash and then fell back to ratios closer to their initial levels. Especially for Spain and Ireland the P/R-ratio served as a clear warning sign that house prices were overvalued. In an article in *The Economist* from 2005 the paper predicted that the housing market in the US, UK, Spain, France and Australia was overvalued using P/R. Unfortunately the P/R-approach is an unsuitable measurement for Sweden due to the rent regulations. Since the Swedish credit market was deregulated in the mid-eighties the P/R-ratio has increased fivefold (*The Economist*, 2011), which is definitely a cause for worry. The fivefold increase in Sweden can be compared to the sevenfold increase in Ireland and a tenfold increase for Spain at their respective peaks in the same time span. The development might be explained by house price increases which are a natural consequence of the increased demand caused by the new access to credit. The results of the P/R-analyses is largely dependent on what starting data is used, since the Swedish rental market has been regulated for such a long time there is no available observation when both apartments and houses were priced by the free market. One cannot assume that the starting point is in equilibrium and therefore it is not possible to know whether the changes in the ratio imply an adjustment to equilibrium or if it implies further mispricing. In the Riksbank's analyses (2011, chapter I.1) shows that the P/R-ratio in 2010 was roughly equal to the ratio in 1980 but that there was a large dip in the early 90s. There is really no question whether Swedish rental apartments are underpriced; it is obviously the case. The question in the Swedish case is if this underpricing of rental apartments is big enough to explain the high P/R-ratio. Unfortunately this question will remain unanswered. The limited conclusions which can be derived from P/R shows that house prices has increased

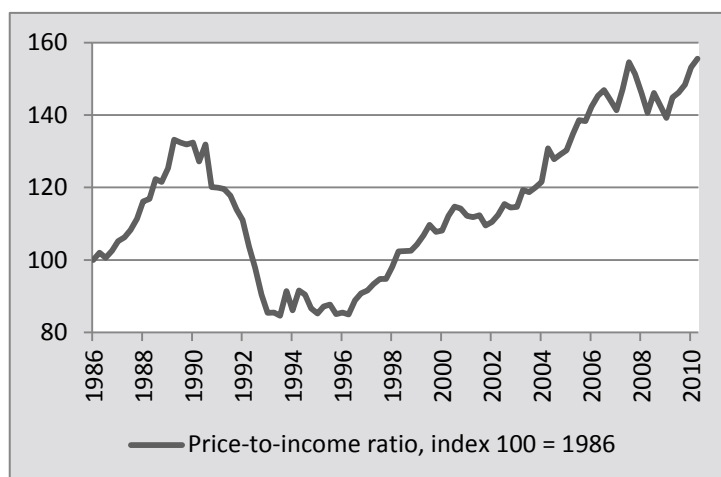
much faster than rents which could be an indication of a bubble or a consequence of the rent regulations.

## PRICE TO INCOME (P/I)

*Price-to-income* can serve as a simple indicator of the sustainability of house prices. If the ratio keeps increasing, individuals become more vulnerable to falling house prices, increased mortgage rates and unemployment since a change will be larger relative to the individual's ability to pay. There are several weaknesses with the P/I-approach. Firstly, it only considers average income, which could be misleading if house prices have changed mainly in low-income or high-income areas. While the change might look stable on an aggregated level it could still be the case that a certain socio-economic group has unsustainable P/I-ratios. Secondly, the method omits one of the main determinants of housing prices, namely mortgage rate. While this certainly has its

drawbacks it also has a positive effect. Unlike income which is generally trending upwards, mortgage rates are cyclical. This means that while low mortgage rate might temporary drive up house prices the mortgage rate is bound to eventually increase again and consequently draw the house

FIGURE 5 - PRICE-TO-INCOME RATIO, INDEX 1986 = 100



prices downwards again. As banks should require homeowners to be able to pay their installments no matter where in the cycle mortgage rates happens to be at the time the fundamental determinant ought to be income. As Figure 5 shows the P/I-ratio has increased by approximately 80 percent since 1995 and the current value is 35 percent higher than the average ratio since 1986. If we compare the development of the Swedish P/I-ratio with some relevant countries using data from *The Economist* (2011) we can see that the Swedish P/I-ratio has increased but not as much as in some other countries. Using 1985 as the starting year (index 100) Swedish P/I-ratio has increased to 140 while Spain peaked at 220 and Ireland at 200 before the crash, which could be interpreted as a sign that there is some margin until the Swedish house prices are completely unsustainable. On the other hand the US peaked at 130 and Denmark at 160 before the rather modest Danish crash. This could be interpreted as Sweden is in a vulnerable position. It is hard to draw any definite conclusion from the P/I-

ratio; there is certainly no threshold value which could be used to unambiguously confirm if there is a bubble. A very sharp increase in the P/I-ratio should be interpreted as a warning sign and the Swedish ratio is cause for concern even if it does not prove that there is a bubble.

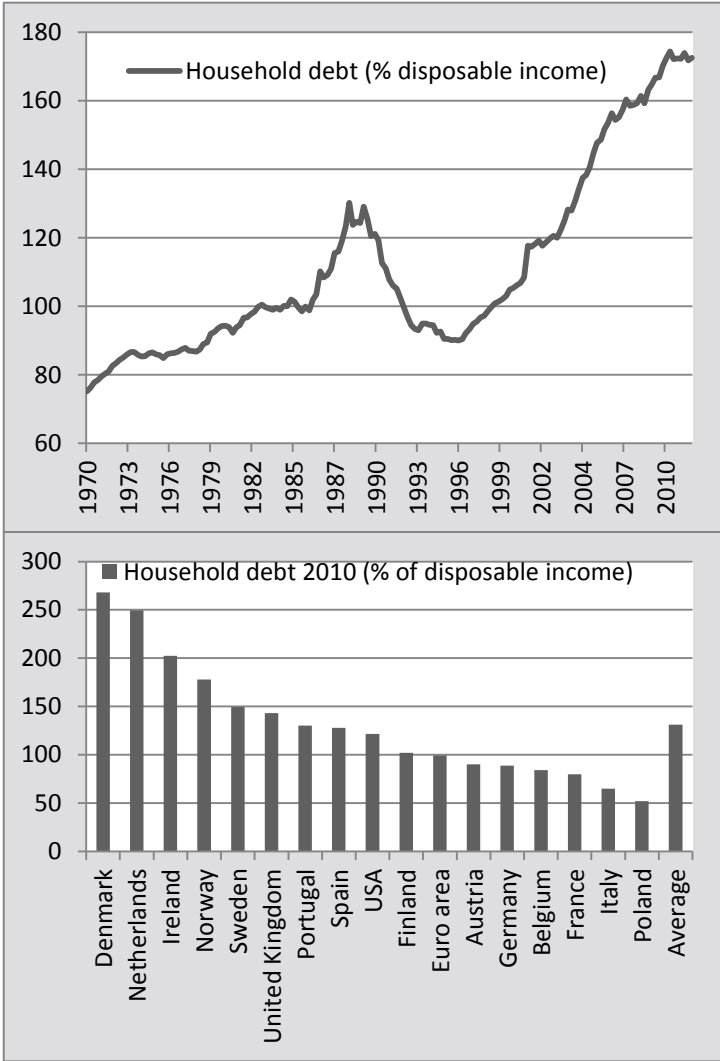
**HOUSEHOLD DEBT AND INCOME**

A very similar measure to the P/I-ratio is to look a debt and disposable income. It is a measure which is often used in the public debate, not at least by the Swedish Riksbank. As the only difference to the P/I is that debt is used instead of price most of the statements in the previous section applies here as well. One could argue whether house prices or debt is the best indicator when analyzing bubbles, the two often moves together and the distinction between them becomes irrelevant.

As long as banks and mortgage institutions maintain a constant standard in their assessments of credit applications, house prices and debt will move simultaneous. If banks become much more liberal in their credit assessment, a relatively small price changes could still be a problem as the households are more leveraged and thus more exposed.

This was the case in the US subprime mortgage crisis where the creditworthiness of new loans was a disaster. As long a credit standard remains high the market can sustain a much larger house price increase before it becomes a problem. Furthermore high credit standards has a restraining effect on house prices as it keeps demand down by keeping those with low creditworthiness out of the market. Just analyzing debt at a macro level could be misleading,

**FIGURE 6 - HOUSEHOLD DEBT (% OF DISPOSABLE INCOME)**  
**TOP: SWEDEN - BELOW: INTERNATIONAL COMPARISON 2010**



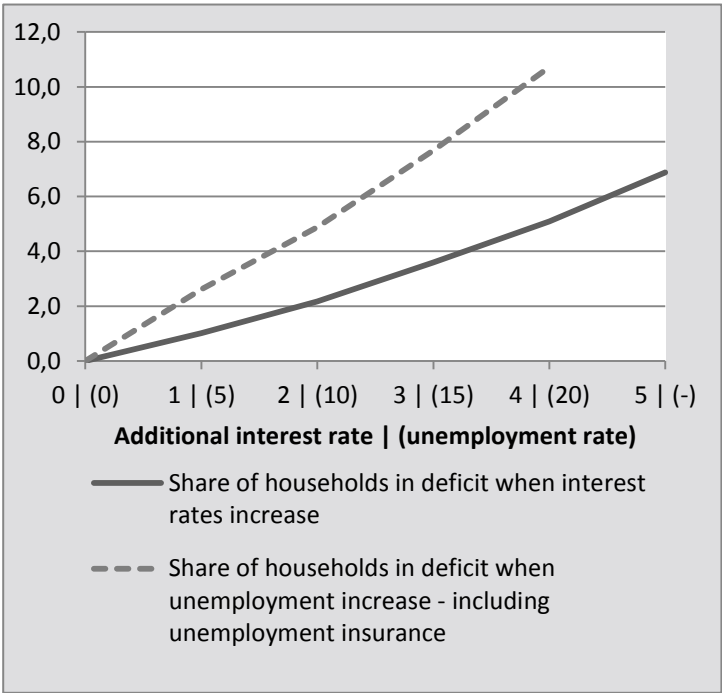
as the sustainability of the debt level depends on the creditworthiness of those individuals who receive the loans. The debt level in the US before the crisis might have been sustainable if the loans would have gone to middle- and upper-class households instead of households with a subprime creditworthiness. This does not imply that aggregated debt data is useless but it should preferably be complemented with additional information on debt distribution.

The debt of Swedish households relative to income has increased as can be seen in Figure 6. During the past 15 years, debt has increased from 90 percent of disposable income in 1996 to 172 percent in 2012. As can be observed from the graph current debt level is considerably higher than during the peak before the crash in the early 90s, which is worrying. Compared to other countries the Swedish household debt is high, as is shown in in the lower half of Figure 6. Out of the four countries in the Riksbank’s (2012) data set with higher debt levels than Sweden, three have had a housing bubble and the situation in the fourth, Norway, is unclear. The director of the Riksbank Stefan Ingves, has expressed clear concerns over the level of household debt and stated that aggregated debt cannot be allowed to rise over 200% of disposable income (SvD, 2013). As the distribution of debt has such an important role for the sustainability it is hard to justify any fixed limit on debt. The Swedish household debt has increased at an unprecedented speed and is substantially higher than the average in the Eurozone. Even if it does not necessarily means that there is a bubble it is certainly a cause for alarm. In order to draw any further conclusions one would like to investigate how debt is distributed among individuals.

FIGURE 7 - STRESS TESTS

HOUSEHOLD BALANCE SHEET

The IMF (2011, p.5) finds that among those countries which had a “twin boom”, i.e. a boom in both house prices and debt levels, 21 out of 23 countries suffered from a financial crisis or a severe decrease in GDP. This could be compared to countries where house prices did increase but debt remained relatively stable only two out of seven of those countries had a





crisis, and in both cases a relatively mild recession. Koo (2008) argues that the Japanese lost decade and the Great Depression was caused by balance sheet problems and this notion has later been formalized by Eggertsson and Krugman (2012). There has been an increased interest in the use of models based balance sheet data during recent years (Bezemer 2010, Mian and Rao 2011, SCB 2010 and Stiglitz 2009).

The Swedish Financial Supervisory Authority (FSA) has recently begun demanding micro-data for all approved loan applications from banks and mortgage institutes; unfortunately this data set is not available for researchers due to bank confidentiality. However some aggregated data has been published. From the data it is clear that credit standard has degraded during the past decade; in 2002 the average loan-to-value ratio was 59 percent and in 2011 it increased to 69 percent (FSA, 2013). Other than loan-to-value there are no indications of how creditworthiness has changed over time. The FSA has carried out stress-tests on all new loans in their data set by controlling how large share of the households would have their finances in deficit if the interest rate or unemployment were to increase, as shown in Figure 7 - Stress tests. These predictions are made with *ceteris paribus* conditions which mean that only the direct effect of an interest rate increase is included and not the indirect effect it will have on unemployment and wages. Consequently one can suspect that the share of households in deficit is underestimated to some extent.

### CHAPTER 3 - THE NEOCLASSICAL FRAMEWORK

The neoclassical school has been the most influential school of thought within economics for quite some time. The concept of bubbles has always been rather hard to explain and model within a neoclassical framework. To a large extent the very idea of bubbles is contradictory to central pieces of neoclassical thought, such as *rational expectations* and the *efficient markets hypothesis*. Rational expectations is a concept originally created by John F. Muth but is generally associated with the works of Robert Lucas (with Prescott 1971, 1978) and Thomas Sargent. The theory states that agents take the expected future value of an asset into account when making a valuation, as compared to *adaptive expectations* where the historical values are used to form the expectation of the future value. Rational expectation is a self-referring model, which intuitively can be explained as “The agents in the model have a model of the model” to use the words of Peter Albin (Minsky 1996 p.1). This means that the value of an asset today is highly influenced by the expectations of the future value of the asset. The

choice between rational and adaptive expectations is an important issue and will be discussed in the chapter on econometric models.

One might of course debate whether or not the assumption of rationality is a reasonable simplification of human behavior. Whatever answer might be, it is hard to deny that it is a highly convenient assumption, which in most cases greatly simplifies economic models, but this is not the case when analyzing bubbles. The assumption of rationality greatly complicates the analysis of bubbles and makes it necessary to add several additional assumptions in order to get any meaningful conclusion.

The second piece of neoclassical thinking which is central to the analyses of bubbles is the *Efficient Markets Hypothesis* (EMH) which is in many ways similar to rational expectations but has some differences as well. EMH was developed independently by Fama and Samuelson during the 1960s. The hypothesis can be operationalized in several different ways, Malkiel and Fama (1970) mentions three different ways in their review. The *weak form* in which information only refers to historical prices; the *semi-strong form* where prices adjust to publicly available information; and lastly the *strong form* which test whether agents with inside information price assets different than agents without inside information. For the purpose here it is enough to use EMH in its simplistic form which states that a market is efficient when prices fully reflect all available information. The problem with the simplistic form is that it is not testable.

Due to the vast amount of research within the neoclassical school it is not possible to summarize *one* single position which can be said to represent neoclassical thinking. A rather crude simplification of neoclassicism can however reduce a large portion of the literature into *two* major standpoints. The first one could be call *denial*, according to this view there is no such thing as a bubble. Since agents are rational and use all available information to make the best possible investment decision, there cannot possibly be something as irrational and destructive as a bubble. If prices of an asset lie above what can be motivated by market fundamentals no rational individual would be willing to buy the asset and prices would naturally fall. This adjustment process would be so quick that no significant deviation from the fundamental value which could be classified as a bubble could ever occur. Even if a bubble is predicted not to burst for several periods, prices today will still adjust to lower levels since no one wants to be the one to own the overvalued asset when the crash occur. This is known as backwards induction. But historical experience tells us that bubbles actually do

occur, how could this be accounted for? This leads us to the second standpoint which could be called *rational bubbles*. This standpoint claims that bubbles can occur but that they are in fact the product of fully rational individuals maximizing their utility and profit. There are a few different ideas as to why the bubble can be created but common for all explanations is the conviction that the bubbles cannot be predicted, because if investors *could* detect them, investors *would* detect them. And why would a rational individual buy an asset which price is strongly inflated? Therefore according to the neoclassical school a predictable bubble is impossible but an unpredictable bubble could indeed occur. This leads us to the question of why these unpredictable bubbles are created in the first place. There are three major explanations for this: growing bubbles, information bubbles and diverse prediction bubbles.

### GROWING BUBBLES

*Growing bubbles* can explain why bubbles can occur even when agents are rational; in order for this theory to work we need several additional assumptions. We need to assume that asset life, wealth and the number of traders are unlimited and that the asset is limited in supply (Camerer 1989). For a simplistic form we also need to assume that there is no difference in belief, no insurance, risk-neutrality, agents have identical information and identical discount rate. Under these circumstances the asset price today will be determined solely by the discounted sum of the dividends and the resell price of the asset in the next time period. As long as the bubble keeps growing at equal or higher rate than the discount rate it will be rational to invest in the asset. There will not be any large profits since the asset prices today will be adjusted for the price increase in the next period, in fact the expected profit will be zero, just as in any other market if the *efficient market hypothesis* is valid. The growth of the bubble could be higher than the discount rate only if there is a risk that the bubble will burst. Then the probability of the burst and its eventual magnitude will be included into the model requiring a higher growth rate, while of course the expected return will remain zero.

The assumptions of asset life, wealth, traders and supply are necessary because they can create a rationale why the bubble can keep growing for a long time. If asset life, wealth or traders were limited or supply was unlimited a rational agent would be able to predict that the bubble could not be sustained since the market size would be constrained. The crash could then be predicted and therefore would be predicted by rational agents and prices would adjust to their fundamental level before a bubble could even occur.

Is *growing bubbles* a good framework for explaining housing bubbles? Let's first examine whether the assumptions are realistic. Is the asset's life unlimited? Almost, there are few goods if any which are as durable as houses provided that they are well built and properly maintained. Are there an unlimited number of traders and wealth? Since houses are mainly bought by individuals and not by financial institutions the number of traders is very high. Buying a house is the biggest investment most people make in their life, which implies that size of the market is not limited in any significant way. Are houses limited in supply? Yes, there are several factors which can negatively affect how the supply of houses responds to changes in price. The most obvious one is that available land is a finite commodity, especially around metropolitan areas where the demand is high. Restrictive zoning laws and regulations regarding construction and price regulations for rental apartments also make the market more rigid. This might lead us to the conclusion that the fundamental assumptions used in the growing bubble theory are indeed reasonable when applied to the Swedish housing market.

How does the *growing bubble* theory stand up to Swedish data? One central piece of the theory is, as the name implies, that growing bubbles must grow in order to be sustained. A decline or stagnation in house prices inevitably leads to a crash of the potential bubble. Swedish house prices began to grow in the middle of the 90s, and kept growing with an average of 8% per year until the financial crisis struck and by early 2009 prices had fallen by a total of 6% from their peak value (EU 2012). This decrease might seem small and even irrelevant given the substantial growth in previous years, but according to the theory any price decrease should lead to the collapse of a bubble. If one looks at the quarterly data for the same period one can note that there have been several quarters when prices have fallen, as of the time of writing this the latest nationwide decrease was in January 2013 (SCB). This leaves us with two possible conclusions regarding the growing bubble theory.

1. There is no bubble.
2. The model is incorrect.

Which of these two options is true is not possible to say *ex ante*. The theory states that it is not possible to predict bubbles. The fact that we cannot say which option is true could be interpreted as a support for the model. This would however be putting the ambition level too low. Even if it were true that bubbles cannot be predicted it is a completely useless knowledge. Unless there is a complete certainty in the non-predictability statement, further

research into other explanations could provide valuable insights, something which the growing bubble theory never can.

## INFORMATION BUBBLES

*Information bubbles* are based on the idea that actors have different information or process the information using different models (Camerer 1989). In a perfectly functioning market actors without complete information should be able to deduct the lacking information from the prices which actors with complete information are trading at. This is of course reliant upon that it is known which actor has information and which actor lacks information. *Information bubbles* can be explained both with and without the assumption of rationality. According to Camerer (1989, p.26) information bubbles tend to be short-lived and limited in scope. Given that the subject matter of this paper is an eventual Swedish property bubble, which is getting close to two decades of rapid price increases it hardly seems relevant to apply an explanation which could only account for minor deviations during a limited time-frame.

## DIVERSE PREDICTIONS

Abreu and Brunnermeier (2003) offers another explanation of bubbles while keeping the assumption of rationality or at least near-rationality. Abreu and Brunnermeier take their starting point in the assumption that there are two kinds of traders, rational traders and behavioral trader. This is by no means a radical assumption, even Fama acknowledge that there can be some non-rational traders in the marketplace and there is a quite substantial literature which shows such behavior (Abreu et al 2003, footnote 3). In an *EMH*-model arbitrageurs would exploit the non-rational traders' mispricing in order to increase profits; thereby prices would adjust to their fundamental value. Unlike the *growing bubble theory* where traders will avoid any bubble which will not be able to grow unlimited due to backward induction, Abreu and Brunnermeier assumes that a rational traders will try to keep the asset which is overvalued for as long as possible and sell just before the crash. Since the model assumes that there are some non-rational trades it could be possible to sell just before the crash, something which would not be possible if all traders were rational. The crash will occur either because a sufficient share of the traders decide to sell simultaneous or because of an exogenous shock. Finding the exact moment of the crash could be difficult and different traders might reach different conclusions. Because the time of selling is diverse the exact moment of the crash cannot be predicted and this is what allows the bubble to grow in the first place. If the moment of the crash could be predicted the bubble would not occur due to

backward induction. The fact that different traders reach different predictions could be seen as irrational behavior but it could also be explained through asymmetrical information. Because traders cannot determine whether they have more or less information than other traders they cannot use deductive methods such as Bayes Law.

After discovering the bubble, traders always have the option of selling but as long as the risk of a synchronized selling is low the best strategy is to keep the bubble asset and let it appreciate further. Traders who are trying to ride the bubble have to worry about two things: an exogenous shock which can burst the bubble and an endogenous shock where rational traders decide to sell simultaneously. The effect of an exogenous shock could be much larger than the shock intrinsically could motivate, this is because traders could use minor shocks as a way of synchronizing their selling strategy. Behavioral traders on the other hand will create a rationale for the bubble and perceive that it can keep growing eternally. According to the theory bubbles can be large in scope and last for a long time if rational trades fail to synchronize their action.

Are the assumptions of this model reasonable? As have already been discussed the assumption both rational and non-rational agents participating in the market is hardly new and has been thoroughly investigated in previous literature. What about the assumption that the traders' predictions of the bubble's peak are diverse? This assumption is a bit difficult to test, but for anyone following the issue of bubbles through well regarded newspapers, government reports or academic research will find that opinions are highly diverse. Some traders successfully manage to pinpoint the moment of the crash while others fail could be due to asymmetrical information, better models or luck. But what is quite clear, regardless of the reason behind it, is that traders predictions are diverse and that the assumption is clearly reasonable.

Even if Abreu and Brunnermeier's theory and the *growing bubble theory* have substantial differences in their assumptions, both models justify the existence of bubbles using the same concept. In both models the assumptions strive to create a situation where the moment of the bubble's crash cannot be predicted. Put in a different way: the central issue when explaining bubbles in a neoclassical framework is to motivate why the process of backwards induction is not taking place. A bubble which crash can be predicted will never occur in the first place. Given this predicament, it is hard from a neoclassical point of view to motivate why it would

ever be meaningful to investigate bubbles, as the only answer which is theoretically possible to get is that the crash and the bubble could never be predicted.

The model presented by Abreu and Brunnermeier require some sort of shock for the traders to be able to synchronize their selling strategy. If there is indeed a bubble one have to question how the countless negative shocks and news stories which have occurred since the financial crash has not managed to the traders to synchronize their strategies. If the worst economic crash since the great depression, followed by a prolonged currency crisis in the Eurozone has not been enough to induce a crash in Sweden, either through changes in fundamental values or because of changes in the endogenous selling strategies, it is hard to imagine what would.

Might the explanation why traders have not managed to synchronize their strategies be the inherent characteristics of houses as an asset? The market is completely dominated by individual traders who like all people need somewhere to live. The only way of realizing profits made from increasing house prices is by selling the house. This implies that a synchronized selling behavior from rational traders would require that a large number of people sell their homes and move either into rental apartments or to much less attractive and cheaper houses. As explained in the introductory chapters the Swedish rental market is highly dysfunctional and it is quite simply impossible for a major shift from ownership to rental in metropolitan areas. There are not enough rental apartments to enable a synchronized selling behavior.

What does this lead us to conclude regarding Abreu and Brunnermeier's model? Given the substantial negative exogenous shocks and the abundance of negative news stories during the past years it seems unlikely that a bubble could have persisted according to the model. The most reasonable application of the theory would suggest that there is no bubble and that there has not been any house price bubble in Sweden during the past years. Or, of course, that the model is incorrect. Without the knowledge of whether what we are seeing is in fact a bubble or not it is not possible to judge the theory further.

## DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM MODELS

Dynamic stochastic general equilibrium (DSGE) models are commonly used by central banks and other institutions for economic forecasting (Sbordone et al 2010). It is not entirely fair to place DSGE models in the neoclassical section. DSGE models can be neoclassical but they can also be based on a New Keynesian framework with the difference being that neoclassical

models assume flexible prices while the New Keynesian models assume sticky prices. For the purpose here that distinction is not of great importance. As the name indicates DSGE models are based on general equilibrium theory. Equilibrium is found using macroeconomic models which are derived from microeconomics. Agents are assumed to be forward-looking which implies rationality. DSGE models has been heavily criticized after the financial crisis in 2008 for failing to incorporate financial markets into the models and for underestimating the systemic risk when financial markets has been incorporated (Riksbanken 2011, page 198). When analyzing bubbles the DSGE model suffers from structural problems. Since the model strive to reach equilibrium, assets cannot stay mispriced in the model, instead some explanatory variable change in a way which would justify the price. In the case of a housing bubble a DSGE model is prone to find that the households' preferences for housing has increased which would justify the boom. As there is no way of directly observing preferences the model estimates preferences in such a way that the market appear to be in equilibrium, even if might not be the case.

## CHAPTER 4 - THE ECONOMETRIC APPROACH

Econometrics is widely used by central banks and academia to analyze housing bubbles. The process of analyzing bubbles using econometrics can be divided into two parts. In the first part the determinants of house prices are estimated, this could be done with time series data as in the Error Correction Model (ECM) but it could also be done using cross-sectional data. In the second part both a long-run and short-run equilibrium price is estimated using the coefficients from the first step and time series data. The difference between the long-run and short-run equilibrium shows how much houses are over- or undervalued. This chapter will first explain and discuss the ECM and then present some papers applied to interesting cases.

### ERROR CORRECTION MODELS

A common approach in econometric analysis of bubbles is to use an ECM. This part will focus on Carl Andreas Claussen's paper *Are Swedish Houses Overpriced* (2012). The ECM is based on the relation between the short-run equilibrium and the long-run fundamental equilibrium. House prices are assumed to be determined by independent variables such as disposable income, interest rate and financial wealth. When an independent variable shifts it directly affects the short-run equilibrium but since it takes time for the supply to adjust, due to construction time and the planning process etcetera the long-run will be in disequilibrium for some time. *Error correction* refers to the gradual processes where the short-run market



adjusts to the fundamental long-run equilibrium. The first practical step of the ECM is to test if the independent variables are non-stationary, which can be done with the Augmented Dickey-Fuller test or the Phillips-Perron test. If the variables are non-stationary it is only if they are cointegrated there can be any meaningful interpretation of the results, otherwise the results will be spurious. The next step is to run the regression, in Claussen's case a dynamic OLS, which is a normal OLS augmented with leads and lags for the integrated variables. The regression is tested for cointegration using various tests such as Johansen System Cointegration test, the Engle-Granger test, the Hansen instability test and the Phillips-Ouliaris test. The results in Claussen's paper are not entirely conclusive but strong enough to proceed with the cointegration approach. The results can be divided into two parts, the first part is the interpretation of the coefficient results and the second part is whether the short-run equilibrium differs from the level determined by the fundamentals in the long-run. A short-run price higher than the long-run price would imply a bubble. The regression results show that a one percentage point increase in real disposable income increases house prices by 1.3 percent and a one percentage point increase in real interest rate decreases house prices by 6 percent. These results are higher than what earlier studies on Sweden have found but remain well within the interval which papers on other countries have shown, as is shown in Table 1.

Claussen finds that 30 percent of the difference between the short-run and long-run equilibrium is closed every year. The paper concludes that 62 percent of the price increases since 1996 can be attributed to increases in real disposable income while 25 percent of the increase can be explained by the falling real interest rate. Claussen finds that there is no house prices bubble, since the short-run price and long-run fundamental price is roughly equal.

Table 1 - ECM Results	Country	Real income	Real interest
Claussen (2012)	Sweden	1.3	-6
Adams and Füss (2010)	Sweden	0.99	-4.5
Hort (1998)	Sweden	0.6 to 0.97	-2.5 to -2.9
Francke (2010)	Netherlands	1.4	-3.5
Oikarinen (2005)	Finland	0.8 to 1.3	-2.2 to -7.5
Coefficients denote the percent change in house prices caused by a one percentage point increase in the variables. Claussen (2012)			

## CRITIQUE OF ECM

A relevant question to ask is whether these estimated coefficients are stable or if they are likely to change in the event of a crisis. Econometric models are always based on historical data from which relations between variables are derived. The fact that a relation has been stable over time is not a guarantee that it will be stable in the future. When a bubble bursts it is often followed, or is caused, by a dramatic shift in the expectations of the future relationship. A recent example of this is the subprime market which was radically reevaluated around 2007. It had previously been perceived as possible to balance out the high risk by creating MBS with a large geographical spread as the US housing market had never fallen in all states at the same time before. This previously “true” relation was invalidated and the behavior in the market changed drastically with the revelation. The same is also true for the dotcom bubble and countless other bubbles throughout history. While it is likely that a one percent increase in real disposable income has indeed on average led to a 1.3 percent increase in house prices, as Claussen finds, the relation might change if it turns out that there is indeed a bubble. Ganoulis and Giuliadori (2010) finds that their income coefficient can vary between 0.7 and 1.5 depending on how the model is specified. That might not seem like such a big difference but if one applies both coefficients to Swedish income data it cause a 30 percent difference in the estimation of the long-run house price equilibrium. This is not saying that Claussen’s estimation is wrong; it is merely saying that crashing bubbles often shatters perceptions which were held to be true not only for history but also for the future.

Another important critique of the ECM when applied to bubbles is that the observations can be biased. Since the build-up of a bubble could go on for a very long time there is a real possibility that a large portion of the observations are under the influence of the bubble. What is in fact an unsustainable development can be misinterpreted by the model as sustainable simply because it has gone on for such a long time. In the case of Claussen’s article the data set starts in 1986 and ends in 2011. If we for the sake of the argument assume that the house price trend which started in 1996 is in fact a bubble that would imply that approximately sixty percent of the observations are influenced by the hypothetical on-going bubble. On top of that are the observations from 1986 to 1990 which we, with the benefit of hindsight, know were part of a housing bubble. If we add the hypothetical and the known bubble years they account for more than three fourths of all the observations in the data set. I am not claiming that this is the case, but since nobody really knows whether what we are seeing is in fact a bubble or not, we cannot discard the possibility that a large portion of the observations which are used are in fact biased towards type I error, where the correct hypothesis is falsely rejected. Econometric

models can only use historical observations to estimate relations between variables. If the observations are part of an on-going bubble, the unsustainable relationship between the variables will become the norm which all new observations are judged against. The model can fail to detect the bubble because the model has come to regard the exuberance of the bubble as normal. This issue could be resolved by using longer data sets but this is often not possible, either due to lack of longer data sets or because the market has seen such radical reforms that earlier data cannot be expected to behave in the same way as under the current circumstances.

One way of dealing with the possibility of biased observations is used by IMF (2003). By excluding the observations in the latter part of the time series where one could suspect a bubble the coefficients are estimated using only earlier historical data where we know there was no bubble. The coefficients estimated from the earlier time periods are then applied to the latter time periods. The risk of biased observations is greatly diminished but some new problems could occur. First of all the number of observations is decreased which makes it harder to find statistically significant results. Another problem is that the coefficient values could have changed for reasons which has nothing to do with the eventual bubble. The preference for housing could increase or decrease over time and the marginal effect of an income increase on housing could change as income level increases. This could lead to the opposite problem that the analysis shows that there is a bubble when there in fact only has been a change in preferences. One could say that this method shifts the risk of a type I error into a risk of a type II error.

#### ADDITIONAL EXAMPLES OF ECONOMETRIC PAPERS

Kieran McQuinn and Gerard O'Reilly (2007) carry out a cross-country analysis between 16 OECD countries. The model is based on the role of credit in the formation of house prices. It assumes that lending from mortgage institutions is determined by household disposable income and interest rates. The size of the mortgage can reasonably be expected to be an important determinant of housing demand. The paper estimates both a long-run relationship between house prices and the size of the funds available for borrowing; and a short-run model which determines the speed of the adjustment to the long-run equilibrium. The method is very similar to the ECM but with panel data instead of time series data.

Fernández-Kranz and Hon tries to estimate the income elasticity of housing demand using a cross-sectional dataset with fifty Spanish provinces. In the literature study the paper finds that studies which use a cross-sectional approach estimates considerably lower elasticity

coefficients than studies based on time series approaches. One might of course argue over which estimation is closest to the true value, but in the context of finding bubbles lower coefficient estimates makes it easier to reach the conclusion that the market is overvalued. In the model the income elasticity of housing demand is estimated using the cross-sectional data. The income elasticity is then applied in a time-series setting one can estimate the difference between the current price level and the long-run equilibrium using an ECM. Fernández-Kranz and Hon finds that Spanish house prices in 2003 were overvalued by between 24.0% and 34.3% dependent on the exact specifications of the model. Ex post we know that house prices fell by more than a third since the beginning of the crisis. The predictions by Fernández-Kranz and Hon were made in 2003 while the market started falling in 2008, this makes it unsuitable to directly compare the numbers with the ex post outcome since there were four to five years where the prices kept increasing.

Maurice J. Roche's article *Will There Be A Crash In Irish House Price?* (2003) can safely be put in the category of papers which completely failed in their predictions. The article is partly written as a response to a report from the IMF (2003) and an article in *The Economist* (2003) entitled *Close to bursting: A survey of property*. The IMF-report warned that there was a substantial risk that Irish houses were overvalued, an ECM similar to that conducted by Claussen (2012) showed that prices were 16.5 percent above the long-run equilibrium. In order to solve the problem of biased observations due to an enduring on-going bubble the IMF tries to estimate the coefficients using only historical data (1978-1997) and then applies those coefficients on current data. With this approach the IMF found that house prices could be overvalued with as much as 50 percent. *The Economist* analysis found that prices were overvalued by 40 percent and was predicted to decrease by 20 percent within the next four years. Roche wrote that these analyses were "pessimistic" and "sensationalist". With hindsight we know that following the peak in 2007 Irish house prices fell by 56 percent which implies that even the "pessimistic" analyses from IMF and *The Economist* were in fact slightly optimistic. Roche finds that house prices were at most overvalued by five percent or at line with fundamentals. It is hard to say why Roche's analysis missed the bubble; it could be due to the observation bias. It could also be because of the specification of the model, as Ganoulis and Giuliadori (2010) points out that makes a big difference. This is one of the problems with econometric models; while they might appear objective their results are in fact highly subjective to the arbitrary specifications of the model.

## CHAPTER 5 - BEHAVIORAL THEORY

Behavioral economics is hardly a new field within economics, quite the opposite. It has been around since the foundation of economics in the 18<sup>th</sup> century. This chapter is not intended to be a complete history of behavioral economics, it is rather meant as an overview of some of the central pieces of behavioral theory which is relevant to the subject matter of bubbles. The main issues will revolve around the concept of rationality and how it can be criticized using behavioral economics; and some explanations of why bubbles occur according to behavioral economics.

With the assumption of rationality, bubbles can only occur under very specific circumstances, most notable a bubble cannot grow if its crash can be predicted as prices will be brought back to their fundamental level through a process of backwards induction. But is it reasonable to assume that individuals and markets act in such a perfectly rational way? John Maynard Keynes would most likely have answered *no* to that question. As far as I can determine there are two main ideas in *The General Theory* (1936) which would counter the strict notion of backwards inductions. The first piece is *uncertainty*. It is essential that we separate the concept of *risk* from the concept of *uncertainty*. In neoclassical theory we use the concept of risk. When making predictions each possible outcome is given a quantified probability of occurring and each outcome also have a quantified cost or benefit attached to it. The individual chooses the course of action which outcomes will yield the highest possible expected utility given certain risk preferences. But how often can the future be quantified in terms of probabilities and magnitudes? Not very often according to Keynes:

“[...]we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes to nothing; or even five years hence. In fact, those who seriously attempt to make any such estimate are often so much in the minority that their behaviour does not govern the market.” (Keynes 1936, p.149)

The future is often uncertain, by which we mean that we simply don't know what is going to happen. There is often no way of calculating the probabilities or quantify the impact of future events. Unlike risk there is no meaningful way of incorporating uncertainty into a rational utility maximizing framework. There is no expected utility from an uncertain future and therefore it cannot enter any equation. There is quite simply no rational way of dealing with uncertainty. This is not saying that all future events are completely uncertain or that there is

no rationality, it is merely saying that rationality alone cannot explain all decisions. As the future always involves some amount of uncertainty all predictions lack a complete information basis for a fully rational decision.

This leaves us with an important question, when it is not possible for market participants to form their expectations in a rational way, then how do they decide what to do? There are several possible non-rational alternatives which could guide the decision-making process.

The first one is to move from rational expectations to adaptive expectations or some similar system, such as heuristic models. In models with rational expectations the agent base his decisions on utility maximization with predictions about the future as the main determinant; in models with adaptive expectations the agent uses historical information to predict future events. It should be pointed out that adaptive expectations are not rational. Historical data can be a part of a rational decision but it cannot alone be enough to induce a rational decision. Since it is the forward-looking part of the decision-making process which is the main cause for why bubbles cannot occur, the absence of certain information about the future is crucial for understanding the creation of bubbles. The only certain information is often the historical information and consequently the effect can be that extrapolated past trends can be the best *available* information to base a decision on. This has the implication that trends can be fueled by speculators into bubbles. If house prices has been increasing, which could be due to changes in the fundamentals, the upwards trend in prices can continue even when the fundamental values stagnates, purely because individuals have come to expect house price increases in the future and are therefore willing to pay a higher price for objects. In Sweden the expectations of future house price increases, as measured by SEB's Boprisindikator (2013), has been dominating during the past decade with the notable exceptions right after the crisis in 2008, and during the worse turmoil in the Eurozone in 2011. Boverket (2013) found in a report that one third of the house price increase in Sweden since the mid-90s could be explained by adaptive expectations. Given the huge possible explanatory value of expectations there is surprisingly little information available regarding the general public's expectations of the price development. It could of course be the case that financial institutes which gather this information keep it confidential to get a competitive advantage. As far as I can determine the only Swedish institute to collect and publish survey information about expectations on house prices is the bank SEB with their "Boprisindikator". The problem with this measure is that they only ask whether prices will increase, decrease or stay still during the next 12 months. It does not ask the respondent to quantify their answer with how large they

think the change will be. The method can misrepresent the public's view if the magnitude of the positive and the negative expectations differ, that is for example if those who expect a price decrease believe the decrease will be relatively small while those who believe in a price increase expects it to be substantial.

A second alternative to assuming rationality is *Animal Spirits*, a concept most associated with Keynes but which is also used by contemporary economists such as Akerlof and Shiller. *Animal Spirits* is not a clearly defined psychological term but more of a general description of a decision-making process different from the calculated rational one. The core of *Animal Spirits*, according to Keynes, is a psychological urge to take action rather than remaining passive. Even if there is uncertainty whether which of existing options will yield the greatest return it lies in human nature to just pick one option and stick with it. Taking a decision is often a necessity, even when the information is not sufficient to make a rational decision. Buying or selling a house is often related to changes in the family structure or job changes which force the individual to make a decision regardless of the level of certainty. Passivity, even if that also could be perceived as a course of action, is therefore not always an option when it comes to situations with great uncertainty.

*Animal Spirits* is a central piece of Keynes argument in the *General Theory* but somewhat surprisingly it is not a very important part of Keynesian economics. When Keynesian economics was formalized after Keynes death the concept of animal spirits was downplayed in order to make the new theory fit better into the already existing neoclassical framework in order to speed up its implementation in public policy (Akerlof & Shiller 2010 p. x).

Akerlof and Shiller (2010) use five subcategories of animal spirits which they claim affect people's decision in addition to rational factors, namely: confidence, fairness, corruption, money illusion and narrative. Not all these factors are of any significant importance for the property market but confidence, money illusion and narrative can reasonably be expected to be important

Confidence is an important concept for investors according to Keynes and to Akerlof and Shiller. While it might be natural to think that investors make their investment decisions based on predictions of the development of the real economy Keynes claims that financial markets are run with a much shorter perspective in mind. The fundamental determinant of an assets value is not what can be called *market fundamentals* but instead what investors think other investors are willing to pay. As Keynes write "For it is not sensible to pay 25 for an

investment of which you believe the prospective yield to justify a value of 30, if you also believe that the market will value it at 20 three months hence“(1936, p 155). The most profitable strategy is therefore not to predict the real economy but to predict what other predictors will predict the other predictors to predict and so on. Or in the case of selling a house, the important thing is what someone is willing to pay the price, not that the price equals the intrinsic value. Confidence, which can be said to be ones prediction of others predictions, is therefore at the core of any investment decision. It appears to be a rather substantial discrepancy between the economic academia and actual market participants regarding confidence. Confidence is seldom a topic in economics and is seldom incorporated into models. While if one listen to chief economists at banks and financial institutes they often speak in terms of confidence and market sentiment. It is of course not possible to determine here whether confidence actually guides investment decisions or if it is just a simple concept which is easily communicated outwards as a sort of marketing. Confidence is similar to expectations with the notable difference that confidence is more exclusively focused on opinions rather than facts. Confidence add to the expectation concept by showing the important role of market sentiments, how opinions feeds opinions which affect prices.

The second part of animal spirits which has a substantial effect on the market according to Akerlof and Shiller (2010) is *stories* or *narrative*. This is based on the idea that humans are much more likely to respond to a story than to plain logic and statistics. There are countless examples of issues which have been well covered scientifically and statistically but it is first when someone has made a story of them, whether fictional or documentary, that the issue becomes important to the general public. For example Al Gore brought a new awareness to global warming by portraying it as a personal struggle at the core of his life story and Charles Dickens brought the issue of poverty to the public mind through his fictional novels. The reader might ask what this has to do with property prices. Akerlof and Shiller focus quite a lot on stories which in hindsight can be seen as excuses for why an ill-boding trend which eventually lead to the collapse of the US housing market were perceived as an opportunity. Houses were through a process of storytelling transformed from being mere residences into being investment object. Not just any investment, but in fact “the best investment” (Akerlof & Shiller, 2010 p.149). Houses were pitched as an investment object which was not only very safe but also destined to keep increasing in value. Both of these statements are in fact false and they were false when they were told. There is definitely a risk with owning a house, prices might not be as volatile as the stock market but there is still a substantial risk due to the



cyclicality, especially since houses is often the by far largest investment many people do during their lifetime which implies even relative minor changes could have a considerable effect on households' economy.

A false rationale which is often used to explain perpetual increases in house prices is that land is a finite resource and as population increases and becomes more urban the demand will increase while supply will remain fixed, hence price of land and therefore the price of houses is bound to increase. While it is true that land prices are mostly higher in densely populated areas this is no guarantee that prices will not fall. Highly populated cities where land is scarce, such as London, New York and Tokyo have all seen prices fall in recent history which clearly shows the fallacy in the land argument. Both Edward Glaeser (2013) and Shiller (2007) have found that market participants tend to underestimate how elastic housing supply is. In other words, when house prices increase the construction rate will also increase which increase the supply of houses which drives prices down again. Why Swedish construction rates remain at such a low level despite the house price increase is puzzling, and is one of the main arguments for why the current situation is not a bubble.

Stories of successful and profitable house purchases are spread through media and gossip, and eventually come to form the perception of the market for households. This view is based on the idea that individuals form their worldview from what they encounter; this puts more focus on the personal experiences of friends and family and less focus on statistics. With the development for Swedish house prices during the past fifteen it is hardly surprising that these stories have been overwhelmingly positive which could have fueled the optimism.

The third animal spirit mentioned by Akerlof and Shiller, *the money illusion*, further increases the impact of these stories. The money illusion is based on the idea that people in general focus on nominal value and not real value which would be the rational thing to do. Another way of putting it is that people don't always take inflation into account. This is not claiming that people never care about inflation but it is reasonable to suspect that people care only when inflation has a significant effect on the personal economy. The money illusion creates an optimistic bias in the stories told about the housing market. I have not found any data on this but I think it is quite reasonable to assume that people generally know what the nominal purchasing price of their houses is, but when the house is sold several year or even decades later they do not know what the nominal prices would be equivalent to in today's general price level. A house bought in Sweden in 1981 will on average have a nominal value a bit

over four times the original purchasing price in 2011, but approximately forty percent of that increase is caused by inflation. If the house owner only look at the purchasing price and the selling price the success of the investment will be greatly overestimated. This overestimates success could be an important reason to the creation of positive stories about the housing market. It is naturally difficult to quantify stories, but it could be possible to estimate stories by analyzing newspaper archives and try to see if the number of articles has increased or if the perspective has become more or less positive; this is however outside of the scope of this paper. For a regular reader of newspaper some patterns can be observed. During the first half of the 00s there was a clear trend of renovating houses and a semi-professional market for buying old houses, renovating them and then selling them was created. To what extent this market was actually important is hard to say but it certainly was a part in a wider transformation of houses from mere residences into an investment asset. Another illustration of the narrative of the housing market is the concept of property ladder. This notion that owning a property, with loaned money, would somehow increase ones chance of eventually getting a better property is hard if not impossible to justify with economic theory. Only with the perception that houses are investment objects which will inevitable increase in value can the concept of a property ladder make sense. With the more accurate perception that houses are risky, often highly leveraged assets it is hard to motivate that there is such a thing as a property ladder. In the period after the financial crisis the medial and probably also public's stories have shifted to a much more negative point of view. Articles on bubbles and the unsustainability of house prices have become a common feature in newspaper and the risk has become the main story instead of the optimistic outlook which dominated the reporting before the crisis.

Akerlof and Shiller use two additional parts of animal spirits, fairness and corruption. These concepts are of lesser importance for the housing market but have a somewhat more important role in the rental market. Very shortly one could say that fairness is an important motive behind the price regulations in the rental market with the ambition of decreasing segregation, even if one can claim that the policy miss the objective. Corruption is said to be quite widespread in the rental market with payments under the table to get underpriced first hand contracts. For natural reasons the information is quite limited. There are probably a lot of cases but since it is not in the interest of neither the buyer nor the seller to disclose the illegal transaction and the issue does not seem to be prioritized by the authorities the size of the

problem remains unknown. As the housing market is much less regulated than the rental market these issues are resolved by the market.

What empirical evidence is there to support the claim that markets are at least partly governed by behavioral concepts which are incompatible with rationality? Support for the behavioral approach can be found in economic experiments. There are several experimental studies which find that bubbles can and do occur even in controlled settings where there are no rational reason for bubbles occur. For example Noussair et al. (2001) finds that bubbles occur in an experimental setting where the fundamental value of the traded asset should rationally be constant during all periods. Smith (2012) shows that even participants who show a high understanding of the market purchases assets when the price is over the fundamental value.

Boverket (2013) has conducted a study where the price increase in the previous period is used as an explanatory variable, thus modeling for adaptive expectations. In a rational market past price changes should have no predictive power since any such pattern would be exploited by arbitrageurs. Boverket (2013, p.12) finds that the price change in the previous period can explain roughly 30 percent of the price increase in the next period. Given how simple it is to model for adaptive expectations and how large explanatory value it can have, it is surprising how seldom it is done. What this depends on is hard to say, it might be a consequence of the dominant position rational expectations has in mainstream economic theory which makes researchers unwilling to try explanations which does not fit in the current paradigm. If expectations are adaptive and they play an important role in the upward price trend they can also be expected to play a role in a price downturn, by making people believe that one price decrease will be followed by another, thus amplifying the effect of a downturn.

The behavioral approach certainly gives explanations to why a property bubble may occur, but is there some meaningful way of operationalize the theory? There are no formal tests as far as I can determine but there are several valuable insights which can guide economists trying to assess a potential bubble. The first benefit, as compared with neoclassical theory, is that the necessary conditions for a bubble to occur are much less rigorous. Bubbles are seen as a rather natural phenomenon instead of a product of very strict requirements. The second benefit it that bubbles actually can be predicted, a central piece in the neoclassical theory is that bubbles which can be predicted cannot occur. This implies that there is a real benefit of trying to find bubbles which increases awareness.

## CHAPTER 6 - CONCLUSION

It is claimed that Harry S. Truman in frustration said that he wanted a one-handed economist because all his economic advisors said “on the one hand...on the other”. This thesis clearly falls in the two-handed economist category. The sad fact of the matter is that we simply don’t know whether Sweden has a housing bubble or not. There are certainly statistics and models which are cause for alarm. House prices and debt has increased faster than ever; loan-to-value ratios have increased and half of all new mortgages do not require amortization. There are also several reasons which could justify this development. There is a housing shortage in many areas which should drive up house prices; the disposable income has steadily increased over the last decades and mortgage rates are at their lowest rate for decades.

While this thesis does not conclude that any specific model is “the right one”, it certainly argues that some models are worse than others. The neoclassical approach stands out for its lack of usefulness. As the neoclassical model is reliant upon the bubble being unpredictable it offers no predictive power. The DSGE model face similar problems, since the model always assumes equilibrium it creates a false rationale to justify that a bubble is in fact only a change in preferences. These two models do not predict any bubbles simply because they are constructed in a way which makes bubbles a theoretical anomaly. These theories might be useful for other purposes but for finding bubbles they offer little insight.

The econometric approach also faces some structural problems but unlike the neoclassical approach there are possible solutions to at least some of the problems. The first problem is the observation bias which implies that the results might be biased because a large share of the observations is drawn from a time period when the economy is in a bubble and thusly the results can be corrupted. This thesis argues that using elasticities, estimated from historical periods where we with hindsight know there was no bubble, could be a good way of testing the robustness of econometric models. The second problem is that the role of expectations is often overlooked in econometric models. Modeling for adaptive expectations is easy and would be a good first step; but just using lagged house price changes is unsatisfactory since houses are often bought as a long-term investment and the year-to-year changes are of lesser importance compared to the long-term expectations. A better way would be to start regularly collecting survey data on households’ expectations for house prices in the short, medium and long-run (for example 1, 5 and 10 years) and incorporating it into the econometric models. Given the importance of house prices for the real economy and the importance of expectations

in explaining house prices it is surprising that this data does not exist. The third problem is that a bubble's burst often radically transforms the expectations of the future and the relationships between variables. What was widely seen as sustainable in the boom turns out to be unsustainable in the bust. In econometric terminology the bust often turns out to be a structural break which cannot be incorporated into econometric model *ex ante*. Despite this problem the econometric approach offers a plausible way forward if carried out properly.

The behavioral approach offers valuable insights when it comes to the limits of rationality and the human decision-making process. It also offers several explanatory variables; such as expectations, confidence and narrative, which are commonly omitted from mainstream analysis. By being aware of these explanations it is easier to understand why prices can change in a way which cannot be explained by fundamental variables. The obvious problem with the behavioral approach is that there are no formal tests or definite answers.

This thesis does not claim to finally answer the question whether or not there is a housing bubble. The evidence available is too ambiguous to induce a certain conclusion, especially the effect on house prices caused by the housing shortage is hard to quantify. Even if there is no certain answer this thesis would argue that from a policy perspective there is adequate evidence to proceed under the assumption that there is a housing bubble. The main policy objectives in the coming years ought to be to keep house prices stable; increase the households' and financial institutes' resilience to a downturn and increasing housing supply. With a conspicuous lack of humility I would propose these following policy recommendations in order reach these objectives:

- Phase out the deductibility for interest costs. Thereby reducing the incentives for households to take on debt.
- Make it a legal requirement to amortize debt until the LTV-ratio has reached a certain percent, for example 70 percent. This would make households and the financial system more resilient to shocks.
- Remove or phase out the rent regulations. Thereby increasing the incentives to build rental apartments and eventually giving people a realistic alternative to buying a house.
- Liberalize zoning laws, building regulations and appeal processes. Thereby making it easier to construct new houses and eventually solving the housing shortage.

## REFERENCES

- Abreu, D., & Brunnermeier, M. K. (2003). Bubbles and crashes. *Econometrica*, 71(1), 173-204.
- Akerlof, G. A., & Shiller, R. J. (2010). *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism (New in Paper)*. Princeton University Press.
- Bentzel, R., Lindbeck, A., & Ståhl, I. (1963). *Bostadsbristen. En studie av prisbildningen på bostadsmarknaden*. Stockholm.
- Bergendahl P.A. (2012). Att hyra – från en rätt för allt färre till en möjlighet för allt fler. *SOU*, 2012:88).
- Bezemer, D. J. (2010). Understanding financial crisis through accounting models. *Accounting, Organizations and Society*, 35(7), 676-688.
- Boverket (2012). *Bostadsbristen ur ett marknadsperspektiv. Rapport 2012:18, Regeringsuppdrag*.
- Boverket (2013). *Drivs huspriserna av bostadsbrist? Marknadsrapport, februari 2013*.
- Camerer, C. (1989). Bubbles and fads in asset prices. *Journal of Economic Surveys*, 3(1), 3-41.
- Case, K. E., & Shiller, R. J. (2003). Is there a bubble in the housing market? *Brookings Papers on Economic Activity*, 2003(2), 299-362.
- Case, K. E., Shiller, R. J., & Thompson, A. (2012). What have they been thinking? Home buyer behavior in hot and cold markets (No. w18400). *National Bureau of Economic Research*.
- Claussen, C. A. (2012). *Are Swedish Houses Overpriced? Riksbanken – Working Paper*.
- Crowe, C., Dell'Ariccia, G., Igan, D., & Rabanal, P. (2011). How to deal with real estate booms: lessons from country experiences. *IMF Working Papers*, 1-58.

Dow, S. (2010). 13 The psychology of financial markets: Keynes, Minsky and emotional finance. *The Elgar Companion to Hyman Minsky*, 246.

Economist, the (2003). Close to bursting: A survey of property.

Economist, the (2005). *Will the walls come falling down?* <http://www.economist.com/node/3886356>

Economist, the (2011). *Global House Prices - Location, location, location.* <http://www.economist.com/blogs/dailychart/2011/11/global-house-prices>

Eggertsson, G. B., & Krugman, P. (2012). Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach\*. *The Quarterly Journal of Economics*, 127(3), 1469-1513.

EU Commission (2012). In-Depth Review for SWEDEN in accordance with Article 5 of Regulation (EU) No 1176/2011 on the prevention and correction of macroeconomic imbalances. *Commission Staff Working Document*, Brussels, 30.5.2012.

Fama, E. F. (1991). Efficient capital markets: II. *The journal of finance*, 46(5), 1575-1617.

Fernández-Kranz, D., & Hon, M. T. (2006). A cross-section analysis of the income elasticity of housing demand in Spain: Is there a real estate bubble?. *The Journal of Real Estate Finance and Economics*, 32(4), 449-470.

Fisher, I. (1933). The debt-deflation theory of great depressions. *Econometrica: Journal of the Econometric Society*, 337-357.

FSA - Finansinspektionen (2012). Den svenska bolånemarknaden. *Rapport*, 13 mars 2012.

Ganoulis, I., & Giuliadori, M. (2011). Financial liberalization and house price dynamics in Europe. *Applied Economics*, 43(21), 2671-2688.

Glaeser, E. L. (2013). A Nation Of Gamblers: Real Estate Speculation And American History (No. w18825). National Bureau of Economic Research.

IMF. (2003). IMF Article IV Staff Report on Ireland, IMF Country Report No. 03/242.

Kaminsky, G. L., & Reinhart, C. M. (1999). The twin crises: the causes of banking and balance-of-payments problems. *American economic review*, 473-500.

- Keynes, J. M. (1936, reprint: 2006). *General theory of employment, interest and money*. Atlantic Publishers & Dist.
- Koo, R. C. (2011). *The holy grail of macroeconomics: lessons from Japans great recession*. Wiley.
- Lindbeck, A. (2012). *Ekonomi är att välja*. Albert Bonniers Förlag, Stockholm.
- Lucas, R. E. (1976, January). Econometric policy evaluation: A critique. In *Carnegie-Rochester conference series on public policy* (Vol. 1, No. 1, pp. 19-46).
- Lucas, R. E. (1978). Asset prices in an exchange economy. *Econometrica* 46, 1429–45.
- Lucas, R. E. and Prescott, E.C. (1971). Investment under uncertainty. *Econometrica* 39, 659–81.
- Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *The Journal of Economic Perspectives*, 17(1), 59-82.
- Malkiel, B. G. (2005). Reflections on the efficient market hypothesis: 30 years later. *Financial Review*, 40(1), 1-9.
- Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: a review of theory and empirical work\*. *The journal of Finance*, 25(2), 383-417.
- McQuinn, K., & O'Reilly, G. (2007). A model of cross-country house prices. *Research Technical Paper*, 5.
- Mian, A., Rao, K., & Sufi, A. (2011). Household balance sheets, consumption, and the economic slump. *Consumption, and the Economic Slump* (June 1, 2012).
- Minsky, H. P. (1992). The financial instability hypothesis. *The Jerome Levy Economics Institute Working Paper* No. 74
- Minsky, H. P. (1996). Uncertainty and the institutional structure of capitalist economies: remarks upon receiving the Veblen-Commons award. *Journal of Economic Issues*, 30(2), 357-368.
- Noussair, C., Robin, S., & Ruffieux, B. (2001). Price bubbles in laboratory asset markets with constant fundamental values. *Experimental Economics*, 4(1), 87-105.



- Riksbanken (2011). The Riksbank's inquiry into the risks in the Swedish housing market.
- Riksbanken (2013). Penningpolitisk rapport februari 2013 - Hushållens balansräkning och den makroekonomiska bedömningen.
- Roche, M. J. (2003). Will There Be A Crash in Irish House Prices? *Quarterly Economic Commentary*, Winter 2003 edition.
- Sbordone, A., Tambalotti, A., Rao, K., & Walsh, K. (2010). Policy analysis using DSGE models: an introduction. *Economic Policy Review*, 16(2).
- SCB – Statistics Sweden (2010). Assets, liabilities and holding gains – Role of balance sheets underestimated in statistics.
- SCB – Statistics Sweden (2013). Dataset.
- SEB (2013) – Boprisindikatorn. Available at [www.seb.se](http://www.seb.se)
- Shiller, R. J. (2003). From efficient markets theory to behavioral finance. *The Journal of Economic Perspectives*, 17(1), 83-104.
- Shiller, R. J. (2006). Tools for financial innovation: neoclassical versus behavioral finance. *Financial Review*, 41(1), 1-8.
- Shiller, R. J. (2007). Understanding recent trends in house prices and home ownership (No. w13553). *National Bureau of Economic Research*.
- Shiller, R. J. (2008). Historic turning points in real estate. *Eastern Economic Journal*, 34(1), 1-13.
- Smith, N. (2012). Individual Trader Behavior in Experimental Asset Markets.
- Sorensen, J. (2006). The Dynamics of House Prices-International Evidence. Available at *SSRN 1273183*.
- Stiglitz, J. E. (2009). Commission on the Measurement of Economic Performance and Social Progress – Executive Summary. *Report by the commission on the measurement of economic performance and social progress*.

SvD (2013). *Ingves slår ett slag för sänkta ränteavdrag*. [http://www.svd.se/naringsliv/branscher/bank-och-fastighet/ingves-slar-ett-slag-for-sankta-ranteavdrag\\_8096180.svd](http://www.svd.se/naringsliv/branscher/bank-och-fastighet/ingves-slar-ett-slag-for-sankta-ranteavdrag_8096180.svd) April 17.

#### REFERENCES FOR FIGURES AND TABLES

Figure 1 – Real House prices. Sources: The Riksbank (Original source BIS, Reuters EcoWin and the Riksbank)

Figure 2 – Real Disposable Income and Real Mortgage Rates after Tax- Sources: SCB and the Riksbank

Figure 3 – Housing Investment. Source: The Riksbank "Monetary Policy Report October 2010"

Figure 4 – Real House Prices, Yearly change. Source: SCB Fastighetsprisindex

Figure 5 – Price-to-income. Sources: SCB and the Riksbank

Figure 6 – Household debt. Source: The Riksbank (original source: Eurostat, Federal Reserve and Bureau of Economic Analysis) and SCB

Figure 7 – Stress Test. Source: FSA – Finansinspektionen – Den Svenska Bolånemarknaden (2012)

Table 1 – ECM Results. Source: Claussen, C. A. (2012). Are Swedish Houses Overpriced? Riksbanken – *Working Paper*