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Housing Bubble in Finland's Capital Area

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Speculation of a bubble in the housing market is a contemporary topic in Finland. Foreign economists are claiming that the bubble exists and Finland's domestic economists deny the bubble along with the Bank of Finland. Opinions in media are very controversial. Meanwhile housing prices in capital areas have rocketed up. This paper gathers relevant figures and reviews about the present and future situation through numbers and historical data. It does not try to offer a complete model or a pattern to assess the situation in housing markets but rather to compare trends with historical data and seek ways to understand prevailing situation and how it was generated. Secondary sources are used in this study and the reader must apply critical thinking since facts are mainly provided by Finnish sources. This study aims to clarify housing market fundamentals and forecasts possible future scenario.

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Helsinki
Metropolia
University of Applied Sciences

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1 Introduction

1.1 Background

The debate concerning housing bubbles in developed economies is heating up. Especially inside European Union because its economy has been in turmoil ever since the sub-prime crisis shored from the United States. Prices of real estate have traditionally been a good indicator for forecasting economic cycles. However, the situation has changed and housing markets are deteriorated from the role of an indicator. There are many opinions in this debate where leading economists in Europe either agree or disagree with each other. Case is extremely interesting and the paper is trying to analyse modern situation.

In this study the past, present and future of Finland's housing market is reviewed. In the beginning the theoretical foundation is explained and after that the focus is on Finland's housing market. Housing prices per square meter have grown significantly in metropolitan area and this trend does not show any signs to end.

As mentioned above in the past housing prices were seen as a good indicator what forecasts economic development accurately. However, after strong globalisation many different forces started to have an influence on world's economy. Furthermore, in globalised and connected world it means that countries may suffer from actions of others despite their good work for country's economy. Latest example of this type of global meltdown was the financial crisis around 2008.

1.2 Objective & Research Question

The direction of housing market development in Finland's capital area is reviewed in light of historical data. It helps to formulate a clearer picture of what has happened, why it happened and how does it affect to the future.

The author of this paper wanted to research the theory behind housing price formation as well as the formation of housing bubbles. History has shown that each bubble has individual characteristics depending on the location where it appears. This paper is

focused on Finland's capital area. The capital area consists of four cities: Helsinki, Espoo, Vantaa and Kauniainen.

The research question is:

"Is there a housing bubble in Finland's metropolitan area?"

1.3   Methodology

The data collected to the Bachelor Paper is mainly from secondary sources. These sources are academic journals, books, reports and newspaper articles. The reason for chosen sources is the character of the topic: it affects primarily to the people of Helsinki's metropolitan area and secondarily to the Finland's and ultimately the whole Europe's citizens because connected markets will spread the affects around the whole marketplace. Finland and the Nordic region are extremely important for European Union and the situation has been extremely sensible after bailing out of some southern EU countries. Since the bail outs the economy has slowly showed signs of recovery. The busting of housing markets could be seen as a first sign of fall of the Nordic region.

1.4   Structure

The first chapter goes through a simple theoretical background of housing prices. Generally in the beginning there is the theory of housing prices and also theory of housing bubble formation.

After theoretical part the history of the capital area of Finland is taken under review. Many different indicators are examined thoroughly and findings of these indicators are reviewed. Main timeframe for this study is from 1985 to 2013.

After the historical part and the indicators there are notions of Bank of Finland. Along with the Bank of Finland's view the contemporary discussion around this topic is reviewed. Many economists have their say in housing market situation in Finland and Northern Europe and these different statements are reassessed. After the contemporary discussion, which is mainly taken from newspapers, there is a sub-chapter of academic findings. In this chapter there are recent claims gathered from academic world concerning this topic.

The last part is the author's conclusion of the topic. Conclusion is seeking to summarise the whole paper and also give something to think concerning the future.

1.5 Limitations

This paper is based mainly on secondary research so the only available material what could be used was already published researches. Expert interviews were left out as well as polls. Already published previous studies that concern Finland's capital area's housing market are rare so mainly Bank of Finland's material has been used. Moreover, Statistics Finland does not have complete statistics from long period of time for each indicator. This is the reason why 1985 was set to be the starting point.

The statistics and facts of this paper are mainly provided by Statistics Finland and Bank of Finland. Both parties are stakeholders in this matter and that is why it is essential to think critically while reading this paper. Finland is perceived as a country with freedom of press. However, in these facts provided by bank of Finland there might be unintentionally biased information. Also newspapers of Finland are used as sources and they are profit seeking companies, in other words they write what people want to buy. This is why even the darkest forecasts they provide no always reflect the truth.

2   Housing Price Formation

In macroeconomics the traditional approach to the price formation of real estate has been the stock-flow model approach. The stock-flow theory states that the demand for housing in metropolitan area can be given by:

$$H^d = f (P, U, R, D), \qquad \text{(i)}$$

Where

P = real housing price level;
U = expected real cost of owning and dwelling;
R = rental price level; and
D = other fundamental variables affecting housing demand

Similarly, market supply can be defined as:

$$H^s = f (P, S), \qquad \text{(ii)}$$

Where

S = other fundamental variables affecting housing supply.
In equilibrium $H^d = H^s$ so that the reduced form equation for housing price level is:

$$P = f (D, S, U, R) \qquad \text{(iii)}$$

The expected real cost of owning and dwelling, U, depends on the opportunity cost of the capital what is tied to housing and the real after-tax mortgage rate. If mortgage rate is high, tax-deductibility of mortgage payments is low and the opportunity cost of capital is high they all increase the user costs and vice versa. U includes also other types of costs which occur when owning real estate, especially real estate taxes and housing depreciation or equivalently the maintenance costs. Moreover, the expected rate of future price appreciation decreases the expected user cost because of the expected capital gains. (Oikarinen, 2005)

In U the expected future housing appreciation plays a significant role. This is because the expected appreciation is dependent on the expectations in relation to the fundamental variables driving house prices. This means simply that the expectations of future values of housing affects to current housing demand. Moreover, the expected price appreciation may create housing bubbles. High expectation on appraising price can turn into a self-fulfilling prophecy because housing demand can increase through lower expected user costs. All this might occur even without a change in the market fundamentals. "According to Stiglitz (1990, p. 13) "if the reason that the price is high today is only that the selling prices will be high tomorrow – when 'fundamental' factors do not seem to justify such a price – then a bubble exists"." (ibid)

Built on the theory above and presuming that the real interest rate stays still and despite the speed of inflation and the opportunity cost of capital, equals the after-tax mortgage rate, the user cost can be showed as:

$$U = [(r + i)(1 − t) + T + d − (g + i)] P, \qquad \text{(iv)}$$

Where

> r = real mortgage rate;
> i = inflation rate;
> t = rate of tax deductibility of interest payments for mortgages;
> T = real estate tax rate;
> d = depreciation and maintenance as a percentage of P; and
> g = expected growth rate of real housing prices.

Inflation has two different roles in different equations. In (iv) the inflation rate has a negative influence to U and in (iii) when inflation rate gets higher it reduces nominal costs. This occurs because when nominal mortgage interest payments are tax deductible, the capital gains are not taxed. There are two reasons why the rental price level is taken into account in (iii). Firstly the rental level illustrates the cost of owners would have to meet if they would not own the dwelling and secondly for investors the rent represents cash flows coming from investing to housing. (ibid)

There are also other variables which influence housing demand (D), for example the demographic variables, income and unemployment. These factors are often thought to be extrinsic to housing prices. If the level of income grows or number of households rise it will naturally increase the demand for housing. There is a debate whether the real permanent income or current income should be taken into account in this model. Another controversial topic is the issue of a household since in a short term the structure of a household may vary significantly. Even though the variables in (D) are sometimes thought to be extrinsic they can also be intrinsic. The amount of households in a metropolitan area is likely to be negatively affected by the housing price levels. "For example Hämäläinen and Böckerman (2004) have found that housing prices affect net migration negatively in Finland." There are extrinsic factors also in S. However, chapter 3.2 these factors are examined thoroughly. (ibid)

3   Housing Bubbles

In the previous chapter the housing bubble has been a secondary issue and the emphasis has been on basic theory. In this chapter the main focus in on the actual housing bubbles. In the beginning concept of a housing bubble is explained and later on different indicators are represented.

3.1   Concept of a housing bubble

The historical origin for the term bubble means that there is a sudden dramatic boost in the asset price, in this case dwellings price, and then almost instantaneously the price level diminishes close to the original level. Definition of a housing bubble could be as follows:

"There is a bubble if the (real) price of an asset (dwelling) first increases dramatically over a period of several months or years and then almost immediately falls dramatically." (Lind, 2009)

If the definition is defined more precisely some terms have to be explained. Dramatic price increase at housing market can be defined as:

"*Real prices have at least doubled during a five year period or real prices have in-creased with at least 50 per cent during a three-year period.*" (ibid)

The next thing in this definition to consider is the length of the time period when prices rapidly decrease and how much do they have to fall. Historically in times of a bubble there has been no stable time period between rise and fall of the prices. If there is one then the rise and fall should be considered to be two unconnected events. Also, in many historical bubbles prices fell at least to the level where they were before the start bubble. However, even though the prices will not fall exactly to original level it is fair to say that bubble existed if prices fall more than 50 per cent. (ibid)

3.2   Bubble Explained

There are number of models and explanations that try to reveal bubble's fundamental nature. To name a one there is a complex model called "INUS-condition model". INUS is an abbreviation and it means: "Insufficient but Necessary part of the Unnecessary but Sufficient complex". This refers to nature of causality, e.g. if a house burns down because of a short circuit the circuit itself is an unnecessary because itself it cannot set the house on fire, however it is still necessary to set the house on fire. Long story short: In this case the short circuit is an INUS condition for the incident. (ibid)

When researching a formation of a bubble there are certain characteristics that arise. These characteristics are illustrated in Figure 1 and below the figure these characteristics are examined thoroughly.
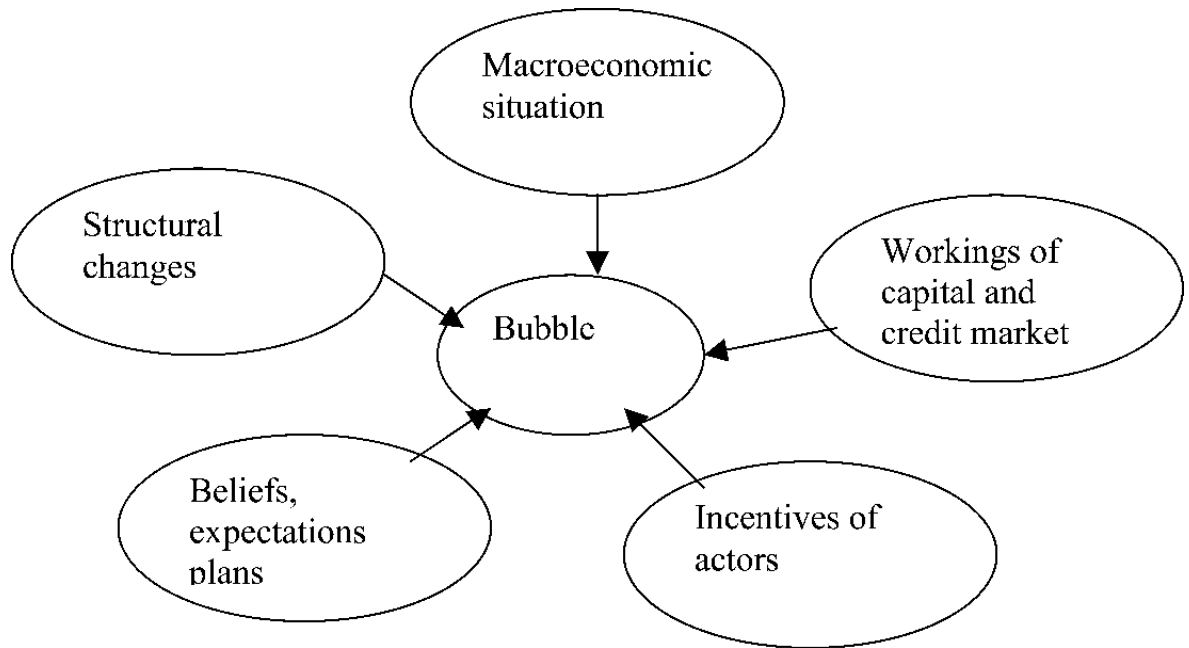
Figure 1. Factors of a bubble

3.2.1 Macroeconomic situation

It is common that bubbles occur in long lasting period of boom. Another factor is that often macroeconomic policies have not been restrictive. Hence, the level of regulation has been low. (ibid)

3.2.2 Structural changes

In many studies concerning bubbles it has been noted that the period when bubble begins is often imbalanced. Good example of this type of change is the series of de-regulation in the 1980's which lead to a bubble in various countries in the 1990's. (ibid)

3.2.3 Working of capital and credit market

Well-functioning capital and credit market is needed in times of booming prices be-cause actors on the market must be able to pay the increasing prices and good access to capital is crucial. In various analyses the Sweden's housing bubble around 1990's related to loose lending policies by the banks. (ibid)

3.2.4 The beliefs and expectations of the actors

As much as many mathematical and rational factors affect to bubbles the actors in housing market have a big impact on bubble formation. Length of an asset holding period is important because in period of rapid price increase people often think they will only keep the asset for a while and wait for the price to grow. Expectations mean that people are only buying because they believe that the asset's price will increase in future. Waiting is the most expensive activity because asset is cheaper always today than tomorrow. The last factor is the rationality of the actors. The assumption is that large share of actors are not acting rationally during a period of rising prices. (ibid)

3.2.5   Incentives of actors

Many studies have shown that in time of bubble individuals make decisions that seem rational to them but irrational to outsiders. Example of this type of behaviour can be seen during Tulip mania. During this time the actors on market knew that they will not be made to pay the prices what were agreed in the contracts. (ibid)

3.3   Three Different types of bubbles

Housing bubbles occur around the world and each one has different dimension depending on the structure of the respective country's economy, demographics etc. Still, there are characteristics that unify these bubbles.

3.3.1   Speculative bubble

In a speculative bubble buyers tend to believe that the asset is overpriced but they opportunistically think that they are able to sell the asset with a profit before the price decreases. This type of bubble is unlikely to occur in housing markets since transaction costs are rather high. (ibid)

3.3.2   Irrational expectations bubble

In irrational expectations bubble the players on housing market behave over optimistically and they believe that the asset will grow in price for a long, unforeseeable time and beat the historical average. Hence, it is logical to buy an asset today and keep it for a longer period of time. (ibid)

3.3.3 Irrational institutions bubble

The main idea behind this third type of bubble are principal-agent problems, where players in housing market are willing to pay higher prices than the historical average or strong evidence might suggest. In this model the buyer of the asset does not antici-pate to take the losses when the bubble bursts. The agent who lends the money also thinks that he is able to shift the default risk somewhere else. Latest example of this type of a bubble is the sub-prime lending that lead to worldwide economic crisis. (ibid)

3.4 Indicators of a bubble

There is not a single "one size fits all" model what can be used to identify financial bub-bles. Many economists do not agree with all the parameters that should be taken into account when assessing different areas. Even though, the model does not exist since there are some indicators which can be very helpful identifying bubbles.

3.4.1 Example of different indicators

In the figure below there is a simple example of bubble indicators which can be helpful identifying a possible housing bubble. There are different aspects taken into account which will be discussed respectively.

Table 1. Bubble indicator example

Type	Specific index	Bubble reference standard	
		Little bubble	Serious bubble
Price index	Selling price	Housing price to income ratio<1:6	Housing price to income ratio >1:10
	Price increase rate	Housing price increase rate/average income increase rate per capita>1	Housing price increase rate>30%
	Increase range	All kinds of property price increased nationally	All kinds of property price increased nationally
	Rent level	Rent level index/CPI index<1	Rent level index<100
	Investors' psychology	Quite optimistic	Very optimistic

In this model two different categories are made: little bubble and serious bubble. In the little bubble there are slightly increased prices and a little froth in the housing market. In serious bubble the little froth has changed to a massive housing bubble i.e. overpriced dwellings. First thing what is looked on is the selling price. In case of a little bubble the housing price to income ratio, which is a measure of affordability, is smaller than 1:6 and in serious bubble greater than 1:10.

Secondly price increase rate is checked. If the housing price increase rate divided by average income increase rate per capita is greater than one per cent it may be a sign of a little bubble and if it is greater than 30 per cent it, according to this model, is a sign of a serious bubble. The increase range is a range where national property prices move.

Thirdly if rent level divided by CPI index and the result is smaller than 1 it could be a sign of a small bubble and if it is smaller than 100 it could indicate a serious housing bubble. The last parameter is Investors' psychology but the range is very vague and it is hard to measure with scientific methods.

3.5   Price-to-income and Price-to-rent ratios

These ratios, price-to-income and price-to-rent give a diverse representation of possible overvaluation in the housing market. In the figure below these ratios are illustrated. Blue line is showing price-to-rent ratio and blue dotted line is price-to-income ratio. As 100 in this index is the calculated long-term average. (C. André, C. García, 2012)
Source: (C. André, C. García, 2012)
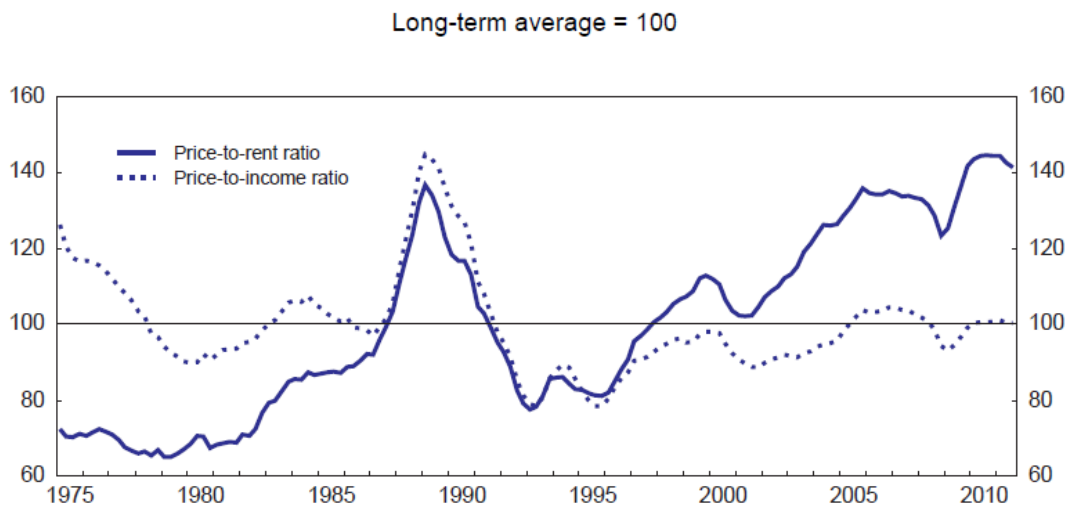
Long-term average = 100

Figure 2. Price-to-rent and price-to-income ratios

Price-to-income ratio is currently close to its long-term average. It follows the trend of price-to-rent-ratio but seems to be less volatile. The peak was during the recession in late 80's and early 90's in Finland. Since then the variation has been moderate.

Price-to-rent ratio seems to be 40 per cent higher than its long-term average. One explanation for this is the low interest rates because they are lowering the living costs of housing. Another significant factor to keep in mind is that rent index, what is a rent component of consumer price index, includes below-markets rents that are subsidised e.g. by government. Share of these rents is approximately 50 per cent and this may push the price-to-rent ratio up. (bid)

Both of these ratios will be examined more thorough later in the text. Furthermore, these ratios are compared to other significant figures concerning housing market evaluation.

3.6 Different factors influencing housing prices

Housing prices have a negative response to increase in mortgage rates and housing stock and positive response to growth of income and size of population aged between 25 and 44. If everything else remains static an increase of 1 per cent in income per capita and population aged between 25 and 44 increases housing prices by 2, 5 per cent and population between given range by 2 per cent. If housing stock increases by 1

per cent then prices lower by over 1 per cent. If mortgage rates drop a one percentage point it increases prices by almost 3 per cent. Also investments react strongly to housing prices: 1 per cent increase in prices leads to a 1, 25 per cent increase in investments. Same with construction costs: 1 per cent increase in costs reduces investments by almost 2 per cent. (C. André, C. García, 2012)

4 History of housing and price development in Finland's capital area.

4.1 History

When looking at the real housing prices from the last 30 years the biggest change can be seen between the years 1988 and 1993. The prices grew over 50 per cent in two years. After this rapid growth there was a gigantic drop due to the burst of the bubble. The prices fell again over 50 per cent and the drop lasted for four years. The following figure illustrates the real housing prices from 1983 to 2012. The blue line shows metropolitan areas housing prices and the red line Finland's real rents. (Kivistö, 2012)
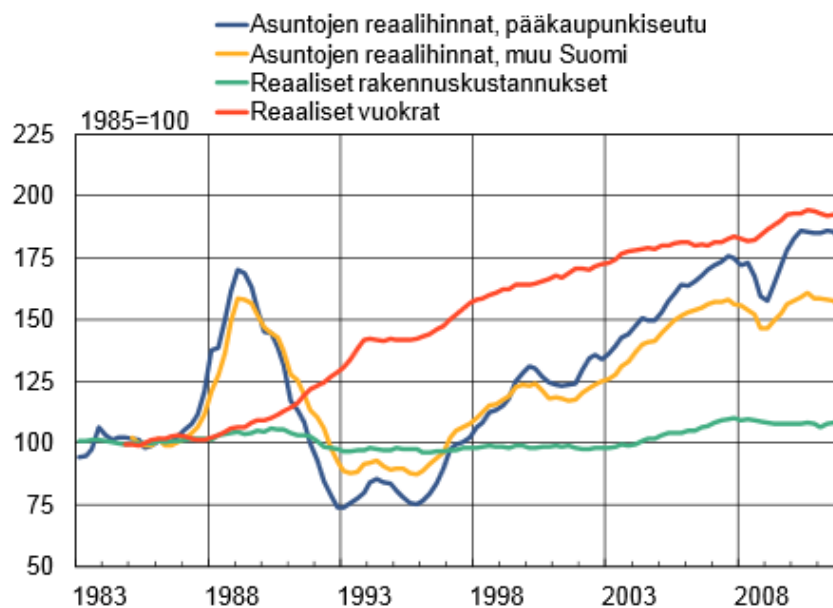

Figure 3. Real Housing Prices in Finland 1983 – 2012

The reasons behind the drop were the recession in Finland in later 80's and early 90's. The recession occurred because of loose monetary policy which led to a structural change in the housing markets. The access to mortgages improved and the required share of capital contributed by borrower decreased. The development of housing mar-

kets during that time was only one part of a big bubble in the whole economy of Finland. The figure shows how only in the 1996 the housing prices turned to more permanent growth. The next clear fluctuation was not the "dotcom" boom and bust but the sub-prime crisis in 2008. The figure illustrates how the housing prices in metropolitan area fell almost 25 index points between 2008 and 2009. However, the drop lasted only for a year. In 2011 housing prices grew to higher level than they were before 2008. (ibid)

Compared to other countries and their housing price development since 1985 Finland sets approximately in the middle. The real prices of housing in Finland have increased approximately 70 per cent. In some European countries the increase has been over 100 per cent and even over 200 per cent. The countries where prices have rocketed up are e.g. Spain, the United Kingdom, the Netherlands and Belgium. There are few countries where the real prices of housing have declined e.g. Germany and Japan. (ibid)

4.2 Price development of housing

In the last ten years the interest rates of mortgages have dropped to record low levels at the same time when maturities of mortgages have lengthened significantly. In theory the prices of houses should reflect the input price of a building: costs of construction and price of land. However, the rise of the prices has been faster than the growth of the input prices especially in the capital area. (Kivistö, 2012)

In the next figure the blue line illustrates the housing prices, green line costs of construction, yellow line non-subsidised rents and red line price of land in Finland. The figure shows price development from 1985 to 2012 (when 1997 = 100).
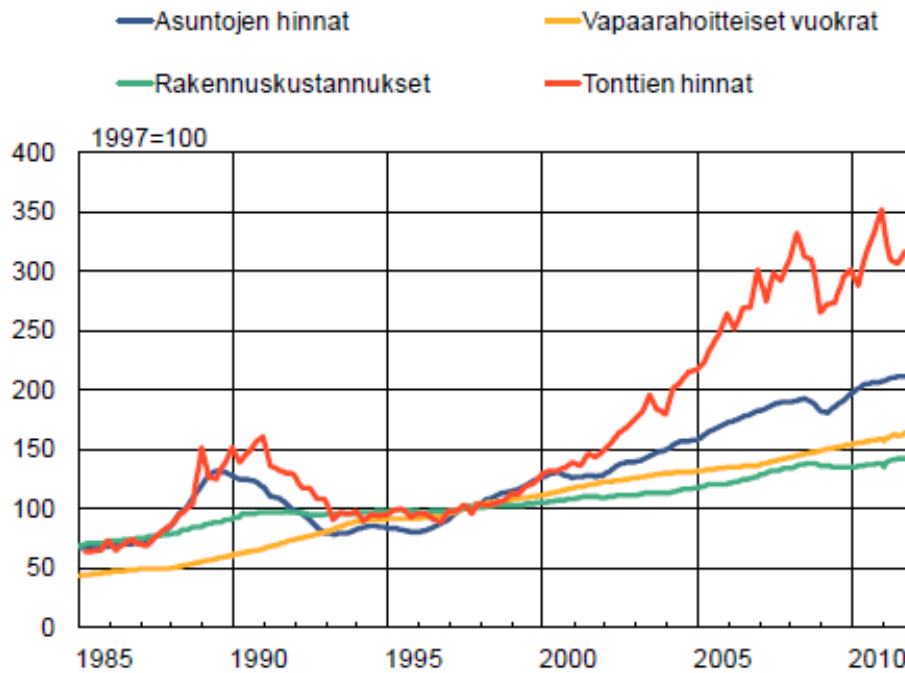
Figure 4. Nominal values of housing prices, costs of construction, non-subsidised rents and land price

The price of land has clearly grown faster than price of housing from 1997. Costs of construction have been steady during this time period and the margins have not grown significantly in construction business. This means that the growth of housing prices has capitalised to the price of land. Similar phenomenon happened in the end of 1980's when Finland had a housing bubble which burst. It appears to be that the housing prices dictate the price of land and not vice versa as it was stated before, but the causality is not as simple as one might think. Land is scarce resource in the areas where people want to live as it is in the capital are of Finland. This has an impact on reformation of prices. (ibid)

Along with the input price the classic theory of supply and demand has an effect to housing prices too. The demand can grow because of a few different factors: migration, population growth, income growth and growth in housing density. Oikarinen (2005) researched factors that effect to development of housing prices in Finland's capital area with an econometric model and found that growth of real income and decrease of real interest rates explain the price development of housing until the middle of 2000's. Based on the research effect of real interest rates grew significant only after deregulation of financial markets. Also, the study revealed that housing prices reflect mostly demand in short- and long-term. (Kivistö, 2012; Oikarinen, 2005)

4.3 External Effects

There are many other things that influence to housing prices as well as theoretical models. One of these factors is institutional changes. Many regulations in the public sector, e.g. credit rationing of housing loans, rent control and tax regulation can have an effect on demand for housing. (Oikarinen, 2005)

A credit rationing may have an effect to the way how demand of housing reacts to changes in the fundamental variables and the elimination of the credit rationing will probably have a straight influence on housing prices. This is because due the credit rationing the expected future income is likely to decrease and the significance of current income increase because of short loan maturities and high down payment requirements. Furthermore, during credit reasoning the volatility on interest rate changes is smaller because the smaller the mortgage rate is compared with the cost of capital for the financial institutions offering mortgage loans, the smaller is the quantity of mortgages offered in the market. Therefore, many who would be willing to borrow for buying a house are not able to get a mortgage. Moreover, nominal lending rate may become more important than real lending rate in the middle of credit rationing, particularly if the maturities of loans are short. If the maturity cannot be lengthened the income constraint tightens as the nominal lending rate rises. This means that the nominal lending rate is more closely related to this income constraint than the real rate, in short run. (Oikarinen, 2005)

Another factor that can affect to housing demand and thus prices is existence of rent control. If control is tightened the influence to owner-occupied housing might be positive because if the returns are lower on housing in relation to other investments it causes a decline in the rental markets. In the markets where owner-occupied houses are in dominant position, like Finland, tight rent control leads to high price-to-rent ratio because the effect may be lagged due to time taken by dismissal of a rental contract and by the change of inhabitant. (ibid)

There are also other implications occurring from rent control abolition. If there are expectations of loosening rent control the rental level will likely increase based on higher expectations. This will reflect to the housing prices so that it will be higher to existing

rents. Therefore expectations of deregulation of the rental control will likely lead to a higher equilibrium price-to-rent ratio compared to free market mechanism. The other side of the same coin is that when rent control is higher the risks involved in renting may be higher from owner's or investor's point of view. This could have an increasing impact on owner-occupied housing. This explains why deregulation does not necessarily lead to a lower rent level. It is mainly an empirical question. (ibid)

Increase in tax deductibility of mortgage payments automatically leads to higher real after-tax mortgage rate and higher demand on housing. Moreover, tax regulations might reinforce the connection between current income and housing demand. This occurs if the deductibility of mortgage payments is based on marginal income rate. When looking at Finland's housing market these institutional changes as external effect play a significant role. This is because there has been a big change in housing finance as well as in tax deductibility of mortgage interest payments and in the rental markets in Finland during 21st century. (ibid)

5   Structure of housing in Finland's capital area

In Finland's capital area there are few features that are typical only for this specific region. Firstly, the rental flat stock has been quite strong for a long period of time, secondly the most dominant type of a dwelling is a block of flats and thirdly average size of an apartment is rather small. Rental housing was the most popular style to live in city area from 1900 but the trend started to change after World War II and in 1990 there were more owner-occupied houses (55 per cent) and less rental houses (38 per cent). After recession and deregulating the rental housing market trend changed again when coming to the new millennium. The share of owner-occupied houses fell to 43 per cent and rental houses rose to 47 per cent. (Vihavainen & Kuparinen, 2013)

In years 2000 to 2012 there was no such a significant change. In the end of year 2012 the proportion of rental housing was 44, 7 per cent and owner-occupied housing 44 per cent from the total of 333 409 houses. (ibid)

5.1   Government intervention

City of Helsinki started an aggressive housing policy in the 90's. Growth of the rental flats owned by city grew 41 per cent. The numerical amount grew from 32 300 to 45 400. After that the number of rental flats what the city owns has not increased as fast. Total growth from 2000 to 2012 was nine per cent and the share of city's whole housing stock was 15 per cent and from rental housing stock 33 per cent. In the whole capital area the number is smaller since city of Espoo's share of the housing is 12 per cent from the whole stock and 37 per cent from rental housing stock and Vantaa's share is 10 per cent from the whole share and 30 per cent from rental housing stock. (ibid)

5.2   Different types and styles of housing

As mentioned before the block of flats is the most popular dwelling type in Helsinki and it dominates the housing stock with total share of 86 per cent and rental housing stock with 95 per cent. From owner-occupied houses 75 per cent is in block of flats so it is fair to say that this really is the most popular style of living in Helsinki. Single-family housing is not so popular in the capital area. In 2012 its share of the total housing

stock was 13 per cent. Single-family housing's share of the owner-occupied houses is 24 per cent so almost every fifth household lives in the single-family house. Trend in construction has not changed for a while so any structural differences are not seen to appear in the near future. The different house type's share of the total housing stock has been relatively stable for decades. (ibid)

The block of flats is the dominant house type in capital area. Another significant fact is that single room and two room flats form a majority of housing supply. In 2012, 59 per cent were these small flats. From these one and two room flats 56 per cent were owner-occupied and 32 per cent rental. Especially the supply of private rental flats is unique in Helsinki area. 80 per cent of the total private rental supply was one or two room flats. (ibid)

The private rental level in Helsinki is notably greater compared to the rest of the capital area. In 2005 the average rent in private markets was 9 per cent higher than in Espoo and 19 per cent higher than in Vantaa. Compared to the rest of Finland the level was 36 per cent higher. The growth of this imbalance is significant. When looking at the statistics from 2012 the difference between Helsinki and Espoo was already 14 per cent and 21 per cent higher than in Vantaa. The change between capital and rest of Finland was five percentage points. (ibid)

6 Housing markets evaluated by rents and housing prices

6.1 Rent-price ratio and operating costs of living

In economics a house is often assimilated to a capital good what produces a service, in this case the service is living. Investors are seeking rental income from housing markets that matches the income from alternative investments. When market is balanced the marginal revenue is equal to its marginal cost. Consumers are buying service (living) from housing markets and this service can traditionally be bought in two forms: rental or owner-occupied. From consumers point of view when the housing market is balanced the owner-occupied housing costs should be equal to the cost of rental housing costs. Based on this hypothesis it is possible to form an equation that illustrates the effects of rental income and operating cost of capital to the balance in the market. (Kivistö, 2012)

$$R = ((1-t) i + t_k + d - \pi) P, \qquad\qquad (v)$$

Where:

R = rent,

t = capital taxation rate,

i = nominal rate of invested capital,

d = maintenance cost,

t_k = effective real estate tax,

π = expected change in fair value of dwelling

P = price of dwelling

In addition a risk premium can be included to this equation what investor normally demands from this type of an investment. However, in this case it is not used because it is a difficult variable to assess. (ibid)

When the equation above is reorganised it is possible to detect a link between price-rent ratio and operating costs.

$$\frac{R}{P} = i_t + t_k + d - \pi, \qquad\qquad\qquad\qquad (vi)$$

Where:

i_t = after tax interest cost

if it is presumed that rental housing market exists and that rental living is a substitute for owner-occupation then level of rents and value of house owners housing services should correlate. (ibid)

6.2   Development of Price-to-Rent ratio in Finland

In theory there should be a balance between prices and rents. In next figure Finland's price-to-rent ratio is illustrated. Usually the balance of housing market is assessed by calculated long-term average of price-to-rent ratio and then observations are being compared to it. (Kivistö, 2012)

Blue line shows the whole country's price-to-rent ratio and dotted blue line is average of price-to-rent ratio. Green line illustrates price-to-rent ratio of Finland's capital area and dotted green line shows capital areas average.
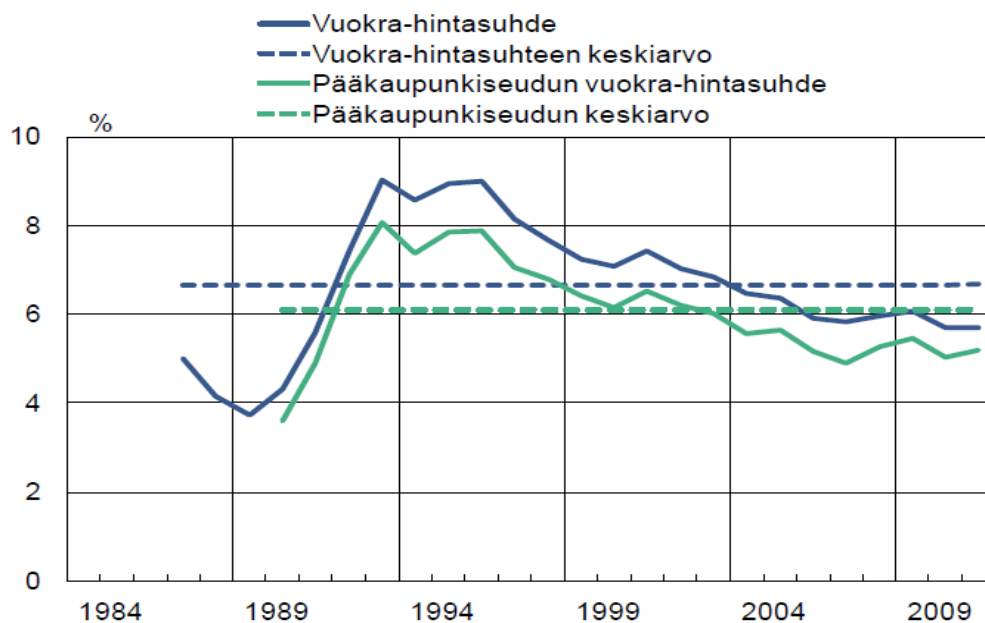

Figure 5. Price-to-Rent Ratio

Price-to-rent ratio has decreased since 1997 because the housing prices have increased faster than the rents. In capital area of Finland price-to-rent level is lower compared to the rest of Finland but development has been similar. The influence of capital area is significant in the whole country's statistics and this explains the similar development. In both cases the price-to-rent ratio has dropped below its average. This might be a signal of unbalanced situation between housing prices and rents. Rental agreements are often tied to consumer price index. Based on this index the prices are evaluated annually. In this comparison new rental agreements should rather be included because always new prices reflect the prevailing rental level. This data is available only from 2005 so in the figure above old and new rental prices are mixed together. (ibid)

Few other notions should be made towards rents. Firstly, rent control was completely abolished in 1995. Rent development has not been as flexible before abolition. Another limitation concerns the supply of rental dwellings because it does not match the supply of owner-occupied dwelling market in quality or quantity. Approximately half of the rental dwellings are production of Housing Fund of Finland (ARA) and these dwelling's distribution is based on social needs. This is why owner-occupied dwellings and rental dwellings are not perfect substitutes in Finland's housing market. However, development of rents has been similar in non-subsidized and in government subsidised dwellings. (ibid)

6.3   Operating costs of residence in Finland

The right level of price-to-rent ratio is hard to determine and this is a reason why the development of this ratio should be reviewed in relation to operating costs of residence. These operating costs reflect basic elements of housing supply and demand. In this case exceptions in price-to-rent ratio would reveal imbalance in housing markets. If it is assumed that rents reflect precisely the development of operating costs the exceptions can be seen in housing prices. (Kivistö, 2012)

Operating costs of housing have been calculated with the equation above. Time period in this calculation is from 1989 to 2011. Tax variable is capital taxation rate from 1993. Nominal interest rate is Bank of Finland's annual interest rate on mortgages according

to statistics. Real estate tax rate varies between range of 0, 22 per cent and 0, 5 per cent. Effective real estate tax depends on real estate's rateable value to its real market value. In the calculation 73, 5 per cent from real market value is used. In the mainte-nance cost assessment the numbers received from Statistics Finland have been used. Dwellings expected value change is determined by using five years inflation average. (ibid)

In the figure below blue line shows price-to-rent ratio, red line maintenance costs with bond interest rate, yellow line maintenance costs and dotted yellow line maintenance costs without expectations.
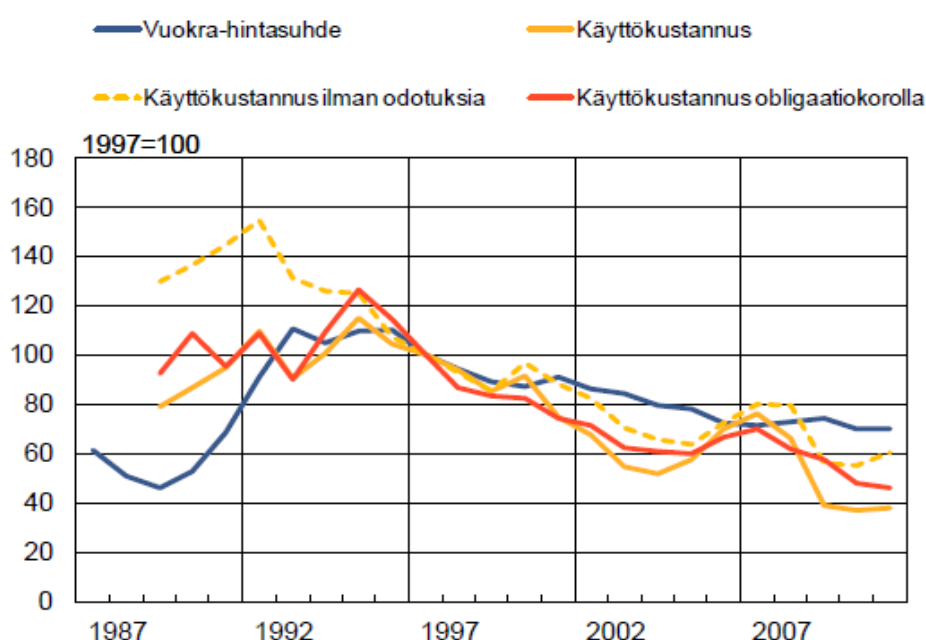
Figure 6. Maintenance Costs and Price-to-Rent ratio

Review of the figure 7 refers to the fact that before 1993 housing prices were overval-ued in relation to rents. In years 1995 – 2000 housing prices seem to have developed in-line with maintenance costs. In 2000 – 2003 maintenance costs decreased faster than price-to-rent ratio. In this period of time the housing prices were undervalued in relation to rents. Between the years 2005 – 2007 maintenance costs increased rapidly and the development of price-to-rent ratio cooled off. Due to the financial crisis around 2008 the maintenance costs lowered until 2009 because of decreased interest rates. From this figure it is possible to conclude that after 2000 even higher housing prices would have been justified by the development of maintenance costs. (ibid)

Maintenance cost analysis reveals also another point of view to the factors affecting housing markets. If it is presumed that rents and housing prices are balanced and maintenance costs are reviewed excluding the expectations of housing prices the spread between maintenance costs and price-to-rent ratios can forecast changes in prices. (ibid)

In maintenance cost calculation the simplest way to proceed is to presume that same interest rate illustrates mortgage interest rate of owned dwelling and the opportunity cost of investment on dwelling. The impact of this assumption to calculation has been tested with Finland's 10 year government bond yield. In 2009 the rapid decline of mortgage interest rates increases the difference significantly. In the figure 8, blue line is real interest rate of mortgage, yellow line is annual interest rate of mortgages, green line is tax-free mortgage interest rate and red line is Finland's 10 year government bond yield. (ibid)
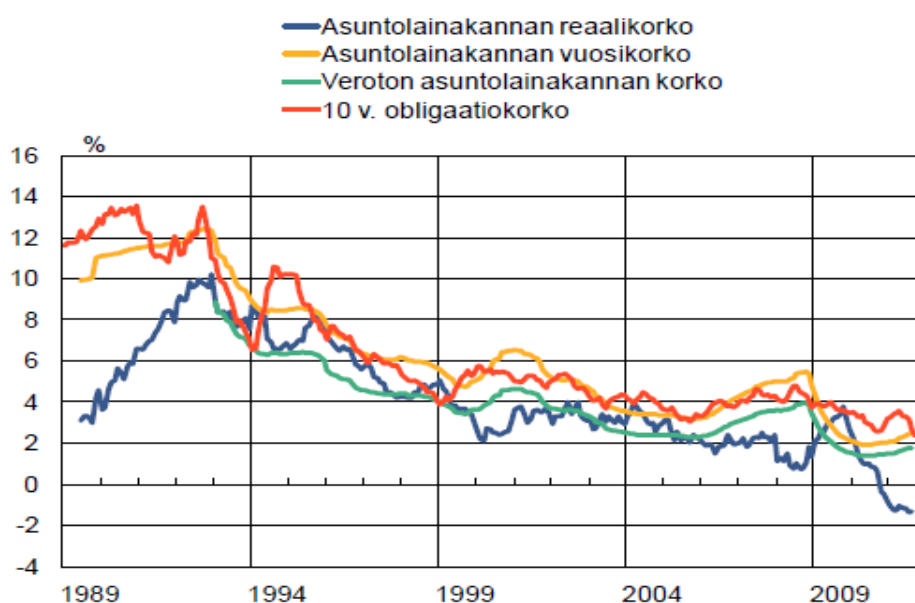

Figure 7. Interest rates 1989 - 2011

Rapid decline of the maintenance costs in the beginning of 2000 is mainly caused by decrease in the nominal mortgage rates. The average interest rate of mortgages has declined notably from 1992 when it was over 12 per cent. In the middle of year 2010 when the mortgage interest rate was at its lowest the percentage was 1, 9. (ibid)

7   Development of housing prices and solvency of households

As concluded in previous chapter the mortgage interest rates have decreased and at the same time maturity has prolonged. This has enabled the growth in loan amounts without higher monthly instalments from consumer's side. In 1998 the average mortgage maturity was 11 years when it is now approximately 18 years. This development left room for greater mortgage amounts. In 1999 average mortgage amount was 28 000 Euros and it has grown significantly. In 2011 the amount was already 82 000 Euros. In real terms the amount has grown 2, 7 times and in relation to housing prices the amount has grown 2, 3 times. In relation to the household income per person the loan size multiplier has grown from 1, 7 to 4, 5. This means that the household's debt burden has grown substantially. In 2010 average debt of indebted household was 156 per cent from available annual income when in 2002 the average debt was 108 per cent. (Kivistö, 2012)

The Figure 9 blue line illustrates the price-to-rent ratio and dotted blue line shows price-to-rent ratio's average in relation to block of flats square meter prices between years 1987 and 2011.
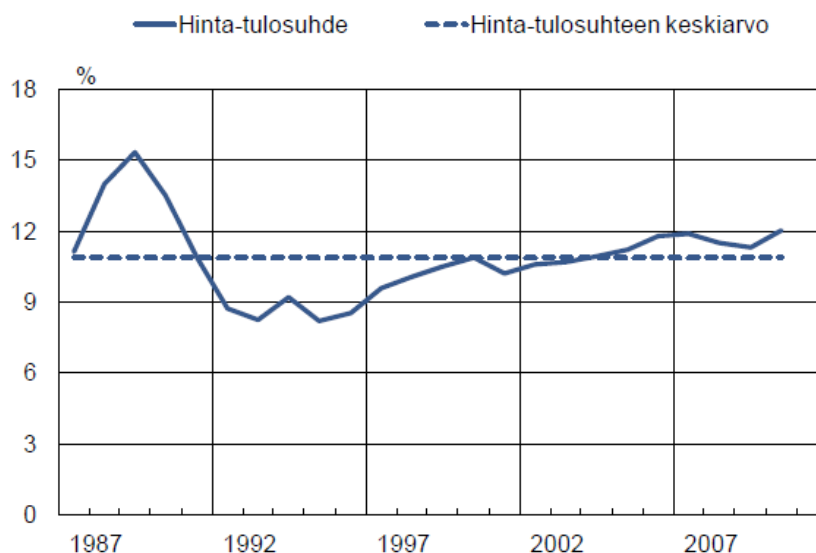

Figure 8. Price-to-income ratio in relation to m2 prices

Price development of housing should also be reviewed in relation to the income development because the relation between prices and income shows household's insolvency. Figure 9 shows the square meter price relation of old block of flats to house-

hold's annual income per person in Finland. The ratio was highest in 1989 from where it decreased with declining housing prices until mid-1990. After that the price-to-income ratio has increased a bit over the period's average. In Finland's capital area a price of one square meter in relation to household's available income has grown from less than 4 per cent to 7, 3 per cent between years 1995 – 2009. (ibid)

If housing prices are reviewed in proportion to development of wage level it is possible to notice that whole Finland's housing prices have not actually increased in relation to development of wage level. In capital area the housing prices have increased approximately by 13 per cent more than earnings from year 1985. Income level index ignores unemployment, taxes, income transfers and capital gain effects to household's available income. This is why it is not as good indicator. On other hand it illustrates the wage development of household where persons are working. Households that take mortgages have higher income on average compared to population as a whole. (ibid)

8   Supply and the demand for housing and the factors behind them

A traditional assumption towards housing market is that it clears quickly. However, there is lots of empirical evidence showing that reaching the equilibrium might actually be a long process (Case, Karl E. – Shiller, Robert J., 1989). In fact rational behaviour might be the cause of slow market clearing. The expected sales time for a dwelling might be long and show significant variance (Chinloy, 1980). It is not easy for an individual seller to determine if significantly long sales time indicates decline in house sales or is it only due to bad luck. Fast price change may not be the rational move under these circumstances. (DiPasquale, 1996) Short-run housing price changes are mainly driven by demand because the short-term supply is not flexible. Supply becomes an important player only in long-term. (Oikarinen, 2005)

8.1   Housing Supply

In the housing markets supply of houses is reformed from the existing amount of houses. This amount increases when new buildings for houses are built and drops through deletion of old houses and buildings. In 2010 the amount of houses was 2.8 million and it grew from previous year by 23 000 houses. Since 1990 the average growth has been 28 000 houses in a year. After housing boom and bust in the early 90's over 60 000 houses were built in Finland but this number dropped fast along with the collapse of prices. (Kivistö, 2012)

The Figure 10 illustrates the percentage of investments to housing from GDP and real prices of housing. The blue line is for investments and green shows real prices.
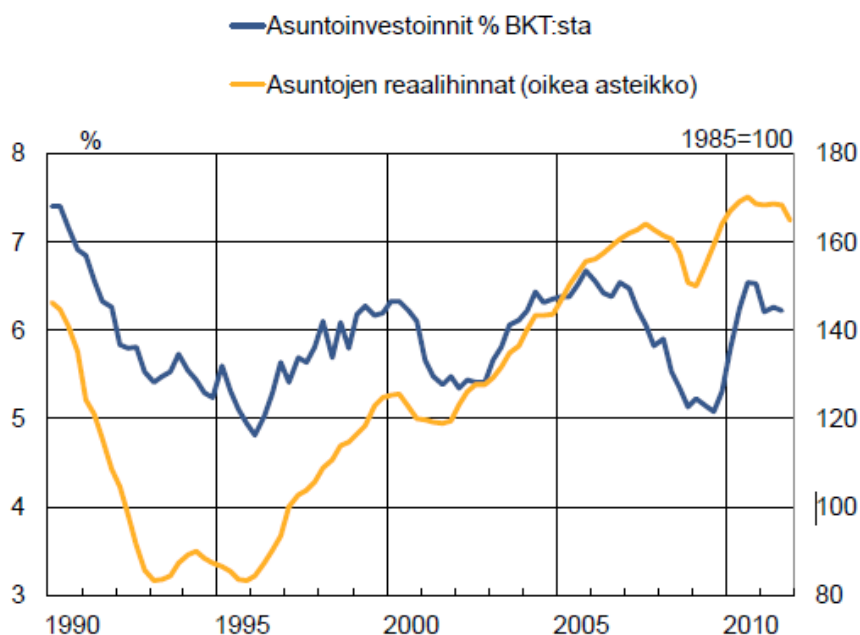
Figure 9. Investments on housing

The amount of housing investments between 1990 and 2010 has varied in a range of 5 – 7 per cent. In the beginning of 2000 investments decreased in line with prices but after 2005 investments dropped because construction industry had a shortage of capacity. This is why prices continued growing and investments decreasing. Financial crisis reduced investments on housing already in 2007 and in recession their share fell to 5 per cent. Construction business rebounded in 2010 when government of Finland intervened and brought it back to life. Government financed the production of subsidised rental houses. (ibid)

Mäki-Fränti et al. (2011) calculated the housing supply elasticity and the result was between 0, 15 – 0, 66. So the supply of housing reacts positively to changes of prices but it is not very sensitive to them. Delays in the construction and government intervention explain the inelasticity. (ibid)

In Finland's capital area the scarcity of land has often been the explanation for limited supply. However, there still is planned and inbuilt land available but the problem is that the owners of this land do not want to sell it out yet. They might have expectations for price increase in the future and this is why they want to wait. Supply for new houses has been greater in capital area of Finland. It means that the supply has been greater in relation to the number of sales made in 2000. Since new houses form only a small

portion of the whole number of houses (1-2per cent) and supply's reaction to changes in prices is inelastic the demand is a significant factor in forming housing prices. (ibid)

8.2 The demand for housing

The demand for housing measured by sales and the housing prices has moved in a parallel manner. This refers to demand-driven price increase in housing markets. Although, reduction of sales has normally only hindered the increase in prices but not dropped them. Especially the housing sales dropped in late 2008 after the financial crisis and at the same time prices of housing fell by 7 per cent. The number of housing sales turned down again in 2011. There are also other factors that affect to the demand for housing than prices. Also the owner-occupied housing costs such as interest rates and taxes, rents, price expectations, income and demographic factors play a role. (Kivistö, 2012)

Migration inside Finland has allocated mainly to urban areas. The net migration of capital area reached a peak of over 5000 persons per year in the end of 1990's and from that it decreased between 2002 and 2004 to less than 2000 persons. After that the net migration of capital area has varied between a range of 2500 and 3000. The number of housing in the same area between 2003 and 2009 has grown approximately by 36 000 houses and at the same time the number of household dwelling-units have grown by 34 500. In Helsinki the new construction has declined in the past years to lower level than the growth of household dwelling-units. This has tightened the situation in capital areas housing market. (ibid)

8.3 Long-term equilibrium

It is rational to presume that a long-term equilibrium connection between different fundamental variables and housing prices exists. These fundamental factors that have an influence on long-term equilibrium level of a real housing prices are expected to include the number of households in the capital area, real income, real construction costs, real after-tax interest rate, the real rental price level and possibly some other variables such as the inflation rate. The long-term equilibrium level of housing prices can be expressed as:

$$P^e = f(N,Y,C,A,R,O), \qquad\qquad\qquad (vii)$$

Where

      Pe= long-run equilibrium real housing price level;

      N = number of households;

      Y = real permanent income;

      C = real construction costs;

      A = real after-tax interest rate; and

      O = other variables affecting housing price level in the long run.

The price level on market of housing can vary from the long-term equilibrium level for many reasons. In reality the actual price level of housing is often different form (v) because of the incapability of prices to change rapidly. Furthermore, the expectations of a price that were included in chapter 2.1 can drive the prices away from their long-term level. Nevertheless the price level has a tendency to move towards the equilibrium. The problem is that in the short-run imperfect beliefs concerning the fundamental value of housing as well as speculation in the market based on the expectations of the future price changes may have a big influence on changes in housing price level. Sometimes these expectations create large deviations between actual price and the long-term equilibrium level. (Oikarinen, 2005)

9 Current situation in Finland

Finland is a small a market and its economy is rather small too. This makes it exposed to shocks of global economy. These shocks effect to housing market as well through income, employment and interest rate variations. There are some structural features that make Finland's housing market prone to volatility. These features include high reliance on variable mortgage interest rates, tax-system what favours home ownership and rigid supply in Finland's capital area.

9.1 Bank of Finland's view

Bank of Finland published a report concerning Finland's economic situation in August 2013. One chapter of this report describes the situation of Finland's housing market.

9.1.1 The Current Situation

In this report it is noted that the nominal housing prices have increased in the whole country and the development of real housing prices has been steady. In international comparison long-term development of housing prices has been rather stable. Before the financial crisis between years 1997 – 2007 real housing prices rose by 60 per cent in Finland. Meanwhile in Sweden, Norway and Denmark the increase was somewhere between 90 and 115 per cent. Also, after financial crisis in 2008 the real prices did not dip as it did in many other developed economies. (Lauri Kajanoja, 2013)

In some areas of Finland the demand of housing has increased rapidly. Especially in urban areas the supply has not changed as crucially. According to economic research of Pellervo for every one per cent increase in housing prices inside a time period of one year followed less than one per cent increase in supply. High demand has also increased the price of land in cities according to study of Oikarinen and Engblom (2012). (ibid)

In the report it is claimed that there are no distinct factors that would refer to housing bubble. Claims are based on a different indicators and theoretical models of housing prices. However, it is noted that there are always uncertainties when housing prices

are measured. One origin of uncertainty is that when housing prices are looked in relation to rents and household's income it does not take into account the fact that the rents and income are deviated from there sustainable level. In the last few years in Finland has had a debt-driven increase in domestic demand. If this turns out to be unsustainable then development of employment, household's income and growth of rents may appear overvalued. (ibid)

9.1.2   Future of Finland's housing

The price level of old houses is expected to rise in 2013 – 2015 at the same pace as consumer prices. Estimate is based on a forecast of slow income development of household's and on assumption that the interest rates will stay on their current level. Nevertheless, there is a great uncertainty towards outlook of income development and housing prices. Household's spending has been greater than income and this type of unsustainable progress will not last for long. In 2012 household's debt percentage was 119 per cent in relation to their yearly income. Level is historically high and in Bank of Finland forecasts that indebtedness will stop at least temporarily, even though the debt ratio of Finnish household's is close to the Euro zone average. It is clearly lower than in other Nordic countries but higher than in Germany, France or Italy. (Lauri Kajanoja, 2013)

Future's demographic development has a lowering impact on the amount of household's who need an apartment and to average income of household's. VTT Technical Research Centre of Finland created three scenarios in 2012 to the development of housing demand based on three different estimates of demographic development and housing stock's deletion. According to this evaluation in Finland there is a need for 26 500 houses early between years 2011 – 2020 and approximately to 25 000 houses between years 2021 – 2030. In recent years there has been constructed 30 000 houses on average but at the same time the housing stock deletion has been 7000 yearly so the net increase has been 23 000 new houses. Scenarios show that demand will exceed the supply in the future. (ibid)

10 Contemporary discussion

In the last few years there has been a debate whether housing bubble exists in many countries. Highly considered economists are sitting on both sides of the table. (Lind, 2009)

10.1 Tug-of-war

In Finland the signs of the debate has been seen as well when the economist of Commerzbank Marco Wagner estimated that there is an overvaluation of 20 per cent in Finland's housing market. Wagner based his view on the fact that in Finland the housing prices have grown after mid 90's at least 20 per cent faster than consumer price index, gross domestic income and development in producer prices. Many Finnish economists and workers in housing industry had an objection to make, e.g. Lauri Uotila, economist from Danske Bank, argued that average price level of housing has grown alongside with average salary. (J. P. Raeste; Heli Suominen, 2013)

Furthermore, American investor Jim Rogers warned Finland of a housing bubble. However, Aktia Banks main economist Timo Tyrväinen answered that for an outsider Finland's and especially the capital area might look overheated but it is something else. He does not think that there is a bubble in the Finland's housing market but there is exaggeration in prices. Tyrväinen argues that the difference between exaggeration and bubble is that exaggeration cannot be burst. Five years ago there were signs that the exaggeration in prices could be a bubble but then in the beginning of financial crisis from spring 2008 to winter 2009 housing prices went down by seven per cent in Finland. Then European Central Bank lowered interest rates and investors returned to housing markets. Housing prices rose by nine per cent in a year in a recession.

Tyrväinen argues that Finland is a special case since the construction market is dominated by only a few big companies. This creates a peculiar phenomenon which was born after recession in 90's when small and medium sized enterprises died away and market started to be dominated by a few big companies. If the price levels of dwellings start to drop the companies will interfere. Tyrväinen notes that bubble cannot burst

because if there is a sign of a drop in housing price level these companies will reduce the amount of construction i.e. supply and thus maintain high prices. (Mannila, 2014)

Another honoured economist, also known as Doctor Doom, Nouriel Roubini wrote that there are signs of a housing bubble in many countries including Finland. He wrote that indicators for these signs include fast-rising home prices, high and rising price-to-income ratios, and high levels of mortgage debt as a share of household debt. Roubini also states that in developed economies countries with a low GDP growth, high unemployment, and low inflation, the wall of liquidity created by conventional and unconventional monetary easing are increasing asset prices such as home prices. The bubble is not about to burst quite yet but the higher the prices will increase the greater the fall will be. (Roubini, 2013)

10.2 Light in the end of the tunnel

In Bloomberg's article a Finnish economist Katja Taipalus claims that she has created an indicator what is able to detect asset-price bubbles in housing markets for a year in advance. "Asset prices have been one of the main components as financial crises have built up" she said in the hall of Bank of Finland in Helsinki. (Pohjanpalo, 2013)

How the indicator works is that when e.g. dividend yields and stock indexes are fed in it signals each significant stock-price bubble since 1871 in United States. Then if rent indexes and house prices are fed in the indicator is able to signal when increases in cost of dwellings are becoming unbalanced. The article also states following: "Taipalus's indicator is able retroactively to detect the U.S. subprime housing-market collapse after prices peaked in 2006, with signals from 1998 to 2001 and again from 2003 until early 2006. The model also could have predicted the Spanish and Irish housing-market booms before the crashes occurred. U.S. house prices are now 23 percent lower than the peak." (ibid)

Erkki Liikanen, European Central Bank Governing Council member and governor of the Bank of Finland, has embraced this indicator. He states that macroprudential supervision is a major challenge which appeared from the financial crisis and good quality research is the right way to develop. (ibid)

Mrs. Taipalus claims that bubbles are created actually by people who know that market is overheated but who think that they are able to walk away from it with a profit before the burst. Previous indicators and models had difficulties in identification. They were not able to tell precisely when the break occurred or failed to measure the booms' general denominators. (ibid)

Yale University Professor Peter C.B. Phillips has been working on a parallel research in the past few years. Many commercial banks and central banks, e.g. United States, Singapore, Hong Kong, Israel and New Zealand, have been interested in his work. In the article he stated the following: "Financial-market stability, particularly global financial stability, is a public good like clean air, clean oceans and a healthy environment. Financial stability is threatened by asset bubbles, excessive credit creation, uncontrolled risk-taking by banks and ballooning sovereign debt. Any econometric methods that assist in detecting these threats are helpful to ensuring financial stability." However, his technique is different from Taipalus' one and he states that it can be used to other researches as well. The future will show if these contemporary methods can warn policy makers on time and prevent big crashes in markets. (ibid)

10.3 Academic findings

Price increase of housing has broken away from development of building costs and has led to strong increase in price of vacant plots. To get the planned vacant plots available for construction it would be good to use all legal proceedings available. Share of housing investments from GDP has not reached in the 2000's to the level of beginning of 1990's. (Kivistö, 2012)

Increase of housing prices in 2000's does not seem to be diverged from its equilibrium level in relation to rents. To this conclusion the rent and price relation comparison to household's insolvency relates to. Especially the decrease of mortgage interest rates has lowered owner-occupied housings operating costs. At the same time the external factors of operating costs e.g. prolonged mortgage maturities has left room for bigger mortgage amounts so that monthly instalments have not increased unreasonably. If housing markets are at the moment in equilibrium the calculations refer to fact that

housing investors' high expectations of future development have not changed lately to rapid price increase. (ibid)

Other than factors in financial markets the demand in Finland has increased by increased incomes, owner-occupied dwellings tax reliefs, population growth, migration to urban areas and increase of dwelling units. Gradual decrease of tax reliefs and real estate tax rates probable increase as well as interest rates probable increase will raise the operating costs of owner-occupied housing. In uncertain economic situation housing prices may react rapidly to reduction of demand. (ibid)

Researcher from University of Turku Elias Oikarinen claims that housing price collapse cannot be expected to happen in the future. According to Oikarinen the current situation differs from the bubble in the late 1980's. Oikarinen says that back then there was a bubble in housing prices but at the moment there is now bubble in relation to prevailing fundamentals. Circumstances are now completely different than during previous crises so it is useless to be afraid that history will repeat itself Oikarinen alleges. (Taloussanomat, 2013)

Researcher from Bank of Finland Antti Kuusterä says that since 2000's there has been exceptionally strong areal differentiation. Kuusterä notes that in Helsinki there is no upper limit in housing prices meanwhile in some regressing cities a house is priceless. According to Kuusterä there has not been even an approach to this problem. (ibid)
Elias Oikarinen underlines that recession has a big impact on development of housing prices. If Finland falls to recession the effect would be significant. According to him if the unemployment level would double it would most likely lead to a two-digit decrease of housing prices. Oikarinen states that it is clear that general economic situation affects straight to housing prices. (ibid)

11 Conclusion

Before this research was made the author had an assumption that there are clear signs of a housing bubble in Finland's capital areas housing market. This view was lacking scientific background and that is why this paper was written. In the beginning of research the notion could be made that the situation in capital areas housing market is far more complex and simple answers were inaccurate.

The paper starts with theoretical framework and simple mathematical equations behind housing prices are introduced. Oikarinen's (2005) study on Finnish housing market had a significant impact to the theoretical part. It was extremely important to have a solid theoretical base for housing price formation before reviewing a specific location, in this case Finland's capital area.

After theory the history of Finnish housing is taken under review. History in this paper goes to 1985. This year was chosen because of good access to information and other aspect was that after 1985 there has been one major burst of a bubble around 1990's and smaller dips in dot-com-boom and bust as well as in financial crisis 2008. Author's idea was to try to seek for similarities from these dips and bursts but it turned out to be an impossible task since fundamentals and characteristics of these housing price crashes has been different. In the chapter where bubbles were generally explained it could also be noted that there are many factors influencing to reformation of a bubble and based on the causality model these factors were not able to generate a bubble individually. They rather stimulated each other so that rapid price increases started to escalate.

Many different ratios and calculations try to illustrate today's situation and forecast the future. History has never been the best tool to use for forecasting future but it is usually the best tool available and this is why it is used. All ratios showed and examined in this paper seem to suggest that there is no significant overvaluation in Finland's capital areas housing market. In the light of current statistics there might be some frothiness in the capital area but certainly not a bubble. Furthermore, economists have claimed that bubble is not the correct term to describe the modern situation since the construc-

tion market is dominated by a few companies and they are able to reduce the supply of housing if prices start to decline.

The Finnish economists are mainly denying that bubble exists even though their American and Central European colleagues claim the exact opposite. Finnish economists defend their selves by statistics and claiming that Americans and other Europeans are not completely aware of all the characteristics of Finland's housing market. Government is rather a big player in Finnish market through subsidised rental apartments and benefits to homeowners.

In the end of the paper there are several different newspapers and Bank of Finland's study quoted. The author thought that the topic is very up to date and touches over a million people, who are living in the Finland's capital area, directly so the paper needed some contemporary findings and opinions. Another reason behind this was to show how controversial the discussion is around this topic even among highly appreciated economists. Especially Dr. Doom, Nouriel Roubini, is an interesting economist to follow since he predicted many things correctly before financial crisis in 2008. He has a strong belief that Finland's housing market is a bubble but only the future can show who was right and who was wrong.

One interesting statement found during writing of this paper was the notion that even though modern indicators might not show any overvaluation or even frothiness prices might crash. Today's global economy's connectedness ensures that every country is related to one another and as it has been able to see before, economical depression is contagious. Crisis around 2008 spread rapidly from America to Europe and to Asia and many developed economies experienced a major downturn in their respective housing market.

In Taloussanomat (2013) Oikarinen states regardless of the evidence that there is no bubble the housing prices would start to come down e.g. if unemployment would start to increase rapidly the demand in housing market would decrease significantly and the prices would start to fall. That statement is very serious and it means that housing does not necessarily indicate the development of global economy but it rather reacts to its changes

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