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FPI in Sweden

An economic approach to Swedish housing prices 1996-2014

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Abstract

Swedish house prices have increased substantially in recent years and this paper investigates, using OLS, if the key drivers for housing prices are the same across the nation, or if there are any regional differences.

The variables used are household income, household debt to income ratio, mortgage interest rate, population in the nation, the number of housing units in the nation and inflation. The data are divided into groups based on the NUTS classification and spans the period from 1996 until 2014, a total of 19 observations for each of the eight regions and the nation as a whole. These variables are used in two rounds of OLS regressions, with the second round using the stepwise-method to remove insignificant variables and reduce multicollinearity, with a housing price index for Sweden as the dependent variable.

The results imply that the drivers are the same in most of the nation, with differences in some regions. The most noteworthy differences are between the farthest south and the farthest north of the nation.

List of abbreviations

FPI – Fastighetsprisindex, Housing Price Index

GDP – Gross Domestic Product

KPI – Konsumentprisindex, Consumer Price Index

NUTS – Nomenclature of Territorial Units for Statistics

OLS – Ordinary Least Squares

SCB - Statistiska Centralbyrån, Statistics Sweden

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1. Introduction

Recent years has seen a substantial increase in housing prices, an increase which is faster than most assets (The Economist, 7/11-15). The increase in housing prices has grown into a popular topic in the daily press (svd.se/om/bopriserna) and for everyone ever so slightly interested in moving in the foreseeable future. It is interesting to know why they are increasing, and what drives the prices. If prices are solely driven by changes in the population, the number of inhabitants in a nation or region, a certain set of actions are applicable if policymakers wish to slow down the increase. If the income of the population is the driver other solutions are better. There are many papers discussing this, both for Sweden, Scandinavia and Europe. But what if there are regional differences? It is not impossible that some regions in a nations are poorer than others, or have experienced different changes in population size. This might create different results for what drives the prices for different regions, which might not be the same as on a national level.

This paper builds on the work from several papers investigating house price-dynamics in Scandinavia and Europe, to investigate if the drivers are the same all over the nation or if there are any regional differences. This disaggregated analysis has not been conducted for Sweden in recent years, as far as the authors could find, which is the main contribution of this paper. Literature exists for most parts of Europe, however not on the Swedish national and regional level for recent years. There is, nevertheless, a substantial body of work regarding house prices, spanning from distance in time or space to the impact of location or income on prices. The conventional knowledge, if you will, says that prices for housing decreases the further you go from an economic centre or central business district. The same kind of wisdom also states that as the mortgage interest rates go down prices goes up because of the mathematical relationship between mortgage interest rates and the discounted present value of a house.

This paper expands on the subject of key drivers for house prices. It uses a price index and a set of variables over 19 years to determine the correlation of, for example, income with the housing prices in Sweden. This is done both on a national and regional level.

Two questions were asked prior to the analysis: Are prices driven by the same variables all over the nation? Are there any regional differences with regards to what drives housing prices?

The nation is divided into parts based on statistical regions. A housing price index, FPI, is used to measure the evolution of prices and an OLS analysis is used to measure the relevance of different variables. The OLS regression is subjected to several techniques to control for robustness, heteroscedasticity and other standard tests.

The paper is structured as follows: Part 1 is this introduction, the second part is a review of previous work and part 3 is background information about the Swedish housing market. The fourth part describes the data, part 5 describes the method used, part six is the results, part seven is an analysis of the results while the eight concludes.

2. Previous work

Numerous articles and books have been written on the subject of house-price dynamics, and similar, subjects. This review is far from exhaustive, but instead highlights the most important articles for this paper which motivates the chosen variables for the regressions. First is a brief overview of existing literature focusing on the Nordic countries, after that comes papers on a European scale and a third part is about subjects connected to our variables of choice such as land costs and migration.

In Sweden, Berg (2002) found that differences between mortgage interest rates were important in driving prices, as well as industrial productivity and stock markets. The mortgage interest rates affect the prices by affecting the amount of debt a household is able and willing to acquire. When mortgage interest rates decrease a loan becomes cheaper. It also changes the discounted present value of the house – which increases when mortgage interest rates decreases. Hort (1998) found, in a study for 20 Swedish urban areas between 1967 and 1994, that user costs, production costs and income drove prices. User costs are the cost of living in a house for one year, for example interest payments on the mortgage and costs for heating. Koskela et al (1992) wrote a similar paper focusing on Finland over a time period of 20 years. They saw that the financial deregulations Finland went through in the mid-1980s caused a drop in the savings rate for Finnish households. This decrease in the savings rate caused households to acquire loans, to a higher degree than before, in order to finance their homes instead of saving and paying cash. This, in turn, caused rapid increases in prices because of the increased access to capital. The indebtedness of households turned out to be a driver for prices, as well as demographics to some degree, while the effect of income could not be estimated precisely. Vihriälä and Skurnik (1985) on their part found that population and migration were a key driver for prices in Helsinki, Finland, together with availability of credit. Income was, surprisingly for the Vihriälä and Skurnik, insignificant.

In a geographically greater study, Englund and Ioannides (1997) concluded that GDP growth and interest rates were significant drivers for 15 OECD nations. However, demographics turned out to be insignificant in their survey. Egert and Mihajliek (2007) also conducted a similar study on eastern Europe and compared it to several Central European states, amongst them Sweden. They used, together with other variables, mortgage interest rates, GDP/capita and demographics, and found a relationship between prices and real interest rates, demand and prices as well as debt and prices. Aligieri (2013) found that mortgage interest rates, income, GDP and a random term affected the prices.
Hilbers, Hoffmaister, Banerji and Shi, (2008) divided Europe into slow-, average and fast-lane nations according to their movements in price. Their paper found that lower interest rates and lower expected capital gains increased prices. Lower interest rates increased house prices in the fast lane and average nations such as the UK. Nations further from the major cities of Europe had a slower increase in prices. Sweden was classified as an average performer which suggested that prices are moderately sensitive to income.

There are several papers within the field of urban and spatial economics regarding location and its effects on housing prices. One of these papers are written by De Bruyne and Van Hove (2013) who examined the effect of location on Belgian house prices. They found that a 1% increase in wealth in a Belgian municipality increased the prices by 0,3%. They also found that a house in a municipality closer to an economic center, such as Brussels, demanded a higher price than in a municipality further away, which is consistent with Hilbers et. al (2008).
On the other hand, Ottensman, Peyton and Man (2008) saw that travel distance is not as important as travel time, to a central business district, and that a ten-minute increase in travel time decreased prices with between 3,3 and 6,4 percent. The shorter, in time, a commute is the higher the price regardless of distance.
This is consistent with Alonso (1984) who describes prices in the form of a land-rent model where land becomes more expensive the closer it gets to the city center. Individuals then maximizes their utility and finds a match between traveling distance and land price. If two identical houses are constructed, one in a location close to the city and one far away, it is likely that the one close to a city

is more expensive because of the combined land and construction costs in the two locations. Muth (1969) wrote an article with similar findings, that prices go up the closer you are to the central business district. A third paper with similar results is Bourassa et. al (2010) who found that land prices are the key driver for housing prices in Switzerland where more attractive land is more expensive. Ihlandfeldt and Mayek (2010) found that regulations, instead of location, are a driver for land and housing prices. Locations with a higher degree of land regulation is found to increase house prices while it decreases land prices. One might believe that rural areas has a lower degree of regulation while cities have a higher degree. Rural land is then, given a lower rate of regulation, less expensive. Ley and Tutchener (2001) concluded that, among other factors, immigration was a key driver for demand and subsequently prices in the cities of Toronto and Vancouver in Canada.

The sum of these articles provides support to the idea that prices are affected by mortgage interest rates, income, debt to income ratios, location, and demographical changes.

3. Background

3.1 The characteristics of Sweden and the Swedish housing market

In order to execute a proper analysis of the data at hand, and understand and interpret the results later on, some basic knowledge about Sweden and its housing market is needed.
Sweden is a fairly large nation, by European standards, located in Northern Europe. It spans 21 counties, with different characteristics in different parts. The north is characterized by forests, mountains and a subarctic climate while the south has a temperate climate and consists mainly of farmland. The major cities are located in the south, Malmö, the southwest, Gothenburg, and the east, Stockholm. 85% of the population are living in cities (SCB Nr 2015:96), which creates a population density of 22/km^2. Major industries in Sweden are forestry, mining and waterpower which are mostly located outside of the cities in the northern parts. The cities have a higher share of tech-companies, especially Stockholm. The south of Sweden is more densely populated than the north and middle of the nation. The population density, especially in the south, has increased in the recent years thanks to a high inflow of refugees and immigrants who arrive in and mainly settles in the south and the major cities. (SCB Nr 2014:14)
The market is characterized by heterogeneity, both with respect to houses, their size and standard, but also location.

The market for housing consists of three parts; rented apartments, houses and condos. The first part is the market for rented apartments. Hans Lind (2014) describes the Swedish market for rented apartments as rent-controlled through negotiations between the market participants, such as the tenant's association and the owners. A large share of the apartments is owned by the state and local municipalities and the rents for these apartments serves as a benchmark for similar apartments.
The second part is the market for regular-one family houses and vacation homes which is unregulated in terms of price. Their prices are heavily influenced by location, proximity to communications and schools and similar. These range from small summer homes without hot water to mansions. These houses can also be rented, creating a situation for the tenant that is similar to living in an apartment.
The third part is the cooperative housing or condo, in Swedish known as the bostadsrätt, which is similar to a regular house or vacation home in many ways. Together the sales of condos in the three major cities of Sweden adds up to a total value of 152 billion SEK which is roughly a tenth of the total value of the market (SCB nr: 2014:161).

5. Data

The data is collected from several different sources. The main dataset is the FPI, Housing Price Index, from Ekonomifakta.se which is a website about the Swedish economy (made by the industry group Svensk Näringsliv). The FPI is a time-series based on data from Statistics Sweden, SCB, which combines data of sold one and two family homes as well as terraced and town houses, called permanent living small houses. The observations are the first quarter each year, stretching over a period of 19 years with the first quarter in 1996 indexed as one. Furthermore, the data are nationwide as well as divided into regions based on the Nomenclatures of Territorial Units for Statistics for Sweden (NUTS) as defined by SCB (MIS 2015:1). The observations are also deflated by the Consumer Price Index from SCB, the KPI, for the same period to adjust for inflation.
Each quarter spans three months with the first month being January in each year.

The number of housing units in the nation, also grouped into NUTS regions, are from SCB, in absolute numbers observed yearly spanning 19 years from 1996 onwards. The same is the case for the population. The income is a yearly mean across the population, from SCB as well. All variables are grouped in NUTS regions except household debt to income ratio, mortgage interest rates and inflation which are the same for the entire nation.

The mortgage interest rates are a yearly mean rate for a fixed five-year mortgage from the Swedish bank Swedbank.

The mean was calculated by using the following formula $\bar{X} = \frac{\sum X_i}{n}$ where n is the number of observations, i is each available month's value and X is each month's interest rate. $\bar{X}$ is then the mean mortgage interest rate used in the regressions.

6. Method

To measure the effect of different variables on housing prices in different regions it is necessary to do an econometric analysis. This paper will use an Ordinary Least Squares, OLS, regression in two steps to accomplish this. It also uses robust standard errors for a more reliable result. These results shows if a variable is statistically significant, if it correlates to the prices, or not and the magnitude of the correlation.

6.1 Model specification

Below is the specification of the model used for the OLS regression. FPI is the dependent variable, the House Price Index, and the right hand side of the equation contains the values for the different variables.

$$FPI_{it} = \alpha + \beta_1 Houseinc_{it} + \beta_2 Housedebt_t + \beta_3 Population_{it} + \beta_4 Mortgagerate_t + \beta_5 Housingunits_{it} + \beta_6 Inflation_t + \varepsilon_{it}$$

FPI - Dependent variable, The Real estate price index in Sweden, and in each NUTS region.

$Houseinc$ - Household income, the average income in Sweden, and in each NUTS region.

$Housedebt$ - The average debt to income-ratio for households in the nation.

$Population$ - Total amount of population in Sweden, and in each NUTS region.

$Mortgagerate$ - Mortgage interest rate is the average level of interest cost each year for borrowing money to buy a house, in percent. This is calculated by summarizing the monthly lending rate for mortgages for each year and dividing by the number of observations each year, thus creating a yearly average. The mortgage interest rate is the same for all regions as well as for the nation.

$Housingunits$ - The total amount of housing units in Sweden, and in each NUTS region.

$Inflation$ – The amount of inflation in Sweden in percent. The inflation is the same for all regions and for the nation.

α - Intercept of the regression.

ϵ - Error term.

i – Region, the individual explaining effect on FPI in each NUTS region.
Stockholms län (Stockholm County) Östra mellansverige (Uppsala County, Södermanlands County, Östergötlands County, Örebro County, Västmanlands County) Småland med öarna (Jönköping County, Kronoberg County, Kalmar County, Gotlands County) Sydsverige (Blekinge County, Skåne County) Väst Sverige (Hallands County, Västra Götalands County) Norra mellansverige(Värmlands County, Dalarnas County, Gävleborgs County) Mellersta Norrland (Västernorrlands county, Jämtlands County) Övre Norrland (Västerbottens County, Norrbottens County).

t - Time, yearly from 1996 to 2014

6.2 OLS Regression

The OLS regressions are executed separately for the nation as a whole and for each region. When done in this way it is possible to observe the individual effect for each explanatory variable in each region, and to separate which explanatory variables correlates the most to the FPI in respective region. The regressions use robust standard errors. (Stata.com, Variance estimator).

$$FPI_{it} = \alpha + \beta_1 Houseinc_{it} + \beta_2 Housedebt_t + \beta_3 Population_{it} + \beta_4 Mortgagerate_t + \beta_5 Housingunits_{it} + \beta_6 Inflation_t + \varepsilon_{it}$$

Table 1

FPI_{it}	α	β1$Houseinc_{it}$	β2$Housedebt_t$	β3$Population_{it}$	β4$Mortgagerate_t$	β5$Housingunits_{it}$	β6$Inflation_t$
(Robust std error)							
Nation Total	-847.7133***	0.0009938*	1.674937***	0.00002	660.4827**	-0.0000669	0.3812244
	(-203.4216)	(0.0003139)	(0.2662957)	(0.0000563)	(181.3239)	(0.0001348)	(2.709378)
Stockholms län	-1381.253***	0.0021951***	0.963731	-0.0000311	750.1812*	0.0002263	1.196266
	(312.9682)	(0.0004125	(0.5403049)	(0.0000678)	(288.1322)	(0.0003027)	(0.25)
Östra mellansverige	-509.5994**	0,0006449**	1,575889***	-0,0004375	415,1466**	0,0000354	0,1313097
	(148,8936)	(0,0001876)	(0,2731382)	(0,0003947)	(132,2363)	(0,0001421)	(1,342463)
Småland med öarna	-322.1121	0.0003023*	1.654519***	-0.0018633	603.5002***	-0.0001625	-2.49071*
	(198.9573)	(0.0001299)	(0.1607029)	(0.0009272)	(122.6524)	(0.0001536)	(1.178113)
Sydsverige	-902.2181**	0.0008009*	2.878195***	-0.0007807*	933.5913**	0.0001198	0.5075655
	(291.3008)	(0.00034)	(0.6149752)	(0.0002949)	(306.1269)	(0.0003117)	2.481447
Västsverige	-844.0522*	0.000432	2.339893***	-0.000033	680.7661**	-0.0000773	0.5681351
	(245.4442)	(0.0002647)	(0.3145626)	(0.0001715)	(193.7163)	(0.0001925)	(2.950265)
Norra mellansverige	-435.8929	-0.0001763	1.524089***	-0.0004203	611.9057***	-0.0002788	-3.471397**
	(330.2273)	(0.0003974)	(0.215678)	(0.0009782)	(118.0898)	(0.0001811)	(0.953242)
Mellersta Norrland	-270.7245	-0.000442	1.389664***	-0.0013546	613.7456**	-0.0004136	-1.835405
	(358.0299)	(0.0003423)	(0.1308273)	(0.0009526)	(147.3139)	0.0002003)	1.269777
Övre Norrland	-657.3453	0.0007039	0.8162341***	0.0004794	472.4917*	-0.0003282	-1.538819
	(435.6605)	(0.0003404)	(0.1434314)	(0.0009289)	(170.8146)	(0.0002957)	(2.446234)

*- Statistically different from zero at the 5% level
**- Statistically different from zero at the 1% level
***- Statistically different from zero at the 0.1% level

Table 1: Regression Table
Statacode: tsset Time, Yearly
reg FPI Houseinc Housedebt Population Mortgagerate Housingunits Inflation, vce(robust)

Observing table 1, the coefficients for the variables Household income, household debt to income ratio and mortgage interest rate are the variables which are significant in the majority of the regressions for the regions.

6.3 Multicollinearity Test and regression model significance test

Table 2

	R2	F(6. 12)	Mean VIF
Total Sweden nation	0.9933	469.94	59.1
Stockholms län	0.9892	431.45	18.54
Östra mellansverige	0.9960	2400,6	15.29
Småland med öarna	0.9970	834.83	24.21
Sydsverige	0.9922	513.49	25.31
Västsverige	0.9941	451.84	23.84
Norra mellansverige	0.9941	721.34	27.98
Mellersta Norrland	0.9893	417.77	24.24
Övre Norrland	0.9833	288.61	27.69

Table 2: Significance testing

Statacode: tsset Time, Yearly

reg FPI Houseinc Housedebt Population Mortgagerate Housingunits Inflation, vce(robust)

Estat VIF

Observing table 2, there is a high VIF value for every regression. The VIF-value measures the collinearity between the variables. If the variables are highly correlated with each other it might create problems when estimating the significance of an explanatory variable. A regression with a VIF-value greater than 10 should be re-evaluated since the regression are affected by multicollinearity.
Reducing the VIF-value/ multicollinearity could be done by using different methods. The methods of choice in this paper are to transform variables into log-form and dropping the most highly correlated variables. The multicollinear variables effectively works as one, therefore only the significant variables for each individual regression is kept in the next round of regressions (Cortinhas, Black 2012).

When variables are suffering from multicollinearity it is necessary to execute a second round of regressions to improve the results.
To address the multicollinearity, and choose which variables will be of interest and used in the new round, each regression will be run stepwise to determine which variables are individually significant to the FPI in each region. When knowing which variables carries significance to the individual models, those variables will be kept.
The R^2 value is above 0.99 for all counties, which means that the regressions explains the changes in FPI by 99% for all regions. This is addressed further down in the results section.

The F-value is above 288 for all regressions. All regressions are significant for explaining the yearly change in FPI.

6.4 Residuals vs Fitted Values

Figure 1

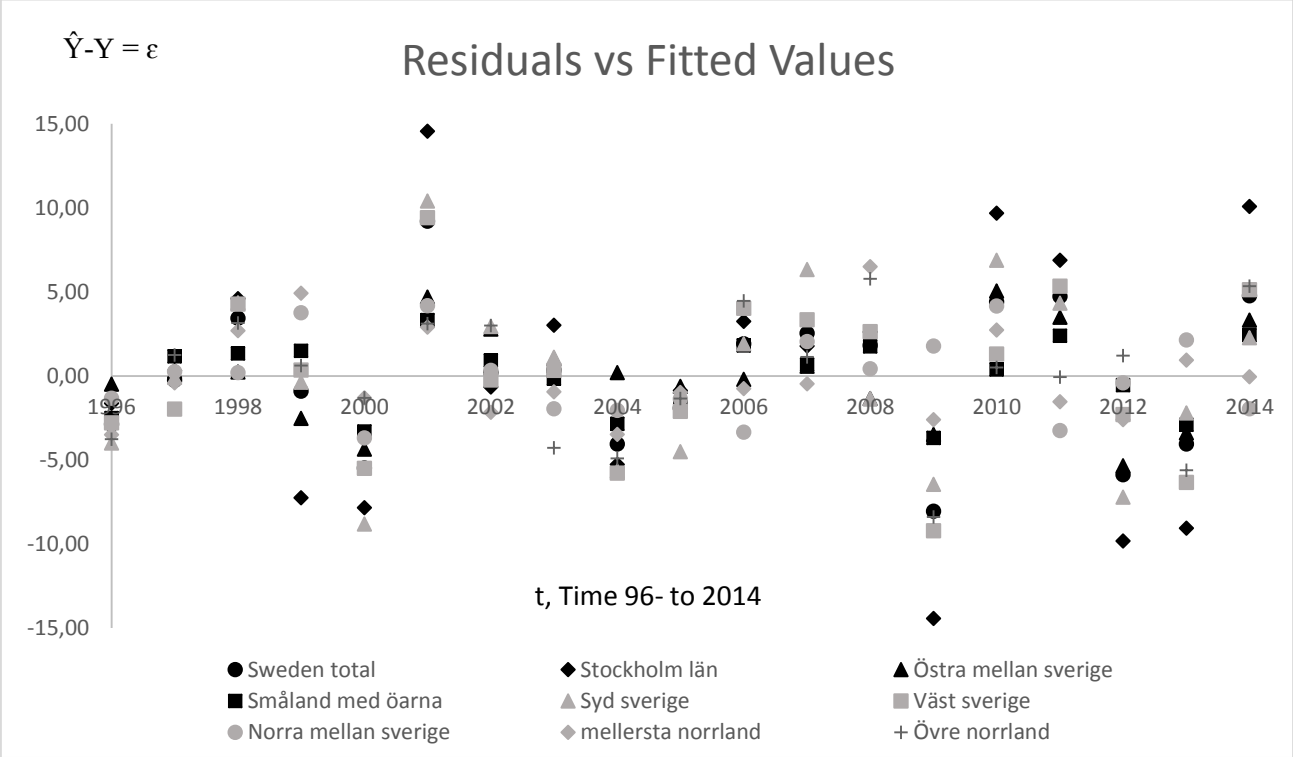

Figure 1: Residuals vs Fitted Values
Statacode: tsset Time, Yearly
reg FPI Houseinc Housedebt Population Mortgagerate Housingunits, Inflation, vce(robust)
predict e, residuals
rvfplot recast(scatter)

Figure 1, the residual plot of table 1. There seems to be a linearity among the majority of the regressions. The fitted values translate into the predicted value $\hat{Y}$ FPI. The residuals indicate the difference/ error of the predicted value and the observed value (Wooldrige 2014).

Table 3, Residuals vs fitted values table

Time	Sweden total	Stockholm län	Östra mellansverige	Småland med öarna	Sydsverige	Väst Sverige	Norra mellansverige	mellersta Norrland	Övre Norrland
1996	-2,86	-1,63	-0,49	-2,49	-3,99	-2,79	-1,32	-3,49	-3,76
1997	-0,25	0,31	0,27	1,18	-0,08	-1,97	0,25	-0,41	1,26
1998	3,44	4,60	0,24	1,34	4,36	4,28	0,20	2,70	3,16
1999	-0,90	-7,25	-2,53	1,50	-0,36	0,36	3,77	4,93	0,63
2000	-5,47	-7,84	-4,35	-3,31	-8,80	-5,50	-3,69	-1,30	-1,29
2001	**9,21**	**14,56**	**4,71**	**3,32**	**10,42**	**9,42**	**4,18**	**2,90**	**3,12**
2002	0,20	-0,65	2,79	0,93	2,94	-0,23	0,33	-2,16	3,01
2003	0,36	3,03	1,04	-0,16	1,11	0,34	-1,95	-0,93	-4,28
2004	-4,04	-5,27	0,20	-2,85	-5,65	-5,78	-2,04	-3,48	-4,91
2005	-1,92	-0,87	-0,62	-1,82	-4,50	-2,10	-1,36	-0,98	-1,35
2006	1,91	3,25	-0,20	1,83	1,91	4,03	-3,34	-0,74	4,47
2007	2,55	1,78	0,59	0,68	6,33	3,35	2,05	-0,47	1,14
2008	1,82	2,62	-1,35	1,76	-1,35	2,64	0,42	6,50	5,79
2009	**-8,05**	**-14,43**	**-3,48**	**-3,67**	**-6,45**	**-9,21**	**1,78**	**-2,60**	**-8,39**
2010	4,41	9,68	5,07	0,40	6,89	1,30	4,16	2,74	0,51
2011	4,75	6,88	3,50	2,39	4,33	5,35	-3,24	-1,54	-0,06
2012	-5,87	-9,82	-5,33	-0,54	-7,20	-2,29	-0,41	-2,60	1,21
2013	-4,04	-9,05	-3,39	-2,91	-2,19	-6,33	2,15	0,95	-5,61
2014	4,77	10,09	3,33	2,42	2,28	5,13	-1,96	-0,04	5,34

Table 3: Residuals vs Fitted Values
Statacode: tsset Time, Yearly
reg FPI Houseinc Housedebt Population Mortgagerate Housingunits Inflation, vce(robust)
predict e, residuals

Table 3, the residual table of the regression table 1. A perfect fit of the residuals is when the residuals are equal to zero. A good fit is when the residuals are near zero. When the residuals value is zero, or near zero, the model explains the shift in FPI perfectly or very well. If the residuals are not near zero or equal to zero, the model is having difficulties in explaining the changes in the FPI. However, a regression model does rarely predict all the changes in the dependent variable. If the model does, there is likely something wrong with the model. The highlighted values, for the years 2001 and 2009, stand out from the rest. Those years are corresponding to turbulent times on the stock markets.

6.5 Regression with lowered multicollinearity.

A second round of regressions is conducted using stepwise, to lower the multicollinearity and get more reliable results.

$$FPI_{it} = \alpha + log\beta_1 Houseinc_{it} + \beta_2 Housedebt_t + \beta_3 Population_{it} + \beta_4 Mortgagerate_t + \beta_5 Housingunits_{it} + \beta_6 Inflation_t + \varepsilon_{it}$$

Table 4

Yit	α	logβ1Houseincit	β2Housedebtt	β3Populationit	β4Mortgageratet	β5Housingunitsit	β6Inflationt
(Robust std error)							
Nation Total	-3091.571***	187.2667**	1.617851***	-	707.1819***	-	-
(std error)	(603.2795)	(44.48053)	(0.1609851)	-	(123.7147)	-	-
Stockholms län	-6792.46***	471.9765***	1.429762***	-	918.2987***	-	-
(std error)	(1002.13)	(74.42319)	(0.276156)	-	(187.8765)	-	-
Östra mellansverige	-2195.03***	137.5416***	1.487127***	-	452.9825***	-	-
(std error)	(378.9708)	(28.02937)	(0.1050375)	-	(77.44547)	-	-
Småland med öarna	-1567.54***	85.90307**	1.392278***	-	463.0856**	-	-
(std error)	(342.6312)	(2.9208)	(0.0785757)	-	(112.2785)	-	-
Sydsverige	-2671.299**	157.1514*	3.039286***	-0.000807***	1013.241***	-	-
(std error)	(869.08)	(59.62439)	(0.2864946)	(0.0001475)	(182.8662)	-	-
Västsverige	-1885.523**	86.00508*	2.271153***	-	673.7376***		
(std error)	(563.0982)	(40.31958)	(0.1630913)	-	(141.2399)		
Norra mellansverige	-598.541***	-	1.444715***	-	603.9956***	0.6860153*	-3.139798***
(std error)	(85.32152)	-	(0.0465323)	-	(79.58923)	(0.0000822)	(0.6860153)
Mellersta Norrland	-570.388**	-	1.217371***	-	563.7194***	-0.0002739*	-
(std error)	(156.2682)	-	(0.0825691)	-	(136.1415)	(0.0001234)	-
Övre Norrland	-4336.432**	266.7055**	0.5650333**	0.0024949*	461.645**	-	-
(std error)	(1147.041)	(73.92349)	(0.189232)	(0.0009636)	(160.5608)	-	-

*- *Statistically different from zero at the 5% level*

**- *Statistically different from zero at the 1% level*

***- *Statistically different from zero at the 0.1% level*

Table 4: Regression with lowered multicollinearity
Statacode: tsset Time, Yearly
gen logHouseinc = ln(Houseinc)
stepwise, pr(.05): regress FPI logHouseinc Housedebt Population Mortgagerate Housingunits Inflation
reg FPI logHouseinc Housedebt Population Mortgagerate Housingunits Inflation, vce(robust)

In table 4 the VIF, multicollinearity factor, has been greatly reduced by dropping the least significant variables from table 1 and by changing the household income variable into log form. Every unit of household income increases the FPI by a percentage amount. The household income variable was

changed into log percentage, because it had the most effect on lowering the multicollinearity. Observing Table 4, the household debt to income ratio and mortgage interest rate are significant in all regions. The household income is significant in 6 regions and in the total Swedish nation. The population is significant in the regions Sydsverige and Övre Norrland. Housing units are significant in Norra mellansverige and Mellersta Norrland. The inflation is only significant in Norra mellansverige.

6.6 Regression model testing with lowered multicollinearity

Table 5

	R^2	F(3. 15)	Mean VIF
Nation Total	0.9935	1115.01	11.29
Stockholmslän	0.9888	647.25	10.21
Östra mellansverige	0.9954	1695.70	10.52
Småland med öarna	0.9959	1073.15	10.86
Västsverige	0.9941	1095.23	13.59
Mellersta Norrland	0.9873	502.16	3.72
	R^2	F(4, 14)	Mean VIF
Norra mellansverige	0.9940	577.58	3.13
Övre Norrland	0.9818	192.04	18.87
Sydsverige	0.9923	812.02	17.82

Table 5: Regression testing and multicollinearity testing
Statacode: tsset Time, Yearly
gen logHouseinc= ln(Houseinc)
estat vif
reg FPI logHouseinc Housedebt Population Mortgagerate Housingunits Inflation, vce(robust)

By observing the coefficients in table 4 the values remain similar to table, 1 even when the VIF-value has been reduced. This implies that table 1 have variables that are highly correlated, but it does not affect the result in a critical way. Övre Norrland and Sydsverige, still have a high VIF-value.

The R^2-value still explains the variation in the regression model by over 99% for all regions, after dropping insignificant variables. This implies that the dropped insignificant variables have a low contribution to the model when explaining the variation in FPI.

The F-value is statistically significant for every regression after dropping the non-significant variables. There are three explanatory variables for the majority of the regressions. In Norra mellansverige, Övre Norrland and Sydsverige there are four explanatory variables. This is because there were more significant variables in these regions and also why there are different degrees of freedom for these regions.

6.7 Residuals vs Fitted Values(Significance)

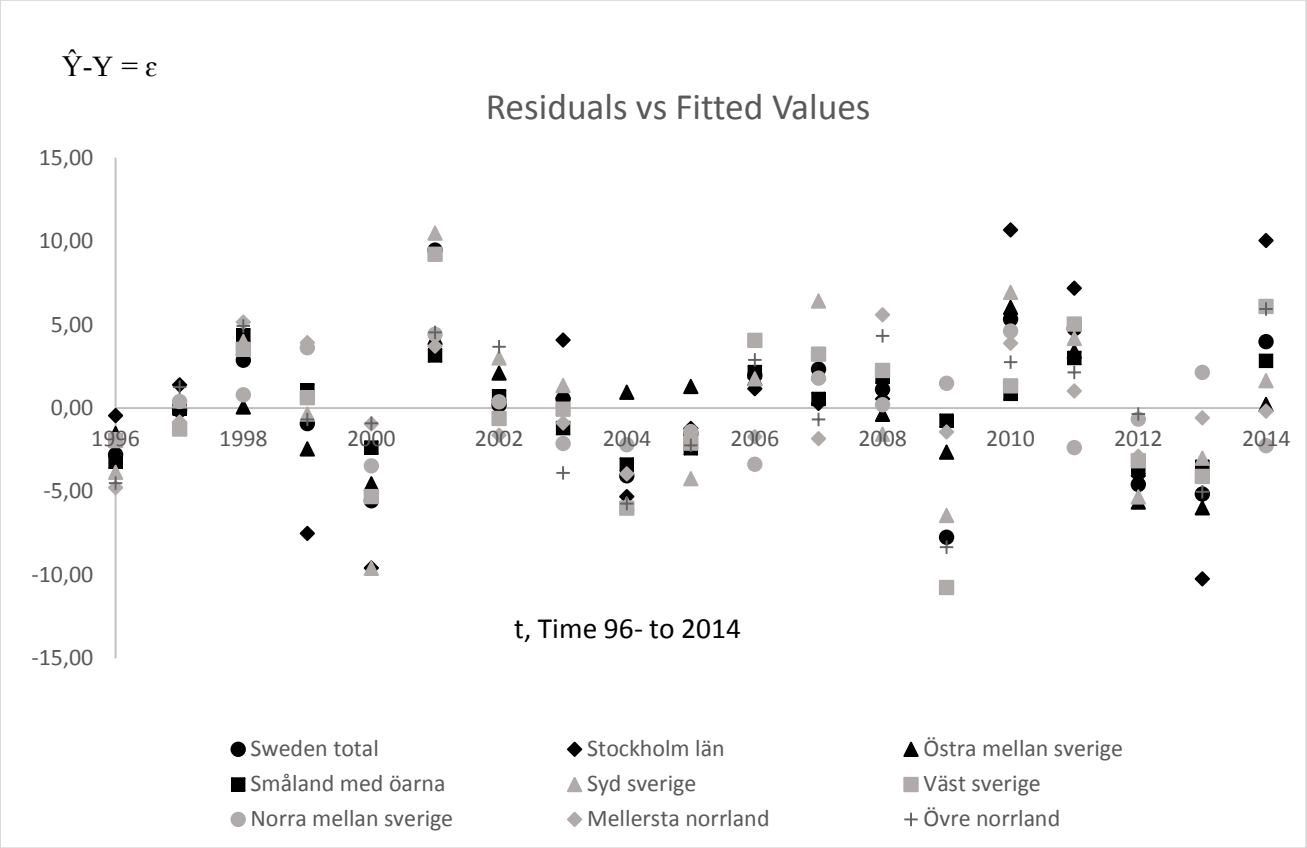

Figure 2: Residuals vs Fitted Values
Statacode: tsset Time, Yearly
gen logHouseinc = ln(Houseinc)
stepwise, pr(.05): regress FPI logHouseinc Housedebt Population Mortgagerate Housingunits Inflation
reg FPI logHouseinc Housedebt Population Mortgagerate Housingunits Inflation, vce(robust)
predict e, residuals
rvfplot recast(scatter)

6.8 Residuals vs fitted values (significance) table

Table 6

Time	Sweden total	Stockholm län	Östra mellansverige	Småland med öarna	Sydsverige	Väst Sverige	Norra mellansverige	Mellersta Norrland	Övre Norrland
1996	-2,79	-0,45	-1,53	-3,21	-3,85	-1,96	-1,89	-4,76	-4,50
1997	-0,13	1,38	0,06	-0,03	0,42	-1,26	0,38	-0,83	1,26
1998	2,86	3,18	0,06	4,35	3,99	3,51	0,78	5,14	4,91
1999	-0,93	-7,51	-2,46	1,06	-0,36	0,63	3,60	3,92	-0,69
2000	-5,56	-9,59	-4,54	-2,38	-9,61	-5,31	-3,46	-0,96	-0,91
2001	9,47	15,22	4,23	3,15	10,48	9,22	4,42	3,70	4,53
2002	0,17	0,47	2,09	0,70	3,01	-0,63	0,36	-1,63	3,67
2003	0,54	4,07	0,96	-1,21	1,34	-0,07	-2,13	-0,89	-3,89
2004	-4,06	-5,31	0,94	-3,40	-5,75	-5,99	-2,20	-3,95	-5,72
2005	-1,53	-1,21	1,29	-2,42	-4,23	-2,10	-1,42	-1,55	-2,23
2006	1,96	1,16	1,77	2,15	1,76	4,05	-3,37	-1,71	2,87
2007	2,32	0,27	2,10	0,54	6,41	3,22	1,79	-1,84	-0,69
2008	1,11	0,54	-0,38	1,86	-1,56	2,24	0,19	5,59	4,33
2009	-7,75	-15,82	-2,64	-0,76	-6,44	-10,76	1,49	-1,44	-8,33
2010	5,31	10,67	6,04	0,85	6,93	1,34	4,62	3,88	2,74
2011	4,76	7,17	3,40	3,00	4,16	5,02	-2,38	1,03	2,13
2012	-4,58	-4,06	-5,63	-3,56	-5,34	-3,16	-0,66	-2,90	-0,36
2013	-5,15	-10,23	-5,97	-3,52	-3,00	-4,09	2,13	-0,60	-5,02
2014	3,98	10,05	0,22	2,82	1,63	6,09	-2,26	-0,19	5,92

Table 6: Residuals vs Fitted Values
Statacode: tsset Time, Yearly
gen logHouseinc = ln(Houseinc)
stepwise, pr(.05): regress FPI logHouseinc Housedebt Population Mortgagerate HousingunitsInflation
reg FPI logHouseinc Housedebt Population Mortgagerate Housingunits Inflation, vce(robust)
predict e, residuals
rvfplot recast(scatter)

Residual table of regression table 4. In table 6 the multicollinearity has been reduced and the difference/ error remains similar to table 3. There is no relevant information lost after dropping the insignificant variables. In some of the regions the residuals have been lowered after dropping variables.

Results

The time series OLS regressions were conducted in order to observe how the individual variables correlates to the FPI. The first round had a full set of variables, household income, household debt to income ratio, total population in the nation, interest rates on mortgages, number of housing units and inflation.

This produced several statistically insignificant variables which made it necessary to execute a second round using the statistically significant variables. The variables in the second round was chosen using a step-wise regression, where only the specific statistically significant variables were used for each region.

First is a simplified table of the results of the first and second round of regressions. Following those are comments of the residual plots.

The results of the first round are found in Table 1. A summary is seen below, where the X marks significance on either the 5%, 1% or 0,1 % level.

	Houseinc	Housedebt	Population	Mortgagerate	Housingunits	Inflation
Nation total	X	X		X		
Stockholm	X			X		
Ö. Mellansverige	X	X		X		
Småland med öarna	X	X		X		X
Sydsverige	X	X	X	X		
Västsverige		X		X		
Norra Mellansverige		X		X		X
Mellersta Norrland		X		X		
Övre Norrland		X		X		

Table 7: Simplified results of the first round of regressions, as seen in table 1

As seen in table 7 there is a pattern where income, debt and mortgage interest rates were statistically significant in the majority of the cases. Worth noting is that Stockholm did not correlate to the debt, that Sydsverige and Västsverige is affected by changes in population and that Småland med öarna and Norra Mellansverige was significant with regard to inflation.

The second round was conducted with separate regressions for each region using only the significant variables, as decided by the stepwise regression in STATA, for that region. An X is used to mark a significant value, while a – is used for a dropped variable.

	Houseinc	Housedebt	Population	Mortgagerate	Housingunits	Inflation
Nation total	x	x	-	x	-	-
Stockholm	x	x	-	x	-	-
Ö. Mellansverige	x	x	-	x	-	-
Småland med öarna	x	x	-	x	-	-
Sydsverige	x	x	x	x	-	-
Västsverige	x	x	-	x	-	-
Norra Mellansverige	-	x	-	x	x	x
Mellersta Norrland	-	x	-	x	x	-
Övre Norrland	x	x	x	x	-	-

Table 8: Simplified results of the second round of regressions, as seen in table 3

The second round, now using only significant variables with lowered multicollinearity, produces slightly different results. The income is now significant for 6 of 8 regions and the nation. Debt to income ratio is significant for all regions and the nation, the same with mortgage interest rates. The

more interesting results are that Sydsverige is still sensitive to changes in population and that Övre Norrland is as well. Norra mellansverige and Mellersta Norrland has now become sensitive to the number of housing units, and inflation is now significant for Norra Mellansverige.

The residuals for the different regions, for the first regression, follows the trend closely the majority of the time. They differ from the trend the most in 2001 and 2009, which corresponds to major stock market crashes.

The pattern is similar in the second round, with less movement around the trend but still some difference in 2001 and 2009-2010 as well as a major dip in 2013. Again, this corresponds to times of stock market crashes, which suggests that housing is affected by the mood in the general economy.

There is also some slight difference in size of the coefficients between the regressions. For example, population shifted from 2,8 to over 3 in Sydsverige. In general, the coefficients are higher in the second round with lower multicollinearity.

The R^2 is high, 0,99, throughout the regressions which is not necessarily good in this case. As one add explanatory variables to the regression the R^2 increases, so a high R^2 does not automatically indicate a good fit between the variables in the regression. There was also high multicollinearity which were addressed by a VIF-test.

This is a good time to review the purpose of these regressions and how the results relate to the questions stated in the introduction. The questions to be answered was if the same variables are driving prices all over Sweden, and if there are any regional differences.
As table 7 and 8 shows the majority of the regions share the whole nations key drivers, but with some regional differences.

However, the results might be shaky because of the low degrees of freedom.

7. Analysis

The regressions yielded several expected and some more interesting, unexpected, results. The significance for income, debt to income ratio and mortgage interest rates were expected while the lack of relevance for the remaining variables were unexpected. Expected or not, the results still suggest some regional differences with regards to which the key drivers for housing prices are.

As seen in Regression table 1 the income, debt to income ratio and mortgage interest rates have a positive effect on prices when the nation is treated as a single unit. This was expected and also seen in previous research. When an individual has higher income he can consume more, better or higher quality housing. Housing is considered a normal good, which increases the demand and puts an upwards pressure on the prices for housing as income rises. The effects were bigger in the areas where the economic centers are located. For example, Stockholm had a coefficient of 470 while Småland had a coefficient of 85. This pattern is also seen in Hilbers et. al who saw that nations close to the major European economic centers, such as London, had more sensitivity to income. A house in an attractive, location must have a higher price because the demand for it is higher than an identical house in an unattractive location. Stockholm must then, by this line of reasoning, be considered a more attractive region than Småland. As De Bruyne and Van Hove (2013) and Ottensman et al (2008) found, prices for houses close to cities are more expensive than further away from them– both closer in travel time and closer in space. This is consistent with the findings in this paper, where prices are more volatile in the regions with large cities. When income rise, prices in Stockholm rises most of all regions.

Individuals with higher incomes are able to pay the higher prices motivated by shorter commuting times. Individuals with higher incomes can also acquire larger loans in nominal terms, which in turn helps to drive the prices upwards. In high income areas this is more pronounced than in a low-income area such as the north of Sweden where money might be used in other ways as suggested by the results.
Egert and Mihajliek, as well as Englund and Ionnides found that mortgage interest rates had a significant effect on prices, which the results in this paper supports. However, the size of the mortgagerate coefficient are different for different regions in Sweden and the regions with higher coefficients for mortgage interest rates are also those closer to the economic centers. The highest difference is between Sydsverige and Mellersta Norrland, where Mellersta Norrland had half the coefficient of Sydsverige. This is interesting, why is the population of the south so much more affected by the change in mortgage interest rates than in the north?
This sensitivity to mortgage interest rates suggests that as income rises, individuals are willing to acquire larger, in nominal terms, loans in order to keep their debt to income ratio constant in order to purchase the best house possible. This is consistent with Hilbers et al as well as Koskela et al and also seen in this papers regressions. When mortgage interest rates go up for a house, or an illiquid asset in general, the price of the house goes down. Conversely the price increases when mortgage interest rates go down because of the change in discontinued present values of the house. Again there is a pronounced difference between the north and the south of the nation. Sydsverige has a coefficient for debt to income ratio of 3, while Övre Norrland has 0,5. It is remarkable to see such a distinct difference and it is unclear from this kind of data and analysis to find out with precision why this is the case.

The unexpected results from the regressions are the lack of relevance for the population variable which was expected to be highly significant, as well as the negative coefficients on income for some regions. An increase in population should, according to Aligieri, result in a higher demand and an upwards pressure on prices. The results of Ley and Tutchener also supported this idea, that globalization and immigration puts an upwards pressure on demand and prices in the areas to where migrants relocate. The only regions with significant coefficients for population was Sydsverige and Småland, areas to which a large share of immigrants and refugees first arrive and later settle in. However, it might be

relevant to investigate what kind of immigration is occurring, or if the increase in population is because of a higher fertility- or lower mortality rate than other regions, or if the decreased population in the north (see Appendix B) has a connection to the increase in the south. The reason behind an increase in population might be relevant for the analysis of its effect on prices.

An interesting result is the negative coefficients on income for Mellersta Norrland and Northern Mellansverige. Hort (1998) states that income is a significant driver, but not in which direction.

The number of housing units also proved to be insignificant, which was unexpected. If differences between prices and rents, a consequence of rigidity in the supply, as Ayuso and Rostoy suggested, an increase in supply would return prices to their equilibrium and the supply would have an effect on pricing. This is highly intriguing because one of the most intuitive factors of prices on a market is the relationship between the supply and demand. However, it is not known how prices are in equilibrium, so they might go either up or down to reach it.

There seems to be regional differences as to what drives housing prices, as regions far away from economic centers behave differently than the regions with the major cities. Why this is the case is outside of the scope of this paper, but previous research, Muth (1969), Alonso (1964), suggests that land prices might be a factor. As seen in Appendix B, prices are higher in the regions where the economic centers are located.

By observing the results of the regressions in this paper, it is possible to see similarities between these results and previous research. The takeaways are that prices are more sensitive to income the closer one gets to major cities. The prices seem to be less correlated to income further away from economic centers. Changes in mortgage interest rates and debt to income ratio are relevant across the nation, but differs in size. This difference is substantial between some areas, which is an interesting result.
The amount of housing units, and shifts in population proved to be insignificant except in two cases.

8. Conclusions

Previous research has shown that several factors affects prices for housing. This paper set out to investigate if the same factors are driving prices all over Sweden on a national level and if there are differences between regions. This disaggregation on a regional level has not, to the authors' knowledge, been conducted with data for recent years and aims to increase the understanding of Swedish house price dynamics and regional differences. An OLS analysis, with two rounds of regressions, was conducted using time series data on a housing price index to see how connected income, population, mortgage interest rates, debt to income ratio, inflation and the amount of housing units was to the index.

The results showed that a majority of the regions had the same statistically significant drivers as the nation, with some exceptions. For example, Sydsverige and Småland had significant coefficients for population which neither the nation nor any other regions had. The most surprising result was that Norra Mellansverige and Mellersta Norrland had a negative coefficient for income. Prices and income had an inverse relationship in these regions, which goes against the pattern of the other regions. Income, mortgage interest rates and debt to income ratio was statistically significant in the majority of the regions. All statistically significant variables had a positive effect in all regions, except for the two where income had a negative. The size of the coefficients increased in the second step-wise round of regressions, where statistically insignificant variables had been removed.
As expected, the prices were most sensitive to income, mortgage interest rates and debt to income ratios in regions with large cities.

The answer to the questions in the introduction is therefore that the results implies that there exist differences between regions, both in variables and in their size, and between regions and the nation.

Possible future lines of research are to investigate if these results hold over time and into why this may or not be the case. It is also relevant to investigate if there are differences within cities, between comparable cities and to investigate further into why certain regions do not follow the same pattern as the rest. It is also relevant to investigate further into the population movements between cities and rural regions and what implication this might have for the economic performance and similar in the affected regions.

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9.7 Figures

10. Appendix A

10.1 Statistical regions

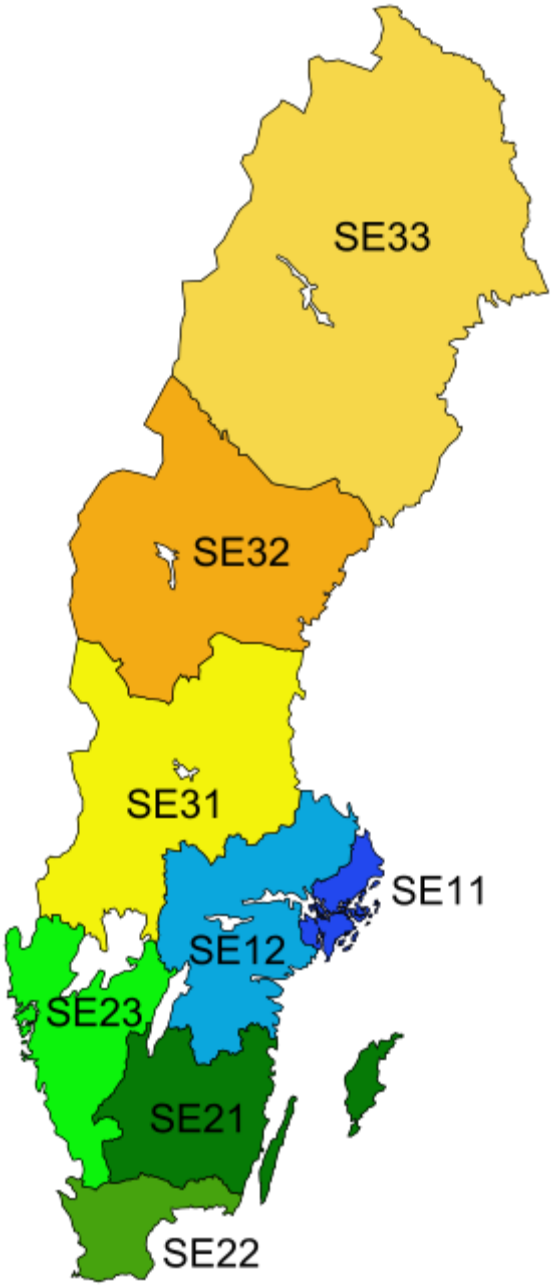

Figure 3: Source: SCB MIS 2015:1, Regional divisions in Sweden

9. NUTS-indelning
9. NUTS classification

Kod *Code*	NUTS 1 NUTS 2 NUTS 3
SE1	**Östra Sverige**
SE11	**Stockholm**
SE110	Stockholms län
SE12	**Östra Mellansverige**
SE121	Uppsala län
SE122	Södermanlands län
SE123	Östergötlands län
SE124	Örebro län
SE125	Västmanlands län
SE2	**Södra Sverige**
SE21	**Småland med öarna**
SE211	Jönköpings län
SE212	Kronobergs län
SE213	Kalmar län
SE214	Gotlands län
SE22	**Sydsverige**
SE221	Blekinge län
SE224	Skåne län
SE23	**Västsverige**
SE231	Hallands län
SE232	Västra Götalands län
SE3	**Norra Sverige**
SE31	**Norra Mellansverige**
SE311	Värmlands län
SE312	Dalarnas län
SE313	Gävleborgs län
SE32	**Mellersta Norrland**
SE321	Västernorrlands län
SE322	Jämtlands län
SE33	**Övre Norrland**
SE331	Västerbottens län
SE332	Norrbottens län

Figure 4: Source: SCB MIS 2015:1, Regional divisions in Sweden

8. Riksområden
8. National districts

Riksområde *National district*		Omfattning *Extent*
1	**Stockholm**	Stockholms län
2	**Östra Mellansverige**	Uppsala län Södermanlands län Östergötlands län Örebro län Västmanlands län
3	**Småland med öarna**	Jönköpings län Kronobergs län Kalmar län Gotlands län
4	**Sydsverige**	Blekinge län Skåne län
5	**Västsverige**	Hallands län Västra Götalands län
6	**Norra Mellansverige**	Värmlands län Dalarnas län Gävleborgs län
7	**Mellersta Norrland**	Västernorrlands län Jämtlands län
8	**Övre Norrland**	Västerbottens län Norrbottens län

Figure 5: Source: SCB MIS 2015:1, Regional divisions in Sweden

10.2. Literature table

Author	Year	Method	Conclusions
Aligieri	2013	Stochastic trends	Structural changes have an effect on house prices.
Alonso	1964	Bid rent theory	Land close to the city center is more expensive.
Berg	2002	OLS	A shock in the rate of unemployment has a strong impact on house prices.
Bourassa et al	2010	Error correction models	House prices are affected by construction costs, GDP/cap, population.
De Bruyne, Van Hove	2013	Utility maximization	Geographical barriers have effects on housing prices.
Ihlanfeldt, Mayock	2010	Instrumental Variables	Greater regulation restrictiveness is found to increase house prices and decrease land prices.
Egert, Mihaljek	2007	OLS	Prices are explained fairly well by market fundamentals such as interest rates.
Englund, Ioannides	1997	Difference in difference	Lagged GDP growth and interest rates are highly predictive of house prices.
Hilbers et al	2008	Dynamic OLS	Prices in different groups of nations are driven by different variables.
Hort K	1998	Error-correction model	Prices, user costs and construction costs have a significant impact on housing prices.
Koskela et al	1992	OLS	Changes in house prices is traced to changes in financial market conditions, such as higher debt to income ratios.
Ley, Tutchener	2001	OLS	Immigration and GDP growth has a large impact on prices.
Muth	1969	Utility maximization	The further from a central business district a plot of land is the lower the price is.
Ottensman	2008	OLS	An increase in travel time, by 10 minutes, to a central business district decreased house prices with up to 6,4%

Vihriälä, Skurnik	1985	OLS	Net migration and availability of credit creates swings in house prices in Helsinki.
Muth	1969	Utility maximization	The further from a central business district a plot of land is the lower the price is.

10.1 Equations and models

10.1.2 Estimating the regression

The regression to predict the dependent value which would be the FPI, would look like this if viewed as an equation. Which we predict by looking at our constant α and the variable that change after each year $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$.

Simple regression line

$$FPI_{it} = \alpha + \beta_1 Houseinc_{it} + \beta_2 Housedebt_t + \beta_3 Population_{it} + \beta_4 Mortgagerate_t + \beta_5 NewRealestates_{it} + \beta_6 Inflation_t + \varepsilon_{it}$$

Step by step
The following section is a step-by-step approach to how we obtained our main linear regression and the R^2.

To predict our y-value we use this equation to estimate each individual explanatory variable to observe their respective individual effect on the dependent variable. Each explanatory variable means $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$.which are equal to Household income, Household debt to income ratio, Population, Mortgagerate, amount of housing units in the nation and inflation.

The x value will be the observed value, and $\bar{x}$ is the sample mean of the x value. The same goes for the observed y value, $\bar{y}$ is the sample mean of the y value.

Slope of the regression line.

$$b_1 = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

To estimate the intercept α we use this type of y-intercept equation. This constant will be the effect on the predicted y if all the explanatory variables are held constant over a certain period of time. The value n is a parameter for the amount of observed values.

y-intercept of the regression line.

$$b_0 = y^2 - b_1\bar{x} = \frac{\sum y}{n} - b_1\frac{(\sum x)}{n}$$

10.1.3 Estimating R^2

The Sum of squares of the errors will be the first step we calculate in order to estimate our R^2 value later on. The Sum of squares of errors is a measurement of the discrepancy between the data and an estimation model.

Sum of squares of error.

$$SSE = \sum(y - \hat{y})^2 = \sum y^2 - b_0 \sum y - b_1 \sum xy$$

This will be the final step to estimate the data fit in the regression. The R^2 value is a way to estimate how much of the variation in the regression model are described by the explanatory variables.

Coefficient of determination.

$$r^2 = 1 - \frac{SSE}{\sum y^2 - \frac{(\sum y)^2}{n}}$$

10.1.4 Testing the regression model for significance with t- and F-test.

When we estimate the regression and R^2 value, it is highly relevant to also test the significance of the slope, before going any further in our statements.

First we will calculate the sum of squares $SSxx$ and $SSyy$. This is because we need them later on to calculate the t-test test of the slope and the $F - value$.

Sum of squares.

$$SS_{xx} = \sum x^2 - \frac{(\sum x)^2}{n}$$

$$SS_{yy} = \sum y^2 - \frac{(\sum y)^2}{n}$$

Standard error of the estimate is the next step in the calculation to be able to calculate the test of the slope. The standard error is a measurement of how far the predicted value is from the true value.

Standard error of the estimate.

$$S_e = \sqrt{\frac{SSE}{n-2}}$$

When acquiring the sum of squares $SSxx$ and Standard error of the estimate, we will be able to calculate the S_b value which is needed for the t-test.

Test of slope.

$$S_b = \frac{S_e}{\sqrt{SS_{xx}}}$$

t-test tests the significance of the explanatory variables we use in our regression.

t-test, significance testing

$$t = \frac{b_1 - \beta_1}{s_b}$$

Since we have already calculated the sum of squares SS_{yy}, SSE which would be the sum of squares error and the R^2 value above, we can now estimate our Sum of squares residual SSR and do our F-test.

Sum of squares residual

$$SSR = r^2(SS_{yy})$$

By doing the F-test we will be able to obtain the significance level of the complete residual.

F-test

$$F = \frac{SSR/k}{SSE/(N-k-1)}$$

10.1.5 Testing the regression.

Observe the residual and to estimate difference between observed y and predicted $\hat{y}$.

Residual

$$e = y - \hat{y}$$

To be able to determine which variables to keep, when having multicollinearity affecting the result, the VIF value indicates which variables that should be dropped, if they have a value above 10, they should be reconsidered or at least re-evaluated. Explanatory variables which creates a variance inflation among them

VIF, Variance Inflation Factor

$$VIF = \frac{1}{1 - R_i^2}$$

11. Appendix B

Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FPI					
FPI Sweden	19	183.8947	53.90104	100	256
FPI Stockholm	19	222.4737	72.97059	100	330
FPI Östra mellansverige	19	173.7895	47.0444	100	234
FPI Småland med Öarna	19	162.1053	40.0304	100	215
FPI Sydsverige	19	193.7895	59.52458	100	266
FPI Väst Sverige	19	189.9474	61.93946	100	274
FPI Norra mellansverige	19	141.7368	32.50956	100	186
FPI Mellersta Norrland	19	135.6316	26.94482	100	172
FPI Övre Norrland	19	143.7368	30.40256	100	198
Household Income	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Household Income Sweden	19	220997.5	21224.55	180134	252774
Household Income Stockholm	19	244432.3	23840.96	198558	281925
Household Income Östra mellansverige	19	217833.9	20344.35	178050.8	247239.8
Household Income Småland med Öarna	19	211745.3	20922.65	170786.5	241674.8
Household Income Sydsverige	19	209659.2	18291.2	173284.7	235484.5
Household Income Väst Sverige	19	220830.5	23802.43	177181.2	256520.5
Household Income Norra mellansverige	19	212601.8	18799.66	176315.3	238991.3
Household Income Mellersta Norrland	19	212989.5	19928.04	175220.7	242553.5
Household Income Övre Norrland	19	219506	20636.59	182306.7	252709
Household debt to income ratio	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Household debt to income ratio Sweden	19	135.4211	27.07866	94.2	171.5
Mortgage interest rate	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Mortgage interest rate Sweden	19	1.053963	.0153401	1.0282	1.0897
Inflation	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
inflation Sweden	19	.6993158	.7456649	-.98	1.034

Population	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Population Sweden	19	9144077	281442.3	8844499	9694194
Population Stockholm	19	1933280	140035.3	1744330	2198044
Population Östra mellansverige	19	306720	8373.415	298069.6	324313.2
Population Småland med Öarna	19	201500.5	2093.148	199128.8	206560.8
Population Sydsverige	19	668470.5	29960.31	633170	721532.5
Population Väst Sverige	19	913396.3	30161.88	877537	971338.5
Population Norra mellansverige	19	277149.8	3097.052	274951	285702.3
Population Mellersta Norrland	19	186962.8	3381.05	184091	195574
Population Övre Norrland	19	255719.1	2425.88	253744.5	262107.5

Housing units	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Housing units Sweden	19	4399543	134853.5	4236610	4669081
Housing units Stockholm	19	907048.5	42634.91	847516	975975
Housing units Östra mellansverige	19	736250.5	17555.66	717281	770185
Housing units Småland med Öarna	19	386086.7	8608.581	367309	399373
Housing units Sydsverige	19	633490.1	17950.35	607557	661676
Housing units Väst Sverige	19	855183.6	21903.99	823253	890621
Housing units Norra mellansverige	19	420714.7	8232.295	397981	427937
Housing units Mellersta Norrland	19	193449.2	6465.168	177843	198159
Housing units Övre Norrland	19	254301.1	6953.304	236136	263203

11.2 Data table

11.2.1 Averages for Sweden

Time	FPI Sweden	Household Income Sweden	Household debt to income ratio	Population Sweden	Mortgage interest rate Sweden	Housing units in Sweden	Inflation Sweden
1996	100	180134	94	8844499	1,09	4236610	0,005
1997	104	184245	99	8847625	1,074	4246038	0,005
1998	113	192289	103	8854322	1,063	4254976	-0,02
1999	124	200298	106	8861426	1,064	4264007	0,005
2000	135	205928	110	8882792	1,07	4273147	0,01
2001	150	209690	110	8909128	1,065	4284983	0,024
2002	150	213556	114	8940788	1,066	4304654	0,022
2003	158	216393	121	8975670	1,055	4324717	0,019
2004	170	220792	131	9011392	1,051	4350895	0,004
2005	183	224613	140	9047752	1,038	4373342	0,005
2006	206	228400	147	9113257	1,045	4403104	0,014
2007	219	232326	150	9182927	1,05	4434914	0,02
2008	231	234377	155	9256347	1,056	4466110	0,034
2009	224	238905	159	9340682	1,044	4487626	-0,03
2010	245	236943	166	9417000	1,042	4508373	0,013
2011	249	236755	165	9446812	1,05	4524292	0,026
2012	235	242295	164	9514406	1,039	4550779	0,009
2013	242	248239	167	9596436	1,036	4633678	0
2014	256	252774	172	9694194	1,028	4669081	-0,02

11.2.2 Swedish household income divided by NUTS regions

Time	Stockholms län	Östra mellansverige	Småland med öarna	Sydsverige	Väst Sverige	Norra mellansverige	Mellersta Norrland	Övre Norrland
1996	198558	178051	170787	173285	177181	176315	175221	182307
1997	203505	182214	175255	177110	180638	179690	178992	185873
1998	212042	190084	183364	184552	188700	187165	186775	193334
1999	221725	197757	191074	191522	196836	194226	193444	200089
2000	229017	203386	196744	196599	202624	198394	197879	203879
2001	234304	206873	200548	199630	206404	200994	200666	206030
2002	237087	211438	204377	203884	211294	205283	204821	209634
2003	238187	214137	207559	207265	215029	209404	208440	212903
2004	242217	218501	212223	211217	220407	213904	213060	217568
2005	246112	221775	215820	214694	224948	217748	216834	221568
2006	250616	225212	219956	218022	228903	220950	220704	225589
2007	255432	228995	223742	220710	233358	223329	224390	229570
2008	258188	230999	225763	221940	235867	224763	225727	231899
2009	263595	235375	229668	225199	240644	229270	230353	237128
2010	263088	232826	227601	222369	238963	226762	228436	236064
2011	263020	232692	227538	221315	239823	225720	227152	234991
2012	269486	237890	231898	226448	245914	230498	232632	241463
2013	276109	243398	237568	232281	251727	236027	238721	248018
2014	281925	247240	241675	235485	256521	238991	242554	252709

Tabell 1: Source: Income in table form - Statistiska Centralbyrån. 2016. Sammanräknad förvärvsinkomst per kommun 2000 och 2012-2014. Medianinkomst i 2014 års priser . [ONLINE] Available at: http://www.scb.se/sv_/Hitta-statistik/Statistik-efter-amne/Hushallens-ek

11.2.3 Swedish FPI divided by NUTS regions

Time	Stockholms län	Östra mellansverige	Småland med öarna	Sydsverige	Västsverige	Norra mellansverige	Mellersta Norrland	Övre Norrland
1996	100	100	100	100	100	100	100	100
1997	106	105	105	106	103	100	101	103
1998	122	111	113	114	112	105	105	110
1999	139	120	119	127	122	108	109	112
2000	163	130	126	137	131	110	112	118
2001	194	139	131	152	144	115	114	121
2002	190	145	135	155	144	116	113	126
2003	197	152	140	165	156	118	117	122
2004	205	167	151	182	171	129	123	130
2005	219	178	161	199	190	136	130	138
2006	246	194	180	229	218	148	142	155
2007	264	204	187	245	230	161	149	159
2008	281	212	198	251	244	169	165	171
2009	269	213	197	242	234	175	156	161
2010	302	229	206	266	259	182	171	174
2011	305	229	211	265	267	179	172	176
2012	294	217	200	242	252	173	161	176
2013	301	223	205	250	258	183	168	181
2014	330	234	215	255	274	186	169	198

Tabell 2: Source: Ekonomifakta. 2016. Bostadspriser - Fastighetsprisindex - Ekonomifakta. [ONLINE] Available at:http://www.ekonomifakta.se/Fakta/Ekonomi/Hushallens-ekonomi/Bostadspriser/?graph=/16121/1,5,6,7,8,9,10,11,12/1996-/. [Accessed 16 May 2016].

11.2.4 Swedish population divided by NUTS regions

Time	Stockholms län	Östra mellansverige	Småland med öarna	Sydsverige	Västsverige	Norra mellansverige	Mellersta Norrland	Övre Norrland
1996	1744330	299607	202062	633170	877537	285702	195574	262108
1997	1762924	299081	201260	634148	878468	283349	193749	260740
1998	1783440	298468	200471	635920	879729	281146	191825	259138
1999	1803377	298070	199586	637206	881123	279297	190002	257402
2000	1823210	298416	199293	639908	884823	277508	188235	255939
2001	1838882	299461	199129	643294	888755	276371	186832	254776
2002	1850467	300685	199239	647483	893391	275689	186133	254431
2003	1860872	301968	199632	651293	898157	275650	185875	254415
2004	1872900	302910	199935	655627	902842	275396	185810	254730
2005	1889945	303615	200014	660080	907162	275012	185382	254696
2006	1918104	304902	200562	667968	913572	274951	185499	254734
2007	1949516	306906	201338	675629	919346	275000	185193	254098
2008	1981263	309117	201968	683509	925851	275050	185135	253745
2009	2019182	311658	202517	691827	933142	275310	184854	253784
2010	2054343	313850	202903	698278	939891	275607	184658	253948
2011	2091473	315619	203237	702956	946164	275144	184227	254106
2012	2127006	317964	203948	707702	952282	275424	184091	254427
2013	2163042	321069	204857	713413	960962	276378	184309	255274
2014	2198044	324313	206561	721533	971339	277862	184913	256175

Tabell 3: Source: Population in a spreadsheet - Statistikdatabasen. 2016. Statistikdatabasen - välj variabler och värden . [ONLINE] Available at:http://www.statistikdatabasen.scb.se/sq/12370. [Accessed 16 May 2016].

11.2.5 Swedish housing units divided by NUTS regions

Time	Stockholms län	Östra mellansverige	Småland med öarna	Sydsverige	Västsverige	Norra mellansverige	Mellersta Norrland	Övre Norrland
1996	847516	717281	378617	607557	823253	425033	196492	253172
1997	851439	718538	379847	609641	825223	424512	196692	254505
1998	855611	719788	380534	611954	827800	424457	196600	254657
1999	860747	720995	381299	614305	830220	423304	196845	254761
2000	865729	721493	382387	616226	833730	422783	196873	254423
2001	871265	722588	383547	619205	837484	422443	196556	254450
2002	879684	725349	385523	622376	842247	422525	196432	255044
2003	887458	729452	387000	625067	847425	422724	196445	255737
2004	896706	733667	389101	629645	853477	423159	196592	257194
2005	903687	736812	391093	634568	858959	423784	196896	258260
2006	913222	741173	393682	640989	865541	424352	197198	259746
2007	923940	746642	395682	647452	871866	425585	197325	261280
2008	934901	751063	398001	652191	879378	427040	197773	262694
2009	944020	755051	399373	655460	883422	427937	198159	263203
2010	961732	763694	389432	655553	878706	419062	187605	252589
2011	968524	766124	390418	658196	881757	418891	187529	252853
2012	975975	770185	392248	661676	890621	419246	187438	253390
2013	940798	721958	367309	634619	855573	397981	177843	236136
2014	950968	726906	370554	639632	861807	398761	178241	237626

Tabell 4: Source: Statistiska Centralbyrån. 2016. Antal lägenheter efter hustyp 1990-2015 . *[ONLINE] Available at:http://www.scb.se/sv_/Hitta-statistik/Statistik-efter-amne/Boende-byggande-och-bebyggelse/Bostadsbyggande-och-ombyggnad/Bostadsbestand/87469/87476/374826/. [Accessed 16 May 2016].*