STOCKHOLM SCHOOL OF ECONOMICS
Master Thesis within Finance

THE EFFECT OF LOCAL ECONOMIC FACTORS ON LOCAL HOUSE PRICES

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Abstract:
Local economic factors such as unemployment rate, housing per capita ratio and vacancy rate, along with national house prices, are all found to affect local house prices. This study shows that some of these factors produce different effects in large as opposed to small municipalities, with house prices in large municipalities in general being more sensitive to changes in these factors. Furthermore, the study investigates the effect of local negative shocks in the form of layoffs on local house prices. However, the study is unable to detect any significant effects.

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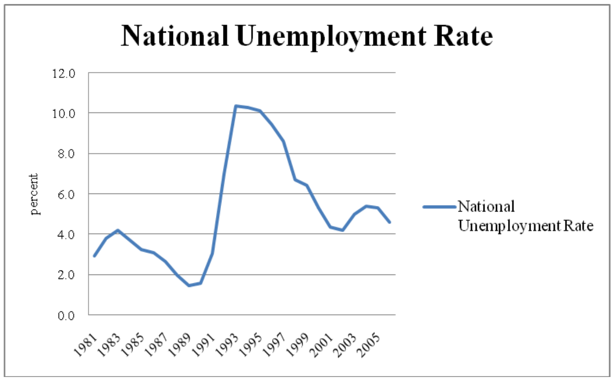
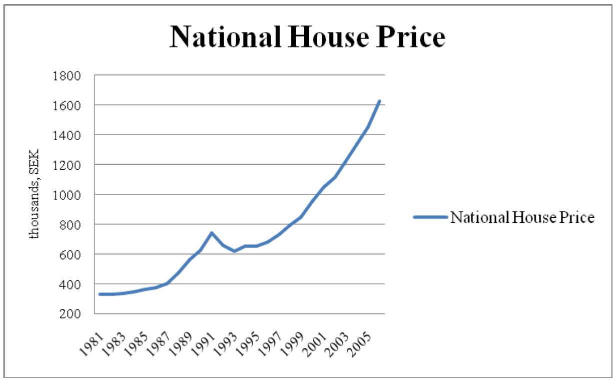
1. Introduction

The Swedish economy underwent significant changes during the 1990's. An extensive part of this period was characterized by a deep global recession resulting in a sharp increase in unemployment rates and plunging house prices that plagued the nation in the beginning of the 1990's. Another significant event was the extensive tax reform that took place in 1991, the so called TR91. It was a decade of transformations, deregulations and privatizations. The nation had reached a new era.



Graph1. National unemployment rate, 1981-2006



Graph2. National house price, 1981-2006

During these last decades, several industries have experienced significant cut-downs resulting in plant closures and layoffs. When occurring in smaller municipalities, a relatively large part of the local population has been affected. Furthermore, an increasing amount of reports have highlighted the recent depopulation phenomenon from more rural areas to larger urban areas in part due to the younger generation moving to more urban areas in pursuit of better jobs and a better living. Although explanations of these phenomena are many and complex, they provide the basis for interesting studies and research. In particular to explore the different effects they have within both small and large municipalities.

Obviously, plant closures and large layoffs provide negative shocks to the system. Investigating the effects that these extreme events have may provide even more interesting insights. The ability of municipalities to recover from such events, in particular for smaller municipalities who may be over-reliant on one or two firms, may be crucial for their ability to prosper in the long-term. They may also represent a form of economic measurement over the success of programmes implemented in the wake of such events.

One part of the local economy that should be affected by many of these changes is the real estate market. As the local economy prospers, local inhabitants will have increased incomes and at the same time the area will become more attractive to outsiders; both affects pushing house prices upwards. Similarly, the opposite effects are present when the local economy is in decline and thus house prices fall. How house prices are affected by local economic factors and local events such as layoffs is thus of great interest and can be viewed as the health of the local area compared to neighbouring areas.

This study thus consists of three main parts; firstly, to study the effect of certain economic factors on local house prices; secondly, to investigate how different factors affect house prices in large and small municipalities allowing comparisons between the two; and thirdly, to investigate the effects of layoffs on house prices. For the last two parts, existing studies are relatively scarce, and hence the study will hopefully contribute with interesting insights and provide a basis for further study. In order to perform the study thirteen carefully selected municipalities of different sizes will be investigated over the time period 1990 through 2006. Thus we hope to provide an interesting contribution and extension to the current literature on house prices.

The study shows that the national house price index, unemployment rate, housing per capita ratio and vacancy rate all contribute to explain changes in local house price indices. Further, there are some observable differences between large and small municipalities but the presence of them and the significance of their effects varies between variables. In particular, large municipalities seem to be more sensitive to changes than small municipalities. Finally, investigating the effects of layoffs no significant effects could be found in the sample, perhaps indicating that the ability of firms in conjunction with local and national authorities to return people into employment is good.

The layout of the thesis will be as follows. In chapter two we will go through the theories and previous research that will be used to support our choice of data and method. In chapters three and four, the data and method used will be presented and thoroughly explained. In chapter five the empirical findings will be presented and analyzed. Lastly, our final conclusions will be summarized in chapter six, followed by suggestions for further research in chapter seven.

2. Theoretical Framework

In many previous research papers, house price equations are derived through the merging of supply and demand functions (Abelson et al., 2005; Jacobsen and Naug, 2005; Peek and Wilcox, 1991). In the supply function, common variables include housing stock and construction cost, while the demand function usually consists of variables like disposable income, user cost[1], unemployment rate and demographic variables. In the following section, we will focus on previous research that shows and explains the importance of the variables in our models. We will start by introducing the dependent variable followed by the independent variables.

2.1 Local Indices - Local Purchase Price Coefficients[2]

When studying the price development of dwellings, or real estate in general, it is of necessity to control for changes in factors like quality and size of the dwelling in order to make adequate comparisons. Using regular house price series, such as the purchase price, such changes over time would be disregarded. Hence we use a quality and size standardized index variable (*purchase price coefficient*) that is derived from the purchase price of the house and its assessed value. The usage of similar variables in other research papers is quite common (Berg, 2002; Hort, 1998; Peek and Wilcox, 1991). This is an index variable specific to Sweden, commonly used to get an approximate value of ones house. The derivation of this variable will be dealt with in chapter three.

2.2 National Index – National Purchase Price Coefficient

Inflation is an important indicator of the state of the economy. Not only does it affect consumption but high expected inflation suggests a higher expected interest rate resulting in a cooling effect on the entire economy. The impacts of an increased interest rate affect both the supply and demand side of the house price equation. On the demand side it raises mortgage costs for existing home-owners, and discourages non-homeowners from buying houses by increasing their borrowing costs. On the supply side it affects the cost of financing construction and investment (Barot and Yang, 2002).

Tax is another influential variable in the house price equation. It influences the buyer's decision making process through property taxes, income taxes, tax shields etc. It is important that tax effects are not omitted, especially considering that our time period begins in 1990, one year prior to the comprehensive tax reform that took place in 1991.

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[1] User costs usually cover taxes, interest rates and inflation.
[2] These are the so called *köpeskillingskoefficient*, abbreviated as KT.

Based on the reasoning in 2.1, we also use the purchase price coefficient to measure national house price developments. We incorporate this national index variable to compensate for changes on a national level that affect the average house prices, such as changes in interest rates, taxes and other major policies. A few of the effects incorporated in the index deserved some extra attention and are thus explored further.

The national index variable can be seen as an indicator of the future real estate market. If the real estate market does well nationwide, it will promote positive expectations, giving the housing market an upward push. Thus one should expect a positive relationship between national house prices and local house prices. In fact an increase in national houses may even lead to proportional changes in local house prices.

2.3 Unemployment

Unemployment is indeed a crucial variable in the economy as it affects not only the housing market but also other factors such as population growth (in terms of encouraging migration), consumption and future expectations (Johnes and Hyclack, 1995). The majority of relevant previous research papers include unemployment as an explanatory variable in house price determination models, since most house price models typically including labour market variables (Johnes and Hyclack, 1995). The unemployment rate affects house demand in that increased unemployment rates indicate poor future expectations leading to deflated demand putting a negative pressure on house prices.

Unemployment affects the local migration rate, which ultimately will have an effect on the local house prices (Cameron et al., 2005; Muelbauer and Murphy, 1988). On the demand side, the number of people or households eligible to buy a house is crucial and hence unemployment is an important decision criterion for people considering whether to move from or to an area. It can be seen as a proxy for the probability of getting a job. Hence a higher unemployment rate implies a lower probability of obtaining a job, hence less people would be attracted to move to or stay in the area creating a negative price pressure on the local housing market (Cannari et al., 2000). However, in the long run, more people and businesses may migrate to these less fortunate places as they provide relatively cheaper housing, rents and wages.

The most important contribution of the unemployment rate is its ability to measure economic trends, households' income constraints and their future expectations. After experiencing increased unemployment personal financial uncertainty combined with national economic uncertainty will have a significant negative impact on the house demand (Berg, 2002; Jacobsen and Naug, 2005; Peek and Wilcox, 1991). In previous research papers, unemployment rate has either been measured as percentage of openly or registered unemployed, or as the gap between the percentage openly unemployed and the equilibrium unemployment rate. The second option puts a cyclical spin on the unemployment variable. However, the overall effect of the unemployment rate is unanimously negative.

As a final note, it is interesting to point out that some research focus on the opposite effect. They refer to unemployment as caused by financial down-turns and the housing market, mostly through labour immobility (Cameron and Muelbauer, 2001; Hughes and McCormick, 1987; Minford et al., 1988).

2.3.1 Layoffs

Layoffs represent negative shocks to both the population and the labour force. However, layoffs can also be seen, to a certain extent, as an indicator of the future. When expecting major layoffs, one would expect increased future unemployment rates, changes in the population, increased income constraints and to some degree changes in the local business structure. Every factor has its effect on people's future expectations, which ultimately affect local house prices. However, we have only come across limited research including this variable in a house price determination mode, although we have found studies on large shut-downs of military bases in the US, but with primary focus on commercial real estate (Avery, 2007; Diesenhouse, 2003). The conclusion from these studies was that the ramifications of closures or layoffs were far more widespread than one would imagine, with the complexity of these effects outside the scope of this thesis. However, we are convinced that there is a connection between layoffs and the real estate market. Especially a smaller town experiencing a negative shock, such as a layoff or plant closure, will be affected by the relocation of retirees, households and other related businesses, hence affecting the housing market (McCary, 2007). A positive labour shock would clearly have the opposite effect. Previous research has shown that house prices are more sensitive to negative than positive shocks (Glaeser and Gyourko, 2005; Harrigan et al., 1986; Mitchell, 1988). We note that these studies primarily focus on the US market, with equivalent data for the Swedish market difficult to find.

2.4 Housing Stock

In short-term models, housing stock is almost always assumed to follow an inelastic supply function and is hence excluded from most short-term price models. It is nevertheless very common to include the variable in long-term price models (Abelson et al., 2005; Hort, 1998; Johnes and Hyclak, 1995). Simple economic theory shows that an increased housing stock will lead to decreased house prices, as confirmed by several research papers (Abelson et al., 2005; Peek and Wilcox, 1991).

2.5 Population

Population is often included in house demand functions and hence also in price determination models as it reflects both the supply of people in the labour force and the supply of people that can become house owners (Heiborn, 1994). This variable can change due to either migration patterns, local birth and death rates, and may also contribute to a model's explanatory power by picking up effects from income and temporary unemployment rate movements (Peek and Wilcox, 1991).

Clearly, demographic changes in an area have significant effects on local house prices (Foley, 2004; Holly and Jones, 1997; Pain and Westaway, 1997; Peek and Wilcox, 1991). For instance, studies have shown that an increased share of people between the ages of 20-29, puts a negative pressure on local house prices (Peek and Wilcox, 1991). Further, in cities experiencing significant slow-downs in development, the impact of a shock on the local population will be much harder compared to cities experiencing growth since in declining cities, housing is considerably cheaper (Glaeser and Gyourko, 2005). This implies that cities that have experienced a shock will ultimately attract more people with limited or low income due to their relatively cheap housing, while the skilled workforce with fewer constraints is likely to flee the city in pursuit of higher incomes in other regions. However, in the long-run, the results of this might prove to be attractive to certain businesses.

In conclusion, there should be a positive impact of increased population on house prices (Heiborn 1994; Mankiw and Weil, 1989). However, in a few studies the authors found no significant impact (Berg, 1996; Engelhardt and Poterba, 1991).

2.6 Vacancy Rate for Rentable Apartments

The possibility to rent apartments plays an important role in labour mobility and local population growth (Hughes and McCormick, 1981; Minford et al., 1988). The housing tenure mix of the region and the local house prices are of great importance in terms of attracting in-migration and influencing in- and outflows of unemployment (Jackman and Savouri, 1992; Robson, 2003).

The vacancy rate can be seen as a proxy for the construction of new apartment complexes, with increasing vacancy rates implying an increasing supply of rentable apartments. Hence instead of buying, more people would tend to rent, leading to decreasing house prices. A high vacancy rate is especially attractive for people in financial distress, due to for example unemployment, as renting is more flexible and less financially demanding. Regions with relatively high house prices and low proportions of rented housing have a lower unemployment rate (Robson, 2003). In a city that has experienced a negative shock such as a layoff, people who rent are more inclined to move in search of new employment, compared to house-owners (Robson, 2003). Thus an increased vacancy rate leads to negative pressure on house prices. In conclusion, we should expect to find a negative correlation between vacancy rates and local house prices.

2.7 Included Variables

The variables that we choose to include in our study can be divided into two types; national and region specific. The national index variable covers all changes on a national level such as interest rates and taxes. The region specific variables included are the local unemployment rate, population, housing stock and vacancy rate. We suspect that there is a strong correlation between housing and population and thus including both may lead to multicollinearity[3]. Hence we combine these two variables to create the housing per capita ratio which will be used henceforth. This variable incorporates the same amount of data as using the two original variables, but in measuring the relative effects between the two excludes the multicollinearity in the model.

The layoff variable will not be used as an explanatory variable in our initial model but instead in the last part of our study. Its initial exclusion is based on the lack of literature in this area, and hence we want to use this opportunity to dig deeper and explore the possible outcomes. It also gives us an opportunity to examine the quality of the so called re-employment and re-education programmes[4] usually offered to people that have been laid off. These programmes usually last for one year and are intended to help the unemployed to get back into the workforce. The effects of layoffs do generally not show up in unemployment statistics until one year after the actual layoff.

2.8 Excluded Variables

There were other factors relevant to our study that could have been included. Our decision to exclude them was based on mainly two reasons; firstly, that their effects have been incorporated into an already chosen variable[5]; or secondly, that the data was not available on a municipal level or did not cover the examined time period. Using too many proxies would dilute the municipal effects, and too short a time period would significantly reduce the robustness of our results.

Construction costs

High construction costs imply fewer new constructions. However, this variable is usually not adjusted for changes in the quality or size of buildings. Further, the data was not available on a municipal level, nor for the desired time period.

Income

Disposable income commonly included in house price determination models given its role in the house

[3] In fact, tests showed the multicollinearity between housing and population to be as high as 0.998
[4] *Omställningsprogram*
[5] These refer to national variables such as taxes, inflation and interest rates being incorporated in the national index variable.

demand function. An increased disposable income increases the population's consumption and thus raises the houses prices. The problem with this variable was twofold; we were not able to acquire data for the entire time period nor were the income coefficients significant when testing during the time period for which we did have data. Thus the variable was not included in our model.

Rents

The price of renting an apartment has been used to measure the status of the substitute market for houses. However, given restrictions on rent-setting, it will not reflect the natural reactions of the market. Hence this variable was inadequate compared to the vacancy rate and not available on a municipal level.

2.9 Hypotheses

Our study is divided into three parts. A summary of all hypotheses and their expected outcomes is given in table 1.

2.9.1 Part I: Basic Price Model

Firstly, we derive a house price model used throughout the study. Based on our argumentations in the previous sections we lay forth the following hypotheses for Part I:

H_1: *Increase in the national index will lead to a proportional increase in local indices.*

H_2: *Increase in the local unemployment rate will have a negative effect on local indices.*

H_3: *Increase in the local housing per capita ratio will have a negative effect on the local indices.*

H_4: *Increase in the local vacancy rate will have a negative effect on the local indices.*

2.9.2 Part II: Comparison across Municipality Sizes

Secondly, we inspect whether there are differences in the impact of the national index, unemployment rates, vacancy rates and housing per capita ratios have on local indices, comparing between smaller and larger municipalities. Although we suspect significant differences in the sensibility between the two groups, it is difficult to predict the outcomes beforehand.

On the one hand, larger municipalities could be more sensitive to changes in the variables as house prices are much more liquid. National changes usually commence in larger municipalities making impacts more powerful, direct and immediate there. On the other hand, smaller municipalities could be more sensitive to changes as a change would be relatively large in a small municipality compared to a large municipality. Further, prices in smaller municipalities may be more sensitive to certain changes, such as the unemployment rate, especially if the local workforce and local business environment in a small town is very dependent on a few factories or companies.

Thus, the execution of this part will resemble an exploratory study rather than straight-forward hypothesis testing. It is especially interesting as we have not found any previous research of a similar scope.

2.9.3 Part III: Layoff Effects

For the final part of our study, we examine the existence of layoff effects on the local indices and unemployment rates. If there is a layoff effect, we believe it will most likely be found in smaller municipalities, as they would be more sensitive to the effects, and thus also investigate if layoff effects might differentiate depending on the size of the municipality. Given that it might take up to a year before the layoff effect reaches the market due to the re-employment schemes we also test if there is a negative effect one year after the layoff.

H_5: Layoffs have a negative effect on local indices.

H_6: Layoffs have a negative effect on local indices, one year after the layoff.

Further, we look into the effects of a layoff on the unemployment rate. If the so called re-employment schemes were successful, the local unemployment rate should not be significantly negatively affected. However, we assume that an effect will be present.

H_7: Layoffs have a negative effect on local unemployment rates.

H_8: Layoffs have a negative effect on local unemployment rates, one year after the layoff.

In hypotheses five through eight we will also test and compare results between differently sized municipalities for robustness and possible municipality size effects.

Table 1. Summary of hypotheses

Hypothesis	**Expected outcomes**
Part I	
H_1: Increase in the national index will lead to a proportional increase in local indices.	Coefficient equal to one
H_2: Increase in local unemployment rate will have a negative effect on local house prices.	Negative
H_3: Increase in local housing per capita ratio will have a negative effect on the local house prices.	Negative
H_4: Increase in local vacancy rate will have a negative effect on the local house prices.	Negative
Part II	
Difference in sensitivity to different variables	Inconclusive
Part III	

H_5: Layoffs have a negative effect on local house prices.	Negative
H_6: Layoffs have a negative effect on local house prices, one year after the layoff.	Negative
H_7: Layoffs have a negative effect on local unemployment rates.	Negative
H_8: Layoffs have a negative effect on local unemployment rates, one year after the layoff.	Negative

2.10 Limitations

Due to the focus and scope of our thesis the supply of previous research of a similar nature was limited. While allowing us to significantly contribute to the current literature, the lack of relevant literature makes it difficult for us to be precise in our expectations, particularly regarding municipality sizes and layoffs. For national effects, the ignition will usually take place in the metropolitan areas, specifically in Stockholm, and progressively ripple throughout the nation (Berg, 2002). This could indicate that for national effects, these might be expected to have a greater impact on metropolitan areas. For region specific effects, such as unemployment, the complexity of different impacts makes it far more difficult to predict an outcome.

3. Data

In the following sections, we will describe our data sample, the derivation of the dependent and independent variables and the choice of municipalities.

Our sample consists of quarterly and balanced panel data, for thirteen municipalities, reaching from the first quarter 1990 to the fourth quarter 2006[6]. For all municipalities, we have three area specific explanatory variables and one national index variable that is the same for all thirteen municipalities. This gives us a data sample consisting of 4381 observations.

We choose to use quarterly data for three reasons. Firstly, examining the development of house prices, we believe it is doubtful that changes will be visible on a monthly basis, since the data is far too volatile due to too few observations. Secondly, quarterly data will give us more observations and more degrees of freedom than semi-annual or annual data which is important as we have somewhat limited amount of data. Thirdly, using annual data, it is likely that the targeted effects would not be present.

A problem encountered during data collection was that several of the variables were only available on a yearly basis, so we had to use interpolation. Too many interpolated variables can lead to autocorrelation issues. Luckily our robustness tests did not show evidence of autocorrelation.

3.1 Choice of Municipalities

Finding data at a municipality level proved difficult with some data only collected on special requests. Nevertheless, we did manage to collect enough data to proceed with our study, even though the limitations did have a great influence on our choices. Initially, we would have liked to include even more municipalities to generate a better sample, however due to the unavailability of data free of charge, we had to settle with a study on a smaller scale.

Since, in the last part of our study, we examine the possible existence of a layoff effect, and in order to use the same municipalities throughout, we ran a search for the biggest layoffs during the last decade. Thirteen municipalities were chosen, as presented in table 2. Of these, eight municipalities are included in the last part of our study, since we required a minimum of one percent of the local population to be affected by the chosen layoff[7]. We believe that layoffs of certain sizes are needed in order to reliably

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[6] This does not apply to the housing stock variable, hence giving us fewer observations to use in our regressions. More on this issue in the following sections.
[7] See table 4.

investigate their effects on house prices and unemployment rates. We note that it is the largest municipalities that as a result are excluded. Although the total number of people laid off might be large, these numbers are small relative to the local population. Further, with many layoffs occurring in these municipalities, as opposed to individual events, coupling effects to specific layoffs may prove too difficult.

A possible concern regarding the choice of municipalities is selection bias. By choosing municipalities affected by negative effects during our time period, there is a risk of artificially creating relationships between dependent and independent variables. However, as the events stretch through only a small part of the entire time period, we do not believe that they will pose a significant threat to the credibility of our results. Also, from the last part of our study, we will be able to judge to what extent layoffs may affect unemployment rates and house prices.

Table 2. Choice of municipalities

Municipality	Size of population in 1990*
Bengtsfors	6918
Degerfors	7180
Kumla	11.231
Gislaved	18.214
Katrineholm	19.763
Västervik	23.900
Motala	25.335
Kalmar	35.066
Norrköping	75.166
Linköping	77.881
Malmö	146.748
Göteborg	279.602
Stockholm	427.115

** These numbers include everyone from the ages of 16-65*

3.2 Dependent Variable[8]

Local indices – lnktloc

The types of dwellings investigated in this study are one and two-dwelling buildings. The quarterly data is provided to us by the SCB (*Statistics Sweden*)[9]. We remark that according to the SCB, there may be an insufficient number of transactions in the small municipalities to create a fully reliable index on a quarterly basis. This may lead to some measurement errors. The calculation of this variable as used by the SCB is shown below.

[8] Descriptive statistics are presented in Appendix 9.2

[9] *Statistiska Centralbyrån*

$$KT = \frac{1}{N}\sum_{i=1}^{N}\frac{K_i}{T_i}$$

K_i = Purchase price for dwelling i

T_i = Assessed value for dwelling i

N = Number of transactions

An issue with this variable is the adjustment for the assessed values. These have been adjusted upwards, on a national level, in the beginning of 1990, 1996, 2003 and 2006[10]. In the SCB's calculations, however, these adjustments have not been corrected for resulting in sudden drops of the index series. In order to correct for this, we adjust the index using the following method.

$$KT_{m,t}^{adj} = KT_{m,t}^{unadj} \times \left(\frac{AssessedValue_{m,t}}{AssessedValue_{m,1990q1}}\right)$$

$KT_{m,t}^{adj}$ = Adjusted indices

$KT_{m,t}^{unadj}$ = Unadjusted indices

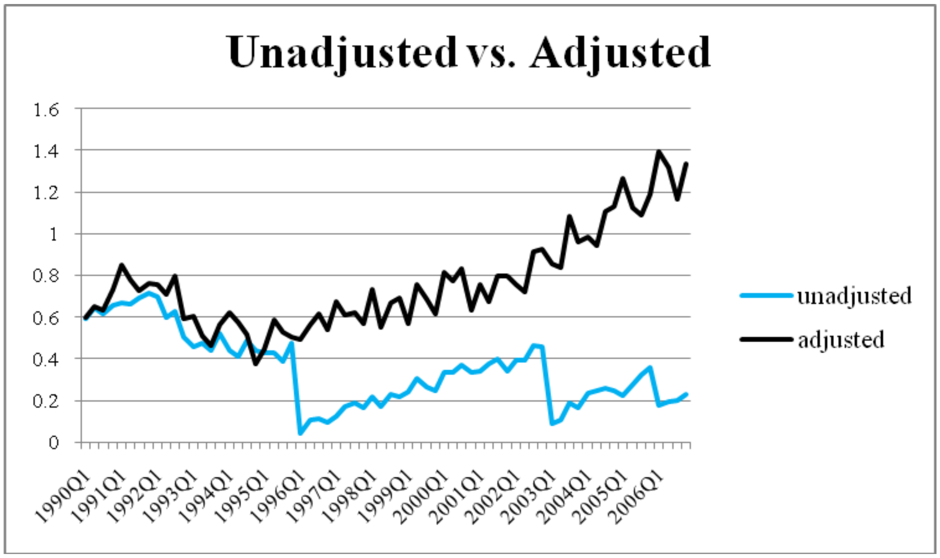
m = Municipality

t = Time, where 1990q1 is the base quarter

The difference between adjusted and unadjusted indices is clear as illustrated in graph 3, where we show both the adjusted and unadjusted indices for one of our municipalities (Kalmar), with similar effects observable for the other municipalities.

Since we are interested in real and not nominal house price developments, we will deflate the values by the CPI (*Consumer Price Index)*. Finally, we take logarithms.

[10] There have also been adjustments prior to 1990, however these will not affect our data.



Graph 3. Adjusted versus unadjusted purchase price coefficients for Kalmar

3.3 Independent Variables

The index (national purchase price coefficient) – lnktswe

The derivation of this variable is the same as the one used for local indices.

Unemployment rate – unempl

The unemployment rate refers to openly unemployed. We received monthly data for the number of unemployed in each municipality, and annual data for the local population between the ages of 16-65, both from the AMS (*Swedish Public Employment Service*)[11]. The unemployment rate is then calculated by dividing the number of unemployed by the local population consistent with the method used by the AMS. From the monthly unemployment rates, we generate quarterly data by taking the average of the monthly data in each quarter.

Vacancy rate – vac

The vacancy rate refers to the percentage of available apartments to rent in each municipality calculated manually from the number of apartments and the number of available apartments in each municipality. The obtained annual data was interpolated in order to generate quarterly data.

Housing per capita – hpc

Both the population and housing stock data were only available on an annual basis, with quarterly data generated through interpolation. With housing stock data only available from May 1990 to May 2006, we note that including this variable decreases the number of time periods examined from 68 to 65 quarters.

[11] *Arbetsmarknadsstyrelsen*

3.4 Data Sources

Following special requests, quarterly purchase price coefficients were provided to us for the sole purpose of this thesis, by the SCB. The housing stock and vacancy numbers were also retrieved from the SCB. The population and unemployment numbers were provided to us by the AMS.

4. Method

4.1 Part I: Basic Price Model

Since we have two-dimensional data, in terms of both time and municipality, we use panel data regression. With panel data one can use fixed effects, which assume that the effects of changes in the explanatory variables are the same for each municipality but with different intercepts, or random effects, which consider the individual differences as random disturbances drawn from a specified distribution, i.e. that the individual differences cannot be estimated. Thus the random effects model, in comparison to the fixed effects model, has no correlation between the regressors and the individual differences. Testing for the existence of this correlation is the most common method used to decide on which model to use, more commonly known as the Hausman test. However, given that the fixed effects model is more appropriate for few individuals (or municipalities in this case), and the random effects model more appropriate when many individuals are being used, it is expected that the fixed effects model will be used.

The main advantage of the fixed effects model is that it allows the error terms to be correlated with the individual effects. However, the fixed effects model may significantly reduce the degrees of freedom but given the low number of cases it should not have a significant impact in this case. Fixed effects models are also considerably more susceptible to suffer from autocorrelation, heteroscedasticity and multicollinearity than random effects model.

Multicollinearity occurs when there is a high degree of correlation between two or more explanatory variables making it difficult to distinguish the effects of the independent variables on the dependent variable. Multicollinearity is often reduced with large datasets and thus may pose a problem given the limited size of our dataset. Multicollinearity will be tested by looking at the correlations between the independent variables with multicollinearity assumed, and one of the variables dropped, if the correlation between any two variables is greater than 0.8.

Autocorrelation in the residuals violates the OLS-assumption that the error terms are uncorrelated. Although they do not bias the coefficient estimates the standard errors may be underestimated. Autocorrelation is measured using the Wooldridge test for autocorrelation. If found to be present, autocorrelation can be corrected by introducing a lagged dependent variable as an explanatory variable.

Heteroscedasticity occurs when the error terms have different variances. Coefficient estimates remain unbiased, but variances and thus standard errors may be underestimated. To test for the presence of heteroscedasticity the Breusch-Pagan and the Modified Wald test will both be used. If detected it will be corrected by clustering the variables by municipality, allowing observations to be independent across groups but not necessarily within groups. This will not affect the coefficients' values but will increase their standard errors reducing the likelihood of believing an insignificant coefficient to be significant.

Given the explanatory variables the regression that will be run will be of the following form, where the subscript t represents the time dimension, and the subscript i represents the municipality dimension:

$$lnktloc_{it} = \beta_0 + \beta_1 lnktswe_t + \beta_2 unempl_{it} + \beta_3 hpc_{it} + \beta_4 vac_{it} + u_{it}$$

4.2 Part II: Comparison across Municipality Sizes

To test if the chosen explanatory variables have a significantly different impact when modeling the local indices in small or large municipalities the model is extended to include dummy variables for municipality size. For example, to investigate the effect of large and small municipalities for the national index a regression formula of the following form would be investigated:

$$lnktloc_{it} = \beta_0 + \beta_1 lnktswe_t + \beta_2 D_i lnktswe_t + \beta_3 unempl_{it} + \beta_4 hpc_{it} + \beta_5 vac_{it} + u_{it}$$

The dummy variable, D_i, takes the value one for all the municipalities in focus and the value zero for the remaining municipalities. For example, if the focus is to study large municipalities, the dummy variable takes the value one for these municipalities and the value zero for all remaining smaller municipalities. The dummy variable is then multiplied with the relevant explanatory variable to test if there is a significantly different effect in this variable for differently sized municipalities when determining effects on local indices. Or alternatively, the coefficient for the national index for the large municipalities in this case would be $\beta_1 + \beta_2$, whilst for the other municipalities it would be β_1. Similar regressions are run for the other explanatory variables allowing the investigation of large and small municipalities on each variable individually.

Furthermore, these regressions allow testing for yet another effect. By looking at the effect of including municipality size interaction effects these regressions provide a form of robustness testing in the form of specification tests. They allow us to see how other variables than the one being studied vary when municipality size interaction effects are included. Ideally the coefficients for the other variables should remain unchanged relative to the initial results from Part I.

Table 3. The four size groups

	L3	L5	S3	S5
Bengtsfors			X	X
Degerfors			X	X
Kumla			X	X
Gislaved				X
Katrineholm				X
Västervik				
Motala				
Kalmar				
Norrköping		X		
Linköping		X		
Malmö	X	X		
Göteborg	X	X		
Stockholm	X	X		

For robustness, different definitions of large and small municipalities, as presented in table 3, are used to ensure that the obtained results are not present solely as a result of the choice of municipalities. Large municipalities have been divided into two groups; L3 denotes the three largest municipalities, whilst L5 denotes the five largest municipalities. For the small municipalities two similar groupings have been chosen. S3 represents the three smallest municipalities in the sample and S5 represents the five smallest municipalities in the sample.

4.3 Part III: Layoff Effects

To test for the effect of particular events a dummy variable is again created. The layoff dummy, *closeall*, takes the value one the quarter that the layoff takes place, and zero for all other quarters. A second regression is run with the dummy variable, *closeall1*, taking the value one all quarters one year after the event, and the value zero otherwise. The regression run is of the following form with the first case being exemplified:

$$lnktloc_{it} = \beta_0 + \beta_1 lnktswe_t + \beta_2 unempl_{it} + \beta_3 closeall_i + \beta_4 hpc_{it} + \beta_5 vac_{it} + u_{it}$$

The effect on unemployment is also investigated, with the dummy variable being multiplied with the unemployment variable generating a regression formula of the form, noting again that the effects one year after the layoff are also investigated:

$$lnktloc_{it} = \beta_0 + \beta_1 lnktswe_t + \beta_2 unempl_{it} + \beta_3 unemplca_{it} + \beta_4 hpc_{it} + \beta_5 vac_{it} + u_{it}$$

The choice of municipalities with layoffs is detailed in chapter 3.1 with results presented in table 4. More information about the actual layoffs can be found in Appendix 9.1. Since many of the layoffs are from the small groups, we extend the investigation by looking at the effects of layoffs both directly on house prices, and indirectly through unemployment.

Table 4. Municipalities with relevant layoffs

	Chosen municipalities
Bengtsfors	X
Degerfors	X
Kumla	X
Gislaved	X
Katrineholm	X
Västervik	X
Motala	X
Kalmar	X
Norrköping	
Linköping	
Malmö	
Göteborg	
Stockholm	

5. Results & Analysis

All regressions and tests were performed in Stata. We have opted to combine results and analysis into one section in order to simplify for the reader.

5.1 Part I: Basic Price Model

In this part the chosen model is investigated to discover if the explanatory variables produce significant and correct coefficients, and to test the robustness of the model.

Table 5. Results from local indices regression

Variable	Lnktswe	Unempl	Hpc	Vac	R^2
Coefficient	0.864	-2.622	-4.793	0.907	79.71%
Standard Error	0.066	0.625	0.818	0.327	
P-value (H_0=0)	0.000	0.001	0.000	0.017	
P-value (H_0=1)	0.062				

As can be seen from table 5 above, we have achieved a high R^2 value of 79.71 percent indicating that the explanatory variables explain almost eighty percent of the variation in local indices. Although the figure is high it is not exceptionally high given that the national index is included as an explanatory variable. All the coefficients are significant at a five percent level and three of them have the correct sign. Vacancy, however, has a positive sign in contrast to the negative sign predicted by the theory, perhaps an effect of the limited number of municipalities. Finally, the sizes of the coefficients are interesting to note. The *lnktswe* coefficient is insignificantly different from one at a five percent level confirming the hypothesis that it should be one. Further, the coefficient for housing per capita seems somewhat large indicating that a one percent increase in housing per capita decreases the local index by 4.793 percent. Similar pattern is found for unemployment.

Further robustness tests outlined in chapter 4.1 were performed with results presented in Appendix 9.4. The Hausman test showed that the null hypothesis that random effects are consistent and efficient can be rejected, clearly indicating the use of fixed effects, as predicted by the theory. No multicollinearity or autocorrelation was detected. However, there was heteroscedasticity present. By using clustering this was slightly corrected for but not to the extent that there was no heteroscedasticity present in the sample. Although not a major concern it does imply that one has to be more careful when interpreting the significance levels of the coefficients as insignificant coefficients may appear significant.

Thus it is possible to confirm hypotheses one through three. However, hypothesis four is rejected.

5.2 Part II: Comparison across Municipality Sizes

The second part of the thesis attempts to discover whether the explanatory variables have different effects when studying large or small municipalities, with the large and small groups of municipalities as presented in table 3.

5.2.1 National Index

Table 6. Results from national index regressions for municipalities of different sizes

Regressions, Coefficients & Significance Levels							
Regression	**Values**	**Lnktswe**	**Lnktswe***	**Unempl**	**Hpc**	**Vac**	**R^2**
	Coefficient	0.864		-2.622	-4.793	0.907	
All municipalities	*Standard Error*	0.066		0.625	0.818	0.327	79.71%
	P-value (H_0=0)	0.000		0.001	0.000	0.017	
	P-value (H_0=1)	0.062					
	Coefficient	0.747	0.406	-2.483	-3.661	0.555	
3 largest municipalities	*Standard Error*	0.072	0.091	0.502	0.915	0.349	80.64%
	P-value (H_0=0)	0.000	0.001	0.000	0.002	0.138	
	P-value (H_0=1)	0.004					
	Coefficient	0.667	0.422	-2.464	-3.221	0.390	
5 largest municipalities	*Standard Error*	0.057	0.101	0.505	0.881	0.349	77.04%
	P-value (H_0=0)	0.000	0.001	0.000	0.003	0.286	
	P-value (H_0=1)	0.000					
	Coefficient	0.987	-0.348	-2.209	-3.841	0.563	
5 smallest municipalities	*Standard Error*	0.068	0.098	0.597	0.629	0.345	79.71%
	P-value (H_0=0)	0.000	0.004	0.003	0.000	0.128	
	P-value (H_0=1)	0.856					
	Coefficient	0.914	-0.264	-2.467	-4.076	0.727	
3 smallest municipalities	*Standard Error*	0.077	0.112	0.643	0.622	0.275	81.14%
	P-value (H_0=0)	0.000	0.037	0.002	0.000	0.021	
	P-value (H_0=1)	0.287					

** Represents the different groups: L3, L5, S5 and S3 respectively*

For the national index regressions, the results are displayed in table 6. Different results between large and small municipalities are obtained. All national index coefficients are positive in line with the theory that the national index has a positive effect on local indices.

There is however, a distinct difference between large and small municipalities. Running the regressions for the large municipalities the *lnktswe* variable coefficient, representing all the non-large municipalities, is significantly different from one, in fact lower than one. However, the *lnktswe** coefficient is positive and significantly different from zero for both large groups. In fact the effect of the national index on local indices is 1.153 for the L3 group, and 1.089 for the L5 group. Testing whether these coefficients are significantly close to one we perform a F-test, showing us that for the L5 group the coefficient is insignificantly different from one (p-value(H_0=1)=0.2702) but the L3 coefficient is significantly different from one (p-value(H_0=1)=0.0030). For the small municipality regressions the *lnktswe* coefficients for all non-small municipalities are significantly equal to one at a five percent level. The negative and significant *lnktswe** coefficients indicate that for the small municipalities the effect is not proportional. Thus all four regressions produce similar results; namely that for large municipalities local indices' changes are more or less proportional to changes in the national index, whilst for small municipalities the effect is less than proportional.

The obtained effect is not completely surprising. The Swedish house price boom during the late 1990's was driven by the major urban areas of Stockholm, Göteborg and Malmö. Thus one would expect a strong correlation between local and national house prices in these regions. It is possible that if a lagged variable had been used then a slightly different pattern may have been detected. The ripple effect from the major cities would probably have increased the coefficient for the smaller municipalities.

Investigating robustness, we note that the R^2 values are all similar in size, indicating that no explanatory power is lost or gained in using the extra municipality size dummy variable. Both unemployment and housing per capita remain unchanged. The vacancy variable is insignificant for all regressions apart from when investigating the three smallest variables suggesting that some of the explanation previously included in the vacancy variable is now included in the *lnktswe** variable. Further, it indicates that the vacancy variable is not as robust to the choice of data as the other variables.

5.2.2 Unemployment

Table 7. Results from unemployment regressions for municipalities of different sizes

Regressions, Coefficients & Significance Levels							
Regression	**Values**	**Lnktswe**	**Unempl**	**Unempl***	**Hpc**	**Vac**	**R^2**
All municipalities	*Coefficient*	0.864	-2.622		-4.793	0.907	
	Standard Error	0.066	0.625		0.818	0.327	79.71%
	P-value (H_0=0)	0.000	0.001		0.000	0.017	
3 largest municipalities	*Coefficient*	0.852	-2.207	-1.899	-4.439	0.788	
	Standard Error	0.069	0.431	2.198	0.767	0.310	80.93%
	P-value (H_0=0)	0.000	0.000	0.405	0.000	0.026	
5 largest municipalities	*Coefficient*	0.852	-1.955	-1.825	-4.422	0.800	
	Standard Error	0.066	0.494	1.340	0.713	0.304	80.70%
	P-value (H_0=0)	0.000	0.002	0.198	0.000	0.022	
5 smallest municipalities	*Coefficient*	0.858	-2.909	0.840	-4.671	0.869	
	Standard Error	0.067	0.893	0.977	0.718	0.311	79.44%
	P-value (H_0=0)	0.000	0.007	0.407	0.000	0.016	
3 smallest municipalities	*Coefficient*	0.860	-2.828	0.900	-4.682	0.908	
	Standard Error	0.067	0.775	1.163	0.717	0.321	79.35%
	P-value (H_0=0)	0.000	0.003	0.454	0.000	0.015	

** Represents the different groups: L3, L5, S5 and S3 respectively*

The results for the unemployment regressions, presented in table 7, show that the R^2 value remains virtually unchanged. However, the *unempl* coefficients are significant but all interaction variables insignificant. The effect of unemployment is still negative in line with the theory.

Despite insignificant coefficients there exist indications that different effects are present in large versus small municipalities; large municipalities have a more negative coefficient than small municipalities. This is best illustrated by the *unempl** variable. For the large municipalities the difference compared to the other municipalities is negative, but for the small municipalities the difference is positive. As discussed in the theory, this could be due to the fact that house prices in larger municipalities are more liquid and thus more sensitive to changes in the local environment. However, with no significant effects detected it is difficult to confirm any definite difference in effects between large and small municipalities in this case.

The choice of municipalities was to a large extent dictated by unemployment effects in that they were chosen as a result of sizeable plant closures or layoffs occurring during the study period which may have affected the results. Again, robustness is investigated. Apart from consistent R^2 values, all the other explanatory variables are robust to the inclusion of interaction terms.

5.2.3 Housing per Capita

Table 8. Results from housing per capita regressions for municipalities of different sizes

Regressions, Coefficients & Significance Levels							
Regression	**Values**	**Lnktswe**	**Unempl**	**Hpc**	**Hpc***	**Vac**	**R^2**
All municipalities	*Coefficient*	0.864	-2.622	-4.793		0.907	
	Standard Error	0.066	0.625	0.818		0.327	79.71%
	P-value (H_0=0)	0.000	0.001	0.000		0.017	
3 largest municipalities	*Coefficient*	0.850	-2.525	-4.514	-1.312	0.827	
	Standard Error	0.075	0.557	0.966	1.831	0.342	67.11%
	P-value (H_0=0)	0.000	0.001	0.001	0.487	0.032	
5 largest municipalities	*Coefficient*	0.853	-2.559	-4.578	-0.929	0.854	
	Standard Error	0.078	0.572	1.004	1.741	0.340	59.14%
	P-value (H_0=0)	0.000	0.001	0.001	0.603	0.027	
5 smallest municipalities	*Coefficient*	0.879	-2.674	-4.107	-1.388	1.063	
	Standard Error	0.072	0.619	0.711	1.054	0.378	61.04%
	P-value (H_0=0)	0.000	0.001	0.000	0.213	0.016	
3 smallest municipalities	*Coefficient*	0.877	-2.690	-4.140	-1.357	1.042	
	Standard Error	0.070	0.622	0.713	0.997	0.377	62.68%
	P-value (H_0=0)	0.000	0.001	0.000	0.198	0.017	

** Represents the different groups: L3, L5, S5 and S3 respectively*

The results for the housing per capita regressions as presented in table 8, indicate that the R^2 values drop considerably when the housing per capita dummy variables are included. Further, all the coefficients for *hpc** are insignificant, suggesting that information is lost in dividing the housing per capita data into size groups in this way. Thus the results from the housing per capita variable may not have been very robust.

However, although all the housing per capita variables are negative, there are no observable effects or patterns between large and small municipalities. It seems fair to conclude that municipality size is not a factor in explaining housing per capita. However, given the loss in R^2 the whole robustness and reliability of the test results seem somewhat unclear. Investigating the robustness of the results beyond the R^2 values, all the other explanatory variables remain significant and their coefficient sizes unchanged.

5.2.4 Vacancy Rate

Table 9. Results from vacancy regressions for municipalities of different sizes

Regressions, Coefficients & Significance Levels							
Regression	**Values**	**Lnktswe**	**Unempl**	**Hpc**	**Vac**	**Vac***	**R^2**
All municipalities	*Coefficient*	0.864	-2.622	-4.793	0.907		
	Standard Error	0.066	0.625	0.818	0.327		79.71%
	P-value (H_0=0)	0.000	0.001	0.000	0.017		
3 largest municipalities	*Coefficient*	0.828	-2.605	-4.473	0.958	-4.898	
	Standard Error	0.063	0.584	0.899	0.299	1.626	81.38%
	P-value (H_0=0)	0.000	0.001	0.000	0.008	0.011	
5 largest municipalities	*Coefficient*	0.847	-2.518	-4.666	1.104	-2.404	
	Standard Error	0.060	0.624	0.873	0.280	1.361	80.34%
	P-value (H_0=0)	0.000	0.002	0.000	0.002	0.103	
5 smallest municipalities	*Coefficient*	0.853	-2.536	-4.761	-0.034	1.122	
	Standard Error	0.063	0.654	0.822	0.807	0.833	79.59%
	P-value (H_0=0)	0.000	0.002	0.000	0.967	0.203	
3 smallest municipalities	*Coefficient*	0.855	-2.492	-4.830	0.290	0.928	
	Standard Error	0.065	0.672	0.835	0.521	0.572	79.33%
	P-value (H_0=0)	0.000	0.003	0.000	0.588	0.131	

** Represents the different groups: L3, L5, S5 and S3 respectively*

The vacancy regression results, presented in table 9, are not consistent with the other studied variables probably due to that in the regression formula obtained in Part I the vacancy coefficient was positive, and not negative as expected according to the theory.

The results show that very different effects are detected for large and small municipalities. The effect of *vac** is interesting. For the three largest municipalities the result is a vacancy coefficient of -3.940, and for the five largest municipalities a coefficient of -1.300, although not significant in the latter case. These coefficient signs are in line with the theory indicating that the desired vacancy effect is present in the largest municipalities. For the small municipalities the *vac** coefficient is positive indicating that it is the small municipalities that cause a positive coefficient for the vacancy variable is in Part I.

So, large and small municipalities do produce different effects. For large municipalities an increase in the vacancy rate decreases local house prices, which can be interpreted as a greater supply than demand for living accommodation resulting in local house prices to falling. For small municipalities a positive coefficient indicates that an increase in the vacancy rate increases local house prices. A possible alternative explanation, although not based on any theory, could be that as vacancies reflect a demand shift from rented apartments to owned homes in the form of flats or houses such that when the demand for rented apartments drops, the demand for owned housing increases.

Looking at robustness, all the other variables are unchanged by the inclusion of interaction effects in the vacancy term. However, although the R^2 values remain virtually unchanged, they are marginally higher for the large municipality regressions suggesting that an interaction term for the large municipalities could produce a better model.

5.2.5 Summary

Summarize the results of municipality size effects we can conclude that they varied depending on the different variables. The national index produces a proportional change for large municipalities but a less than proportionally change for small municipalities. For unemployment it was potentially possible to detect an effect although it was insignificant. No effect was observable for housing per capita, but a drop in R^2 values suggests some sort of robustness problem. Vacancy produced a clear effect with large municipalities experiencing a negative effect as predicted by the theory, and small municipalities experiencing a positive effect.

Both the national index and unemployment were robust throughout. However, housing per capita produced considerably lower R^2 values when divided over municipality sizes, and vacancy had insignificant coefficients when running the national index regressions. Across municipality sizes, the results were more or less robust.

5.3 Part III: Layoff Effects

The final part of the thesis is to inspect if a plant closure or layoff in a municipality causes any form of significant effect.

Table 10. Results from the layoff regressions, the same quarter as the layoff

Regression	Values	Lnktswe	Unempl	Closeall*	Hpc	Vac	R^2
All municipalities	*Coefficient*	0.864	-2.649	-0.037	-4.782	0.907	79.74%
	Standard Error	0.066	0.631	0.025	0.822	0.329	
	P-value (H_0=0)	0.000	0.001	0.163	0.000	0.018	
5 smallest municipalities	*Coefficient*	0.864	-2.630	-0.014	-4.791	0.908	79.72%
	Standard Error	0.066	0.631	0.017	0.817	0.328	
	P-value (H_0=0)	0.000	0.001	0.447	0.000	0.017	
3 smallest municipalities	*Coefficient*	0.864	-2.622	0.000	-4.793	0.907	79.71%
	Standard Error	0.066	0.629	0.016	0.818	0.329	
	P-value (H_0=0)	0.000	0.001	0.988	0.000	0.017	

** Represents the different groups: S5 and S3 respectively*

Table 11. Results from the layoff regressions, one year after the layoff

Regression	Values	Lnktswe	Unempl	Closeall1*	Hpc	Vac	R^2
All municipalities	*Coefficient*	0.864	-2.626	-0.018	-4.785	0.903	79.73%
	Standard Error	0.066	0.628	0.027	0.821	0.329	
	P-value (H_0=0)	0.000	0.001	0.523	0.000	0.018	
5 smallest municipalities	*Coefficient*	0.864	-2.631	-0.040	-4.780	0.901	79.76%
	Standard Error	0.066	0.628	0.024	0.816	0.328	
	P-value (H_0=0)	0.000	0.001	0.129	0.000	0.018	
3 smallest municipalities	*Coefficient*	0.864	-2.626	-0.033	-4.784	0.904	79.74%
	Standard Error	0.066	0.626	0.031	0.817	0.327	
	P-value (H_0=0)	0.000	0.001	0.310	0.000	0.017	

** Represents the different groups: S5 and S3 respectively*

Table 12. Results from the layoff regressions with unemployment interactions, the same quarter as the layoff

Regression	Values	Lnktswe	Unempl	Unemplca*	Hpc	Vac	R^2
All municipalities	*Coefficient*	0.864	-2.648	-1.200	-4.782	0.911	79.73%
	Standard Error	0.066	0.631	0.726	0.823	0.330	
	P-value (H_0=0)	0.000	0.001	0.124	0.000	0.017	
5 smallest municipalities	*Coefficient*	0.864	-2.629	-0.364	-4.792	0.910	79.71%
	Standard Error	0.066	0.632	0.567	0.818	0.329	
	P-value (H_0=0)	0.000	0.001	0.533	0.000	0.017	
3 smallest municipalities	*Coefficient*	0.864	-2.622	0.048	-4.793	0.907	79.71%
	Standard Error	0.066	0.629	0.508	0.818	0.330	
	P-value (H_0=0)	0.000	0.001	0.927	0.000	0.018	

** Represents the different groups: S5 and S3 respectively*

Table 13. Results from the layoff regressions with unemployment interactions, one year after the layoff

Regression	Values	Lnktswe	Unempl	Unemplca1*	Hpc	Vac	R^2
		Regressions, Coefficients & Significance Levels					
All municipalities	*Coefficient*	0.864	-2.622	-0.226	-4.789	0.905	79.72%
	Standard Error	0.066	0.625	0.580	0.821	0.329	
	P-value (H_0=0)	0.000	0.001	0.704	0.000	0.017	
5 smallest municipalities	*Coefficient*	0.864	-2.623	-0.728	-4.786	0.905	79.73%
	Standard Error	0.066	0.626	0.674	0.817	0.328	
	P-value (H_0=0)	0.000	0.001	0.302	0.000	0.017	
3 smallest municipalities	*Coefficient*	0.864	-2.621	-0.459	-4.789	0.906	79.72%
	Standard Error	0.066	0.625	0.650	0.818	0.327	
	P-value (H_0=0)	0.000	0.001	0.493	0.000	0.017	

** Represents the different groups: S5 and S3 respectively*

With the layoffs as a dummy variable, the results from the regressions are presented in tables 10-13. Most of the layoff variable coefficients are negative but all insignificant at a five percent level. Furthermore, there is no detectable difference between the effect the same quarter as the layoff and the effect one year after the layoff. The other explanatory variables and R^2 values remain virtually unchanged between the regressions.

According to the theory significant negative shocks could have a significant impact on the local economy, which should be seen in the effect it has on local house prices. It was expected that layoffs would bring about such an effect on local house prices. However, no significant coefficients are achieved on the dummy variables representing layoffs. Furthermore, it was believed that the effect would potentially be stronger one year after the actual layoffs since people who lose their jobs following layoffs usually do not appear in unemployment statistics until one year later. However, even this effect is not present either.

These results are not in line with the predicted results. Perhaps the effectiveness of Swedish authorities in line with trade unions and the companies themselves in returning people to work may be too strong for the effect of a layoff to have a significant effect on local house prices. For example, of the 774 given notice at Continental's plant in Gislaved, only 89 went into unemployment one year later (LO, 2003). Alternatively it is possible that local house prices in more rural municipalities are less liquid, responding slowly to news, supported by the results from Part II, where in general large municipalities experienced the largest changes as a result of changes in the explanatory variables. Another explanation may be that the news was reflected in other factors than price, perhaps the number of sales per month decreased. Finally, it is possible that the impreciseness of using quarterly data in specifying layoff dates prevents significant results from maturing.

Thus, although negative coefficients as predicted in the hypothesis section are achieved, given the insignificance of the coefficients the results are not strong enough to confirm the hypothesis. Thus we reject hypotheses five through eight.

5.4 Hypotheses: Results

The results from the hypotheses presented in section 2.9 are presented below in table 14.

Table 14. Summary of hypotheses results

Hypothesis	**Expected outcomes**	**Reject/Do not reject**
Part I		
H_1: Increase in the national index will lead to a proportional increase in local indices.	Coefficient equal to one	Do not reject
H_2: Increase in local unemployment rate will have a negative effect on local house prices.	Negative	Do not reject
H_3: Increase in local housing per capita ratio will have a negative effect on the local house prices.	Negative	Do not reject
H_4: Increase in local vacancy rate will have a negative effect on the local house prices.	Negative	Reject
Part II		
Difference in sensitivity to different variables	Inconclusive	See 5.2.5
Part III		
H_5: Layoffs have a negative effect on local house prices.	Negative	Reject
H_6: Layoffs have a negative effect on local house prices, one year after the layoff.	Negative	Reject
H_7: Layoffs have a negative effect on local unemployment rates.	Negative	Reject
H_8: Layoffs have a negative effect on local unemployment rates, one year after the layoff.	Negative	Reject

6. Conclusion

The paper aimed to investigate a model for local house prices, and in order to do so we studied the effects of various factors on local indices. It was found that the national index increased local indices proportionally, whilst local unemployment and the local housing per capita ratio both decreased local indices, all in line with the theory. However, local vacancies appeared to increase local indices, contradicting the theory.

The paper also explored if there were different effects between large and small municipalities. The paper found that there indeed were differences. Whilst the national index produced proportional changes for large municipalities this was not the case for smaller municipalities. There was a potential trend that large municipalities were more sensitive to unemployment, although this effect was not significant. Housing per capita produces no effect. Finally, for vacancy rates the results clearly showed that the positive effect contradicting the expectations from the theory was caused as a result of the smaller municipalities. The large municipalities produced a negative coefficient as predicted by the theory. Thus it seems that large municipalities in general are more sensitive to local economic effects. Further, extensive robustness checking was performed with only the vacancy and housing per capita results showing any signs of not being robust throughout.

Finally, the effect of layoffs on local house prices was examined. It was believed that the negative shock this represents would cause local indices to drop. However, no significant effect was detected. Further, it was believed that the effect would be even stronger one year on from the event since unemployment as a result of the layoff often does not appear in official unemployment statistics until one year after the event. However, no such effect was present either. These effects were somewhat surprising and not in line with the expected theory. It is possible that Sweden is very effective at dealing with layoffs such that they do not affect local house prices, that local house prices are too illiquid to react to news of this kind, or that the events chosen for this study simply were not larger enough relative to other factors to generate the desired effect.

7. Further Research

There are without a doubt many ways of continuation. As we have mentioned in previous chapters, literature focusing on the real estate market in rural areas is scarce. One natural way of continuation would be to extend the research to incorporate more municipalities in order to generate a better coverage of different geographical regions. Our choice of municipalities has been predominantly located in the southern part of the nation which is in general more densely populated. Hence it would be very interesting to see if similar effects can be found in the northern part of the nation as well, and perhaps try to find region specific models or explanatory variables. Another interesting approach would be to construct both short-term and long-term models specifically for rural and urban regions. To the best of our knowledge, this approach has only been applied to urban regions.

Obviously, due to the lack of literature focusing on similar areas, improvements of the model are expected. For starters, one could try to find substitutes for the excluded variables. There is also some room for experimentation of different explanatory variables, in particular different lags of each variable.

Another way of building further on our study is to choose a specialization area. In our case, we have tried to focus on unemployment effects, but other interesting effects would be to dig deeper into the effects of demographic changes in the rural areas. These changes would incorporate for example changes in the local age distribution. An impact of this would be changes in the local income distribution and business climate, which ultimately will all have an impact on the local real estate market.

In connection with the last part of our study, the layoff effects, one could try to conduct an event study, very much in line with the ones conducted on stock prices. Our approach bears some resemblance but there is indubitably room for expansion. It would prove to be very valuable if one can find significant abnormal changes in house prices due to specific shocks.

8. References

Academic sources

Abelson, P., Joyeux, R., Milunovich, G., Chung, D., 2005, Explaining House Prices in Australia: 1970-2003, The Economic Record, vol. 81, no. 255, 96-103

Avery, S., 2007, Area Development Site and Facility Planning, Easton Aug/Sep, vol. 42, no. 4

Barot, B., Yang, Z., 2002, House Prices and Housing Investments in Sweden and the United Kingdom. Econometric Analysis for the period 1970-1998, Review of Urban & Regional Development studies (RURDS), vol. 14, no.2

Berg, L., 2002, Price on The Second Hand Market for Swedish Family Houses: Correlation, Causation and Determinants, European Journal of Housing Policy 2(1), 1-24

Bover, o., Muelbauer, J., Murphy, A., 1989, Housing, Wages and UK Labour Markets, Oxford Bulletin of Economics and Statistics, vol. 51, no. 2, 97-136

Cameron, G., Muelbauer, J., 2001, Earnings, Unemployment, and Housing in Britain, Journal of Applied Econometrics, vol. 16, 203-220

Cameron, G., Muelbauer, J., Murphy, A., 2005, Migration within England and Wales and the Housing Market, Economic Outlook, July 2005

Cannari, L., Nucci, F., Sestito, P., 2000, Geographic Labour Mobility and the Cost of Housing: Evidence of Italy, Applied Economics 32, 1899-1906

Diesenhouse, S., 2003, Layoffs Create Glut of Space in Boston Area, New York Times, February 5, p.6

Engelhardt, G.v., Poterba, J.M., 1991, House Prices and Demographic Change: Canadian Evidence, Regional Science and Urban Economics, 21, 539-546

Foley, P., 2004, Are Irish House Price Determined by Fundamentals?, Working Paper, University College Cork, http://www.ucc.ie/ucc/depts/economics/research/workingpapers/

Glaeser, E., Gyourko, J., 2005, Urban Decline and Durable Housing, Journal of Political Economy, vol. 113, no. 2

Harrigan, F.J., Jenkins, J., McGregor, P.G., 1986, A Behavioural Model of Migration: An Evaluation of Neo-classical and Keynesian Altenatives, Discussion Paper 42, Fraser of Allander Institute, University of Strathclyde

Heiborn, M., 1994, Demographic Factors and the Demand for Housing, Department of Economics, Uppsala University, Working Paper 1994:30

Holly, S., Jones, N., 1997, House prices since the 1940s: Cointegration, demography and asymmetries, Economic Modelling, vol.14, no.4

Hort, K., 1998, The Determinants of Urban House Price Fluctuations in Sweden 1968-1994, Journal of Housing Economics 7, 93-120

Hughes, G.A., McCormick, B., 1981, Do Council Housing Policies Reduce Migration Between Regions?, Economic Journal, vol. 91, 919-937

Hughes, G.A., McCormick, B., 1987, Housing Markets, Unemployment and Labour Market Flexibility in the UK, European Economic Review, vol. 31, 615-641

Jackman, R., Savouri, S., 1992, Regional Migration Versus Regrional Commuting: The Identification of Housing and Employment Flows, Scottish Journal of Political Economy, vol. 39, no. 3

Jacobsen, D.H., Naug, B.E., 2005, What Drives House Prices?, Economic Bulletin, Q1

Johns, G., Hyclak, T., 1995, House Prices and Regional Labor Markets, The Annals of Regional Science 33:33-49

Mankiw, G.N., and Weil, D.N., 1989, The Baby Boom, The Baby Bust, and the Housing Market, Regional Science and Urban Economics, 19, 235-258

McCary, J., 2007, Wall Street Journal (Eastern Edition), Regional Economic Roundup (A Special Report); Fighting for Survival: Is There Life After a Military Base Closes?, June 11

Minford, A.P., Peel, M., Ashton, P., 1988, The Effects of Housing Distortions on Unemployment, Oxford Economic Papers, vol. 40, 322-345

Mitchell, P., 1988, Modelling Migration to and from London Using the NHSCR, London Chamber of Commerce

Muelbauer, J., Murphy, A., 1988, UK House Prices and Migration: Economic and Investment Implications, Shearson Lehman Hutton Securities Research Report, November

Pain, N., Westaway, P., 1997, Modelling Structural Change in the UK Housing Market: A Comparison of Alternative House Price Models, Economic Modelling, vol. 14, no.4

Peek, J., Wilcox, J.A., 1991, The Measurement and Determinants of Single-Family House Prices, AREUEA Journal, vol. 19, no. 3

Robson, M., 2003, Housing Markets and Regional Unemployment Flows in Great Britain, The Manchester School, vol. 71, no. 2, 132-155

Non-Academic soucres
Aftonbladet, 22 August 2001, Avesta Polarit planerar nedläggning i Degerfors, 28 September 2007, www.aftonbladet.se/nyheter/article33565.ab

Edström, A., Wass, J., 2002, I Kulturens Grepp: Nedläggningen av Lear Corporations fabrik i Bengtsfors. Ett industriellt drama i tre akter

Eskilstuna-kuriren, 25 November 2001, Nattsvart i Katrineholm, 19 September 2007, www.ekuriren.se/hermes/article/EK_20011025_06_1_4.html

Hjertqvist, H., 9 February 2007, Kommunen delaktig i framtiden, VästerviksTidningen, 21 September 2007, www.vt.se/nyheter/artikel.aspx?ArticleID=2066865

LO, 2003, Efter Gislaved

Länsstyrelsen Östergötland, 11 June 2004, Erfarenheter från omställningsprogram i Östergötland

Niva, E., Tiberg, A., 2003, De drabbade – en studie av varseljournalistik, Mitthögskolan, Sundsvall

Regionförbundet i Kalmar Län, 2 April 2004, Åtgärdsförslag, Kalmar läns kris föder nya utvecklingsmöjligheter

Data sources
www.scb.se
www.ams.se

9. Appendix

9.1 Summary of group size-small municipalities and events

Table 15

Municipality Events*				
Municipality	**Size of layoff**	**Size of population****	**Time of layoff**	**Name of layoff company**
Bengtsfors	682	6363	Mar-99	Lear
Degerfors	330	6296	1-Aug	Avesta Polarits
Gislaved	774	18.765	1-Dec	Continental
Kalmar	500	39.322	4-Mar	Bombardier
Katrineholm	550+327	19.531	1-Oct	Scania & FCI Electronics
Kumla	1500+750	11.787	Mar-01;Sep-02	Ericsson
Motala	620	26.104	2-May	Sanmina-SCI
Västervik	500	22.294	4-Feb	Electrolux

** Information sources regarding the events can be found under Non-Academic sources in References*
*** Size at the time of the layoff. These numbers include everyone from the ages of 16-65*

9.2 Descriptive Statistics

Table 16

Variable	Mean	Std.Dev	Min	Max	Obs	n*	T**
lnktloc	0.727	0.388	-0.105	1.925	884	13	68
lnktswe	1.102	0.228	0.868	1.630	884	13	68
unempl	0.051	0.019	0.014	0.118	884	13	68
vac	0.04	0.042	0	0.223	884	13	68
hpc	0.73	0.115	0.519	0.914	845	13	65

** Number of municipalities*
*** Number of time periods*

9.3 Summary of All Explanatory Variables

Table 17

Part I	
lnktloc	log of local purchase price coefficient
lnktswe	log of national purchase price coefficient
unempl	unemployment rate
vac	vacancy rate
hpc	housing per capita
Part II	
lnktswel3	dummy variable, three largest municipalities take value 1, multiplied with lnktswe
lnktswel5	dummy variable, five largest municipalities take value 1, multiplied with lnktswe
lnktswes3	dummy variable, three smallest municipalities take value 1, multiplied with lnktswe
lnktswes5	dummy variable, five smallest municipalities take value 1, multiplied with lnktswe

unempll3	dummy variable, three largest municipalities take value 1, multiplied with unempl
unempll5	dummy variable, five largest municipalities take value 1, multiplied with unempl
unempls3	dummy variable, three smallest municipalities take value 1, multiplied with unempl
unempls5	dummy variable, five smallest municipalities take value 1, multiplied with unempl
vacl3	dummy variable, three largest municipalities take value 1, multiplied with vac
vacl5	dummy variable, five largest municipalities take value 1, multiplied with vac
vacs3	dummy variable, three smallest municipalities take value 1, multiplied with vac
vacs5	dummy variable, five smallest municipalities take value 1, multiplied with vac
hpcl3	dummy variable, three largest municipalities take value 1, multiplied with hpc
hpcl5	dummy variable, five largest municipalities take value 1, multiplied with hpc
hpcs3	dummy variable, three smallest municipalities take value 1, multiplied with hpc
hpcs5	dummy variable, five smallest municipalities take value 1, multiplied with hpc
Part III	
closeall	dummy variable, event time takes value 1
closealls3	dummy variable, event time, three smallest municipalities take value 1
closealls5	dummy variable, event time, five smallest municipalities take value 1
closeall1	dummy variable, one year after event time take value 1
closeall1s3	dummy variable, one year after event time, three smallest municipalities take value 1
closeall1s5	dummy variable, one year after event time, five smallest municipalities take value 1
unemplca	dummy variable, unemployment rate multiplied with closeall
unemplcas3	dummy variable, unemployment rate multiplied with closealls3
unemplcas5	dummy variable, unemployment rate multiplied with closealls5
unemplca1	dummy variable, unemployment rate multiplied with closeall1
unemplca1s3	dummy variable, unemployment rate multiplied with closeall1s3
unemplca1s5	dummy variable, unemployment rate multiplied with closeall1s5

9.4 Summary of robustness test results

Table 18

Effect & Test	**Results**	
Fixed vs. random effects Hausman test	Chi2(4) = 38.31	P > Chi2 = 0.000
	Hence, null hypothesis of non systematic coefficients is rejected	
Autocorrelation, Wooldridge test	F(1,12) = 1.322	P > F = 0.273
	Hence, null hypothesis of no autocorrelation is not rejected	
Heteroscedasticity, Modified Wald test	Chi2(13) = 4990.60	P > Chi2 = 0.000
	Hence, null hypothesis of homoscedastic residuals is rejected	
Heteroscedasticity, Breusch-Pagan test	Chi2(78) = 1225.980	P > Chi2 = 0.000
	Hence, null hypothesis of homoscedastic residuals is rejected	

Table 19

Multicollinearity Results

	lnktswe	*unempl*	*hpc*	*vac*
lnktswe	1.0000			
unempl	-0.3931	1.0000		
hpc	0.0272	0.3180	1.0000	
vac	-0.1597	0.2677	0.5608	1.0000