Statistics Norway
Statistisk sentralbyrå

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Documents

Price index for new multi-dwelling houses

Sources and methods

Statistics Norway/Department of Industry Statistics/Construction and Service Statistics

Contents

1. Introduction

Eurostat has granted financial contribution to Statistics Norway for developing an output price index for new multi-dwelling houses.

Statistics Norway started this project by obtaining price data from two different sources, the Ground Property, Address and Building Register (GAB), and a questionnaire distributed directly to the contractors. The cost data from the contractors should make it possible to compile output prices, but it turned out that the quality of the data was varying. It is difficult for the contractors, who are also the client in many cases, to sort out the client costs and selling profits from contractor costs and contractor profits.

When the opportunity to use administrative register data from the Norwegian State Housing Bank arose in 2004, Statistics Norway decided to change the data source. The use of administrative data also reduces the reporting and recordkeeping burden of the industry.

Most constructors in Norway apply for loans in the Norwegian State Housing Bank; the state loan fund for the support of private buildings. Final owners of the dwellings decide if they want to take advantage of this funding opportunity. When applying for a loan, constructors must provide the bank with detailed information about price, floor space and other characteristics of the project. This information forms the basis for the data we use in the index calculations. The consequence is that the price index compiled is a seller's price index exclusive of the cost of site and not an ideal output price index.

This report describes the compilation of the index based on the data from the Norwegian State Housing Bank.

2. Summary

The price index for multi-dwelling houses is calculated using the hedonic method. The variables used in the regression analysis correspond to characteristics that influence the price of multi-dwelling houses. These comprise: utility floor space, geographic location, number of dwellings in the project and the proportion of dwellings with energy economizing qualities in the project.

Due to the relatively limited production of multi-dwelling houses, the number of observations is low. In order to ensure the quality of the index, we have decided to publish it twice a year; not quarterly as is the case with the index for detached houses.

The results show that the price of blocks of flats has increased more than the price of small houses from the first half of 2000 to the first half of 2006. During this period, the price of blocks of flats increased by 78.5 per cent, while the price of small houses increased by 53.3 per cent. The total index for multi-dwelling houses increased by 65.6 per cent in the same period.

3. Terms, variables and classifications

The following is an overview of important terms, variables and classifications used in the index.

Price
The price used in the index is the price that the purchaser (final owner) has to pay for a dwelling in a new multi-dwelling house excluding site costs. Costs such as connection to road, water and sewer services, duties and administrative fees, interest on building loans, client profits and VAT are included. Thus, the price is the approximate sales price, excluding site costs. Prices are based on loan applications and are estimates of the final costs, not the actual final costs.

Time of measurement
The index is comprised of multi-dwelling housing projects for which the Norwegian State Housing Bank has granted loans during the six-month reference period. Loans are normally granted before or when the building commences. As a rule, 50 per cent of the dwellings will be sold before building commences.

House classes
We distinguish between two different types of multi-dwelling houses.

- Small houses: Semi-detached houses, row houses, terraced houses and other small houses
- Block of flats: Flat blocks and apartment houses with three or more stories

Total floor space
The floor space used in the index is the utility floor space per dwelling in the building. The floor space of communal area is included. Communal areas include corridors, garage etc. The utility floor space is the area measured within the outer walls, defined in Norwegian Standard NS 3940 Area and volume calculations of buildings.

Price zones
Price trends vary from one region of Norway to another. In order to allow this, Norway is divided into three different price markets or zones:

- Oslo and the municipality of Bærum
- The major cities of Stavanger, Bergen and Trondheim, and the county of Akershus, excluding Bærum.
- The rest of the country

Energy economising qualities
Building classified as having "energy economising qualities" have to meet the goal of more than 20 per cent lower energy consumption than currently set by the building regulations.

The overall goal of the government is that 50 per cent of the dwellings build in 2010 shall have a 50 per cent lower energy consumption than regulated today. Different building works to achieve lower energy consumption are included in this variable, such as insulation, balanced ventilation and thermal pump.

4. Sources of data

The Norwegian State Housing Bank has two different sets of data in their administrative register. Data based on loan applications: costs estimated by the builder of a multi-dwelling house prior to the building of the house. These costs form the basis of the loan application. And secondly, data based on the final costs: the actual costs of the building, as accounted for by the builder. These costs form the basis of the disbursement of loans to each purchaser (final owner) of the dwellings.

4.1. Data based on loan applications

When the Housing Bank grants a loan to a multi-dwelling project, this implies that the final owners may fund the dwellings with the loan. Whether the final owner wants to take advantage of this possibility or use other ways of funding, is optional.

The builder applies for the loan and the application contains a detailed description of the costs, buildings and the dwellings of the project, in addition to information about the applicant (contractor, client, housing cooperation or private individual) and the location of the project (municipality). Applications are, in most cases, dispatched before building commences.

The data are organised in four levels and one project may consist of many records. We have aggregated the information in such a way that each project consists of only one record, containing all information about the buildings in the project.

4.2. Data based on the final costs

If the final owner wants to fund the dwelling with loan from the Housing Bank, they submit the final accounts of the building to the bank, assisted by the builder. However, not all of the final owners choose to use this form of funding, therefore, this set of data has fewer observations than the data based on loan applications.

The data based on final costs can be merged with the data from the loan applications, using the case number assigned by the Housing Bank. Empirically, the time of disbursement of the loan is close to the completion of the building. A comparison of the data we have received so far, shows that about 80 per cent of the loans are disbursed during the first four years after the loans are granted.

4.3. Choice of data source

An examination of the data based on the final costs, shows that it is impossible to separate site costs from the total costs for a substantial amount of the projects (about 1/3 of the projects). The projects in question are therefore unfit to be used in the calculation of the index. In addition, as mentioned above, some purchasers choose sources of funding other than the Housing Bank and are not included in the data. Due to the large number of projects being lost in the data based on the final costs, we have decided to calculate the index using the data based on loan applications. A thorough examination of the two different sets of data shows no systematic deviations between them.

4.4. Sampling errors

Housing projects funded by the Norwegian State Housing Bank must meet certain criteria with regard to costs, construction and characteristics. These conditions are, to some extent, the result of political decisions and are subject to changes. This may lead to sample skewness, as the buildings included in the index are not necessarily representative for all new multi-dwelling houses.

As a result, the share of dwellings with loan in the Housing Bank may vary from one year to another. For instance, in the data we have received so far (loan application data), the number of projects used in the index decreased from 874 to 641 from 2002 to 2003. The group “small houses” decreased the most, while the number of blocks of flats was more stable. The most probable cause of this decrease is the reduced level of interest rate on the private loan market during the last few years. When the loan interests of the banks decreases, loan in the Housing Bank is less sought after. The reason is that the interest in the Housing Bank is in arrears with the rest of the market.

We have compared the number of dwellings in the data based on loan applications, with the number of dwellings ("building permit granted" and "building started") in Statistics Norway's Building statistics during a four year period (2002-2005). The populations are not identical however. The date of applying for loan and the date of building permit granted and building work started, may differ substantially. For instance; the loan application may in some cases be submitted a year before building commences. We compensate for this by looking at four years simultaneously.

Table 4.1 and table 4.2 show the total number of dwellings and the number of dwellings in blocks of flats, by county. The percentages indicate how representative the Housing Bank data is. The figures show that the loan applications comprise about half of the dwellings where building has commenced. The coverage by number of dwellings is higher for blocks of flats than for small houses.

In the price index we distinguish between small houses and blocks of flats (cf. chapter 3.). In the data from the Housing Bank, the number of dwellings in small houses and in blocks of flats constitutes 40.6 and 59.4 per cent of the total number of dwellings in multi-dwelling houses respectively. According to the Building statistics from Statistics Norway ("building work started"), the corresponding numbers are 47.3 and 52.7 per cent.

We have also compared the average utility floor space per dwelling in the data from the Housing Bank and the Building statistics. It turns out that the dwellings in the data from the Housing Bank are somewhat smaller than in the population as a whole. This is plausible, as builders of more exclusive multi-dwelling houses, with larger apartments rarely apply for loan in the Housing Bank.

Table 4.1 The number of dwellings in small houses in the data based on loan applications to the Housing Bank. The number of dwellings in small houses according to the Building statistics. 2002-2005.

County	Building permit granted	Building work started	The Housing Bank	Dwellings with building permit granted. Per cent	Dwellings where building has started. Per cent
Total	**36 499**	**32 130**	**13 391**	**37**	**42**
Østfold	2 781	2 549	1 078	39	42
Akershus	3 971	3 617	698	18	19
Oslo	1 641	1 531	222	14	15
Hedmark	1 312	1 199	718	55	60
Oppland	1 477	1 293	700	47	54
Buskerud	1 966	1 672	488	25	29
Vestfold	2 537	2 123	739	29	35
Telemark	1 177	1 030	321	27	31
Aust-Agder	701	647	210	30	32
Vest-Agder	1 544	1 323	781	51	59
Rogaland	4 366	3 968	2 410	55	61
Hordaland	4 171	3 640	1 546	37	42
Sogn og Fjordane	742	535	186	25	35
Møre og Romsdal	2 210	1 840	795	36	43
Sør-Trøndelag	2 474	2 249	837	34	37
Nord-Trøndelag	1 055	913	449	43	49
Nordland	1 076	864	674	63	78
Troms	842	724	336	40	46
Finnmark	456	413	203	45	49

Table 4.2 The number of dwellings in blocks of flats in the data based on loan applications to the Housing Bank. The number of dwellings in blocks of flats according to the Building statistics. 2002-2005.

County	Building permit granted	Building work started	The Housing Bank	Dwellings with building permit granted. Per cent	Dwellings where building has started. Per cent
Total	**42 029**	**35 830**	**19 611**	**47**	**55**
Østfold	1 423	1 204	670	47	56
Akershus	4 053	3 404	1 524	38	45
Oslo	12 274	10 893	5 691	46	52
Hedmark	822	655	460	56	70
Oppland	504	464	252	50	54
Buskerud	1 886	1 231	501	27	41
Vestfold	1 331	1 156	626	47	54
Telemark	555	525	165	30	31
Aust-Agder	323	321	142	44	44
Vest-Agder	974	980	351	36	36
Rogaland	4 621	3 958	2 053	44	52
Hordaland	3 584	2 729	2 102	59	77
Sogn og Fjordane	167	86	116	69	135
Møre og Romsdal	620	593	377	61	64
Sør-Trøndelag	3 817	3 703	1 705	45	46
Nord-Trøndelag	815	721	999	123	139
Nordland	2 002	1 367	1 216	61	89
Troms	2 000	1 631	573	29	35
Finnmark	258	209	88	34	42

5. The hedonic method

5.1. Theoretical background

Statistics Norway uses the hedonic method in the compilation of the output price indices, the house price indices, and a price index for office and business properties. The method is based on prices set by the market and regression analysis, which describe the relation between the prices and the different characteristics of the buildings. This approach starts on the assumption, that there is a connection between the overall prices at a given time and the characteristics of the object. This connection should be described by a function with the price as the dependent variable and quality characteristics influencing the prices as independent variables or explanatory variables.

Measuring price movements in the housing market is a relatively complicated matter. An index of house prices should not be affected by the fact that houses sold at different points in time differ in quality. In other words a method of "quality purifying" is required.

To achieve this aim the so-called hedonic method can be applied. This method is based on the hypothesis that the value of a product rests upon its characteristics. Hedonic prices are defined as the implicit value of a product's characteristics. A theoretical basis for the study of product markets with differentiated products is presented by Rosen (1974).

With Rosen's model as a starting-point, it can be argued that the market price of a house can be described as a function of the house's characteristics. By calculating a hedonic price function, the various implicit prices can be estimated. This makes it possible to construct a price index for the housing market, adjusted for quality. Two important questions arise when it comes to calculating hedonic price functions. Which characteristics should the function possess, and which form of function should be chosen.

There are no clearly defined theories that can be employed in the choice of characteristics to be assigned. On the basis of empirical research carried out elsewhere, however, it seems reasonable to divide these into three groups. Firstly the characteristics which can be linked to the house itself, such as living area, age, number of bathrooms, etc. The two other relevant factors are the physical and social surroundings, although Griliches (1971) warns against the use of such characteristics as being not so much a characteristic of the building as of the market. In empirical studies, however, such factors do have a significant bearing on the price.

Choosing the type of function is also an empirical question. Wigren (1986) assumes that the connection between the prices of house *i* during a period of time *t*, P_i^t, and the house's qualitative characteristics can be expressed stochastically as

$$P_t^i = F_t(x_t^{1i},....x_t^{mi},\varepsilon_t^i) \qquad i = 1,.....,n \tag{5.1}$$

Where P_t^i is the price for object *i* in period *t*, x_t^{ji} are the explanatory variables $(j = 1,....,m)$ for object *i* in period *t*, ε_t^i is the random error term and *n* is the number of objects.

Rosen and Wigren are both of the opinion that the price equation is multiplicative. It should furthermore have second order derivatives. By choosing a specific equation form one is able to estimate the partial derivatives, i.e. the hedonic prices. Empirical studies in Sweden and the United States show that a logarithmical form of the price equation gives the best fit in a multiple regressions. The regression analysis determines the significance of the variables and estimates their coefficients.

5.2. Hedonic function and regression model

The price information received from the Norwegian State Housing Bank is linked to building projects and not to the individual dwellings. Therefore, the regression analysis has been developed with the project as the unit. The population is divided into two classes of multi-dwelling houses and we estimate separate regression equations for each class.

We choose a log-linear function form in the regression analysis. The regression model is based on two sets of independent variables: Numeric variables such as floor space and number of dwellings, and classification variables such as price regions. The classification variables have the value 1 or 0 according to whether they are part of the class or not.

The hedonic function form can be written as follows:

$$\ln P_t^j = a + b^1 x_t^{1j} + b^2 x_t^{2j} + ... + b^{lj} x_t^{lj} + \varepsilon_t^j \tag{5.2}$$

Where P_t^j is the average dwelling price for project *j* in period *t*, and x_t^j are the independent variables for project *j* in period *t*. The regression coefficients and $b^1 \ldots . b^l$ can be expressed as the theoretical price to the explanatory variables. The coefficient *a,* is the baseline value per project irrespective of changes in the characteristics. The residual ε_t^i is a stochastic variable with an expected value of zero.

The following independent variables are used in the regression analysis

Numeric variables:

- The natural logarithm of average floor space in the project
- The natural logarithm of the number of dwellings in the project
- The proportion of dwellings with energy economizing qualities in the project

Classification variables:

- Price zones
- Years of price measurements

The numeric independent variables, floor space and number of dwellings are transformed into a logarithmic scale in the regression model. The number of observations per year is low. Observations from a period of five years are therefore used in the regression analysis to obtain stable estimates of the hedonic price function. The price coefficients are assumed to be constant for that period of time. In order to achieve the best possible estimate for the coefficients, the regression equations contain yearly classification variables. This prevents price changes due to the passing of time being explained by attributes of the house. The coefficients for the time variables are not used in the calculation of the index.

Alternatively, the function can be written as follows:

$$P_t^j = \exp(a)(y_t^{1j})^{b^1} (y_t^{2j})^{b^2} \exp(b^{3j} x_t^{3j}) .... \exp(b^{lj} x_t^{lj}) \exp(\varepsilon_t^j) \tag{5.3}$$

Where y^1 is average floor space and y^2 is number of dwellings.

6. Index calculation

6.1. Index formula

We want to calculate the average price with the dwelling as the unit. The equation takes the form:

$$\overline{\ln P_t} = a + b^1 \sum_{j=1}^{m_t} w_t^j x_t^{1j} + ... + b^k \sum_{j=1}^{m_t} w_t^j x_t^{kj} \tag{6.1}$$

where m_t is the number of projects in period *t,* and the weight

$w_t^j = \dfrac{n_t^j}{\sum_{j=1}^{m_t} n_t^j}$ is the number of dwellings in project *j,* (n_t^j) divided by the total number of dwellings in period *t.*

We choose the following adjusted Jevons index:

$$I_{0,t} = \frac{\overline{P_t}}{\overline{P_0}} adj(\overline{x_0}, \overline{x_t})$$

where

$$\overline{P_t} = \left(\prod_{j=1}^{m_t} \left(P_t^j\right)^{n_t^j} \right)^{\frac{1}{\sum_{j=1}^{m_t} n_t^j}} = \prod_{j=1}^{m_t} \left(P_t^j\right)^{W_t^j} = \exp(\overline{\ln P_t})$$

The average price is then calculated as a weighted geometrical average adjusted for the weighted average values of the characteristics in the period *t* and in base period 0 as expressed in (6.1). The adjusting component can then be written as follows:

$$adj(\overline{x_0}, \overline{x_t})^{-1} = \frac{\exp\left(b^1 \sum_{j=1}^{m_t} w_t^j x_t^{1j} + ... + b^k \sum_{j=1}^{m_t} w_t^j x_t^{kj} \right)}{\exp\left(b^1 \sum_{j=1}^{m_0} w_0^j x_0^{1j} + ... + b^k \sum_{j=1}^{m_0} w_0^j x_0^{kj} \right)}$$

Such that the index formula is explicitly given by:

$$I_{0,t} = \frac{\exp\left(\overline{\ln P_t} - b^1 \sum_{j=1}^{m_t} w_t^j x_t^{1j} - ..... - b^k \sum_{j=1}^{m_t} w_t^j x_t^{kj} \right)}{\exp\left(\overline{\ln P_0} - b^1 \sum_{j=1}^{m_0} w_0^j x_0^{1j} - ..... - b^k \sum_{j=1}^{m_0} w_0^j x_0^{kj} \right)} \tag{6.2}$$

where

$$\overline{\ln P_t} = \ln\left(\prod_{j=1}^{m} \left(P_t^j\right)^{w_t^j} \right) = \ln\left(\left(P_t^1\right)^{w_t^1} \right) + ... + \ln\left(\left(P_t^m\right)^{w_t^m} \right)$$

6.2. Annual chained index

The price indices for small houses and block of flats are calculated as a chained index with annual links. The shift of the base period takes place in the second half of the year with the previous year as the new base period. Observations from the five last years are used in the regression analysis to obtain more stable estimates of the price coefficients. Chained indices for the period: 2,*t* = second half of year t and period 1,t+1= first half of the next year, can be written as follows:

(6.3) $$I_{2,t}^{chained} = I_{2,t}^{newb} \frac{I_{1,t}^{oldb}}{I_{1,t}^{newb}} \quad \text{and} \quad I_{1,t+1}^{chained} = I_{1,t+1}^{newb} \frac{I_{1,t}^{oldb}}{I_{1,t}^{newb}}$$

6.3. Weights

The indices for the two housing classes are weighted into a total index for multi-dwelling houses. The weights are the proportion of dwellings started per housing class during the last three years, taken from Statistics Norway's building statistics ("building work started"). The weights are shifted yearly in the second half of the year. The total index takes the form:

(6.4) $$I_{0,t}^{total} = I_{0,t-1}^{total}(w_0) I_{t,t-1}^{total}(w_{t-1})$$

where

$$I_{t,t-1}^{total}(w_{t-1}) = I_{t,t-1}^{small} w_{t-1}^{small} + I_{t,t-1}^{block} w_{t-1}^{block}$$

and

$$w^{small} + w^{block} = 1$$

7. Results

7.1. Regression analyses

The analyses in this chapter are based on data from 2002 to the first half of 2006. The multi-dwelling houses are divided into two different categories: Small houses and blocks of flats. And regression analyses is accomplished separate for each category.

Projects with particularly low or high square meter prices are not included in the index calculations. In most cases, these are projects with incorrect information about costs and/or floor space. In 2006 square meter price requirements are as follows:

Small houses: Square meter price between NOK 3 000,- and NOK 34 000,-
Blocks of flats: Square meter price between NOK 4 000,- and NOK 44 000,-

The square meter price requirements will be revised at regular intervals to be in accordance with the market. We have calculated separate regression coefficients for small houses and blocks of flats respectively. The results are shown in tables 7.1 and 7.2.

Table 7.1 Small houses. Regression model with ln price as dependent variable. Data from 2002 – first half of 2006.

Variable	Parameter estimate	Standard error	t-value	P-value
Intercept	11.76526	0.07747	151.87	<.0001
Ln_utility_floor_space	0.44048	0.01642	26.82	<.0001
Ln_number_of_dwellings	0.03302	0.00466	7.09	<.0001
Proportion_energy_economization	0.09359	0.03290	2.84	0.0045
Price_zone_1	0.26277	0.04852	5.42	<.0001
Price_zone_2	0.14168	0.01566	9.05	<.0001
Year_2003	0.01438	0.01184	1.21	0.2245
Year_2004	0.07314	0.01241	5.89	<.0001
Year_2005	0.14288	0.01281	11.15	<.0001
Year_2006	0.19257	0.01911	10.08	<.0001
R-square	0.3613			
Adjusted R-square	0.3584			
Number of observations	2 008			

Table 7.2 Blocks of flats. Regression model with ln price as dependent variable. Data form 2002 – first half of 2006.

Variable	Parameter estimate	Standard error	t-value	P-value
Intercept	10.77368	0.15165	71.04	<.0001
Ln_utility_floor_space	0.70139	0.03299	21.26	<.0001
Ln_number_of_dwellings	0.02394	0.00922	2.60	0.0096
Proportion_energy_economization	0.00959	0.05924	0.16	0.8714
Price_zone_1	0.17732	0.02464	7.20	<.0001
Price_zone_2	0.08712	0.02007	4.34	<.0001
Year_2003	0.06264	0.02316	2.70	0.0070
Year_2004	0.14974	0.02325	6.44	<.0001
Year_2005	0.29039	0.02432	11.94	<.0001
Year_2006	0.41189	0.03397	12.13	<.0001
R-square	0.5142			
Adjusted R-square	0.5079			
Number of observations	703			

All parameter estimates are positive, which means that the variables contribute to increasing the price. Utility floor space is the most crucial factor. Note that we have included the proportion of dwellings with energy economizing qualities in the regression analysis, even if its t-value is as low as 0.16 in the analysis of blocks of flats. Energy economization is a relatively new concept, and was only introduced in the data in the second half of 2005. A minority of the projects possess this quality now, but as this will become more and more common in the years to come, we wish to include the variable in the model at this early stage. We will follow this variable closely in the future.

A common way to decide upon the quality of a regression model, is to look at the residuals; the difference between observed and predicted values. Here, the predicted values are the prices calculated for each project using the regression model. In an Ordinary Least Squares-regression, residuals should be normally distributed, with an expected mean of 0, have constant variance and be uncorrelated with each other (Hamilton, 1992: 110-111). Visually, a plot with residuals plotted against predicted values should appear as random as possible. Furthermore; a quantile-normal plot of the residuals should form an approximate rectilinear line, as close to the line representing normality as possible. Figures 1-4 in appendix A. show that there are no problems with regard to the residuals in our analysis.

7.2. Index figures

We have calculated separate price indices for the two different building categories. The total index for all multi-dwelling houses is the result of weighting the two indices together. The weights are the proportion of dwellings started, per building category, as described in chapter 5.3. The weights used in the index calculations are shown in table 7.3

Table 7.3 Weights used in the calculation of the price index for multi-dwelling houses. Numbers taken from Statistics Norway's Building statistics.

	2000-2002	2001-2003	2002-2004	2003-2005
Small houses	0.540	0.503	0.467	0.464
Blocks of Flats	0.460	0.497	0.533	0.536

In the index we have used 2000-2002 as weights from the first half of 2000 until the first half of 2004, and shifted the weights once a year from that point. The 2003-2005-numbers will be applied from the second half of 2006.

Table 7.4 below, shows the price index of new multi-dwelling houses from the first half of 2000 to the first half of 2006.

Table 7.4 Price index for new multi-dwelling houses, calculated using the hedonic method. 1st half of 2000 – 1st half of 2006. 2000=100

	Total	Small houses	Blocks of flats
1st half of 2000	99.8	98.0	102.1
2nd half of 2000	100.2	102.0	97.9
1st half of 2001	107.2	105.8	108.8
2nd half of 2001	113.4	111.7	115.4
1st half of 2002	116.4	115.7	117.2
2nd half of 2002	122.3	120.4	124.4
1st half of 2003	121.6	118.6	125.3
2nd half of 2003	128.5	124.0	133.9
1st half of 2004	134.3	130.0	139.4
2nd half of 2004	134.1	129.6	139.4
1st half of 2005	142.7	130.9	156.1
2nd half of 2005	150.6	143.3	159.4
1st half of 2006	165.3	150.2	182.2

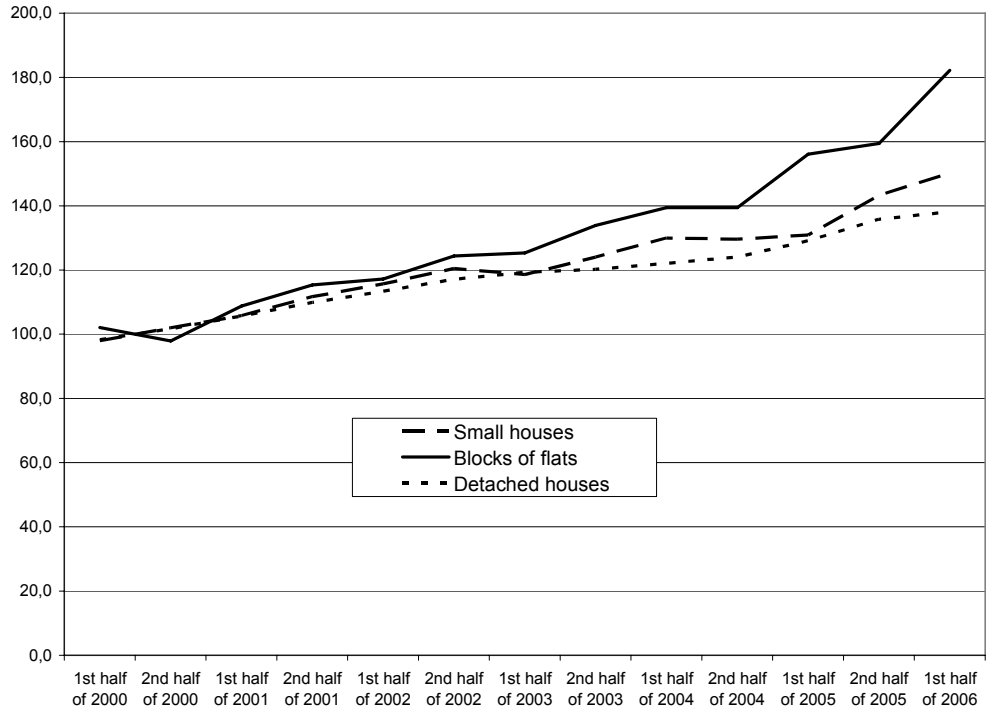
The index shows that on average, prices of new multi-dwelling houses increased by 65.6 per cent from the first half of 2000 to the first half of 2006. Prices of blocks of flats increased the most, by 78.5 per cent, while prices of small houses increased by 53.3 per cent. There is a considerable difference in the development of prices between small houses and blocks of flats. According to representatives from the construction industry, the explanation is that blocks of flats are mainly built in the larger cities, with more expensive resources and lower productivity. In addition blocks of flats are in general more costly to construct.

We have also calculated the index excluding projects in price zone 1 (Oslo and Bærum), to see how this affects the development of the prices. We did this because building projects in Oslo are often built under other conditions than projects in other parts of the country. Sites are smaller and often peculiar (with more narrow working conditions etc.). In addition, the supply of labour may be limited. The index series, however, turned out to be almost identical, whether we included Oslo and Bærum or not and we have not analysed this further.

7.3. Multi-dwelling houses vs. detached houses

We have compared the price index for new multi-dwelling houses with the index for new detached houses. The price index for new detached houses is published quarterly, and in order to compare the two series, we have made half year indices by calculating the average index of the two quarters that constitute the six month reference period.

Figure 7.1 Price index for new multi-dwelling houses and price index for new detached Houses, 1st half of 2000 – 1st half of 2006. 2000=100



The figure 7.1 shows that the prices developed uniformly the first two years. Starting in 2003, prices of new multi-dwelling houses have increased more than prices of detached houses, and the difference seems to increase with time. This difference is primarily caused by the prices of blocks of flats, which have increased the most during the last three years.

When comparing the two series one must keep in mind that the time of measurement differs. The index for detached houses is based on questionnaires distributed when permission to use the house is granted, usually near or after completion of the building work. The price index for new multi-dwelling houses, as mentioned above is based on estimated costs prior to the actual building, and thus the time lag between the series may be a year or more.

We have also compared the price index for multi-dwelling houses with the House price index, and found the same pattern: Prices of flats increase more than prices of dwellings in small houses, even though the difference between the house types is smaller than in the index for multi-dwelling houses.

8. Concluding remarks

The data has been examined thoroughly and we have concluded that they are suitable for use in the index calculations. Sample skewness has been discussed, but does not seem to constitute crucial problems with regard to the index. The data cover about half the population of new multi-dwelling houses, according to Statistics Norway's Building statistics. We have also performed tests of the

regression analysis, and have found the regression model to meet the requirements of Ordinary Least Squares-analysis.

The number of characteristics describing the quality of the buildings is low. As a result, the index will tend to overestimate the increase in prices when the quality of construction improves.

Statistics Norway is now publishing the index as official statistics.

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Appendix A

Figure 1 Residuals versus Predicted *Y* Plot, studentized. Small houses.

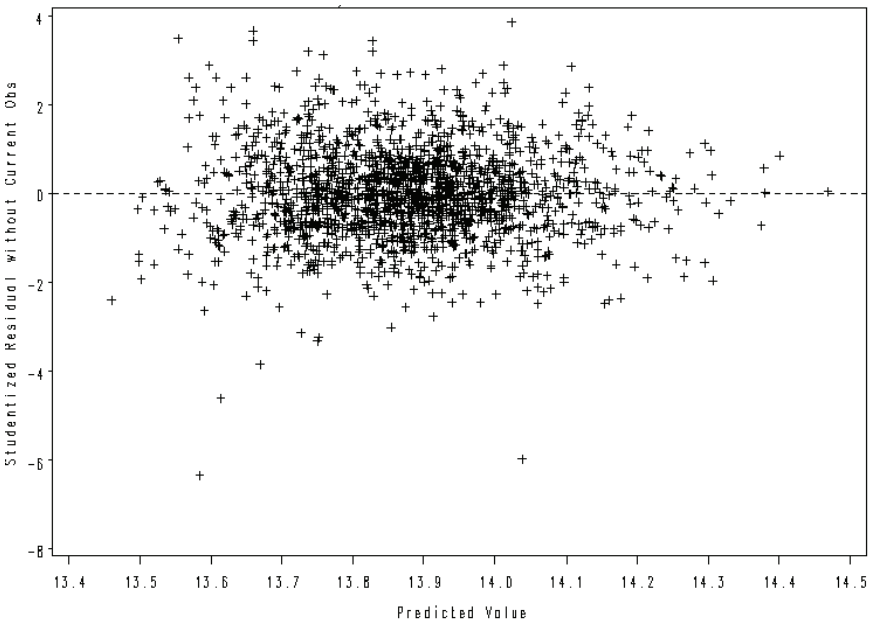

Figure 1 Residuals versus Predicted *Y* Plot, studentized. Blocks of flats.

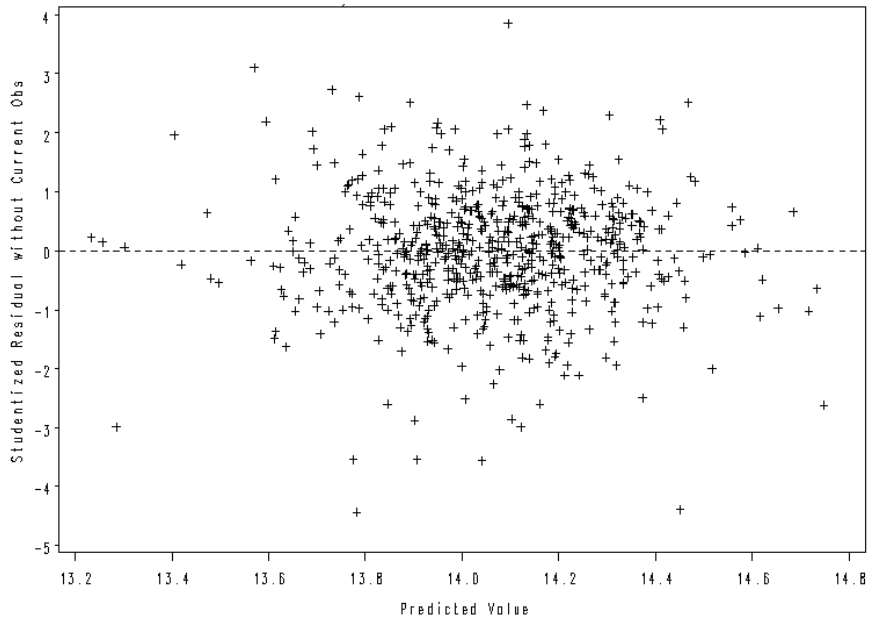

Figure 3 Quantile-Normal Plot, studentized. Small houses.

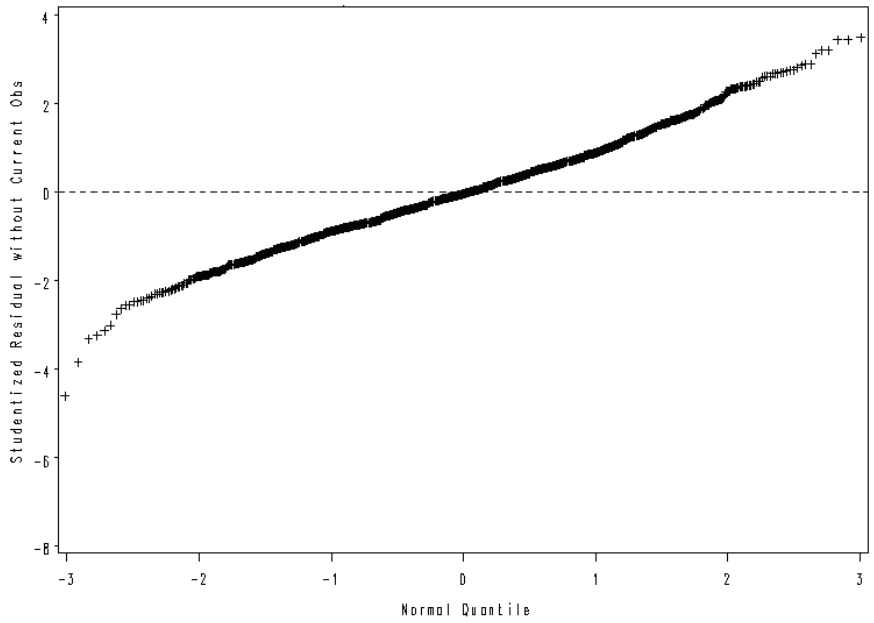

Figure 4 Quantile-Normal Plot, studentized. Blocks of flats.