

Renewing of the hedonic price index for existing single-family houses and plots

Johanna Vuorio*

Statistics Finland, Helsinki, Finland – johanna.vuorio@stat.fi

Elina Vuorio

Statistics Finland, Helsinki, Finland – elina.vuorio@stat.fi

Abstract

In Finland, regional differences in the price development of the housing market are significant. Challenges in the compilation of statistics on real estate are the small number of real estate transactions and the fact that each property is different. There are also many different factors that influence the price and some of them are difficult to measure. The statistical model, review procedures, weight structure and classifications used in the index calculation of old single-family houses and single-family house plots were renewed in 2017. This was done to achieve better information on the price development in different regions. The model renewed in 2017 better takes into account the distance of the real estate to the town or municipality centres. The renewed statistical model of single-family house plots better takes into consideration the distance of the plot, the plot ratio and the quality of the plan in the plot area. Retrospective time series from 2010 onwards according to the new calculation method were calculated for both renewed indices. The results show that the prices of single-family houses stay the same or rise in centres of more than 100 000 inhabitants. The prices of single-family house plots rise in Southern and Western Finland and go down in Eastern and Northern Finland.

Keywords: Real estate prices, single-family house price index, single-family house plots price index, hedonic price index.

1. Introduction

Indices of old single-family houses and single-family house plots were renewed in 2017. The motivation for this renewal was to change the base year of the index for 2015=100. In this connection, it became relevant to renew the statistical model for the index calculation since the last renewal before this was done in 2002 and at the time there was better information available for the hedonic regression model. Besides these factors it was necessary to renew the SAS program for compiling the indices.

Another important factor for the renewal of the price index for single-family house plots was the fact that the National Land Survey of Finland was also publishing the price index of single-family house plots. They were using a different method and the results were inconsistent with the index numbers Statistics Finland was publishing. It was confusing for the public and thus it became necessary to revise the statistical model.

2. Data

The statistics on the prices of single-family houses and plots are based on the data on transaction prices in the National Land Survey's purchase price register, which is supplied to Statistics Finland quarterly. In addition, background information for the transaction price data is retrieved from the Population Register Centre's Building and Dwelling Register. The old and the renewed index are based on the same data but the review procedures were revised. The hedonic regression model is estimated using the previous five years data to get enough information for more reliable estimation. Thus for the index 2015=100 the data of the years 2011–2015 was used.

3. Method

The indices are constructed by combining classification and hedonic quality adjustment. Indices are calculated according to the classification of area and population as the fixed-weight Log-Laspeyres index. Weights of the 2015=100 index of the single-family houses are based on the data on the register of buildings and dwellings for year 2015. Weights are based on the building and dwelling stock instead of the transacted houses because the purpose of the index is to describe the price change of the stock. For the index of single-family house plots the weights are value shares based on transactions in 2015.

At the elementary aggregate level the indices are compiled using two different factors: the price change in an elementary aggregate and the quality adjustment factor. For the indices of single-family houses Finland is divided for 65 regions and for the single-family house plots for 61 regions. The regional stratification is done so that each stratum consists of towns with relatively similar price level. Big cities are their own stratum and some of the smaller towns are in the same stratum with many other towns.

The quality adjustment factor is obtained by the hedonic regression model. In the index regression models, the dependent variable is the logarithmic price per square metre. The explanatory factors in the model of single-family houses are the age of the house, the square of age, abutting a shoreline, floor area and in Greater Helsinki the distance to Helsinki, and elsewhere in the country the distance to a big, medium size and small town. The explanatory factors in the model of single-family house plots are the quality of the plot plan (town/master, sparsely populated), nature of conveyance (municipality/other), abutting a shoreline, the size of the plot, the plot ratio, and in Greater Helsinki the distance to Helsinki, and elsewhere in the country the distance to a big, medium size and small town. The effect on the price per square metre of each explanatory factor is described briefly in the table below.

Table 1. The explanatory factors in the index regression models

| | |
|--|--|
| Distance | Price per square metre falls as distance to the centre of Helsinki or to a big, medium size or small town increases. |
| The age of a house and the square of age | Houses of older vintage are less expensive than newer vintage but the effect is not linear. |
| Building and town plan indicators | Plots located in planned areas are more expensive than those in scattered settlement areas. |
| Bordering on shoreline | Plots bordering on a shoreline are more expensive. |
| Size of a house or a plot (log) | Price per square metre (per square metre of total area) falls when the size of a house or a plot increases. |
| Assignor of the plot is the municipality | Plots sold by municipalities are less expensive. |
| Plot ratio | Plots with higher plot ratio are more expensive. |

The age of a house is calculated by subtracting the year of completion from the price reference year of the index. Thus the interpretation of the estimated age profile as reflecting vintage effects is achieved through the simple variable transformation. The houses of older vintage are less expensive than the newer vintage but the effect is not linear: the price decreases even slower as age increases. (Koev 2013.)

The renewed model for plots takes into account the effect of the plot area separately in town plan area and other area as well as it takes better into consideration the distance of the plot, the plot ratio and the quality of the plan in the plot area.

The macro location of the house or the plot is taken into account by classifying the transactions at fairly detailed level into specific areas (elementary index areas). Higher level indices are published for the whole country, Greater Helsinki, the rest of Finland, satellite municipalities and major regions. The indices are also calculated classified by the number of inhabitants. The regression models are estimated separately for Greater Helsinki and the rest of country. The intercept is estimated separately for each town based on the average price per square metre.

4. Results

The resulting index series for both houses and plots show that the price development differs regionally.

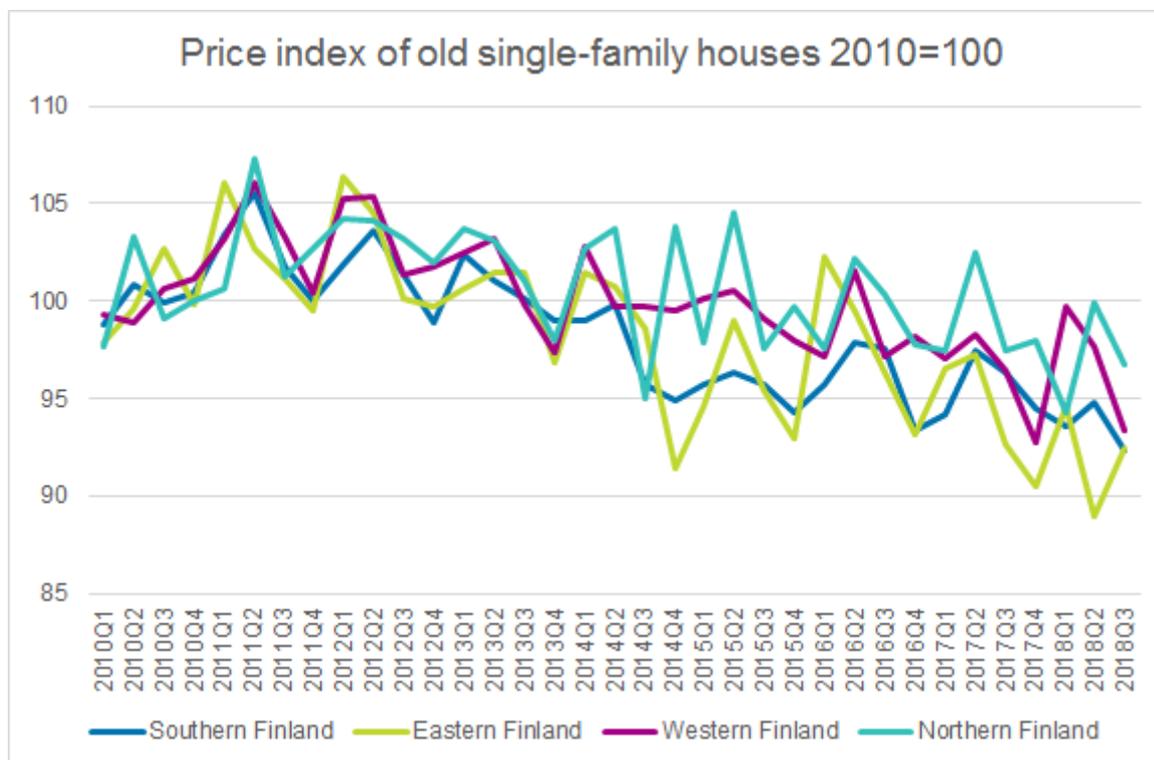


Figure 1. Regional price development of single-family houses in Finland

Figure 1 shows the regional price development of single-family houses in Finland. Prices have decreased all over the country compared with 2010. The figure illustrates that the price index for single-family houses is very volatile especially in Northern and Eastern Finland.

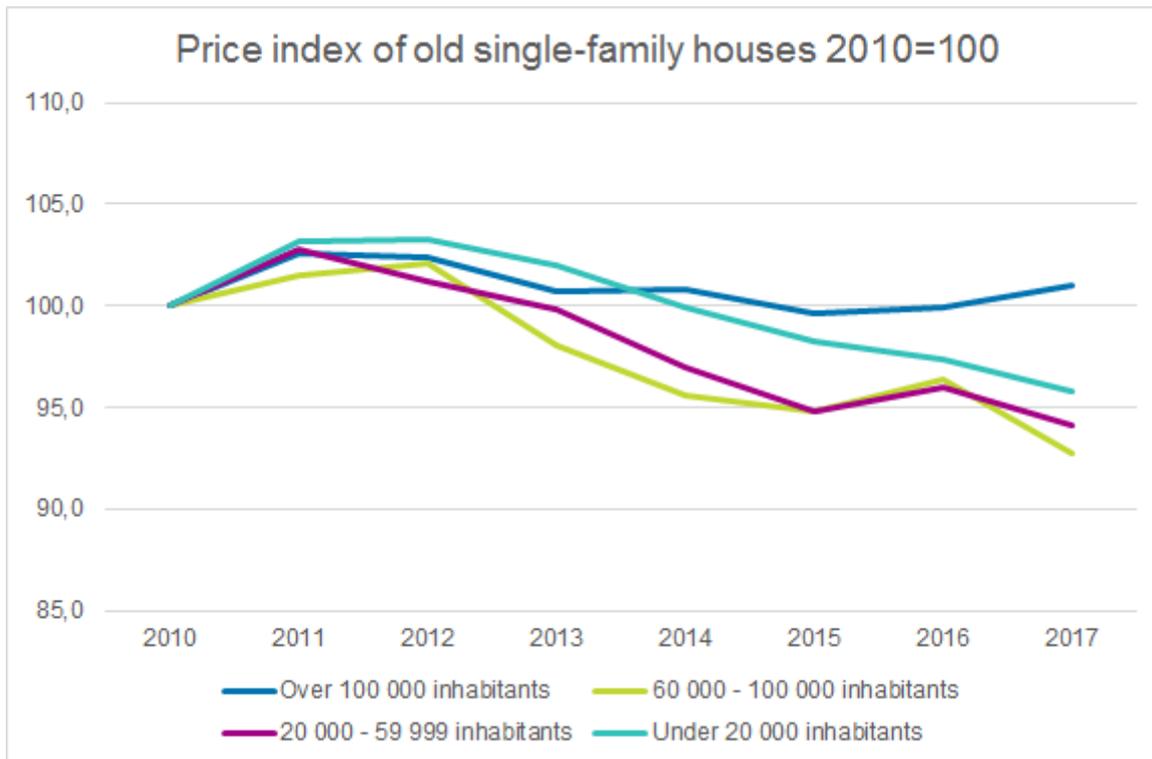


Figure 2. 2010=100 index classified by the number of inhabitants, annual averages

Figure 2 shows that the prices of single-family houses remain at the same level or rise in centres with more than 100 000 inhabitants. In smaller towns the prices have been declining in the past few years.

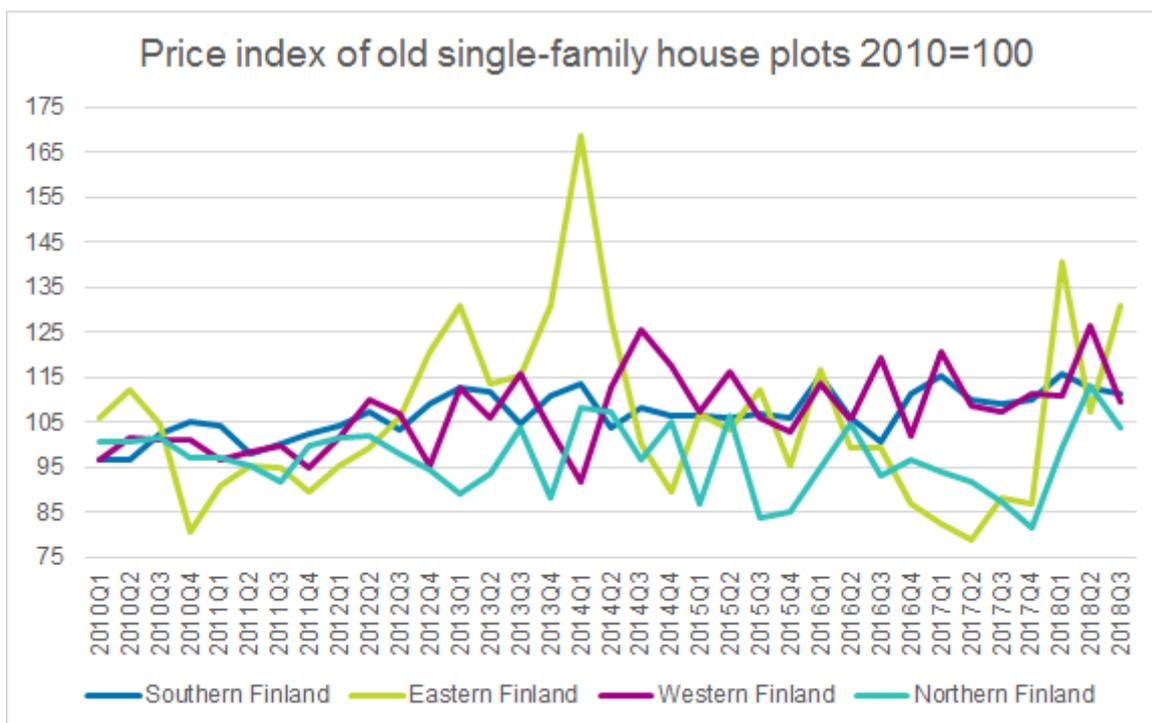


Figure 3. Regional price development of single-family house plots in Finland

Figure 3 shows the price development of single-family house plots in Finland. The prices of single-family house plots rise in Southern and Western Finland and fall in Eastern and Northern Finland. When examining regional price indices, the number of transactions made in the area should be taken into consideration. If only a few transactions are made in the area, a few deviating cases can have a significant effect on the average price in the area. The number of plot transactions is quite low in Eastern Finland and in Greater Helsinki, in particular. In Eastern Finland there are approximately 120 transactions per quarter and 70 transactions in Greater Helsinki per quarter.

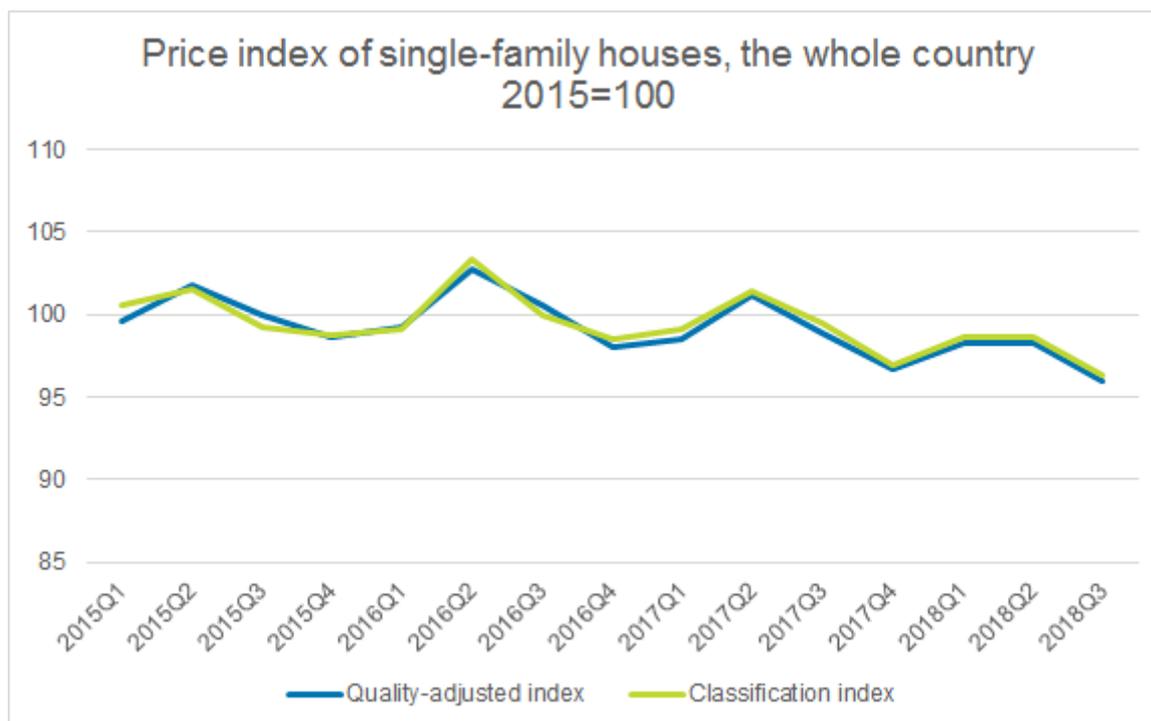


Figure 4. The effect of the quality adjustment on the index for the whole country

Figure 4 illustrates the effect of the quality adjustment. The classification index is the index based on regional stratification. The quality-adjusted index is the combination of classification and the quality adjustment. The indices are almost at the same level the whole time. At the highest level of aggregation it seems that the quality adjustment is not necessary since the classification index results almost the same index numbers. The importance of the quality adjustment is clearer when examining markets with fewer transactions. This is illustrated in figure 5.

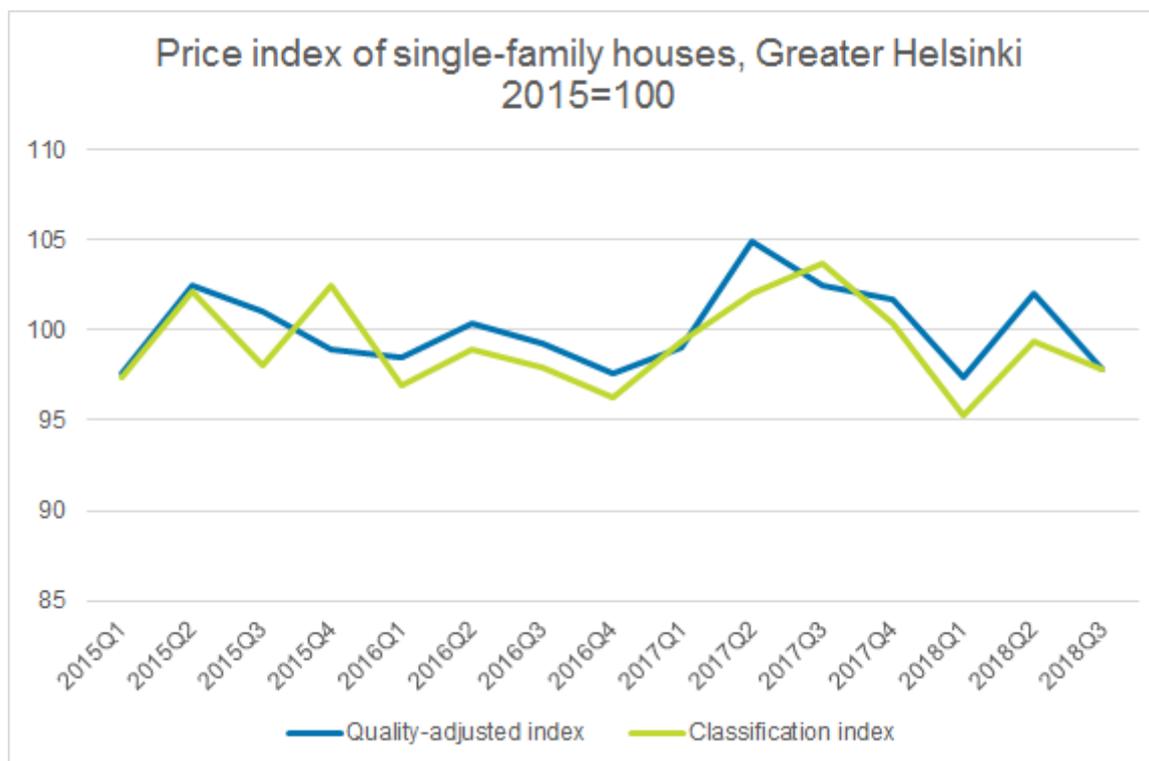


Figure 5. The effect of the quality adjustment on the index for Greater Helsinki

Figure 5 shows the difference between the quality-adjusted index and the index based only on the classification. At the lower level the indices differ from each other more significantly than for the whole country. The classification seems to be inadequate for controlling quality changes at the lower level.

Figures 4 and 5 illustrate that for the whole country the classification index seems to be sufficient due to the large number of transactions but for the lower aggregate, for example Greater Helsinki, the quality adjustment seems to be more important. The average level of transacted houses in a quarter is around 3200 transactions in the whole country and in Greater Helsinki around 160 transactions.

5. Conclusions

The statistical model for the indices improved compared with the previous one. The new model better takes into account the distance of the real estate to the town or municipality centres. The renewed statistical model of single-family house plots better takes into consideration the distance of the plot, the plot ratio and the quality of the plan in the plot area. In addition, the plot model takes into account the effect of the plot area separately in town plan area vs. other area.

The methods for the single-family house and single-family house plot indices are now more consistent with each other. Retrospective time series from 2010 onwards according to the new calculation method were calculated for both renewed indices. Thus it is possible to observe price development with consistent index number series for a longer period of time which gives a new point of view for the comparison of price development of both of these. The longer time series also makes it possible to examine more reliably how well the new model is performing. The new model for the single-family house plots was constructed by combining the best sides of the old model of Statistics Finland and the method of the National Land Survey of Finland. The renewal was done in cooperation with NLS and thus NLS is no longer publishing their own price index of single-family house plots. This is more comprehensible for the users of these statistics since the users don't have to figure out the reasons for two differing index series.

Besides the improvement of the statistical models, the new production system for the index compilation was produced. The new production system is based on SAS Enterprise Guide. In addition, a report of quality adjustment coefficients used on the index in different quarters was added to the production system, to make the index compilation more transparent.

After this renewal, there still remain challenges with the index methods and the data. The explanatory factor *bordering a shoreline* takes only the seaside and not a lakeside into consideration. This is a shortcoming especially in Eastern Finland where there are a lot of big lakes but at the moment the data is not sufficient for estimating the lakeside's effect on the price. This combined with the small amount of transactions in Eastern Finland makes the index very volatile. The statistics also lacks the transactions of single-family houses on rented plots since there is no register information available about these transactions.

References

Koiv, Eugen (2013) Combining classification and quality adjustment in constructing a House Price Index. Helsinki, Statistics Finland, Studies series.

Statistics Finland: Quality description: Real estate prices. http://stat.fi/til/kihi/2018/03/kihi_2018_03_2018-12-04_laa_001_en.html