A comparison of the SPAR and a stratified-model house price indices

12th meeting of the International Working Group on Price Indices (The Ottawa Group), Wellington, New Zealand, 4 - 6 May 2011

Guðrún R. Jónsdóttir
Statistics Iceland
Borgartúni 21a
IS - Reykjavík 150, Iceland
Tel: +354 528 1202
Fax: +354 528 1299
gudrun.jonsdottir@statice.is

Lára G. Jónasdóttir
Statistics Iceland
Borgartúni 21a
IS - Reykjavík 150, Iceland
Tel: +354 528 1208
Fax: +354 528 1299
lara.jonasdottir@statice.is

Abstract

This article compares a house price index produced with a stratification method with an index made using the SPAR-method. Stratification has been used in the Icelandic house price index since 1992. The model keeps fixity on property type, geographic area and size. Major methodological changes were introduced in 2006 including use of geometric estimator and calculating the index as a superlative Fisher index. The Icelandic Property Registry has recently improved their methods for valuating residential properties by introducing hedonics. This has made the use of SPAR possible in house price index calculation. The aim of this study is to compare the methods and to investigate the feasibility of changing from the stratification method to the SPAR-method. First results indicate that SPAR might be a good option for a small housing market as is the case in Iceland and confirms also that stratification is also a good choice where other methods are not applicable or feasible.

Key words: House price index, real estate price indexes, residential property price index (RPPI), SPAR, consumer price index, owner occupied housing.

JEL: C43, C81, D11, E31.

Introduction

Housing price statistics have been available in Iceland for the last two decades. Since 1992 Statistics Iceland has used a simple user cost model to measure the cost of owner occupied housing in the national consumer price index (CPI) using a stratified housing index (Diewert (2003), Guðnason, (2004), Guðnason and Jónsdóttir, (2009a)).

Statistics Iceland currently participates in the 4th stage of Eurostat's pilot project on owner occupied housing within the HICP framework. The aim of the project is to develop indices for owner occupied housing and other costs related to home ownership. The use of Sales Price Appraisal Ratios or SPAR is one of the methods researched within the project framework.

The main prerequisite for SPAR is the access to good property valuations which reflect market values without systematic errors and are revised regularly. Since 2009, the Icelandic Property Registry is required by law to revalue all properties annually by using hedonic methods in the valuation process. This makes it possible for Statistics Iceland to study the possibilities of changing from the stratified model to SPAR.

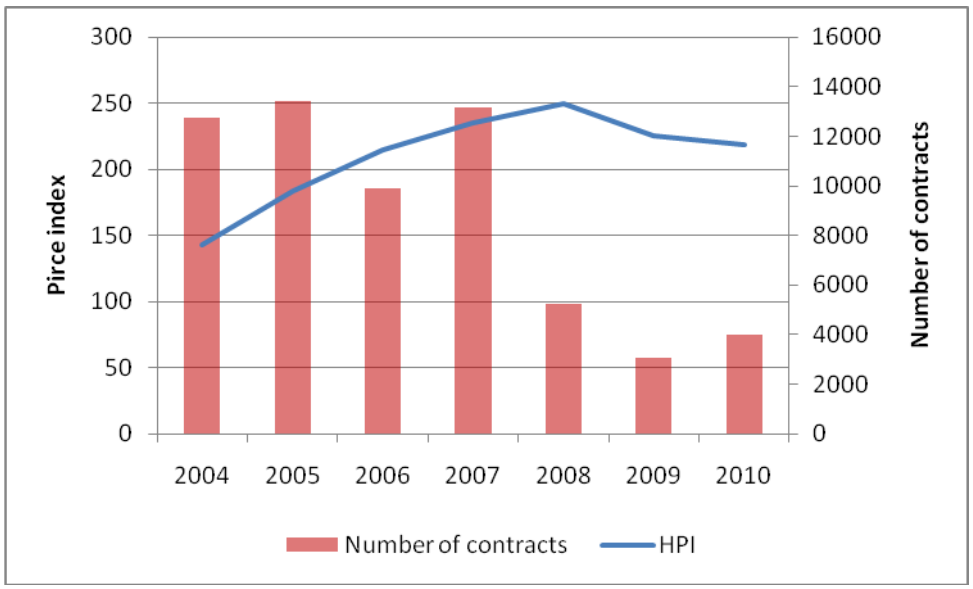
Studies have been made comparing the SPAR method with repeated sales and hedonics (e.g. Bourassa et al., (2006) and Vries et al., (2008)) but not by comparing stratification and SPAR. It is worth investigating how a simple method like stratification compares with the SPAR method where hedonics are used for appraisals to see if stratification can be recommended for NSIs when hedonic appraisals are not available.

The Icelandic housing market

On 1 January 2010 the population of Iceland was 318,000 and the number of residential properties was around 130,000. The Icelandic housing market has been lively in recent years with over 8,000 sales contracts for residential properties on average per year since 1998. In 2005 and 2007 the number of sales contracts reached 13,000. Prices rose by more than 10% per year from 2003 – 2006, with as much as 29% increase in 2005 before house prices peaked in early 2008. As the economic conditions in Iceland deteriorated the number of sales deeds declined drastically before the Icelandic banks crashed in October 2008. Prices started to fall

in 2008 and between 2008 and 2009 prices of housing fell by 10% and by 3% in 2010. These trends are displayed in figure 1.

Figure 1: Price development and number of sales contracts in the Iceland housing market 2004 – 2010.



Source: Statistics Iceland, Icelandic Property Registry.

SPAR

The SPAR method tracks changes in the ratio between sales prices and official appraisal values. The SPAR method has been used to calculate house price indices in New Zealand since the 1960's and is described as a relatively easy method to calculate quality adjusted house price indices (Bourassa et al., 2006). It also has a long history in Sweden (Statistics Sweden, 2011) and is used in Denmark (Statistics Denmark, 2011) and in the Netherlands (Vries et al., 2008).

The formula used in the calculations is:

$$I_t = \frac{\left(\prod_{i=1}^{n^t} {}^{p_i^t}/_{a_i^0}\right)^{\frac{1}{n^t}}}{\left(\prod_{j=1}^{n^0} {}^{p_j^0}/_{a_j^0}\right)^{\frac{1}{n^0}}} * 100$$

Where:

- I_t is the index for period t,
- n^t and n^0 are the number of sales in period t and 0 respectively,
- p_i^t is the price of house i in period t and
- a_i^0 is the appraisal value of house i in the base period (the most recent appraisal period).

The reason for choosing the geometric mean is it's advantage of being less sensitive to outliers (Haan et al., 2008) and the fact that a Jevons index satisfies all 'reasonable' tests of axioms basic in index number theory (International Labour Office, 2004).

For a small NSI like Statistics Iceland the SPAR-method has many advantages.The method is fairly simple and straightforward, and easy to explain and understand. It does not call for the specialized skills necessary to develop and maintain hedonic regression models. It offers better adjustment for quality than stratification because quality differences are adjusted for in the appraisals. If the quality adjustment is good and no systematic bias is present in the appraisals (for example as regards location or type of dwelling) there is no need for stratification. Less stratification is an advantage in a small market like Iceland where the number of contracts in each stratum can be very small. Furthermore, comparing the sales price and the appraisal of a property gives two points of reference for identifying outliers, rather than just the sales price alone.

Data availability

As mentioned earlier good property appraisals, which reflect market prices, and reliable data on sales prices are the main precondition for a SPAR house price index. Appraisals have been issued in Iceland for all properties for a long time and are used for taxation purposes, e.g. for local real estate tax and inheritance tax. Until 2009, the valuation techniques were mostly based on a cost approach, not necessarily reflecting market prices and revaluations were infrequent (Gloudemans, 2007). In 2009, a new law took effect making it compulsory for the Icelandic Property Registry to revalue all properties annually. With assistance from leading experts in the field of mass property valuations linear regression models were developed to make revaluations. Eleven models, for different areas and types of housing, were made, each including 10 – 22 variables of characteristics (Fasteignaskrá Íslands, 2009). The first

appraisals made with this model were published in 2009. For the appraisals issued in 2010 just over 46,000 sales contracts were used, spanning the period January 2004 – April 2010.

In an attempt to estimate the quality of the appraisals, the relationship between the appraisals and the price data was examined. The reference period of the appraisals used was February 2010 and all price data were updated to that month with Statistics Iceland's published house price indices. If the appraisals perfectly reflected market prices the relationship between price and appraisals should be linear intercepting the vertical axis at 0 and the R^2 value should be 1.

This is not the case. The R^2 values for different areas and types of dwellings lie between 0.8 and 0.9 which is fairly good. The intercept of the trend line for the capital area is below zero which calls for further investigation. Outside the capital region the difference is not as substantial. The intercept and the slope of the trend line are similar over the entire Capital region on one hand and similar outside the Capital region on the other hand. This problem could be avoided by dividing the data into the Capital region and outside the Capital area and calculating the results using external weights.

Part of the difference between the sales prices and appraisals can depend on time adjustment factors. The sales prices were updated and compared at the time of the appraisals with the published indices of Statistics Iceland. This is not the same method for price updating as the Icelandic Property Registry uses in their valuation model. This raises questions about the time adjustment made for the appraisal models as the oldest sales contracts that needed to be price updated were six years old. This includes a period when prices rose and fell steeply.

The long time period from which the contracts are chosen and the volatility of the market in that period are further points of concern. The contracts used were not weighted explicitly to give new contracts more weight but keeping the pre-boom year 2004 in the dataset does offset this to some extent.

It should be kept in mind that the valuation method used for the appraisals is new and adjustments are made to the model as it develops. Comparison between SPAR indices made with two different appraisal periods have yet to be made. Shi et al. (2009, p. 348) have pointed out that "...frequent reassessment exercises will marginally improve the precision of a SPAR index but can also introduce a significant inconsistency bias between reassessments. Further, the total effect of the inconsistency bias, if it exists, can be exaggerated in a more

frequently reassessed SPAR index." Frequent reassessment should not be a problem with respect to inconsistency bias if the SPAR index is chained at the time when a new appraisal is introduced.

The stratified model

The stratification method uses available information about characteristics of dwellings sold to divide sales prices into different strata that are kept fixed. Within each stratum the average (Duot) or median sales prices can be calculated but the estimator can just as well be geometric (Jevon). These indices can either be weighted or not weighted.

In the Icelandic house price index the estimator is the geometric mean of the price per square meter and fixity is kept on following characteristics:

- Type of property (houses and flats).
- Geographic area (inner Capital area, outer Capital area, outside Capital area).
- Size (4–5 categories).

To offset the small size of the Icelandic housing market, three months' price data are pooled every month. The index is a superlative Fisher index and price changes are weighted with shares of total sales values for each stratum in two 36 month periods (12 months overlap). The method has been explained thoroughly in papers by Guðnason and Jónsdóttir (e.g. 2006, 2008, 2009a and 2009b).

This approach to house price indices is relatively simple, it requires access to a large amount of data (preferably administrative data or population data) but it doesn't need to be very detailed. It does not require very specialized skills or technology. On the other hand, if the strata are not fairly homogeneous, fluctuations can be troublesome and, especially in economic downturns, the number of contracts available might not cover all strata sufficiently.

Comparison of the methods

The comparison between the two methods was made with data from the Icelandic Property Registry covering the same time interval as the appraisals published in 2010. The whole dataset covered over 46,000 contracts from January 2004 until April 2010. For 2004 and 2005 a large portion of contracts was missing (due to technical reasons) and therefore the study

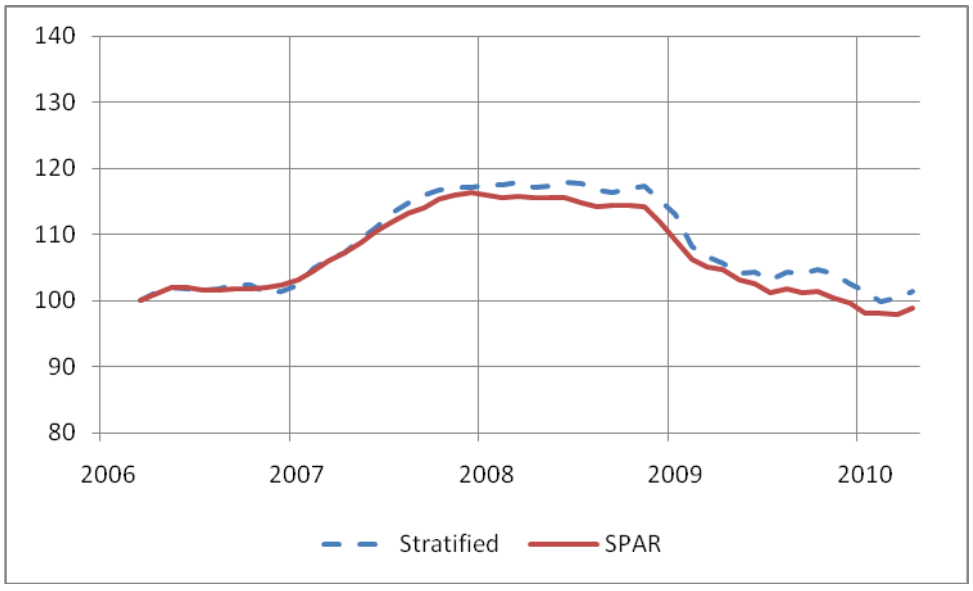
covered the time between January 2006 and April 2010 including approximately 25,000 sales contracts. Data from the three preceding months was pooled every time to offset the small size of the market as is the case for the stratified model. The time reference for the index series is March 2006 = 100.

In both models the same preconditions were set. Only the size categories used in the stratified model were used, and in cases where the ratio between sales price and appraisal was below 0.5 or above 2.0, contracts were automatically classified as outliers and eliminated. Because the appraisals for the Capital area and outside the Capital area might not be fully comparable, the SPAR-index was split into two subindices. These were weighted together with a moving 36-month average of the respective shares of total value, comparable to the Paasche weights of the stratified index (for 2004–2005 CPI housing data were used for weights as the valuation dataset was not representative).

The stratified index presented here is not fully comparable to the published index, but the trend is very similar.

In figure 2, the index series produced with stratification and SPAR respectively, are displayed, and in figure 3, monthly changes are compared.

Figure 2: Stratified index and SPAR index.



The trends are very similar but the stratified index is slightly higher in 2008 and 2009. As mentioned before the number of contracts fell sharply in 2008. For 2007, close to 11,000 sales contracts are available while for 2008 they are less than 4,000 and for 2009 just over 2,000.

Figure 3: Monthly changes in %.

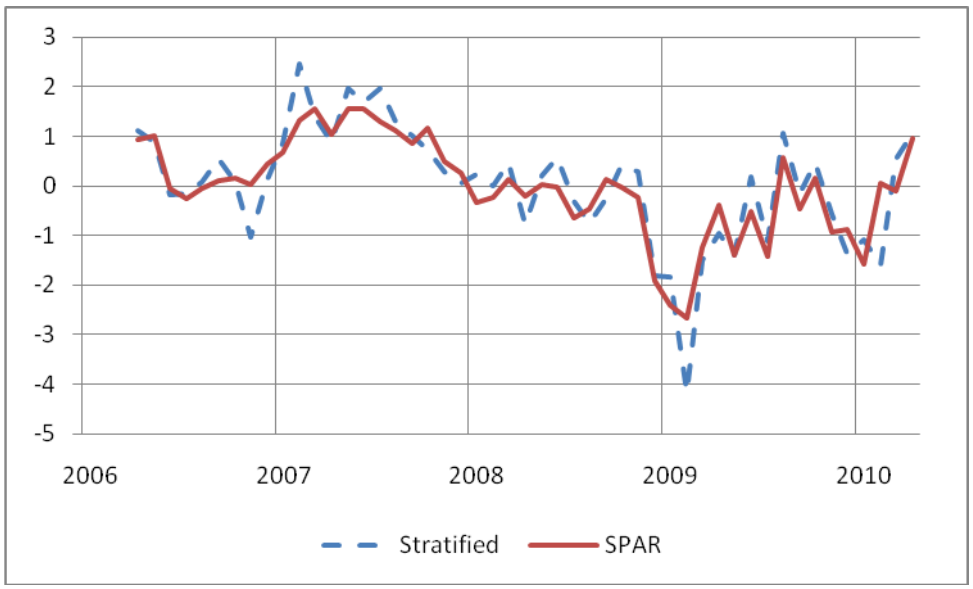


Figure 3 shows that the SPAR index is less volatile than the stratified one. The most obvious points of discrepancies are November 2006, February 2007 and January 2009. A simple test can be made by comparing the monthly changes, changes in the average sales price and in average appraisal values at these points. In all instances monthly changes of average appraisal values come close to explaining the difference between the two index series indicating a change in quality. The difference is probably the quality adjustment factor SPAR offers beyond the stratification model as expected. A paired t-test shows that there is no significant difference between the series.

Conclusions

The small exercise presented here has confirmed that the SPAR method is an attractive alternative to producing house price indices in a small housing market like Iceland.

Even if the valuation methods used for the appraisals are new and should have a longer history before they can be used for producing house price indices, the first results are promising.

Less volatility in the index series and observations at points were differences in results are most obvious, indicate a better quality adjustment by using SPAR. The method has also practical advantages, such as less stratification.

Although SPAR could for these reasons be considered superior to the stratified model the results of the two methods are very similar. During the recent situation prevailing in the Icelandic housing market, conditions could have led to both underestimation (boom where

low quality houses are sold at high prices) and overestimation (downturn where only better quality houses are sold) in the stratified model. The results indicate that stratifying according to the most common price determining factors, such as location, type and size, seems to measure this reasonably well.

Even if the SPAR method is more desirable for the Icelandic situation, stratification should be considered as a good option where more sophisticated methods are not applicable or not feasible for some reason.

References

Bourassa, S. C., Hoesli, M., Sun, J., (2006), A simple alternative house price index method, *Journal of Housing Economics, 15, 80-97*.

Diewert, W. E., (2003), The Treatment of Owner Occupied Housing and Other Durables in a Cost of Living Index, *Discussion Paper 03-08*, Department of Economics, University of British Columbia, Vancouver, Canada, V6T 1Z1. Diewert, W. E., (2006), The Paris OECD-IMF Workshop on Real Estate Price Indexes: *Conclusions and future Directions.* Paper presented at the OECD-IMF Workshop on Real Estate Price Indexes held in Paris, 6-7 November 2006.

Diewert, W. E., (2010), Alternative Approaches to Measuring House Price Inflation, *Discussion Paper 10-10*, Department of Economics, University of British Columbia, Vancouver, Canada, V6T 1Z1.

Fasteignaskrá Íslands, (2009), *Fasteignamat 2010* [A methodological report from the Property registry on the process for the 2010 valuation in Iceland] (in Icelandic). http://www.skra.is/lisalib/getfile.aspx?itemid=4466

Gloudemans, R.J., (2007), *Review of valuation practices of the Land registry of Iceland*. http://www.skra.is/lisalib/getfile.aspx?itemid=4348

Guðnason, R., (2004), Market price approach to simple user cost. *Statistical Journal of the United Nations* ECE 21 (2004), 147-155.

Guðnason, R., Jónsdóttir. G.R., (2006), House price index, market prices and flow of services methods. Paper presented at the OECD-IMF Workshop, Real Estate Price Indexes Paris, 6-7 November 2006.

Guðnason, R., Jónsdóttir, G.R., (2008), House price indexes, Approaches and Methods. Paper presented at the 2008 World Congress on National Accounts and Economic Performance Measures for Nations. Arlington, VA, May 12-17, 2008.

Guðnason, R., Jónsdóttir. G.R., (2009a), Owner Occupied Housing In The Icelandic CPI, Chapter 9, pp. 147-150 in W.E. Diewert, B.M. Balk, D. Fixler, K.J. Fox and A.O. Nakamura (eds.), *Price and Productivity Measurement:Volume 1 - Housing*, Trafford Press.

Guðnason, R., Jónsdóttir. G.R., (2009b), The Impact of Financial Crises on the CPI. *11th meeting of the International Working Group on Price Indices (The Ottawa Group),* Neuchâtel, Switzerland, 27-29 May 2009.

Haan, J. de, Wal, E. van der, Vries, P. de, (2008), *The Measurement of House Prices: A Review of the Sale Price Aprraisal Ratio Method.*

International Labour Office (ILO), (2004), *Consumer Price Index Manual: Theory and Practice*. Geneva: ILO Publications.

Shi, S., Young, M., Hargreaves, B., (2009), Issues in measuring a monthly house price index in New Zealand. *Journal of Housing Economics, 18, 336-350.*

Statistics Denmark, (2011, February 18), Declarations of content: Sales of real propertyhttp://www.dst.dk/HomeUK/Guide/documentation/Varedeklarationer/emnegruppe/emne.aspx?sysrid=906

Statistics Sweden, (2011, February 4), *Fastighetspriser och lagfarter* (in Swedish). http://www.scb.se/Statistik/BO/BO0501/_dokument/BO0501_DO_2009.pdf

Vries, P. de, Haan, J. de, Mariën, G., Wal, E. van der, (2008), *A House Price Index Based on the SPAR method*. Paper presented at the 2008 World Congress on National Accounts and Economic Performance Measures for Nations. Arlington, VA, May 12-17, 2008.