

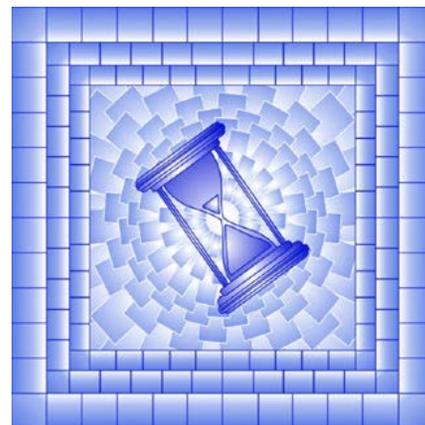
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Technical Guide for the New Housing Price Index (NHPI)

by Lana Stupar

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Technical Guide for the New Housing Price Index (NHPI)

by Lana Stupar

Introduction

The new housing price index (NHPI)¹ measures the change over time in builders' prices of newly built houses (single/semi-detached homes and townhomes). The NHPI is a monthly index available for 27 cities.²

To produce a constant-quality price index, the NHPI uses a matched-model approach—wherein prices for the same house models are compared over time—along with explicit quality adjustments. Data are collected monthly from builders as part of a survey using an electronic questionnaire. The house structure and land components are also indexed independently using builders' estimates collected in the survey.

The NHPI is used by economists, academics, and the general public to monitor trends in the residential sector of the construction industry. Within Statistics Canada, components of the series are used in the calculation of some elements of the Consumer Price Index. In addition, the series are used by the Canada's System of Macroeconomic Accounts for deflating the value of the national housing stock. Due to the level of geographic detail provided and the sensitivity to changes in supply and demand, the NHPI series are of particular interest to the real estate industry for comparison with the resale market. The NHPI is also used by building contractors, market analysts interested in housing policy, suppliers and manufacturers of building products, insurance companies, federal government agencies such as the Canada Mortgage and Housing Corporation (CMHC), and provincial and municipal housing agencies responsible for housing policy.

1 Data

1.1 Sampling process

To ensure that the NHPI continues to measure accurate changes in prices, Statistics Canada subject matter specialists review each city's sample size to determine whether new builders need to be introduced on a monthly basis. The sampling process uses a multi-stage sample design, where the first stage is to select residential builders and the second is to select representative models that will be priced over time.

1.1.1 Online research

To aid in the effort of increasing and maintaining the NHPI's sample size, online research for new builders is completed on a monthly basis.

Subject matter specialists make use of publicly available data on builder websites which depict model characteristics and occasionally prices for a given development to determine whether a builder and its models are in scope and can be reasonably tracked over time. If the builder is successfully initialised for the survey, the builder receives a monthly electronic questionnaire to collect model and price information.

1.1.2 Statistics Canada's Building Permits Survey

An additional source for the sampling frame is Statistics Canada's Building Permits Survey. Builders are selected, within a city, based on the value of their building permits. This helps ensure that large tract builders that develop an entire subdivision are included in the sample. Once a builder is identified as in scope, they select the development they are building with the most lots available for sale within a city and up to three of the top selling house models in this development. This ensures that the same models can be followed over time within the same development, and that these models are broadly representative of market activity for new housing.

1. See the IMDB (link <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=2310>) for more information about the NHPI.

2. Cities included in the NHPI are: St. John's, Charlottetown, Halifax, an aggregate of Saint John, Fredericton, and Moncton, Québec, Sherbrooke, Trois-Rivières, Montréal, Ottawa-Gatineau (Québec part), Ottawa-Gatineau (Ontario part), Oshawa, Toronto, Hamilton, St. Catharines-Niagara, Kitchener-Cambridge-Waterloo, Guelph, London, Windsor, Greater Sudbury, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Kelowna, Vancouver, and Victoria.

1.2 Prices

For the purpose of the NHPI, prices are defined as either the transaction price or the list price for a model of a house as reported by the builder in a given month, exclusive of any sales tax. This is the price received by the builder, and excludes any additional fees paid by the buyer. A model is the floorplan and features of the house structure.

1.2.1 Electronic questionnaire – New Housing Price Report

The survey collects builders' estimates of the current value (evaluated at market price) of the land. These estimates are independently indexed to provide the published series for land. The current value of the structure is also independently indexed and is presented as the house series.

An electronic questionnaire is used to collect price information for these models each month. If a model does not sell in a particular month, the builder is asked for a list price. The sample is periodically refreshed as developments sell out, and builders enter and exit the market. The data collected from builders are manually reviewed for consistency and completeness, and certain records are edited or removed based on judgement.

1.2.2 Administrative and alternative data sources

Prices collected through this method are list prices as posted on the builder's website. Model characteristics such as square footage, number of bedrooms and number of bathrooms is also captured. Online prices do not include estimates of the house component only or land component only so they are calculated using house to total and land to total ratios calculated from previous year's averages.

2 Index calculation

The NHPI is a matched-model index, and prices are stratified by city, builder, and model to produce a price relative for each model that each builder reports in the survey. The value of any promotions or upgrades is removed from the price of a model prior to calculating a price relative. Provided that house models do not change over time, this collection of price relatives has a constant-quality interpretation. The price relatives for each model are then aggregated to the city level using a Jevons index.

To make the index calculation explicit, let P_{mbt} be the price of model m by builder b at time t . These model prices are used to calculate a price relative between period $t-1$ and period t , P_{mbt} / P_{mbt-1} , for each model that each builder reports in the survey. To produce a city-level index, the price relatives for all models by all builders are aggregated with a Jevons index

$$I_t^{t-1} = \prod_{b=1}^{B_t} \prod_{m=1}^{M_{bt}} \left(\frac{P_{mbt}}{P_{mbt-1}} \right)^{1/\sum_{b=1}^{B_t} M_{bt}},$$

where M_{bt} is the number of models produced by builder b , and B_t is the number of builders. This index is then chained with the previous period's index value I_{t-1} to produce an index $I_t = I_t^{t-1} \cdot I_{t-1}$ running from the base period to period t .

2.1 Weights

Weights are estimated annually for each of the house component, land component and the total for each city. Using collected builders' estimates of the current value of the house and land components, house to total and land to total ratios can be calculated for each city using an average of the reported estimates from the previous year.

The weights to further aggregate the city level indexes to higher level geographies are derived from sales values for singles, semis and row house collected from the Canada Mortgage and Housing Corporation's Market Absorption Survey. These aggregate indexes are then calculated using the Lowe formula combining weighted city level indexes to regional, provincial and national totals for each of the house, land and total price index series.

2.2 Model replacement

When a house model is no longer for sale, or no longer representative, and if it is replaced by another model in the sample, a back price for the replacement model is imputed in the first period that it appears in the sample. This allows for a new model to be used in the matched-model index calculation immediately. The imputation is done with a linear regression (hedonic) model that relates house prices to observed characteristics (see de Haan and Diewert (2013, chapter 5) for more details). A model is calculated for each of the 27 cities. No imputation is made when a new model is added to the sample without replacing an old model, nor when a new builder is added to the sample.

Letting p_{mbt} be the price of model m by builder b in period t , the regression model is based on a structural model for house prices

$$\log(p_{mbt}) = \alpha + x_{mbt}\beta + z_{mbt}\gamma + d_b + d_t + \log(\hat{\epsilon}_{mbt}),$$

where x_{mbt} is a (row) vector of model characteristics, z_{mbt} is a vector of location characteristics, d_b and d_t are builder and time specific intercepts, respectively, and $\hat{\epsilon}_{mbt}$ is an error term. Housing characteristics include the log of lot size and house size (square metres), and dummies for the number of garages and number of bathrooms. Location characteristics include dummies for the property's forward sortation area (first three digits of the postal code).

The regression model is estimated using a five year rolling window of data collected for the NHPI. Estimation is done with a robust M-estimator, using the bi-square loss function (see Amemiya (1985, section 2.3) or Wooldridge (2010, chapter 12) for more detail about M-estimation). Under the assumptions of the classical linear regression model, this approach to estimation is more robust to outlying price observations than the usual OLS estimator.

When a new house model is introduced into the sample, the characteristics for the new model and the characteristics for the old model are used to calculate a pair of fitted prices from the regression model. The fitted price for the new model is then subtracted from the fitted price for the old model, and this difference is added to the price for the old model to impute the back price for the new model. This effectively accounts for the difference between the characteristics of the old model and the new model, giving an imputation for what the price of the new model would have been in the previous period. That is, plugging the characteristics for a new model n into the hedonic model produces a fitted price, $\log(\widehat{p}_n)$, and plugging the characteristics of the old model o into the hedonic model produces a fitted price $\log(\widehat{p}_o)$. The difference between these fitted prices $\log(\widehat{p}_n) - \log(\widehat{p}_o)$ is then added to the price for the old model $\log(p_o)$ to produce a back price for the new model $\exp(\log(p_o) + \log(\widehat{p}_n) - \log(\widehat{p}_o))$. The imputed price relative for the new model is then simply

$$\frac{p_n}{\exp(\log(p_o) + \log(\widehat{p}_n) - \log(\widehat{p}_o))}$$

and this is used directly in the index calculation.

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