

**METHODOLOGY FOR THE CALCULATION OF  
DEPRECIATION AND NET RESIDENTIAL STOCK**

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**STATISTICS CANADA**

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## METHODOLOGY FOR THE CALCULATION OF NET RESIDENTIAL STOCK

Statistics Canada uses the perpetual inventory method to calculate the value of residential stock. This method, which is an easy way of developing time-series for capital stock, cumulates capital expenditures to obtain estimates of residential stock for a given year. This calls for information about the value of investments, price indexes and the depreciation method. The perpetual inventory method essentially consists of adding Gross Fixed Capital Formation to the capital stock for each year and subtracting depreciation.

Thus, net residential stock would be calculated as follows for period t:

$$NSt = NSt-1 + GFCFt - DMt - DPt \quad (1)$$

where

$NSt$  = net stock at period t in 1997 dollars

$GFCFt$  = Gross Fixed Capital Formation at period t in 1997 dollars

$DMt$  = value of demolitions at period t in 1997 dollars

$DPt$  = depreciation at period t in 1997 dollars

For the calculation of the DP, a depreciation rate of  $\delta$  is applied to the previous year's stock. Also, it is assumed that Gross Fixed Capital Formation for the current year was used on average mid-way through the period. Consequently, depreciation on newly formed capital corresponds to half of new investments multiplied by the depreciation rate.

Thus,

$$DPt = \delta NSt-1 + \delta (GFCFt / 2) \quad (2)$$

where  $\delta$  is the geometric depreciation rate.

## **THE STARTING POINT**

The starting point is a stock estimate using the market value data provided by the 1941 Census. “It is clear that a bench-mark estimate will be highly approximate but the importance of errors introduced into the stock figures will diminish over time as the base period is left further behind<sup>1</sup>”.

## **THE EQUATION’S VARIABLES**

The calculation of each variable is detailed in the following paragraphs.

### **Gross Fixed Capital Formation at period t (GFCFt)**

GFCF covers the entire residential sector, including new construction, renovations (excluding repairs) and other fees associated with new residential building transactions.

By definition, this includes the construction of new detached, single, semi-detached or double, row and apartment units as well as mobiles, cottages, conversions (creation of additional dwellings from non-residential or other types of residential buildings). This also covers renovations as well as the fees associated with all of these projects (sales taxes, other closing fees, land developers and service fees, the fees for reviewing files for mortgage insurance purposes and the premium).

The inclusion of these latter fees is designed to reflect the value of the investment to the final buyer.

This calculation is based on three key information sources:

- Statistics Canada’s Monthly Building Permit Survey

This provides the estimate of the average value of a construction start as well as the values of conversions, cottages, mobiles and other closing fees.

- Canada Mortgage and Housing Corporation’s Housing Starts and Completions Survey

This provides the number of construction starts by province as well as the number of units completed for detached, semi-detached, row and apartment units.

The third source of information is Statistics Canada’s National Accounts Division, where the value of land developer’s fees, as well as sales taxes and renovations, are estimated on a quarterly basis.

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<sup>1</sup> OECD, *Measuring Capital : A Manual on the Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services, 2001, p.45, section 6.8.*

## **Calculation of Gross Fixed Capital Formation**

The value of investment for the four types covered by the GFCF is determined through a model developed at Statistics Canada.

Every month, there are a number of construction starts, some of which will be completed within one month, others within two and so on. We have a model that is based on previous patterns of units started versus those completed, which enables us to allocate the work done on these start-up units over the month.

Therefore, the investment for a given month will be a function of the work done on units started in that month, in addition to the work done on all the other units under construction (whether or not they are completed in the current month).

Since the CMHC's data are in units, we have to translate them into dollars. This is done by associating each start-up unit with an average value based on the average weighted value of the permits issued for the last five months for each type of dwelling.

The estimate of the investment for conversions, cottages and mobiles is entirely based on the value of permits issued, corrected through a blow-up factor to take into account benchmark data from the Census and the underestimation under the Building Permit Survey.

The estimate of renovations comes directly from the National Accounts System and takes into account the underground economy in this sector.

Acquisition fees comprise the following elements:

- contract closing fees
- file review and mortgage insurance fees (for those who cannot meet the deposit or down-payment terms and conditions)
- sales taxes
- land developers or services

The last two elements are estimated by the National Accounts Divisions. The file review and insurance fees are based on CMHC data.

Closing fees are normally assumed by the builder and passed on to the buyer when the contract is signed. They are taken as representing a certain percentage of the value of the completed units.

The calculation of the depreciation and, later, of the value of residential stock in current and constant dollars requires that the GFCF be deflated through a series of indexes. New construction is deflated through the New Housing Price Index for single, semi-detached and row houses. The Apartment Building Construction Price Index is used for apartment constructions. Renovations to existing dwellings are deflated through a special tailor-made index based on labour force costs and the prices of materials, weighted according to

information obtained through surveys such as the Homeowner Repair and Renovation Expenditure Survey. Industry Price Indexes and Construction Union Wage Rate Index are used.

With the release of 2000 figures, we revised historical data using different price indexes for each province to deflate the residential stock, whereas before, a common Canadian index had been used for every province.

### **Value of demolitions (DMt)**

The value of demolished dwellings comes from the Building Permit Survey. The number of permits issued for the demolition of residential units is collected from the municipalities. A value is established for demolished dwellings based on a portion of the average value that had been derived for the start-up units in the calculation of Gross Fixed Capital Formation.

Dwellings destroyed by fire are also included in the calculation of this variable, based on the Annual Report of the Council of Canadian Fire Marshals and Commissioners.

An implicit price index<sup>2</sup> based on Gross Fixed Capital Formation is used to convert the figures into 1997 constant dollars.

### **Value of depreciation (DPt)**

In Canada, a geometric rate is used to depreciate residential stock. This single rate is set at 2% and does not change with the category of dwelling. The calculation shown in equation (2) must be done with the value of the residential stock for the previous period in **constant dollars** as well as the value of Gross Fixed Capital Formation in **constant dollars**. To calculate the value of depreciation in current dollars, an implicit price index based on Gross Fixed Capital Formation is used. Depreciation then corresponds to the replacement cost, which is in a sense the equivalent of the amount of money needed to keep capital intact.

### **Net stock at period t (NSt)**

Equation (1) is used to calculate the value of net residential stock in 1997 constant dollars. An implicit price index based on Gross Fixed Capital Formation is used to convert the figures into current dollars.

### **References**

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<sup>2</sup> The implicit price index for residential construction is calculated by dividing the gross fixed capital formation in current dollars by the gross fixed capital formation in constant dollars.

-Statistics Canada, Catalogue 13-603F, No.1 – Occasional, Guide to the Income and Expenditure Accounts

-Statistics Canada, Catalogue 13-568, Fixed Capital Flows and Stocks – Historical

-OECD, *Measuring Capital: A Manual on the Measurement of Capital Stocks, Consumption of Fixed Capital and Capital Services, 2001*