

## *Chapter 10*

# **DIFFERENT CONCEPTS FOR MEASURING OWNER OCCUPIED HOUSING COSTS IN A CPI: STATISTICS CANADA'S ANALYTICAL SERIES**

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### **1. Introduction**

The treatment of owner occupied housing (OOH) in a consumer price index (CPI) is conceptually difficult. The characteristics of a house, considered as a commodity, permit and encourage a variety of treatments. A house is a consumer asset, with a long useful life, which is generally purchased on credit, with active resale and rental markets in which households participate as both buyers and sellers. A consumer price index for OOH services may be built around the cost of using a home, the cash outlays on a home, its assumed rental value, or its purchase price. No one treatment is ideal for all uses. Different tradeoffs made among the differing needs for a measure of price level change, and nation specific data problems, have influenced national choices on the concept for OOH services in the CPI. There is considerable variety in how OOH services are defined in the official CPI statistics for different nations. This is in contrast with the treatment of OOH services costs in the system of national accounts (SNA), including for the calculation of gross domestic product (GDP); in that case, most countries, including Canada, use a rental equivalence approach.

The CPI is sensitive to the measurement of price change for OOH services. Shelter is one of the most important CPI components in terms of household expenditure shares, and a large share of the shelter expenditures are for OOH services.

Many consumer durables share some of the characteristics of owner occupied housing, but to lesser degrees. For example, motor vehicles like houses are purchased in large part on credit, but the amortization period is for no more than five years. In contrast, the amortization period for a mortgage loan can sometimes exceed 25 years. Also, expenditures on other durable goods comprise smaller proportions of household expenditures. Finally, few consumer durables

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have lower depreciation rates or longer expected lives than owner occupied dwellings.<sup>2</sup> Although it is usually understood that the alternative approaches to the treatment of OOH services in the CPI could be applied as well to some durable good, like motor vehicles, there is no other consumer durable for which a change from one approach to another would have such a large impact.

International comparisons of the inflationary performance of one country versus others are problematical when the countries have made different choices about how to measure OOH price level change. Faced with this challenge, the Fourteenth International Conference of Labour Statistics adopted a resolution that asked countries to provide, in addition to the All-items CPI, an index that excludes shelter. However, given the importance of shelter costs in household expenditures, it is not fully satisfactory to base international comparisons of inflation rates on an index of price change that *excludes* shelter.

An alternative approach that Canada has tried for dealing with this problem is to construct analytical CPI series for Canada using the main measurement concepts adopted by other nations, thereby facilitating bilateral comparisons of inflationary performance. The Prices Division of Statistics Canada in December 1985 began publishing analytical series as part of the Canadian CPI program.<sup>3</sup> DeVries and Baldwin (1985) explain that the Statistics Canada analytical CPI program initially focused on producing a single analytical Canadian CPI series comparable in methodology with the U.S. CPI for the years before and after 1983. The year 1983 was when the U.S. switched to the rental equivalence approach from the net purchase including interest approach (NP2).

In this report, the Statistics Canada analytical CPI series for dwelling services -- six series based on four main concepts of owner occupied accommodation -- are updated for the period from January 1996 to December 2005. One of the series adopts the concept of the *official CPI*. All-items level indexes embedding the various alternative homeownership series are also presented<sup>4</sup> so that the effects of the different OOH concepts on the overall CPI can be observed.

This study is a pilot project for the regular analytical series program. The estimates of comparative shelter costs in this paper are for one housing area: Ottawa. The data used were obtained from a third party and were, at the time of the study, only available for Ottawa.

One challenge for those outside of Statistics Canada who are interested in these analytical series is that the terminology that Statistics Canada uses, based on past practices in

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<sup>2</sup> A World Bank study on Bosnia and Hercegovina that estimated depreciation rates for 23 different categories of durable goods found rates ranging from 8.9% to 1.8%; all exceeded the 1.5% depreciation rate assumed for OOH in the Canadian CPI. See State Agency for Statistics (BHAS) et al. (2002), p.16.

<sup>3</sup> Baldwin (1985) explains how the analytical concepts were expanded from two to six. The two money outlays concepts that were added build on the arguments presented in Turvey (1981). Turvey outlined both narrowly and broadly defined money outlays concepts for use as escalators. The United Kingdom, Ireland and Iceland adopted this approach. However, the United Kingdom has since added a depreciation component to its OOH index, so the U.K. CPI is now more comparable with the official Canadian CPI. Since the addition of the two money outlays series, there have been no changes except to discontinue the updating of the results for the NP2 series, since the United States is no longer using this. Two of the series, MO2 and NP3, were calculated for their theoretical interest and not because any official CPI was based on these concepts; in fact, the 1985 study likely contained the first empirical estimates ever based on these concepts.

<sup>4</sup> All of these higher-level aggregates differ only in their owned accommodation components; for all aggregates, all other components are based on the official concept.

Canada and other nations, differs from that used in influential recent reviews such as the OECD report by Christensen, Dupont and Schreyer (2005) which adopt the terminology used in the 2004 Consumer Price Index Manual published by the International Labour Office (ILO) on behalf of six international agencies (ILO et al. 2004), referred to hereafter as the 2004 International CPI Manual.<sup>5</sup> Thus in section 2 we briefly review the terminology of the 2004 International CPI Manual and how this relates to the Statistics Canada terminology for their analytical series. The concept used for owner occupied housing services in the official Canadian CPI is also outlined. These details demonstrate the maze of choices that statistical institutes face in specifying measures for the cost of housing services. The data used in this project and a small selection of empirical results are given in section 3. The selected results focus attention on consequences of some of the definitional choices.

## 2. Conceptual Definitions

In chapter 23 of the 2004 International CPI Manual, four basic approaches for dealing with price measurement for durables are introduced: the (a) user cost, (b) rental equivalence, (c) payments, and (d) acquisitions approaches. These are described here.

### 2.1 Canada's Official Choice: a User Cost Concept

The basic idea of the Canadian official concept is to treat homeowners as landlords who rent dwellings to themselves.<sup>6</sup> Whatever a landlord could expense is included in the index, including depreciation, a notional item. Whatever cost items a landlord cannot expense for tax purposes are deemed out of scope. It incorporates six components: (1) mortgage interest costs, (2) property taxes, (3) homeowner's insurance premiums, (4) homeowner's repairs, (5) other homeownership costs including transaction charges (e.g., real estate commissions and legal fees), condominium charges and mortgage insurance, and (6) the replacement cost for that part of the stock assumed to be used up in the year in question.<sup>7</sup>

The official concept is referred to in Statistics Canada materials as a user cost measure of OOH services. However, the Statistics Canada usage of the term differs from the user cost

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<sup>5</sup> The chapters of this manual are available at <http://www.ilo.org/public/english/bureau/stat/guides/cpi/index.htm>.

<sup>6</sup> The official CPI is a chain fixed basket index, which is now updated approximately every four years to reflect more recent expenditure patterns. During the estimation period of the analytical series it was twice updated, first, in April 1982, when it went from a 1974 to a 1978 basket, and then in January 1985, when it went from a 1978 to a 1982 basket. This updating of baskets has been associated with changes in group classification and methodology. Both are somewhat different for the 1982 basket as compared to earlier baskets (see Statistics Canada 1992, pp. 29-32, pp. 40 and 41). The analytical series based on the official concept therefore match the monthly movement of the corresponding official CPI series only from January 1985 forward, when they are all based on a 1982 basket. Also, the analytical series are all Laspeyres indexes with a 1982 base period, including the official concept series. To calculate the analytical series as chain indexes linked in the same way as the official CPI would be more difficult without necessarily improving the analytical usefulness of the series.

<sup>7</sup> On shelter in the Canadian CPI, see also Baldwin and Mansour (2003), Markle (1992), and Prud'homme (1995).

concept presented in the 2004 International CPI Manual. Key points of difference are that foregone interest on an owner's capital invested in their home is ignored on the basis that this is not an explicitly expensed cost, and accrued capital gains are ignored on the grounds that accrued capital gains are not generally treated by landlords as a negative expense.<sup>8</sup>

Some components of the official Statistics Canada concept are controversial because of measurement problems, such as depreciation. Because a landlord can expense the depreciation on a dwelling that he rents, the official measure includes a notional amount for "replacement cost" (or depreciation).<sup>9</sup> Each year, Statistics Canada carries out the Survey of Household Spending (formerly called the Family Expenditure Survey) to update the expenditure weights for most of the commodities in the CPI index basket. However, depreciation is not an out-of-pocket expense (or cash-flow), so its share in the basket must be imputed.

Between 1949 and 1997, the annual housing depreciation rate used for the Canadian CPI was 2%. Kostenbauer (2001) argued that there was evidence to suggest that a 2% depreciation rate is too high. As a consequence, the depreciation rate in the Canadian CPI was revised downward to 1.5%, effective January 1998.

The replacement cost incurred by homeowners is derived using average price data for residential properties obtained from the Survey of Household Spending and based on homeowner appraisals of the values of their properties at the end of the survey year. The average price data for residential properties are multiplied by the "house-to-property ratio," estimated by Statistics Canada, to obtain estimates of the average price of residential houses (exclusive of land). Then the estimated average price of residential houses is multiplied by the assumed depreciation rate to obtain an estimate of the replacement cost. The national replacement cost index that is produced by Statistics Canada is a weighted aggregate of individual area indexes. The weights reflect relative shares of the total value of the national owner occupied housing stock, compiled from the Survey of Household Spending. The replacement cost index is updated every month from the index movements of the New Housing Price Index (NHPI) exclusive of land.<sup>10</sup>

The mortgage interest component of the official concept is also controversial. It is intended to estimate price induced changes in the amount of mortgage interest owed by the target population on outstanding mortgages. The Statistics Canada practice is to hold the volume of mortgage loans, by age of mortgage, constant so that interest owed depends only on house prices and interest rates; not on the changes in lump sum payments or changes in the loan-to-value ratios or amortization periods of the outstanding loans. The house price attached to an outstanding loan dates from the month of purchase. The interest rate dates from the month that

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<sup>8</sup> Finland, Iceland, Sweden and the United Kingdom have also adopted simplified user cost concepts (see Christensen, Dupont and Schreyer 2005). See also Diewert and Nakamura (2007) in this volume.

<sup>9</sup> Depreciation is the only component in the CPI that is not a cash flow.

<sup>10</sup> Other concerns have also been raised about the replacement cost component of the official concept. The price component that pertains most directly to the replacement cost for the owned housing component is for new dwellings, but new dwellings are seldom sold without lots. Thus, dwelling price estimates necessarily depend on the estimates of builders as to what their houses would sell for without their serviced lots. This estimate is likely to be more approximate if a builder has held onto a lot quite a while before building on it, and if the market for residential land is volatile. There is reason to believe that the dwelling price series fails to entirely remove the impact of changes in land prices, and hence that what is calculated is something between an index of dwelling prices and an index for dwelling and lot together.

the loan was last renegotiated, or the month of initiation. Thus, the interest owed on the stock of mortgages in the current month is a function of current and lagged house prices and interest rates, mixed according to the proportion of new and existing mortgages.<sup>11</sup>

## 2.2 The Rental Equivalence Concept

An index based on the rental equivalence concept measures changes in the cost of consuming the dwelling services of a fixed stock of owner occupied housing by imputing rents based on observations for the market rents for tenant occupied dwellings.

## 2.3 The Money Outlays (or Payments) Concept

The payments approach, which Statistics Canada terms the *money outlays approach*, deals with the cash flow costs of home ownership, including mortgage payments.<sup>12</sup> An index based on this concept measures the price induced changes in the consumption related cash outlays on owner occupied homes. Imputed costs are excluded by definition, as are investment related outlays. Most of the components for the official Statistics Canada concept represent cash disbursements, and are in scope under a money outlays concept; this includes repairs, property taxes, insurance premiums and mortgage interest. The important omission from the preceding list is the replacement cost of depreciation, which is included with the official approach, but excluded as an imputed item for the money outlays/payments concept.

In the empirical portion of this study, two variants of this concept are used, one including and one excluding net equity payments (MO1 and MO2, respectively). Net equity payments consist of down payments on owner occupied homes, plus the principal portion of loan repayments when those houses are purchased on credit, less sales of owner occupied homes.

## 2.4 The Net Purchase (or Acquisitions) Concept

With the acquisitions approach, which Statistics Canada terms the *net purchase approach*, the entire cost of a product is charged to the period of purchase, just as with products that are not durable.<sup>13</sup> A series based on the net purchase concept measures changes in current transaction prices for owned accommodation. Net purchases of owner occupied dwellings consist of all purchases of new as well as existing owner occupied dwellings by the household sector less sales of such dwellings; that is, purchases of new dwellings by the household sector plus net household sector purchases of existing dwellings from sellers outside the household sector.

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<sup>11</sup> See Statistics Canada (1992, pp. 113-117).

<sup>12</sup> Ireland uses the payments approach.

<sup>13</sup> Australia and New Zealand use net acquisitions concepts.

When net purchases of pre-existing dwellings are unimportant, an index based on this concept will closely approximate price movements for new homes.

In the empirical portion of this study, the net purchase series for owned accommodation (labelled NP1) includes a home purchase component whose weight is based on net purchases but excludes mortgage interest.<sup>14</sup> This variant is consistent with the treatment of consumer durables in the official CPI, being based entirely on actual (i.e., not hypothetical) prices. For owned housing, the CPI is based on the actual prices for dwelling and lot together.<sup>15</sup>

The scope of the net purchase approach can be extended to include mortgage interest payments. This concept was previously used for a (now discontinued) Statistics Canada analytical net purchase series labelled NP2. From 1953 to 1984, the homeownership component of the U.S. CPI for urban wage earners and clerical employees was based on net purchases including mortgage interest. Under this concept, mortgage interest comprises those negotiated interest payments that are likely to be made.<sup>16</sup> Under this variant, the net purchase weight could vary greatly for a given volume of home purchases depending on the degree of credit financing.<sup>17</sup>

Blinder (1980) argues that the weight attached to a home purchase should be the same whether or not it is purchased on credit.<sup>18</sup> A net purchase approach series including interest was inspired by Blinder's article, and was calculated for the first time as an analytical series in 1985 (NP3). This net purchase concept provides a measure of the change in current consumer prices that takes account of changes in interest rates, but without exaggerating their impact.

### 3. Hedonics

If older houses are of inferior quality, they will depreciate faster, independent of other effects. To control for the complexities of a heterogeneous housing stock, Kostenbauer (2001) and others including Diewert (2003) have recommended the use of hedonic methods.

A house is the sum of its physical parts such as the building materials used and the method of heating, as well as of its "basic attributes" including the age of the house, the size,

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<sup>14</sup> This approach is recommended by some for judging the effectiveness of monetary policy in meeting its price stability targets. It measures the change in current transaction prices but does not reflect interest rate hikes that might be a concomitant of a tight monetary policy intended to reduce the inflation rate.

<sup>15</sup> A replacement cost index for homes is necessarily based on an index for dwellings. The term "hypothetical" applies because this index must be derived from a question about what the dwelling or serviced lot would sell for separately, though they are sold as a package.

<sup>16</sup> The "likely to be made" qualification is necessary because so many mortgages are terminated before the end of their original amortization period due to renegotiations of the mortgage or the sale of the home.

<sup>17</sup> If a member of the target population buys a home for \$100,000 using cash, that purchase will increase the home purchase weight by \$100,000. If the same home is purchased with a \$75,000 mortgage loan at 13% interest, the interest over the first 10 years of a 20-year amortization period would be about \$87,000, which is almost twice the weight in the owned accommodation index compared with the first purchase, though the purchase price is the same.

<sup>18</sup> A net purchase series based on down payments and discounted mortgage payments is similar to the outlays series on an acquisition basis proposed by Turvey (1981), but he considers allowing changes in terms of credit, including the loan-to-value-ratio, to be reflected in his proposed index.

type of roofing, and so on. Even a highly simplified hedonic approach to housing may go a long way toward managing the heterogeneity problem. As Kostenbauer (2001) notes, the steps are: (a) identify the basic attributes, (b) specify the regression equation relating house prices to the attributes, and (c) estimate the parameters. If the regression is specified in a semi-logarithmic form then the effect of each attribute on the house value is given as a percentage mark-up.<sup>19</sup>

The interpretation of basic cross section hedonic regressions is as follows. Assume that a sample includes a house constructed in 1981 and another in 1982. The price of the two houses differs because (i) the 1981 house is one year older than the 1982 house and (ii) the 1982 house may have different attributes. If the regression successfully controls for differences in basic attributes, the coefficient corresponding to “age of the house” is the estimated premium of a 1982 house over a 1981 house. This is an approach that Statistics Canada is now developing.

#### **4. Selected Empirical Results for a Pilot Update**

The data for this pilot update of the Statistics Canada analytical CPI series are for resale houses in the Ottawa area over the period of 1996 to 2005. The data were obtained from the Multiple Listing Service (MLS) that is managed by the Ottawa Real Estate Board. Information on a large number of dwelling characteristics is included.

The distribution of expenditures over the various components of the OOH services costs is shown in tables 1 and 2. The expenditure share values differ considerably depending on the treatment of OOH services adopted, as would be expected.

Table 3 shows the growth rates over the 1996 to 2005 period obtained using the various measures and the implications at the Shelter and the All-items levels of aggregation for the CPI. The range of differences once the various measures are aggregated to the All-items level can also be seen in this table.<sup>20</sup> Note the slightly less than six percentage point difference between the growth rate in the CPI with the MO1 versus the NP1 approach (21.4% vs. 27% at the All-items level). On a monthly basis the differences are 0.16% vs. 0.20%.

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<sup>19</sup> Thus, the presence of a sunroom will have a greater impact on the price of a more expensive house.

<sup>20</sup> The analytical series for All-items (or housing or shelter) incorporating a given homeownership concept is estimated by taking a weighted average of the series for All-items excluding owned accommodation based on the official concept and the series for owned accommodation based on the given homeownership concept. The expenditure weight for the All-items excluding owned accommodation series is always the same but the weight of the owned accommodation series depends on the given homeownership concept, so that the percentage weight of the All-items excluding owned accommodation series changes.

**Table 1. Distribution of Expenditures for Owned Accommodation for Ottawa, by Homeownership Concept, Based on 2001 Expenditures (%)**

Title	Money outlays (payments) concept				Net purchase (acquisitions) concept	
	Official concept	Rental equivalence concept	Without equity payments (MO1)	With equity payments (MO2)	Based on purchases (NP1)	Based on down payments and discounted mortgage payments (NP3)
Maintenance and repairs	8.6	3.9	10.4	7.5	8.0	8.0
Condominium charges	0.5		0.6	0.4	0.5	0.5
Property taxes (including special charges)	20.7		24.9	18.1	19.3	19.1
Insurance premiums	3.4	1.1	4.1	3.0	3.1	3.1
Mortgage insurance	0.8		1.0	0.7		0.7
Mortgage interest cost	44.1		53.2	38.7		
Replacement cost	17.1					
Real estate commissions	2.4		2.9	2.1	2.2	2.2
Legal fees	0.8		1.0	0.7	0.8	0.8
Other shelter services	1.6		2.0	1.4	1.5	1.5
Equivalent rent		95.0				
Down payment						21.2
Principal fraction of mortgage payments				27.4		
Home purchase					64.6	
Discounted mortgage Payments						42.9
Owned accommodation	100.0	100.0	100.0	100.0	100.0	100.0

Note: Basket shares shown in this table may not exactly sum to 100 due to rounding.

**Table 2. Owned Accommodation's Relative Share, by Homeownership Concept, in 2001 Household Expenditures (%)**

Title	Money outlays (payments) concept			Net purchase (acquisitions) concept		
	The official concept	Rental equivalent concept	Without equity payments (MO1)	With equity payments (MO2)	Based on purchases (NP1)	Based on down payments and discounted mortgage payments (NP3)
Shelter	62.0	63.8	57.5	65.1	63.7	63.8
All-items	17.3	18.4	14.8	19.3	18.3	18.4

**Table 3. Growth Rates, January 1996 to December 2005 (%)**

	Owned accommodation	Shelter	All-items
Official	20.5	23.4	23.6
RE	17.4	21.3	22.1
MO1	12.5	18.8	21.4
MO2	18.5	21.7	22.2
NP1	44.7	38.8	27.0
NP2	32.5	31.1	24.9

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