

**“The Missing Link: Inflation Expectations  
and Inflation Targeting in Canada”**

**by Gregor Smith**

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# Introduction

**I like the paper very much and have no serious criticisms of it.**

**What does the paper do? Two main things:**

- An extensive discussion of what exactly should be the price index that the Bank of Canada should target as a guide to the conduct of its monetary policy?**
- How can we best forecast the target index, given that there are somewhat long lags before changes in monetary policy change real economic variables?**

**I have no comparative advantage in discussing the second main question so I will just refer you to Smith's excellent discussion of the difficulties associated with using a core inflation measure as a predictor of future inflation (lots of problems!).**

**However, I have thought a lot about the first question; i.e., what is an appropriate measure of inflation for a central bank to target so I will concentrate my discussion on this first question.**

**Basically, I agree with Gregor that an appropriate target index is some sort of CPI. In my discussion, I will focus on two problems associated with constructing an index of consumer prices.**

**The two CPI problems are:**

- **The problem of seasonality and**
- **The problem of the treatment of owner occupied housing.**

**After discussing these two problems, I will conclude by looking at Smith's list of recommendations that follow from the analysis that he presents in his paper.**

# The Problem of Seasonality

**As Smith notes on page 4 of his paper, the Bank of Canada has a target range for the inflation rate of 1 to 3 percent where the target rate is measured as the year over year growth in the monthly CPI. I would like to convince you that in the context of seasonal commodities, this target index is not particularly reliable. If I can convince you of this, then I will further try to convince you that a rolling year index is a suitable target index. In order to try and convince you, I will present a simple numerical example.**

**We will consider a very simple example where the consumer only consumes 3 commodities and the time period is a half year (so that there are only 2 seasons).**

- The first commodity is consumed in every period with quantity weight 1;**
- The second commodity is consumed only in the first half of each year with quantity weight 1 and**
- The third commodity is consumed only in the second half of each year with quantity weight 1.**
- For simplicity, the quantity weights remain constant over each half year.**

**Note that the prices in the second half of each year cannot be compared with the corresponding prices in the first half of each year, because the commodity bundles are not comparable. This is an example of what I have called strongly seasonal commodities and it can be seen that this phenomenon leads to difficulties in the construction of period to period indexes, since we cannot really compare the incomparable! (Even if we do not really have strongly seasonal commodities so that Christmas trees are always available in every season, there still will be problems due to changing quantity weights from period to period).**

**Suppose that we have the following price and quantity vectors for 3 years or 6 periods (if the commodity is unavailable during the period, then we enter zeros):**

<b>Period</b>	<b>Quantity vector</b>	<b>Price vector</b>	<b>Value of Expenditures</b>
<b>1</b>	<b>[1,1,0]</b>	<b>[10,10,0]</b>	<b>20</b>
<b>2</b>	<b>[1,0,1]</b>	<b>[11,0,10]</b>	<b>21</b>
<b>3</b>	<b>[1,1,0]</b>	<b>[12,10,0]</b>	<b>22</b>
<b>4</b>	<b>[1,0,1]</b>	<b>[13,0,11]</b>	<b>24</b>
<b>5</b>	<b>[1,1,0]</b>	<b>[14,12,0]</b>	<b>26</b>
<b>6</b>	<b>[1,0,1]</b>	<b>[15,0,13]</b>	<b>28</b>

**Forming year over year price indexes is easy in this context since the quantity weights are constant in this situation; we need only calculate expenditure ratios. Note that Laspeyres, Paasche and Fisher price indexes will all be equal under the above assumptions since the quantity vectors are constant when we construct the year over year indexes.**



**The sequence of year over year indexes for the first half of each year are as follows:**

**$1/1 = 1$ ,  $3/1 = 1.10$ ,  $5/3 = 1.18$ .**

**The sequence of year over year indexes for the second half of each year are as follows:**

**$2/2 = 1$ ,  $4/2 = 1.14$ ,  $6/4 = 1.17$ .**

**There is nothing wrong with the above indexes; they certainly could be used as target indexes by the Bank of Canada. Thus the overall sequence of year over year indexes running from period 3 to 6 is:**

**1.10, 1.14, 1.18, 1.17.**

**(Problem: how much inflation is there going from period 1 to 2? We address this later.)**

**However, this is not how a CPI is constructed.**

**Instead of using seasonal baskets, an annual basket is used and the prices for the missing categories (that are out of season) are imputed.**

**There are two main methods of imputation:**

- Just carry forward the last price that was observed (this is obviously not good!) or**
- Impute the movement of the missing price by the movement in a similar category (this is much better!).**

**We will recalculate our CPI using the annual basket [1, 1/2, 1/2] using the second method of imputation.**

**In order to impute the missing prices, we will use the movements in the price of the first (always available) commodity. The resulting sequence of imputed expenditures (using the constant quantity basket [1,1/2,1/2]) is:**

**19.55, 21.50, 19.95, 23.92, 25.92, 27.43.**

**The sequence of actual expenditures is:**

**20, 21, 22, 24, 26, 28.**

**It can be seen that the actual and imputed expenditures only line up approximately. Thus when we calculate the year over year rates of CPI growth using the above imputation methodology, we will get very different results from the “truth”.**

**Using the imputed CPI, we obtain the following year over year results:**

**3/1: Imputed CPI = 1.02; Correct y/y CPI = 1.10**

**5/3: Imputed CPI = 1.30; Correct y/y CPI = 1.18**

**4/2: Imputed CPI = 1.11; Correct y/y CPI = 1.14**

**6/4: Imputed CPI = 1.15; Correct y/y CPI = 1.17**

**Thus there can be very large differences between the “true” year over year CPI that uses seasonal weights compared to the traditional annual weights CPI that uses imputed prices for missing items. I hope that I have convinced you that this is a nontrivial problem. I will finish off my seasonal discussion by defining rolling year indexes.**

**A problem that we mentioned earlier is that using the year over year indexes with seasonal weights does not tell us how much inflation is there going from period 1 to 2. We can address this problem by using a rolling year methodology (which is a generalization of the Mudgett Stone approach to annual indexes, which treats each commodity in each season as a separate commodity). Initially, we could compare prices and quantities of any two consecutive half years with the corresponding prices of the two half years in the base year. This leads to a sequence of rolling year indexes. A refinement is to center these rolling years by taking  $\frac{1}{2}$  of the quantity weight for the first half year in a sequence of 3 consecutive half years, full quantity weight for the middle half year and  $\frac{1}{2}$  of the quantity weight for the third half year and compare this rolling centered year with the corresponding rolling centered year consisting of the first 3 half years. When we do this, we get the following sequence of expenditures for rolling years starting with the centered rolling year at period 2:**

## **Rolling year centered at**

<b>Period</b>	<b>Rolling year expenditure</b>
<b>2</b>	<b>42</b>
<b>3</b>	<b>44.5</b>
<b>4</b>	<b>48</b>
<b>5</b>	<b>52.</b>

**Thus the centered period price index series running from period 2 to 5 is**

**1, 1.06, 1.14, 1.24.**

**If we use the annual weights CPI, we obtain the following comparable series:**

**1, .93, 1.11, 1.21, which is way off in period 3.**

**The above numerical example illustrates why the problem of choosing an accurate target CPI is nontrivial in the context of seasonal commodities.**

**It also illustrates why I like the centered rolling year index as a target index since it has the following desirable features:**

- No imputations are necessary;**
- It essentially smooths volatile subannual year over year indexes in a reproducible way;**
- It is conceptually sound.**

**However, it has the drawback of not being timely! (I do not see this as a huge problem; timely indexes can be used to predict the target index but we should have a conceptually solid target index in mind.)**

# **The Problem of Owner Occupied Housing**

**Smith (page 10) mentioned that there are 5 main approaches that could be used to value the price of Owner Occupied Housing (OOH) in a CPI:**

- (1) Omit it from the index (which is what is done in the Eurostat's Harmonized Index of Consumer Prices (HICP));**
- (2) Use the acquisition price; i.e., just use the price of new additions to the housing stock;**
- (3) Calculate the price that the house could rent for in the marketplace (rental equivalence price);**
- (4) Calculate the user cost of the house or**
- (5) Take the max of (4) and (5), the opportunity cost approach (see Diewert (2007)).**

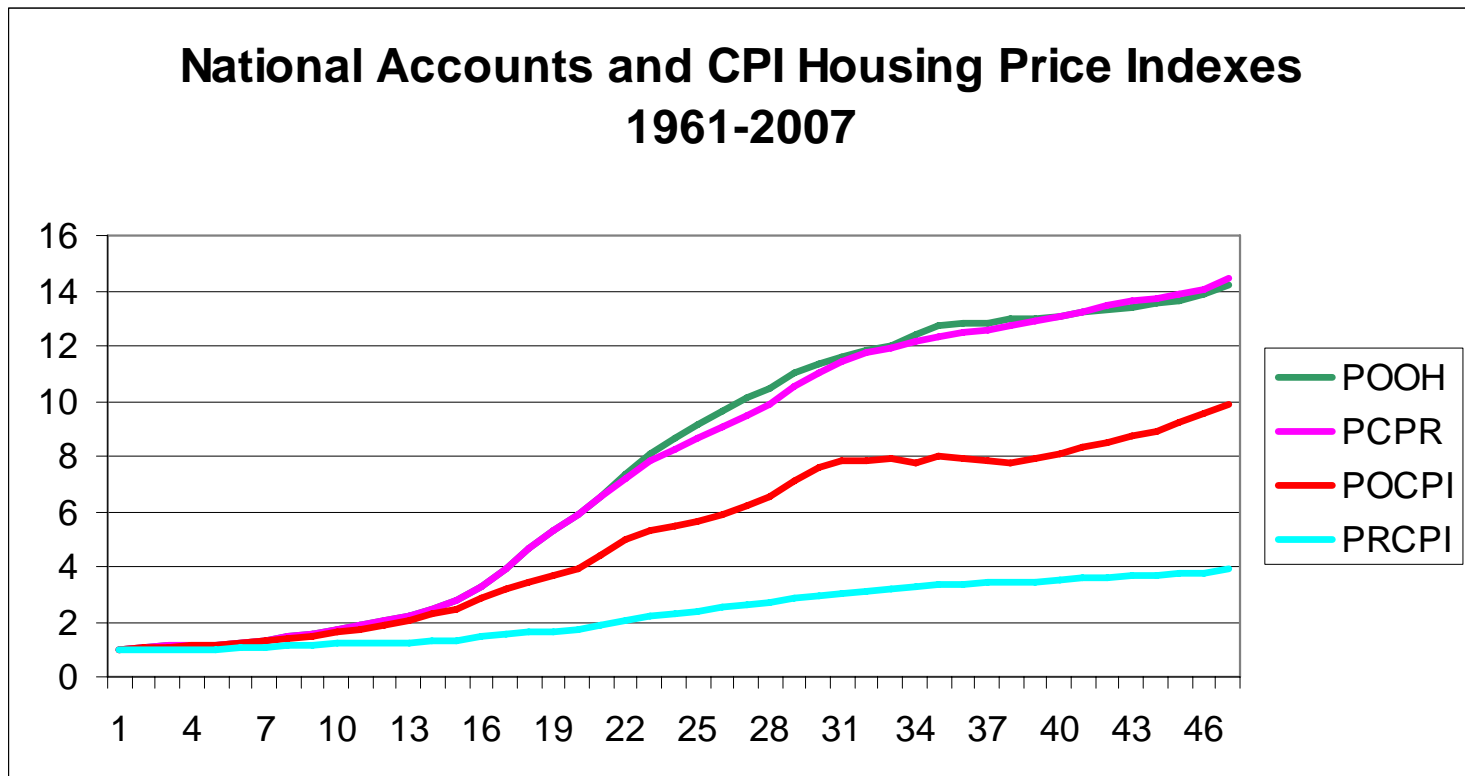


**There are some additional variants that are used in CPI's; for example, Statistics Canada describes its approach as a user cost approach (but their user cost omits an expected inflation term and includes only nominal mortgage interest with no allowance for the equity opportunity cost of capital so I would not regard this concept as a user cost).**

**Given the large weight of owner occupied housing in the average CPI (15 to 25%), the different treatments of OOH can make a huge difference to the CPI.**

**I will attempt to illustrate some of these differences for Canada over the past 48 years.**

**POOH=Price of OOH (national accounts)**  
**PCPR=Price of rental housing (national accts)**  
**POCPI=Price of owned accommodation (CPI)**  
**PRCPI=Price of rented accommodation (CPI)**



- **It can be seen that the national accounts price indexes for rental housing and owner occupied housing are pretty much the same which at first glance seems OK, since they are using a rental equivalence approach to OOH**
- **The 2007 price indexes are POOH=14.2, PCPR=14.5, POCPI=9.9, PRCPI=3.9. Amazing differences! Remember, these indexes should be similar!**
- **For an excellent discussion of the CPI housing indexes, see Baldwin and Mansour (2003).**
- **What should we believe? Probably none of the above, but the national accounts estimates seem closer to the “truth”.**

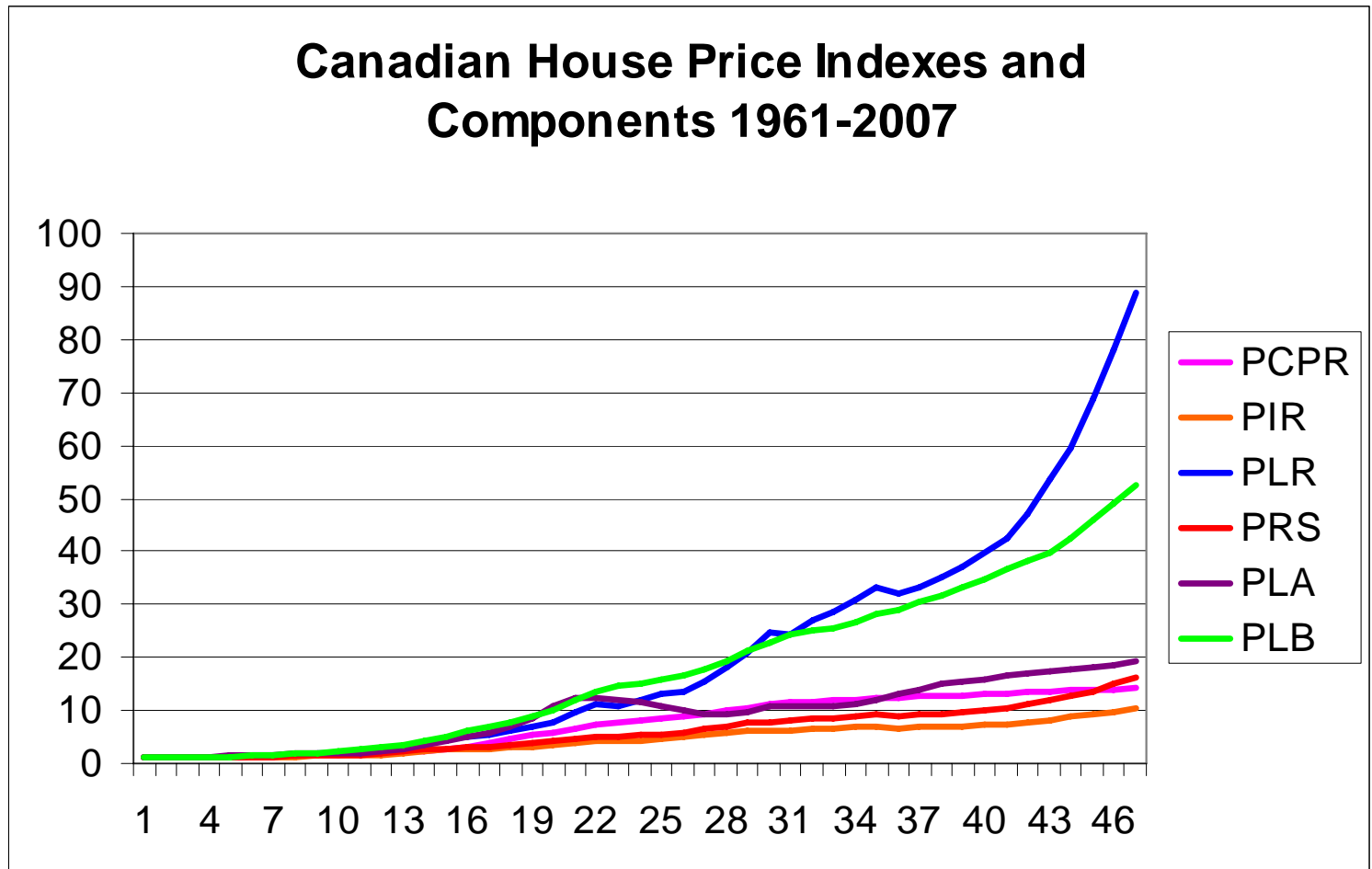
**PCPR=Price of rental housing (national accts) 14.5**

**PIR=Price index for residential construction (nat accts) 10.5**

**PLR=Price index for residential land (my estimate) 88.9**

**PRS=Price index for res housing services (my estimate) 16.3**

**PLA=Price index for agricultural land (my estimate) 19.3**



- In the previous graph, I show the ingredients of the user cost of residential housing: the stock price of residential structures and the price of residential land (business and ag land shown for comparison purposes).**
- The user cost of residential structures is approximately equal to  $(r+d)*PIR$  and of land is  $r*PLR$  where  $d$ =structures depreciation rate (assumed to be 4%) and  $r$  is an average gross real rate of return on housing investments (includes property taxes) which we took to be 6% since this lined up with the national accounts data on average.**
- A chained Fisher aggregate of residential structures and land is the series PRS, which should be comparable to the national accounts series PCPR and POOH (which are the same). My PRS grows much more rapidly than PCPR in recent years, which I think is more credible than PCPR.**
- Basically, the rental equivalence approach is not accurate for more expensive dwelling units.**

**I hope that I have convinced you that constructing estimates for the price of owner occupied housing is a nontrivial task and we should be allocating more resources to measuring this component of price inflation.**

**The conclusion of Baldwin and Mansour (2003; 16) is relevant here:**

**“This research has shown that the Consumer Price Index is indeed sensitive to the choice of the concept of homeownership that is used in the CPI. Although there is no single correct concept, there is an appropriate one depending on the concept of the CPI one is attempting to measure. Of all the analytical series that Statistics Canada has calculated relating to the CPI, the analytical owned accommodation series are potentially the most interesting and useful to policymakers, analysts and the general public. Ideally, these series would be updated every month, along with the official CPI.”**

## **Recommendations**

**Basically, I agree with Smith's recommendations. He has two sets of recommendations which I will repeat here.**

### ***Gregor's Operational Guide Recommendations***

- 1. The Government of Canada could issue real return bonds with maturities of 1, 2, and 5 years.**
- 2. A combination of institutions could regularly survey professional forecasters, so that we gradually assemble a panel of their inflation forecasts.**

## *Gregor's Target Index Recommendations*

- 1. The Bank should revisit its estimates of the bias in the CPI inflation rate on a regular timetable, rather than intermittently.**
- 2. Statistics Canada should update its CPI basket more frequently than every four years. Ideally the updating would be annual. (The existence of the CPIC doesn't obviate the need for this; it too uses stale weights several years out of date.)**
- 3. Statistics Canada could improve its treatment of owner-occupied housing in the CPI, and perhaps also release information that would allow researchers to study alternative treatments.**
- 4. Statistics Canada should try to estimate a monthly, chained, superlative index (with a delay) as is done by the BLS with its C-CPI-U. Despite the delays and revisions that naturally arise with this sort of index, it would improve our tracking of inflation and so would complement the existing CPI.**
- 5. But I would go further and argue that the Bank of Canada should target the inflation rate in this new, superlative index instead of the CPI inflation rate.**

**When I read a preliminary version of Gregor's paper, I suggested that he make a list of recommendations that followed from his analysis and he has done so.**



## **Erwin's 7 recommendations:**

- **Statistics Canada should update its CPI basket more frequently than every 4 years; the updating should preferably be on an annual basis.**
- **The CPI unit of Statistics Canada should endeavor to estimate a superlative index on a delayed basis as is now done by the BLS.**
- **The Bank of Canada should revisit its bias estimates for the CPI on a regular basis rather than on the present intermittent frequency.**
- **It would be good if the author could be more explicit on what his ideal choice of the target index should be; i.e., presumably, he would want to smooth the current month to month CPI which has some degree of volatility and seasonal movements but *exactly* how would he construct the target index?**
- **The present treatment of Owner Occupied Housing in the CPI is problematic. Statistics Canada should choose one of the 5 alternative methodological choices and put it into its headline measure and make other alternatives available as analytic series on a regular basis.**
- **The Bank of Canada, having chosen a target index, should systematically investigate which core inflation measure (constructed by the many variants of exclusion and trimming) best predicts the target measure.**
- **The Government of Canada should issue short maturity real interest bonds.**

# Conclusion

- **Smith's paper has many useful recommendations which should be taken seriously by the Bank of Canada and Statistics Canada**
- **Of the two problems that I highlighted in my discussion, I regard the owner occupied housing problem as the bigger of the two. Seasonality will only cause us difficulties if price movements in seasonal commodities are significantly different from the nonseasonal movements.**

## **Additional Reference:**

**Baldwin, A. and E. Mansour (2003), Different Perspectives on the Rate of Inflation, 1982-2000: The Impact of Homeownership Costs, Research Paper, Statistics Canada, Industry Measures and Analysis Division and Prices Division 13th Floor, Jean Talon Building, Ottawa, K1A 0T6.**