INSTITUT C.D. HOWE INSTITUTE
Essential Policy Intelligence | Conseils indispensables sur les politiques

E-BRIEF

August 12, 2015

MONETARY POLICY

Improving on the CPI: A Proposal for a Better Inflation Indicator

by
Finn Poschmann with Aaron Jacobs

- The Bank of Canada's inflation targeting regime is due for review in 2016, which invites analysis of how inflation is measured for the purpose of conducting monetary policy. There are limitations to any measure, including the Bank's current ones, the Consumer Price Index (CPI) calculated by Statistics Canada, and its core CPI, known as CPIX, which excludes the eight most volatile components, such as fruit and gasoline prices, and mortgage interest costs.
- Statistics Canada does not directly measure the price of resale homes in its CPI, spending on which is an important component of household spending. This should be addressed.
- Meanwhile, the Bank of Canada emphasizes its version of core CPI – CPIX – as its operational guide to monetary policy and in the Bank's communications. It should not provide this measure such pride of place, because it is difficult to interpret, for reasons including ambiguity over whether a measured inflation shock is persistent or transitory.
- The Bank of Canada should instead emphasize a so-called "common component" estimate of inflation pressures, adjusted for housing purchases, which would look through relative price changes and temporary price shocks. This measure should displace what is currently called core inflation in Bank communications.

The federal government and the Bank of Canada now have more than two decades' experience operating under an objectively successful inflation-targeting agreement, which is due for review in 2016.

We thank Steve Ambler, Andrew Baldwin, Erwin Diewert, Paul Jenkins, David Laidler, David Longworth, staff at the Bank of Canada, Statistics Canada, and numerous colleagues at the C.D. Howe Institute, for input and advice, while absolving all of remaining errors. We also thank Mati Dubrovinsky for his extensive statistical assistance at early stages.

Under the agreement, the Bank's role is to conduct monetary policy with the aim of keeping the annual rate of inflation, as measured by the headline consumer price index (CPI) calculated by Statistics Canada, at an annual rate between 1 and 3 percent, with a central target of 2 percent. In its communications, the Bank explains that it employs core CPI, a measure that excludes volatile components such as food and energy, as its operational guide to its monetary policy conduct within the inflation-targeting framework.[1]

A reliable measure of inflation pressure is important to the conduct of monetary policy, which operates with a long and variable lag, and particularly so in an inflation-targeting framework such as Canada's.

Canada's consumer price index, however, is but one form of a cost of living measure. It is clearly useful in some contexts, such as providing input in adjusting tax thresholds and benefits, rents, or wage contracts. But these uses do not address monetary policy's needs, which are best met by capturing a very broad measure of the growth of money and credit relative to the supply of goods and services that money buys: when growth in money and credit outstrips the supply of goods and services, inflationary pressure results.

This E-Brief recommends changing how the consumer price index is calculated, and how derivations of it are employed for the purpose of understanding and communicating monetary policy.

We identify two weaknesses of the CPI and its core inflation counterpart. The first relates to Statistics Canada's construction of the CPI. The index treats owner-occupied housing on a modified "user-cost" basis, rather than measuring actual expenditures on purchases of such housing. Homeowners' costs are interpreted as if they rent the home to themselves. While interest costs on mortgages are included in the CPI's measure of housing costs, the actual purchase prices for homes are not. As a result, the value for replacement housing costs is the only subcategory within the CPI basket that relies on an imputation.[2]

The second weakness concerns exclusions from the core CPI. Determining which components are volatile, and therefore excluded from core inflation, rests on the historical volatility of price categories within the CPI's basket of goods and services. For the most part, this is reasonable. Temporary fluctuations in food prices or competitive market forces that briefly compress or expand retail gasoline price margins are not factors that logically bear on the conduct of monetary policy.

However, market conditions, such as long-term energy supply or demand shocks, may reflect semi-permanent relative price changes, with eventual spillovers elsewhere in the economy. To ignore such impacts, on the basis that the sector generating them is among the volatile group, may lead monetary conditions to be misperceived, and appropriate monetary policy action to be unduly delayed or hastened. Whether it is appropriate to ignore a sharp energy price decrease or increase may only be determined long after the fact, if then.

1 The Bank's rationale for doing so is explained at some length in Hogan, Johnson and Laflèche (2001).

2 The CPI basket refers to the distribution of household spending across product and service categories, which are the components and subcomponents of the consumer price index. The weight attached to price changes in each component, in calculating the CPI, depends on its share of total household spending.

This militates for an agnostic view of the inflation measuring mechanism, not one captive to the language of core versus headline inflation and therefore subject to the fallacy of assuming that any individual price is determined independently of all other individual prices.[3]

In what follows we discuss housing price adjustments to the CPI, and what is termed the common component model for estimating consumer price inflation (following Khan, Morel and Sabourin 2013), which employs no prior assumptions regarding the inflation mechanism.

After discussing changes to the CPI methodology, we examine how using different data would have affected the CPI in the past, then make recommendations for how the data might be interpreted in the conduct of monetary policy.

How to Better Account for Housing

Statistics Canada employs in its estimates of the CPI a modified user-cost approach to account for the cost of owned accommodation. This means that owned homes are treated as if the owner rents it to him or herself. The methodology includes a term for spending on mortgage interest and, in estimating the replacement cost of a home, imputes a value to the dwelling, exclusive of land, based on suppliers' estimates of the dwelling value in new builds. Actual spending on new or resale homes only indirectly enters the CPI.

Canada's current CPI is reasonably well designed as a cost of living indicator. It is less well designed as an indicator of inflationary pressures or lack thereof, which is most important in the conduct of monetary policy:

> [H]ow a purchase is financed matters for a cost-of-living indicator. In the case of the housing market for instance, higher borrowing costs would (everything else constant) negatively affect the state of household finances. Such considerations would not be welcome in an inflation indicator; in fact, in this example, higher costs of borrowing work in the opposite direction: by making consumption and investment more expensive, higher borrowing costs tend to lower inflationary pressures. (Bergevin 2012, fn8).

How best to account for owned accommodation in a price index is the subject of extensive debate, notably Baldwin (1985, 2011), Baldwin and Mansour (2003), Baldwin, Nakamura and Prud'homme (2009), and Bergevin (2012). The biggest issue is with the inclusion of mortgage interest costs. When interest rates rise, other things being equal, housing prices and inflation pressures are likely going down, while the standard CPI would report them as going up.[4] The approach we describe here does not suffer from this oddity, and we believe it is a truer representation of the (replacement) cost of owned accommodation.

3 To illustrate: The statements, "the headline consumer price inflation rate rose above target owing to a sharp increase in food prices," and "core inflation running below target indicates lack of inflationary pressure," are equally fallacious. In the first instance, one might as easily have said "…above target because nonfood prices did not fall by as much as food prices rose," and the second obscures the fact that volatile components of the index might have experienced a long term relative price shock. Rising inflation in the monetary sense can only mean that money is being created at a rate such that its supply exceeds production of goods and services at prior prices, and estimation of such must rely on aggregate measures. Meaningful mechanistic interpretation of individual components, in the monetary policy context, is not contemporaneously possible.

4 Two forces affect total mortgage payments: the amount borrowed, and the mortgage interest rate. A fall in the latter pushes the mortgage payments downward, which the headline CPI currently reflects. Higher demand for housing, however, pushes the former upwards. This dynamic is lost in the current headline CPI.

The main opposition to the net purchases approach is based on the observation that owned housing, and the land to which it is attached, are assets that have "investment good" characteristics as well as "consumption good" properties. This may be true to a limited extent, yet for monetary policy purposes we see no reason to treat net housing purchases differently from any other durable assets – the latter are treated on a simple purchase value basis. More on this discussion appears in Diewert et al. (2009) and in Bergevin (2012), whose approach we follow.

In the data we present below, we implement a simplified version of the net purchases approach described in this literature, and present updated Canadian data.

Our method is simple: we replace elements of the owned accommodation component in the current CPI (mortgage interest and replacement cost) with a resale price index, in this case the Teranet/National Bank Financial House Price Index.[5,6]

The net purchases approach produces, relative to the official CPI, an overall measure of inflation that shows sharply higher upward pressure in the early through middle years of the past decade, as expected given a run-up in resale housing prices through 2008, and a similar pattern since early 2010 (Figure 1).

How to Measure Inflation Agnostically

Given that a robust measure of inflation pressure is important to the conduct of monetary policy, the limitations of the CPI also become important. Temporary factors or relative price shifts within the CPI can make it difficult to interpret for monetary uses, as implicit in the following Bank of Canada overnight rate announcement:

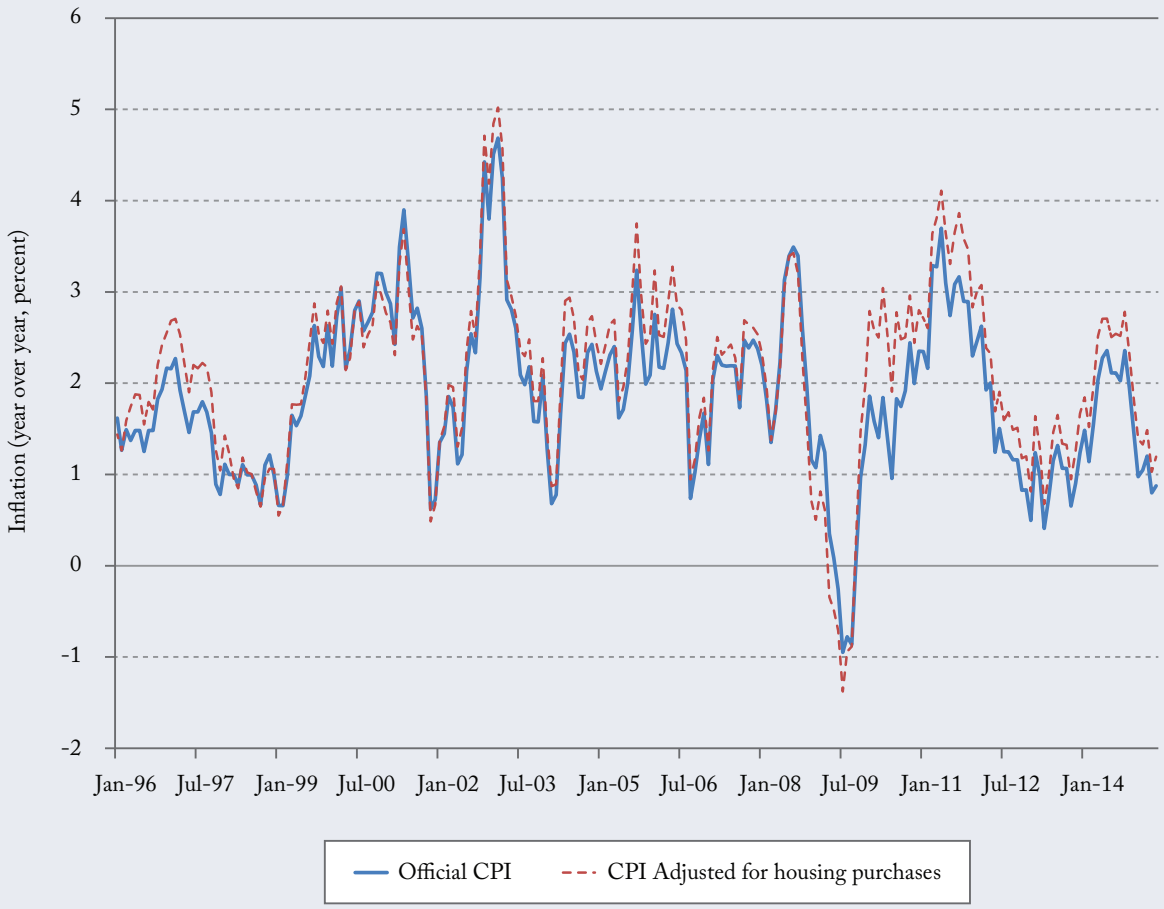
> Inflation has risen by more than expected. The increase in inflation over the past year is largely due to the temporary effects of a lower Canadian dollar and some sector-specific factors, notably telecommunications and meat prices. (Bank of Canada 2014).

Such language in the Bank of Canada's communications may cause confusion over the weight the Bank places on achieving its inflation target in the near term. And uncertainty over the meaning of "temporary" factors is compounded in discussion of the Bank of Canada's operational target or core CPI, meaning the CPIX, which strips out eight of the most historically volatile CPI components, such as fruits and vegetables and mortgage interest. "[E]xcluding some of the most volatile components from the CPI doesn't guarantee that the resulting measure will always be smooth. Some components included in CPIX (for instance, electricity) have shown fairly

5 Two notes on procedure. We do not adjust any of the indices for changes in indirect taxes, and leave property taxes with their current weights, for simplicity of calculation; this is a departure from other methodologies discussed above. To generate historical series for resale housing prices, we backward-link, for years 1999 and prior, the Teranet/National Bank Financial index using Multiple Listing Service historical indices published by the Canadian Real Estate Association. Note that the house price index we use does not allow for a depreciation adjustment, which would be a perhaps desirable feature of an index used for the purpose at hand.

6 CPI data are taken from CANSIM Table 326-0020. We use a recent CPI basket as published by Statistics Canada (2011 weights and prices; http://www23.statcan.gc.ca/imdb-bmdi/document/2301_D48_T9_V2-eng.htm). Following the fall in borrowing rates in late 2008, Statistics Canada decreased the expenditure weight of owner occupied housing in its official CPI measure. Since we use the same weight (minus the weight on taxes) for our housing price series, our final CPI measure is potentially conservative and biased downwards.

Figure 1: Headline CPI and Housing Prices Tell Similar Stories – not Identical Ones



Sources: Authors' calculations, Statistics Canada CANSIM, Teranet / National Bank Financial, Canadian Real Estate Association.

high volatility in recent years, while others, such as the prices of autos and certain regulated services, have tended to move countercyclically, thereby obscuring the relationship between CPIX and the output gap" (Côté 2014).

Such interpretive difficulties militate for avoiding speculation over whether component shifts are temporary, over whether volatile components should be captured, or over what is a volatile component.

Instead, we recommend the Bank of Canada limit the use of, and reference to, its core inflation measure as currently defined, and highlight for operational and communication purposes the "common component price index," which we label CCPI.[7]

The CCPI concept is quite simple. Instead of weighing each subcomponent by its share of household spending (the "basket weights" used to compute headline inflation), we choose weights that explain as much of the overall movement in prices as possible since April 1986.[8] We then employ these weights to generate the new index.[9] By definition this captures the impact on prices of the growth rate of money relative to the growth rate of production activity in the economy as a whole, and by definition it ignores temporary or uncorrelated price changes, whatever they may be.[10]

This approach views the estimation of underlying inflation as a signal extraction problem, as described in Cutler (2001), and therefore extracts the factors within the CPI that are persistent. In doing so, the methodology specifically addresses the goal described in Blinder (1997): to search for an estimator that takes into account the persistence of each component and the extent to which those components co-vary with overall inflation.

Our chosen weights, in the common component model, capture about 20 percent of the total variance of the price indices, reinforcing the fact that much of the movement in the headline CPI is driven by shocks to specific components. The arithmetic of the approach produces a series necessarily smoother than most other CPI measures and, when the CCPI adjusted for housing purchases is compared with headline CPI, displays some interesting properties (Figure 2). First, the common component measure rested above the 2 percent target for an extended period in the early part of the 2000s. Meanwhile, headline CPI showed periods of being well below and occasionally above target during the period and, similarly, from year-end 2005 through year-end 2007. The CCPI is thus indicative of inflation pressures that were not reflected in headline CPI.

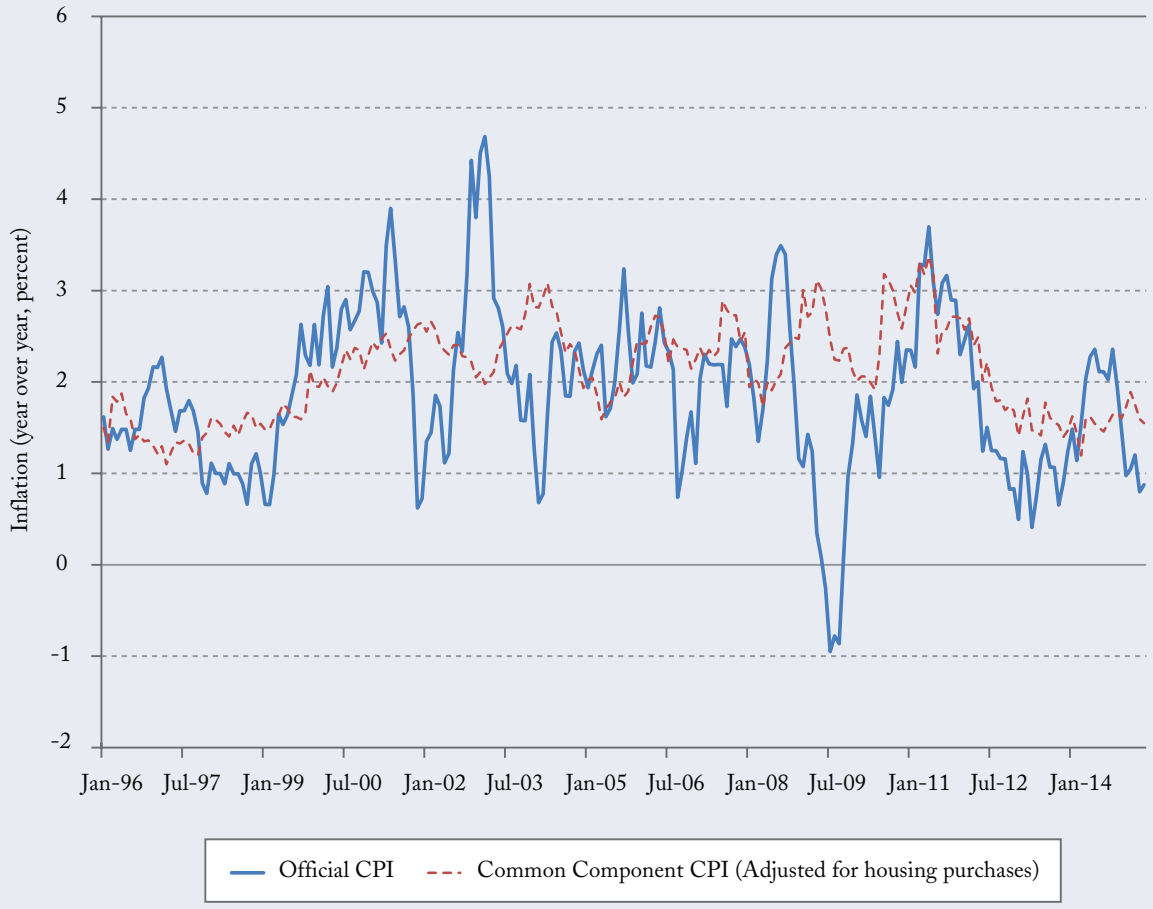
7 This possibility is raised, in the context of the planned 2016 review of the inflation-targeting program, in Côté (2014).

8 This is when Statistics Canada assigned the housing and shelter components of the CPI their current definitions.

9 Formally, we are extracting the first common factor, as computed by the method of principal components, and using this factor to fit a single price index. Our methodology largely follows Khan, Morel and Sabourin (2013), who also found (a) that a dynamic factor model did no better than our static model, and (b) that using a single factor was the optimal statistical choice. We depart from KMS in using a more fully disaggregated 167 CPI subcomponents, rather than the 54 categories in KMS, and replace the owner occupied housing measures of mortgage interest and replacement cost with the Teranet / National Bank Financial housing purchases index. To limit concerns about nonstationarity and seasonal patterns, we take first differences of the indices and use normalized year-over-year growth rates for each index. The first common factor explains about 20 percent of the total variance, as in KMS (the second common factor explains just under 11 percent of the total variance, and the third less than 7 percent), we multiply it by the standard deviation of the official CPI over time, and add its mean. This forces the CCPI's average rate of increase over time to match the CPI's, for ease of exposition.

10 Perhaps owing to its conceptual usefulness, the Bank of Canada in fact calculates and publishes quarterly a common component price index (http://www.bankofcanada.ca/rates/indicators/capacity-and-inflation-pressures/).

Figure 2: The Common Component Model Picks Up Underlying Trends



Sources: Authors' calculations, Statistics Canada CANSIM, Teranet / National Bank Financial, Canadian Real Estate Association, Bank of Canada.

Second, from early 2010, when recovery from the prior recession was fully in swing, the CCPI was likewise above target, presaging the long subsequent period when headline CPI was well above target.[11] These various instances suggest that Canada's monetary policy stance might have been different, and often more aggressive, had it paid attention to the underlying trends revealed by a common component approach that properly accounted for housing prices.

11 In line with Khan, Morel and Sabourin (2013), we find that the Bank of Canada's measure of the gap between actual and potential economic output is a reasonable lagged predictor of the CCPI, lending further conceptual and empirical support to the approach, and addressing in part the concern noted above in Côté (2014).

Box 1: Evaluating the Common Component CPI versus Other Measures of Core Inflation

How should we assess whether the common component CPI is any more useful to monetary policy than the core CPI (the CPIX) that is used today? One key performance comparison is how well these measures of inflation today inform the Bank about the headline inflation rate in the longer term, usually 6, 12, and 18 months into the future.

To assess the predictive power of a core inflation indicator, Bergevin and Busby (2011) suggest regressing the gap between headline and the chosen inflation measure today on the gap between headline inflation 18 months from now and today. In their sample of the various measures of core inflation over 2002-2011, they conclude that the CPIX is indeed the best indicator of headline inflation 18 months out. We follow this approach in Table 1, and include nearer-term horizons for further context: numbers closer to 1 indicate better predictors.

Generally, we find that the predictive power of the CPIX has declined substantially[a] with the inclusion of the years since 2011, and that the CCPI is overall a much better indicator of future headline inflation[b] than both CPIX and the two other core inflation alternatives computed by the Bank of Canada. This provides further confirmation that a statistical construction might better inform decisions about inflation than one constructed in a more ad hoc fashion. Notice also that almost all measures improve in predictive power as the horizon is moved farther into the future.

a More formally, the coefficient of the difference between headline and core inflation in the model used in Bergevin and Busby (2011) has moved from 1.162 to 1.264, farther away from an optimal 1.

b When adjusted for our new indices of owner-occupied housing, as indicated in earlier sections.

Table 1: CCPI is an Efficient Predictor of Future Inflation

Months	CPIX	CPIXFET*	CPIW**	CCPI
6	0 .730	0.696	0.709	0.647
12	1.324	1.145	1.268	1.075
18	1.264	1.093	1.290	0.977

* CPIXFET is CPI excluding food, energy, and the effect of changes in indirect taxes.

** CPIW is a CPI wherein each component is multiplied by a weight inversely proportional to its volatility, adjusted to exclude the effect of changes in indirect taxes.

Finally, over much of the past year the CCPI has been on a steady trend upward toward the 2 percent target, suggesting that the recent surges and drops in headline CPI may have been distractions in seeking to understand underlying inflation pressures. We evaluate, in Box 1, the performance of the CCPI, compared to other indicators, with respect to its predictive power as a measure of inflationary pressure.

Objections to the approach

During review of this paper, readers of an earlier version raised a number of issues that we address in turn.

Issue one: Choice of weights for owner-occupied housing: The current CPI's weight on owned-housing is higher than appropriate for an index that aims only to measure prices for net purchases of resale homes.

We tested a range of lower weights – results employing half the current CPI's weight are displayed here – which reduced the volatility of the results of the revised CPI, while retaining underlying trends. Considerations for future work could include an adjustment for new home purchases, and for condominium sales, for which Statistics Canada is currently constructing an index.[12] Further refinements would include adjustments for changes in indirect taxes.

Issue two: The common component weighting mechanism: This approach applies weights to index components according to the extent to which they explain, arithmetically, the persistence of overall index changes, rather than applying weights according to household spending on those components. This makes the measure sensitive to the degree of disaggregation of the index's components and subcomponents.

Khan, Morel and Sabourin (2013) employed different disaggregations, and neither they nor we found significant impacts on the results.

Issue three: The common component methodology is subject to revision: Because the common component approach reflects the persistence or predictive capacity of the numerous components within the CPI, new data over time will change the result.

Khan, Morel and Sabourin (2013) tested the extent of this influence, and found it to be small, shrinking over time, and not of significant concern.

Issue four: Difficulty in communicating the common component methodology: Bank of Canada communications emphasize core inflation, as measured by CPIX, as the Bank's operational target, and it is widely reported. The common component methodology is little understood.

To address concern over messaging, in elevating the use of the common component approach, the Bank might simply refer to "underlying inflation." For example, the Reserve Bank of New Zealand's topline measure of inflationary pressure (after headline CPI) is their "Sectoral factor model estimate of core inflation," sometimes referred to simply as core, and it is a common component estimate. The Bank of Canada may wish to adopt this approach of simply redefining what is called core.

12 Readers also expressed concern over the use of a proprietary data set in constructing the index. Were this regarded a significant concern, Statistics Canada could consider constructing its own resale price index.

Recommendations and Conclusion

Our conclusion is straightforward. The net purchases approach to accounting for owned accommodation makes for a more logical and comprehensive CPI, and Statistics Canada should consider employing it. The concern is most obvious and pressing in the context of the status quo treatment of mortgage interest which, during a time of falling interest rates, puts downward pressure on the CPI measure, when the cost of purchasing owned accommodation is rising.

Second, the common component approach to measuring inflation pressures, for monetary policy purposes, is superior to the CPI and most variations of it; the CPI was not designed with monetary policy in mind. Accordingly, the Bank of Canada should elevate the CCPI to a prominent role, displacing CPIX as the Bank's main or operational guide to policy, and duly highlight it in Bank communications, while retaining the Bank's current inflation target.

References

Baldwin, Andrew. 1985. "Analytical Consumer Price Index Series for Owned Accommodation." Supplement to Cat. 62-010, Consumer Prices and Price Indexes, July to September 1985.

————. 2011 "A Better Inflation Indicator: A CPI with a Net Purchases Approach to Owned Accommodation, 2005-2010." Paper presented to the 2011 annual meeting of the Canadian Economics Association.

Baldwin, Andrew, Alice O. Nakamura, and Marcel Prud'homme. 2009. "Different Concepts for Measuring Owner Occupied Housing Costs in a CPI: Statistics Canada's Analytical Series." In *Price and Productivity Measurement: Volume 1 – Housing*. Diewert, W. Erwin, Bert M. Balk, Dennis Fixler, Kevin J. Fox and Alice O. Nakamura (eds). Trafford Press. 151-160.

Baldwin, Andrew, and Emad Mansour. 2003. "Different Perspectives on the Rate of Inflation, 1982-2000: The Impact of Homeownership Costs Treatment of Owner Occupied Accommodation in the CPI." Catalogue no. 62F0014MIE – No. 16.

Bergevin, Philippe. 2012. *Housing Bubbles and the Consumer Price Index: A Proposal for a Better Inflation Indicator*. Commentary 362. Toronto: C.D. Howe Institute. September.

Bergevin, Philippe, and Colin Busby. 2011. "Core, What is it Good For? Why the Bank of Canada Should Focus on Headline Inflation." E-Brief 124. Toronto: C.D. Howe Institute. September.

Blinder, Alan. 1997. "Commentary for 'Measuring Short-Run Inflation for Central Bankers.'" *Federal Reserve Bank of St. Louis Review*. St. Louis: Federal Reserve Bank of St. Louis. May/June.

Côté, Agathe. 2014. "Inflation Targeting in the Post-Crisis Era." Remarks by Agathe Côté, Deputy Governor of the Bank of Canada, Calgary CFA Society. November 18. http://www.bankofcanada.ca/2014/11/inflation-targeting-post-crisis-era/

Cutler, Joanne. 2001. "Core Inflation in the UK." Bank of England MPC External Unit Discussion Paper No. 3. London: Bank of England. March.

Diewert, W.E., Alice O. Nakamura, and Leonard I. Nakamura. 2009. "The Housing Bubble and a New Approach to Accounting for Housing in a CPI." *Journal of Housing Economics*, 18:156-171.

Hogan, Seamus, Marianne Johnson, and Thérèse Laflèche. 2001. "Core Inflation." Bank of Canada Technical Report No. 89. Ottawa: Bank of Canada. January.

Khan, Mikael, Louis Morel, and Patrick Sabourin. 2013. "The Common Component of CPI: An Alternative Measure of Underlying Inflation for Canada." Bank of Canada Working Paper No. 2013-35. October.

This E-Brief is a publication of the C.D. Howe Institute.

Finn Poschmann is Vice President, Policy Analysis, at the C.D. Howe Institute.

Aaron Jacobs is a Researcher at the C.D. Howe Institute.

This E-Brief is available at www.cdhowe.org.