# John Murray: Measuring inflation – methodology and misconceptions

Remarks by Mr John Murray, Deputy Governor of the Bank of Canada, to the Certified General Accountants of Ontario, Toronto, 18 September 2008.

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These past few months have been busy for central bankers, to say the least, and the past few days are certainly no exception. While developments on Wall Street have garnered much attention, the cost of living has also been an issue for us all, whether we're buying gas at the pumps, booking an airline ticket, or just picking up a loaf of bread at the grocery store. Of course, the cost of living is always front and centre for us at the Bank of Canada, where our primary monetary policy objective is to ensure that inflation remains low, stable, and predictable over the medium term. Some periods, however, are clearly more challenging than others in terms of meeting this objective. To set effective policies in both tranquil and turbulent times, we must understand what drives inflation and be able to anticipate its future movements.

So tonight I'd like to talk in some depth about inflation: exactly what it is, how we measure it, and how we gauge the underlying economic pressures that cause it to rise or fall. I'd particularly like to discuss the Bank of Canada's "core measure" of inflation, and explain why and how it is used by the Bank as an operational guide for monetary policy. I've chosen this topic because of its timely nature, as we now see rising price pressures in various forms. Along the way, I'd like to use this examination of core inflation to highlight for you just how important the Bank's research is to the conduct of Canada's monetary policy. Innovative research and analysis related to core inflation, like all our research efforts, underpin the Bank's policy formulation and implementation of monetary policy, and contribute significantly to our understanding of how the economy operates.

At this point, I should emphasize that the Bank consistently aims for low and stable inflation – not for its own sake, but because it enhances the economy's performance. Aiming for an explicit 2 per cent inflation target not only helps stabilize prices, it also helps stabilize real output and employment, allowing the economy to grow at its maximum sustainable rate. Experience has shown that this is the best contribution that monetary policy can make to the economic welfare of Canadians.

## Developments in inflation around the globe

Before I go into detail about particular Canadian measures and experiences with inflation, let me take a step back to look at the larger, international picture. As I mentioned a moment ago, Canadians have become increasingly aware of price pressures, but this is, in fact, a global phenomenon. Indeed, sharp increases in inflation have been reported in both advanced and emerging-market economies in recent months. It is true that world prices of oil, natural gas, many minerals, and food products have eased in the past few weeks. Nevertheless, earlier dramatic increases in the prices of these same commodities accounted for sharp increases in inflation. In many cases, these have been some of the highest rates of inflation observed in the past 10 to 15 years.

It is important to note that inflation performance varies widely across countries. In some cases, excessively loose monetary policies, implemented in an attempt to push economic growth higher than the sustainable limits of a country's production capacity, have also been an important contributing factor.

In many countries, the recent surge in inflation has been coupled with a dramatic slowing in real economic growth, rekindling memories of the 1970s and concerns over stagflation – the uncomfortable combination of high inflation and slow or negative growth. Most observers believe it would be too great a stretch to draw parallels between the current experience and that of the 1970s. Still, recent developments do pose a serious policy challenge for central bankers, especially when combined with the dislocation and difficulties evident in global financial markets.

Conventional monetary policy reactions might not be appropriate in circumstances where we see a combination of rising inflation, slowing GDP growth, and concerns about financial instability. Rising inflation, for example, often leads to calls for tighter monetary policy. Yet, would that be wise if a slowing economy and other developments were expected to reverse these inflation pressures in the future? Slower economic activity often leads to calls for easier monetary policy. But would that reaction be wise if inflation pressures were believed to be rising rather than receding?

Around the world, monetary authorities are determined not to repeat the policy errors of the 1970s, when overly stimulative measures led to double-digit inflation and rising inflation expectations. We all seek reliable indicators with which to gauge how serious and long-lasting the current inflation pressures might be. This kind of information can materially affect the stance of monetary policy. This illustrates why monetary policy-makers must gather and weigh as much information as possible in their decision making – and why inflation research is so important.

### Defining and measuring total and core CPI inflation

Before I describe some of our inflation research, let me give you some background on the measures of inflation that we use at the Bank of Canada: measures based on Statistics Canada's consumer price index (CPI). Inflation is, of course, defined as a persistent increase in the average price of goods and services; in other words, a trend increase in the cost of living. In the broadest terms, this is measured by the total, or headline, CPI, which tracks the retail prices of a representative "shopping basket" of goods and services over time. It is also the rate that the Bank of Canada officially targets for its monetary policy. Here I would remind you that the Bank and the federal government have a formal agreement that sets out a target of 2 per cent for the annual rate of increase in the CPI. As I said earlier, we pursue low and stable inflation because it enhances the performance of the economy.

Yet, as much as we aim for low, stable, and predictable inflation, there will always be sharp movements in total or headline inflation. These are generally driven by volatile price changes in a small number of goods and services. In Canada, for example, fully 90 per cent of the observed monthly variations in the CPI are linked to price changes in just 8 of the 54 major goods and services categories included in the CPI. Further, these price changes are often volatile and are often quickly reversed. They therefore add considerable "noise" to total CPI, making it difficult to discern genuine movements in trend inflation.

For this reason, many central banks calculate core inflation measures, which are designed to minimize the influence of the most volatile components of the CPI. Although opinions differ among central bankers concerning the usefulness of core inflation measures, many monetary authorities – including the Bank of Canada – find these measures helpful for two important reasons. First, by focusing on the more stable components of the CPI, policy-makers are able to get a better fix on the underlying trend in inflation. This is important, because monetary policy operates with long and variable lags. It can take as long as two years before the full effect of a policy change is felt on inflation. Monetary policy must therefore be forward-looking, focusing on a one- to two-year horizon. Any attempt to control short-term movements in inflation is likely to prove to be counterproductive and will simply destabilize both inflation and real economic activity. Core inflation can, therefore, serve as a useful operational guide for policy by looking past these short-term price movements.

The second reason core inflation measures can be useful is that they can help anchor the inflation expectations of businesses and households. Having an explicit 2 per cent target for inflation, coupled with a strong commitment to achieve it, goes some distance towards realizing this objective. But providing a reliable measure of core inflation that the public can readily use to track trend movements in the CPI can strengthen the anchoring of expectations by providing assurances that the Bank will not allow the rise in volatile components to spread to other prices.

## The Bank of Canada's core inflation measures

Now, let me talk about our core measures in detail. Measures of core inflation are usually calculated in one of two ways. The "exclusion method" is the most straightforward and, as the name suggests, involves excluding the prices of those goods and services that typically display more than a predetermined amount of variability. The "reweighting method," in contrast, doesn't exclude the prices of any goods and services. Instead, it assigns a weight to each component that is inversely related to its volatility. In other words, more volatile price series are given a lower weight.

The core inflation measure that the Bank of Canada currently uses is called CPIX and is based on the exclusion method. It removes eight of the most volatile components of the total CPI, as well as the effects of changes in indirect taxes such as the GST. The excluded items in CPIX are fruit, vegetables, gasoline, fuel oil, natural gas, mortgage-interest costs, intercity transportation, and tobacco products. It is important to note, however, that the Bank calculates and monitors several different measures of trend inflation, not just CPIX. It uses these, along with many other sources of information, as checks against its preferred core measure. While all of the measures of trend inflation tend to move in a similar fashion, the differences can be informative.

It is also worth noting that the Bank has changed its definition of core inflation over time, to improve its reliability. When the Bank first began targeting inflation in 1991, the core inflation measure it adopted was similar to that used by many other central banks and excluded all food and energy prices. As a result, it was less inclusive than the current measure. After gaining more experience, and through a process of extensive research and analysis, the Bank refined its core inflation measure, as well as the set of additional measures that it currently follows. In 2001, the Bank moved to CPIX because of its demonstrated superiority on both empirical and theoretical grounds. Its advantage was confirmed by additional research when our inflation targets were renewed again in 2006, and it has recently been retested as part of a more comprehensive international study looking at a range of measures of total and core inflation.

Clearly, this process of refinement and retesting never ends. This is because it is crucial that we be able to determine the most effective indicators of underlying inflation and how these might be further refined and improved upon over time. So the next question becomes: how can we distinguish between good and bad measures? An effective core measure must have four key properties. First, and most obviously, a core measure should be less volatile than total inflation. Second, it must be unbiased. By this we mean that the core inflation measure must track long-run movements in the total CPI very closely. Third, a good core measure must also be a reliable predictor of future trend movements in the total CPI. Fourth, a good core measure must be easy to understand and to explain to the public.

When all four requirements are considered together, CPIX has been shown to be as good as, or better than, all of the alternative measures that the Bank might use. Other measures may outperform CPIX when they are judged on just one or two of these four criteria. CPIW, for example, which is calculated using the reweighting method, can give slightly better predictions of the total CPI and bears a somewhat tighter relationship to the long-run trends in the total CPI. These differences are very minor, however, and are offset by other considerations such as ease of understanding. For this reason, CPIX is still the Bank's preferred core measure. Nevertheless, given the demonstrated strengths of CPIW and one or two other trend measures, the Bank continues to monitor a set of indicators rather than relying on any single one.

## Popular misconceptions about core inflation

Our choice of CPIX as an operational guide for monetary policy has, at times, been a source of controversy and has led to several popular misconceptions. Journalists and other interested observers frequently question the use of CPIX and other measures of trend inflation as operational guides. They argue that such measures give an overly sanguine picture of true inflation, especially during episodes of sharply rising food and energy prices. Critics say that CPIX inflation is frequently lower than total CPI inflation because, they claim, the Bank has stripped out the fastest-rising prices. These critics of CPIX argue that it doesn't relate to the real-life experiences of typical households. "After all," they point out, "what household doesn't buy food, drive a car, or have a mortgage?"

I'll respond to these criticisms with three related points. First, and most importantly, the Bank's official target of 2 per cent inflation is based on total CPI inflation, not on CPIX. The latter is only one of several indicators used to judge where the total CPI is likely to go in the future. It is an important indicator that we use to judge what the inflation trends are, but it is not our target.

Second, the Bank's decision to use core inflation as a policy guide is based exclusively on empirical considerations. CPIX is used only because it has been shown to track future movements in total CPI better than the past movements of the total CPI itself. If this were to change, and if CPIX no longer outperformed the total CPI in this regard, we would stop using it.

Finally, as noted earlier, it is critical that the Bank continue to focus on the future trend of CPI inflation, as opposed to its current level, because monetary policy operates with such long and variable lags. If the Bank were to react to every observed change in total CPI, it would destabilize both inflation and real economic growth. It would be reacting to volatile changes in a small subset of prices that would likely reverse course in the near future.

## Is core always a better predictor than total CPI inflation?

Experience in Canada has shown that core inflation does outperform total inflation as an operational guide for policy. When the two series deviate, total CPI inflation tends to converge on core inflation rather than the reverse. Core inflation is therefore a better guide as to where total inflation is going. This phenomenon might reflect the success that the Bank has enjoyed over the past 17 years in keeping total CPI inflation close to its 2 per cent target. When total inflation temporarily moves higher or lower than the target, households and businesses know that it will probably return to target within a relatively short time.

Some countries haven't enjoyed the same positive experience. They've found that core inflation tends to deviate persistently from total CPI inflation and is not a very reliable measure of underlying inflation pressures. These differences have been documented recently by researchers at the Bank, but they are not well understood.[1] They appear to be systematic in nature, as opposed to chance occurrences, and Bank researchers suspect that they reflect differences in the way core inflation is defined, as well as structural differences in

[1] Serious research at the Bank of Canada on alternative measures of core inflation began with the work of Laflèche (1997), Crawford et al. (1998), Hogan et al. (2001), and Macklem (2001), who built on the efforts of Canadian academics such as Parkin (1984) and U.S. policy-makers such as Cogley (1998). It continued with contributions by Armour (2006) and has been extended more recently through the innovative analysis of Hoddenbagh et al. (2008) and Martel (2008).

the various economies. Such a situation isn't so surprising in less-developed countries and in emerging markets; however, long-standing differences between core and total inflation have also been observed in advanced countries. Core inflation measures tend to perform very well in Australia, Canada, New Zealand, and the United States, for example, but they perform poorly in the euro zone, Japan, and the United Kingdom. More research will be needed to understand these differences.[2]

The Bank's successful use of core CPIX has helped anchor Canadian inflation expectations which, in turn, has helped dampen movements in total inflation. If households and businesses are convinced that inflation will soon return to 2 per cent, they are less likely to form extrapolative expectations based on movements in current headline inflation. Consequently, they are less likely to push prices higher or lower. This self-reinforcing cycle makes the Bank of Canada's job much easier and is clearly beneficial for the economy as a whole. Canada's strong performance on the inflation front over the past 17 years is a testament to the usefulness of our inflation targets, our timely monetary policy actions, and the supportive role played by core inflation measures.

### Implications for Canadian inflation

So what is CPIX telling us about current price pressures in Canada? On the face of it, it would seem to suggest that the underlying, or trend rate of inflation has recently been at about 1.5 per cent. Although this measure is likely to rise modestly towards the end of this year, it is still well below the headline or total CPI inflation rate, which has been running at about 3.4 per cent. Because that 1.5 per cent core rate is also below the Bank's 2 per cent target for inflation, can we assume that inflation in Canada is not much of a problem? I wouldn't want to go that far, but the relatively low level of CPIX does provide at least some reassurance that inflationary pressures are reasonably contained. Further, as we said in our 3 September interest rate announcement, we anticipate that certain temporary factors now affecting both the total and CPIX measures of inflation should dissipate over the coming quarters and that both measures will converge on 2 per cent in the second half of 2009. In the interim, total CPI inflation is likely to continue rising, as past energy-price increases push it higher. However, the recent decline in both spot and futures prices for energy commodities means that the spike in total CPI inflation expected between now and the first quarter of 2009 will be lower than projected in July.

Seen from another perspective, does the current 1.5 per cent CPIX rate suggest that inflation is too low, implying underlying economic weakness? I wouldn't want to make that assumption either, because other trend measures suggest that underlying inflation is a touch higher than 2 per cent. Further, there is reason to believe that, over the most recent period, CPIX has shown a very slight downward bias in its estimate of trend inflation. This is due to the higher weight that it assigns to automobile purchases than some of the other trend measures do, plus its exclusion of mortgage interest costs. This has been particularly apparent recently, as auto prices have been falling over the past 12 months, while home-finance costs have been rising faster than many other items in the CPI basket. I don't think this means that the CPIX measure is no longer reliable; rather, this is likely a temporary situation. But it serves to demonstrate why it is important to look at a range of indexes and to understand why they may be moving differently.

Finally, I want to say a few words about inflation and monetary policy in the context of the recent market turmoil in general, and the events of the past few days in particular. We know from experience that inflation control works much more predictably when there are well-

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[2] One cause of the poor performance of core inflation measures in the United Kingdom and euro zone is that these jurisdictions use a harmonized index of consumer prices (HICP) that excludes shelter costs – an important piece of the cost of living.

functioning financial markets operating within a sound and stable financial system. While markets in Canada have certainly been volatile in recent weeks, it is worth noting that strains in Canadian credit markets have been considerably less intense than those seen in the United States and elsewhere. The Bank is committed to supporting the efficient functioning of financial markets, and earlier today, announced that it will enter into a $2-billion, 28-day term purchase and resale agreement. The case for further operations will continue to be reviewed in light of conditions in financial markets. Canadian banks have healthy balance sheets and absolute leverage that is significantly lower than many of their international peers. They are less exposed than their U.S. counterparts to the subprime-mortgage market that is at the root of the market turmoil, and are less dependent on securitization for their financing and on capital markets for their revenues.

Throughout this period of market turmoil, the Bank of Canada has remained in close contact with policy-makers both in Canada and abroad, including colleagues in other major central banks. We are closely monitoring global market developments, and will continue to provide liquidity as required to support the stability of the Canadian financial system and the functioning of financial markets.

## Conclusion

There are four main messages that I would like you take away from this evening's presentation. First, core inflation continues to be a useful operational guide for monetary policy. Second, it is always combined with other information as a check on the current state and future direction of trend inflation. Third, CPIX has not replaced the total CPI as our official inflation target. It is simply a tool that helps us achieve our 2 per cent objective for total CPI inflation. Finally, our continued research on this and other critical policy issues makes a vital contribution to the Bank's ability to successfully carry out its responsibilities.

As I said off the top of my remarks, our research at the Bank has been crucial to the effective conduct of Canada's monetary policy. Of course, our researchers continue to make a contribution today as they explore the feasibility of new and innovative ways to calculate core measures, as opposed to the standard exclusion and reweighting methodologies. Of course, our researchers are working on many issues, which I don't have time to discuss now, but I do encourage you to visit the Bank's website for more information.[3]

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[3] www.bankofcanada.ca/en/fellowship/highlights_res08.html.

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