



MONETARY POLICY

## Core, What is it Good For? Why the Bank of Canada Should Focus on Headline Inflation

By

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- With inflation as measured by the Consumer Price Index (CPI) growing faster than the Bank of Canada's 2 percent target, the Bank has pointed out that core CPI, which excludes items whose prices are especially volatile, is at or below target and, further, that the Bank anticipates total CPI eventually will converge with the core measure.
- The Bank occasionally uses such reasoning in explaining why, despite inflation's running above its target, monetary policy action is unnecessary.
- Our empirical analysis of core CPI shows that, while core is a useful guide to underlying inflationary trends, it has diverged over time from total CPI, and may give misleading signals of future inflation.
- While the Bank is certainly justified in using core CPI as one of many imperfect measures of underlying inflation, our results suggest that the Bank should, at a minimum, revisit the role of core within its inflation-targeting framework and consider de-emphasizing core CPI in its communications or as an operational guide.

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The Bank of Canada's goal is to keep annual inflation at its target level of 2 percent, as measured by the year-over-year growth of the Consumer Price Index (CPI), which is referred to as headline inflation. The annual rate is currently 3.1 percent, and it has been above 2 percent since the third quarter of 2010. The Bank, however, uses core CPI – a measure of underlying inflation that strips out some of the CPI's most volatile components,

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such as gasoline and indirect taxes<sup>1</sup> – as its “operational guide.”<sup>2</sup> In practice this means that, while the Bank ultimately targets headline inflation, it uses core as a short-term guide to better understand inflationary pressures and to communicate its actions to the general public.

The Bank justifies its use of core by the observation that, while headline CPI is widely recognized as the best indicator of inflation in Canada, its year-over-year movements are sometimes caused by temporary fluctuations in the prices of goods and services. Because the Bank can affect inflation only one to two years down the road, it ignores some of these short-lived changes in the price level (Bank of Canada 1991). The use of core CPI as an operational guide, the Bank argues, can help it focus on the longer-term headline inflation rate. For this argument to be valid, core must be a better predictor of inflation in one to two years’ time than the current reading of headline.

The analysis in this *e-brief* confirms core inflation’s predictive power. However, it also highlights that items excluded from core inflation may possess valuable information about future headline inflation, and cautions against emphasizing a single price measure to represent complex underlying inflationary trends. On balance, we interpret these results as evidence that the Bank should reconsider its current use of core within its inflation-targeting regime and potentially de-emphasize its role as an operational guide.

### *A Look Back In Time: An Empirical Investigation*

Since the Bank started targeting 2 percent inflation at the end of 1995, core CPI has proved less volatile than headline, consistent with the Bank’s reasoning for adopting core as its short-term guide (Figure 1). The extra fluctuations associated with headline inflation, as measured by total CPI, however, have caused headline to diverge from core over time.<sup>4</sup> Headline CPI growth, since December 1995, has averaged 1.97 percent annually, compared to 1.77 for core CPI – a statistically significant difference. Hence, although the Bank has done well with respect to its formal target, as measured by headline CPI, headline and core CPI have diverged. While this does not necessarily imply that a monetary tightening by the Bank is in order, given current global economic conditions, it does raise other issues.

When the Bank introduced core as its operational target, it indicated that if core and headline CPI are expected to diverge core would receive a separate annual inflation target (Bank of Canada 1991). Notwithstanding divergent long-term trends, the Bank has never adopted a different target for core.<sup>5</sup>

In what follows, we analyze the second desired characteristic of core – its predictive value in the near future.<sup>6</sup> We examine whether deviations between core and headline CPI today are temporary, and whether core inflation contains information that predicts headline inflation, similar to the analysis that was performed by the Bank when the latest measure of core was

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- 1 Core CPI is defined as Total CPI less eight of the most volatile components of CPI –including, for example, fruits, gasoline and mortgage interest costs – and the effect of indirect taxes. See Appendix A for more details.
  - 2 The Bank of Canada adopted core as an operational guide in 1991, initially referring to it as an operational “target.” The Bank has once changed its preferred measure of core inflation, in 2001, and continues to monitor other measures of underlying inflation. For a list of the alternative measures for underlying inflation, see Appendix A.
  - 3 For example, the most recent interest rate announcement on September 7, 2011, states that, “The Bank expects total CPI inflation to continue to moderate as temporary factors, such as significantly higher food and energy prices, unwind. Core inflation is expected to remain well-contained as labour compensation growth stays modest, productivity recovers, and inflation expectations remain well-anchored. Reflecting all of these factors, the Bank has decided to maintain the target for the overnight rate at 1 per cent.” For an example of how the media uses the core inflation measure to communicate the Bank’s message, see <http://www.cbc.ca/news/business/story/2011/08/19/inflation-consumer-prices-july.html>. (Date of Access: September 7, 2011).
  - 4 As mentioned by the Bank of Canada: “It should be noted, however, that core inflation provides a useful guide to the extent that total CPI inflation is projected to converge to core inflation.” (Bank of Canada 2006).
  - 5 See Appendix Table 1A for a further demonstration of the diverging inflation rates between core and headline inflation.
  - 6 As in Macklem (2001), we use an 18-month time frame on the assumption that transitory fluctuations in inflation are those that last less than 18 months.

Figure 1: Headline CPI versus Core CPI, December 1995=100



Source: Statistics Canada.

adopted (Macklem 2001). Our results show that headline inflation tends to revert back to core in the near-term future, implying that the current core measure is a good indicator of underlying inflation – a statistical relationship that has grown stronger in recent periods (see Appendix A for detailed results).

That said, our results show that movements in core can potentially mislead – the items excluded from core inflation may possess information that would provide value in predicting future headline inflation. Further, other measures of underlying inflation, similar in principle to the Bank’s core measure, are better predictors of total inflation during different time periods, including the most recent one. These results indicate that although core retains value as a predictor of future headline inflation, it should be used carefully, among a suite of other measures.

### *Why The Core Inflation Measure Can Be Misleading*

In setting monetary policy, there are pitfalls associated with relying on the Bank’s current core inflation measure, despite its useful statistical properties, and, more generally, with putting more weight on one measure of underlying inflation than others. First, the exclusion of items that are purchased often by customers – such as fruits, vegetables and gasoline – makes core CPI appear out of touch with their daily experiences.

Further, the overall behaviour of the price level is a function of the level of demand relative to the economy’s capacity to produce (Laidler and Robson 2003). Excessive focus on a subset of total CPI risks causing observers to miss important shifts in relative prices of, say, commodities versus manufactured goods, and to be more tolerant of nascent inflation than they otherwise would.

Concentrating on core CPI can distract the Bank when it might otherwise act against inflationary pressures that are emerging in the economy. When inflation is on target, quickly rising prices for some commodities will be offset by more slowly rising prices, or falling prices, for others. If the Bank’s operational guide were to determine policy and happened to exclude items that were subject to a nontransient upward price shock, headline CPI would rise and remain above target for an extended period, undermining the Bank’s credibility and sowing the seeds of rising inflation expectations on the part of the public.

There are strong reasons to believe that this scenario could materialize in the coming years or decades. A number of long-term economic trends suggest that some of the components excluded from core – notably, those related to food and energy – could be more subject to continuing positive price shocks.<sup>7</sup> Strong population growth, coupled with the continued industrialization of countries such as China and India, will ensure that scarce goods such as gasoline, fruits and vegetables are vulnerable to future price increases. Even if one does not place weight on these projections, the fact remains that core gives misleading signals if and when excluded components are subject to persistent shocks.

### *Implications for Monetary Policy*

The Bank of Canada must communicate the sometimes different signals given by core and total CPI. This makes communication harder and more opaque, especially when other measures of underlying inflation, such as the output gap – the difference between actual economic output and the economy’s potential – also suggest different inflation trends.<sup>8</sup>

On balance, our results suggest that the Bank should focus on headline and de-emphasize core by using it alongside many indicators of underlying inflation trends. The Bank should also give it less priority as an operational guide and in its communications. Over time, the Bank has downgraded core from “target” to “guide” and, given core’s continued divergence with headline and its inconsistent predictive ability over time, the next logical step may well be to relegate it to the role of “indicator.”

The main danger is that retaining the special status of core could lead monetary authorities to read too much into what core has to say – or does not say – about inflationary pressures. Since 1995, core and headline have diverged from one another with important implications for the conduct of monetary policy and, ultimately, the purchasing power of Canadians.

Core CPI can prove an unreliable guidepost for future headline CPI. Although our evidence suggests core is one among a group of helpful indicators of future inflation, the Bank would be better off to concentrate its messaging and actions on its ultimate goal: total CPI.

7 Porter (2011) has made similar comments, noting that by excluding the prices of goods that emerging economies buy, such as food and energy, and including goods that they sell, such as clothing and electronics, in the measure of core inflation, there is a structural bias towards strong headline and weak core inflation.

8 The April 2011 Monetary Policy Report for example juggles with three inflation measures: core CPI, total CPI and underlying Inflation. In particular, the report states: “A number of transitory factors have been dampening the year-over-year rate of core inflation, notably the effects of unusually large increases a year ago for motor vehicles and hotel accommodation (the latter related to the Vancouver Winter Olympics), as well as recent rebates on electricity prices in Ontario. In addition, there is evidence that some of the HST-related tax refunds to businesses have been passed through to consumers, lowering core inflation by about 0.3 percentage points, in line with the Bank’s prior expectations. Looking through these factors, underlying inflation has remained broadly stable at a rate slightly above 1½ per cent, reflecting persistent excess supply in the economy, as well as the moderate growth of unit labour costs [...] and the appreciation of the Canadian dollar. Total CPI inflation averaged 2.3 per cent in January and February, unchanged from its average rate in the fourth quarter of 2010.”

## Appendix A: An Empirical Investigation of the Relationship between Core and Headline Inflation

The Bank of Canada’s measure of core inflation is defined as headline CPI minus fruits, vegetables, gasoline, natural gas, fuel oil, intercity transportation, tobacco products, and mortgage interest costs. This measure is adjusted to exclude the effect of indirect taxes, such as federal and provincial goods and services taxes, excise taxes on cigarettes and alcohol, import duties, fuel and air transport taxes, etc.

Statistics Canada, along with the Bank of Canada, tracks alternative measures of underlying inflation, in addition to core as defined above. The Bank uses alternative measures of inflation because there is no single measure for core that comprehensively reflects underlying trends. In our empirical investigation below, we examine:

- CPI8 – which excludes the same eight goods and services as the Bank of Canada’s core measure, but does not adjust for the effects of indirect taxes; hence, indirect taxes are included in the results.
- CPIW – which “down weights” the volatile components of headline CPI, rather than excluding them.
- CPIXFET – which excludes 12 food and energy components, including meat, fish, and dairy, and electricity prices, and adjusts for the effect of indirect taxes. The Bank of Canada used this measure of core inflation from 1991 to 2001.
- MEANSTD – which excludes the components of the CPI that increase or decrease more than 1.5 standard deviations from the mean in any given month. The weighted average of the remaining components is used to calculate underlying inflation.
- WMEDIAN – which weights the components of the CPI according to the distribution of year-over-year component changes around the mean, with the sum of the weights above (and below) the mean equalling 50 percent.

The descriptive statistics for headline, core, and the above measures of underlying inflation demonstrate that although headline CPI is more volatile than the measures of underlying inflation, as shown by the coefficient of variation figures, the mean results for all measures of underlying inflation diverge from headline CPI’s average (Table 1A). Therefore, these measures of core inflation are, over a long time horizon, biased downward with respect to headline CPI.

### *Estimating the Predictive Power of Core*

For core inflation to be a useful measure of underlying inflation, it should predict near-term future headline CPI inflation better than headline itself. In past studies, rather than modelling headline CPI as a function of its past values, a measure of underlying inflation, Bank of Canada researchers have chosen to use error-correction models: divergence between core and headline CPI inflation is assumed to be temporary, but the two measures will converge over time (Macklem 2001, Lafleche 2006). This is tested with the following model:

$$\pi_{t+18}^T - \pi_t^T = a + b(\pi_t^U - \pi_t^T) + \mu_t$$

where the left-hand side term represents the change in headline CPI inflation in 18 months time, and the right hand side term (in parenthesis) represents the difference between core and headline CPI inflation today. We find this specified model to be straightforward and capable of testing the predictive abilities of core inflation.

Table 1A: Descriptive Statistics of Headline CPI, Core CPI, and Alternative Inflation Measures, Dec. 1995 – Apr. 2011, year-over-year growth in percentages.

	<i>Total CPI</i>	<i>Core</i>	<i>CPI8</i>	<i>CPIW</i>	<i>CPIXFET</i>	<i>MEANSTD</i>	<i>WMEDIAN</i>
Mean	1.970	1.771***	1.728***	1.738***	1.534***	1.789***	1.889*
Coefficient of Variation (CV)	0.473	0.246	0.258	0.348	0.409	0.261	0.315

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Statistics Canada, Bank of Canada, Authors' Calculations.

Table 2A: Core Inflation's Ability to Predict Headline CPI Inflation, Dec. 1995 – Apr. 2011

<i>Coefficient</i>	<b>Measure of Underlying Inflation</b>					
	<i>Core</i>	<i>CPI8</i>	<i>CPIW</i>	<i>CPIXFET</i>	<i>MEANSTD</i>	<i>WMEDIAN</i>
Beta	0.991*** (0.09)	1.017*** (0.087)	1.108*** (0.109)	1.035*** (0.112)	0.929*** (0.095)	0.733*** (0.086)
Constant	0.002** (0.001)	0.003*** (0.001)	0.002* (0.001)	0.004*** (0.001)	0.002** (0.001)	0.001 (0.001)
R-squared	0.419	0.455	0.385	0.343	0.368	0.307
Observations	167	167	167	167	167	167

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Authors' calculations.

If the hypothesis that core inflation is a good predictor of headline CPI inflation is correct, then when core inflation is above headline CPI inflation, future inflation should rise ( $b > 0$ ), and a better predictor would converge to unity ( $b = 1$ ). The results of this regression demonstrate that while all of the measures of underlying inflation are good predictors of headline CPI inflation ( $b$  is significant, close to unity), the CPI8 measure, and to a lesser extent the Bank's measure for core inflation, are marginally better than the other measures at predicting future inflation, as implied by to the values of their coefficients and an R-squared comparison (Table 2A).

The predictive power of core inflation has changed since 1995, when the Bank of Canada began targeting 2 percent inflation (Tables 2B and 2C). More recently, the Bank's measure of core has acted as a better predictor of headline CPI than in the past, with a coefficient closer to unity and a higher R-squared. A Chow test for a structural break confirms evidence that the predictive power of core inflation has changed. Tables 2B and 2C also show that different measures for underlying inflation work better in alternative time periods. For instance, from 1995–2001 WMedian and CPIW were better predictors of headline inflation than the Bank's official measure of core, whereas from 2002–2011 the Bank's measure of core and CPI8 each proved a superior predictor. The lesson is that no single measure for underlying inflation always works best.

Table 2B: Core's Predictive Power, 1995 – 2001

<b>Coefficient</b>	<b>Measure of Underlying Inflation</b>					
	<b>Core</b>	<b>CPI8</b>	<b>CPIW</b>	<b>CPIXFET</b>	<b>MEANSTD</b>	<b>WMEDIAN</b>
Beta	0.724*** (0.167)	0.742*** (0.169)	1.191*** (0.199)	0.952*** (0.197)	1.095*** (0.199)	1.008*** (0.170)
Constant	0.004*** (0.001)	0.004*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.005*** (0.001)	0.006*** (0.001)
R-squared	0.209	0.213	0.335	0.247	0.300	0.331
Observations	73	73	73	73	73	73

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Authors' calculations.

Table 2C: Core's Predictive Power, 2002 – 2011

<b>Coefficient</b>	<b>Measure of Underlying Inflation</b>					
	<b>Core</b>	<b>CPI8</b>	<b>CPIW</b>	<b>CPIXFET</b>	<b>MEANSTD</b>	<b>WMEDIAN</b>
Beta	1.162*** (0.097)	1.136*** (0.092)	1.202*** (0.124)	1.105*** (0.132)	0.911*** (0.106)	0.769*** (0.098)
Constant	0.000 (0.001)	0.001 (0.001)	-0.002 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.003** (0.002)
R-squared	0.609	0.624	0.506	0.433	0.443	0.402
Observations	94	94	94	94	94	94

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Authors' calculations.

An investigation into the ability to predict headline CPI inflation would not be complete, however, without testing whether headline inflation is a good predictor of core inflation. By running the above regression in reverse, we can get a better sense as to whether core is truly leading headline CPI, or if there are elements outside the core measure that could help predict headline CPI. The test, therefore, is whether the difference between underlying and headline inflation predicts future underlying inflation (Macklem 2001, Lafleche and Armour 2006):

$$\pi_{t+18}^U - \pi_t^U = \alpha + \beta(\pi_t^T - \pi_t^U) + \vartheta_t$$

Table 3A: Headline CPI Inflation’s Ability to Predict Core Inflation, Dec. 1995 – Apr. 2011

<b>Coefficient</b>	<b>Measure of Underlying Inflation</b>					
	<b>Core</b>	<b>CPI8</b>	<b>CPIW</b>	<b>CPIXFET</b>	<b>MEANSTD</b>	<b>WMEDIAN</b>
Beta	0.261*** (0.050)	0.183*** (0.050)	-0.088 (0.071)	0.211** (0.085)	0.141*** (0.052)	0.268*** (0.050)
Constant	-0.001 (0.000)	0.000 (0.001)	0.001 (0.000)	-0.001* (0.001)	0.000 (0.001)	0.000 (0.001)
R-squared	0.144	0.074	0.010	0.039	0.042	0.147
Observations	167	167	156	156	167	167

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Authors’ calculations.

where the left hand side variable is the change in underlying inflation in 18 months time, and the right hand side term (in parenthesis) represents the difference between headline CPI and underlying inflation today. If future underlying inflation adjusts in response to differences in headline and underlying inflation today, it should rise with the differences in the price indices today ( $b > 0$ ). Interestingly, in contrast to the results in Macklem (2001) and Lafleche and Armour (2006), for core inflation and four of the five alternative measures of underlying inflation,  $b$  is positive and significantly different from zero (Table 3A). The R-squared values for each regression are however small, as are the coefficients.

Mixed results emerge. First, the power of core inflation to predict headline CPI has improved over time, a finding that is consistent with one of the Bank’s main arguments for using core as an operational guideline. However, because the means of headline and underlying inflation diverge over time, we cannot take for granted convergence in the long run; hence, the logic of using core inflation as a guideline for targeting future headline inflation loses some of its value.

Further, we find that headline inflation is a reasonable predictor of future core inflation; hence core appears to exclude some volatile prices that help predict future inflation.

Finally, other measures of underlying inflation, similar in principle to the Bank’s core measure, are found to be better predictors of total inflation during different time periods.

Bringing together these three empirical results – which push and pull in opposite directions – we feel that the evidence for using core inflation as a guide is weaker than in the past. While the abandonment of core CPI as a measure of underlying inflation does not follow from the empirical findings, the results raise doubt as to the reliability of the Bank’s core measure as a consistent indicator of inflation, and suggest that the Bank would be better off to reduce its reliance on core inflation as an operational guide.

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