



TD Economics

Special Report

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THE CORE ARGUMENT AGAINST TOTAL CPI

Around the world, a wedge has been driven between total CPI and core CPI by surging commodity prices. In Canada, the gap between total CPI and core CPI – excluding indirect taxes in both cases – has grown to a substantial 1.3 percentage points as of May. Given this, it is not at all unreasonable to join the chorus of commentators questioning whether the use of core inflation as an operational guide for monetary policy could be a dated concept.

This question does not simply represent idle speculation – the Swedish central bank recently dumped its core CPI measure. In Canada, the Bank of Canada has indicated that it has a study in the works that will address the issue. The consequences of any change could be far-reaching. For instance, if central banks around the world had been focusing upon total CPI as an operational guide instead of core CPI over the past few years, interest rates

HIGHLIGHTS

- **Around the world, a wedge has been driven between core and total CPI due to surging commodity prices. Canada is no exception.**
- **We examine whether core CPI should be abandoned in favour of another inflation target in Canada.**
- **Core CPI continues to perform well at predicting total CPI and remains admirably smooth. But our calculations suggest it is now slightly biased, and it no longer excludes the most volatile items.**
- **Despite these flaws and several appealing alternatives, we ultimately conclude that core CPI likely remains the best measure for now, though a raft of alternatives are worth watching.**
- **We also revisit the TD inflation forecast and examine four scenarios, finding that core CPI and total CPI are likely to reconverge upon each other by the end of 2009, barring a persistent additional push in commodity prices.**

Bias & Volatility in Total and Core Inflation

	1992-now	2000-now
Bias*		
Headline excl. Indirect Taxes	1.90	2.28
CPIX	1.83	1.87
Spread	0.07	0.41
Volatility**		
Headline excl. Indirect Taxes	0.74	0.73
CPIX	0.42	0.47
Spread	0.32	0.26

*Bias is measured as the difference between core and total inflation. Total inflation is represented by headline excl. indirect taxes. The spread indicates that, in recent years, CPIX has not tracked total CPI as well.

**Volatility is measured as the standard deviation of the year-over-year change in each metric. The spread indicates that CPIX is significantly less volatile than total inflation.

would likely be significantly higher than they currently are.

Crucially, it is entirely within the Bank of Canada's powers to change what measure it uses as an operational guide for monetary policy, and no renegotiation would be required with the federal government. Neither the Bank of Canada Act nor the Bank's current agreement with the Department of Finance make any mention of the use of core CPI as an operational guide. This means that the Bank of Canada could theoretically elect to abandon the current definition of core CPI, reverting to total CPI, or even switching to another form of core CPI.

Why Core CPI?

Before deciding whether the Bank of Canada *should* abandon core CPI, it is necessary to properly understand why core CPI was selected in the first place.

Canada's current measure of core CPI was introduced in May of 2001. This core CPI definition differs from that of many other countries insofar as it does not simply exclude food and energy prices. Instead, it excludes the eight most volatile items at the time out of a pool of 54, while including certain types of food and energy prices. It also excludes the effect of indirect taxes.

The initial motivation for the use of this core CPI definition was threefold: it was smooth, could predict future total CPI, and was unbiased. That is to say, core CPI bounced around less than total CPI; it could actually predict total inflation in the future; and it tended to grow at roughly the same rate as total CPI over time.

Simultaneously, the eight excluded items – fruits, vegetables, mortgage interest costs, natural gas, fuel oil and other fuel, gasoline, inter-city transportation, and tobacco products – all had theoretically appealing reasons for being excluded. Food items tend to be influenced by temporary weather factors (with greatest impact on fruits and vegetables). Temporary supply shocks tend to occasionally bias energy prices and airline costs (with implications for natural gas, fuel oil and other fuel, gasoline, and inter-city transportation via airfare costs). Tobacco prices tend to be affected by one-off changes in excise taxes. Mort-

gage-interest costs have the perverse effect of temporarily increasing inflation every time a central bank hikes rates, giving a misleading signal about underlying inflation. Finally, the exclusion of indirect taxes helps central bankers to look through one-time shifts in prices resulting from sales tax changes.

Should the Bank of Canada Abandon Core CPI?

Having established that there was good initial motivation for the use of core CPI, we can now revisit the relevant metrics to determine if the argument has grown stale. Specifically, is core CPI still smoother than total CPI, can it still predict the future, and is it still unbiased? We also insert a fourth question – does core CPI still hit the mark by excluding the most volatile components of Canadian inflation?

Smooth?

The Bank of Canada's definition of core CPI continues to be substantially smoother than total CPI. The standard deviation of the Y/Y inflation rate since the introduction of inflation targeting in 1991-1992 is 0.74 for total CPI versus just 0.42 for core CPI. In recent years, the advantage has narrowed a touch, but remains huge: since 2000, the total CPI standard deviation has been 0.73 versus just 0.47 for core CPI.

Fortune Teller?

Core CPI also appears to retain its ability to predict

15 Most Volatile Components in Headline CPI			
February 1981 - May 2008		January 2000 - May 2008	
Component	Std. Dev.	Component	Std. Dev.
Natural Gas	21.5	Fuel Oil & Other Fuel	16.6
Fuel Oil & Other Fuel	20.2	Natural Gas	15.7
Gasoline	12.5	Tobacco	15.4
Tobacco	10.5	Gasoline	10.9
Vegetables	7.4	Vegetables	8.1
Other Automotive Operating Expenses	7.0	Inter-City Transportation	5.4
Electricity	5.0	Other Automotive Operating Expenses	5.3
Fruit	4.3	Fruit	4.8
Inter-city Transportation	4.1	Electricity	4.7
Travel Services	4.0	Travel Services	4.3
Meat	3.3	Mortgage Interest Costs	4.2
Mortgage Interest Costs	3.2	Paper, Plastic and Foil Supplies	4
Homeowners' Insurance Premiums	2.7	Homeowners' Insurance Premiums	3.8
Services Related to Household Furnishing	2.6	Rental of Passenger Vehicles	3.8
Rental of Passenger Vehicles	2.5	Owned Accommodation Replacement Cost	3.2

Note: highlighted components are those that are excluded from the current core cpi metric, CPIX

future total CPI. The best and easiest way to measure this is to run a regression in which the change in the annual rate of inflation over the next 18 months is predicted by the current spread between core CPI and total CPI. At its essence, this model posits that when total CPI is higher than core CPI today, total CPI is likely to fall in the future as an offset. As an aside, this 18 month period is attractive because it approximates a central bank's inflation targeting horizon, and so where a central bank should be looking when setting monetary policy. Anything that happens in less than 18 month's time can be viewed as water under the bridge.

When the Bank of Canada initially chose core CPI as its operational guide, the predictive ability of core CPI was well established. Between 1986 and 2000, our model had an R-squared of 0.30 and the explanatory variable had a coefficient of 1.04. This meant that if total CPI was higher than core CPI by one percentage point, total CPI could be expected to fall by 1.04 percentage points over the next eighteen months.

Remarkably, this fortune telling ability of core CPI remains potent. Examining the year 2000 to the present, the same model reveals an increased R-squared of 0.43, while the explanatory variable has a slightly lower (though still high) coefficient of 0.89.

The predictive power of core CPI remains alive and well.

Unbiased?

Where core CPI stumbles a little is in the question of whether it remain unbiased.

It did a bang-up job until the end of 2005, resulting in virtually identical 1992-2005 average total CPI and core CPI annual growth rates of 1.83% and 1.81%, respectively.

However, since 2005, it has not fared quite so well, by virtue of the obvious spike in commodity prices that has allowed total CPI to outgrow core CPI. If one examines the 2000-2008 period, total CPI has averaged 2.28%, versus just 1.87% for core CPI.

Whether this is a problem is somewhat subtler than it would first appear. If one examines too short a time span, there will inevitably be a wedge between total CPI and core CPI. In fact, this is the precise motivation for having a core CPI – it looks through unusually high or low periods of total inflation, focusing upon the broader trend.

Predictive Power* of Core CPI for Total Inflation

	Coefficient	P-value	Adj. R ²
CPIX			
1986-2000	1.04	0.00	0.30
2000-now	0.89	0.00	0.43
CPIXFE			
1986-2000	1.00	0.00	0.16
2000-now	0.74	0.00	0.23

Note: this regression analysis tests how well the spread between Y/Y changes in total and core inflation predict the change in total inflation 18-months in the future.

*A coefficient close to one, a p-value of close to 0 and a high adjusted R-square are desirable because they indicate that core inflation predicts future inflation well.

However, nine years is a fairly long time span to have a divergence of this magnitude, and so we conclude that the bias evident in core CPI is not ideal, and represents the main legitimate complaint regarding Canada's use of core CPI.

Hits The Mark?

When the Bank of Canada initially selected its measure of core CPI, the eight excluded items were also the most volatile. Since then, things have changed a little. Updating the Bank of Canada's last study to include the 1991 to 2008 time period, we find that the original eight items still occupy all six of the most volatile spots (and seven of eight), but that mortgage interest costs has fallen down the list, and now represents just the eleventh most volatile items out of the basket of 54. In its place, Other Automotive Operating Expenses takes the seventh spot.

This actually understates the changes afoot, because this analysis is still heavily weighted towards the pre-2001 period that the Bank of Canada used in arriving at its original decision. At the risk of using an undesirably small dataset, the 2000-2008 period shows that there has been some further deterioration in the ranking of the original eight items. They still occupy the top five spots, but two are now outside of the top eight. Inter-city Transportation falls to number nine, and mortgage interest costs falls to number twelve. Taking their place in the top eight are Other Automotive Operating Expenses and Electricity.

These developments highlight an inherent flaw in any core CPI measure with explicit exclusions, be they simply food and energy or an entire set of eight items: the list of

most volatile items can change over time, resulting in a measure that excludes things it shouldn't, and that includes other things it shouldn't.

The important qualification to this is that insofar as there is good theoretical justification for the original eight exclusions, it remains entirely possible that they will once again reign supreme atop the volatility chart, justifying their exclusion. It would be far more difficult to justify excluding "Other Automotive Operating Expenses" than to exclude mortgage interest costs, say, because at least mortgage interest costs has a proven history of cyclicity and a good theoretical justification.

What Else Could Be Used?

Clearly, the Bank of Canada's core CPI definition is not perfect. Although it continues to do an admirable job of being smooth and of predicting future total CPI – both of which are crucial qualities – it has become somewhat less successful at remaining unbiased and at excluding the most volatile components.

But this does not automatically mean it must be replaced. A classic quote comes to mind: "Democracy is the worst form of government except for all those others that have been tried." This same sentiment could well apply to Canada's core CPI. Without a superior alternative, it could well remain the best option going while simultaneously being far from ideal. So, what do the alternatives have to offer?

Option 1: Revert to Total CPI

One obvious and very populist choice would be to revert to total CPI, abandoning operational guides altogether. The advantage of total CPI is that it has no bias whatsoever (at least relative to the Bank of Canada's mandate; whether the measurement of CPI is biased itself is another issue altogether, and a question for another day). A shift of this sort would also capture any future surges in food and energy prices. However, we believe the odds of this happening are fairly low. Most importantly, total CPI is a massively volatile measure, and would force one of two outcomes. First, if strictly followed, it would prompt a very jerky central bank response that would be undesirable for financial markets or healthy economic functioning.

Second, if somewhat more loosely followed, monetary policy likely wouldn't end up much difference than when under a core CPI target. This is because a central tenet of the Bank of Canada's world view is that price shocks don't last. This means that events like the recent commodity price

spike are expected to fall out of the Y/Y equation long before the Bank's 18-month inflation targeting horizon is reached. The difference between core CPI and total CPI then only becomes relevant if the Bank of Canada has a bold forecast for commodity prices in eighteen month's time and beyond. However, the Bank tends to stick with relatively tame commodity forecasts. The latest Bank forecast calls for approximately flat oil prices and a moderate 15% drop in non-energy prices, and this is about as exciting as the forecasts get. This means that monetary policy set to a hypothetical total CPI target would be only minutely different than monetary policy set to core CPI, since the difference between the two – commodity prices (a simplification, we concede) – are rarely expected to factor substantially.

It would require a substantial cultural shift at the Bank for there to be much added value in directly targeting total CPI, and although new Governor Carney has hinted that he has an opinion on energy prices that extends beyond the party line, we are not convinced he will elect to engineer the wholesale shift at the Bank that would be needed to motivate a total CPI target.

Option 2: Ex Food & Energy

One option for the Bank of Canada would be to revert to an ex-food and ex-energy definition, in line with most other nations. This has the obvious advantage of being simple and easy to understand, though this advantage is largely lost in Canada since the ex-8 core definition is already widely accepted. We place an extremely low probability on ex food and ex energy being the selected measure. By almost every quantitative gauge, it is inferior. It is not as smooth as the ex-8 core definition, it shows even greater bias than the ex-8 core definition, and it has only about half the predictive power for total inflation relative to the performance of the ex-8 core definition.

Option 3: Revamp Current Definition

Another alternative would be to revamp the current definition of core CPI. There are two main directions this could go.

First, the Bank of Canada could change the ex-8 items, shifting to the ones we have identified as now being the most volatile. The number would not even necessarily need to remain at 8: 7 seems to provide a clearer cut-off point as defined by relative volatility, though the Bank of Canada has also mused in the past about a core measure that would

exclude 9 or even 10 components. The logical addition would be Other Automotive Operating Expenses and possibly Electricity, with Mortgage Interest Costs the most obvious candidate for exclusion. Although some central banks – such as the Bank of England – elect to ignore other components, like dwelling costs, this does not have much theoretical justification as it is not especially volatile in Canada, and dwelling costs are unquestionably a very real cost. The issue of whether a capital purchase (in the case of a home purchase) should be included in a consumer basket at all is a question for Statistics Canada and not for the Bank of Canada.

Second, the Bank of Canada could decide to acknowledge the recent bias in core CPI and to pursue a slightly lower target for core CPI in the future to compensate for a presumed continuation of the bias. This does not mean that the Bank of Canada would be pursuing a lower overall rate of inflation. This would remain at 2.0%. Rather, since core CPI has averaged 0.1% lower than total CPI over the past fifteen or so years, and 0.4% lower since 2000, something like a 1.8% core CPI target might be a way to achieve a 2.0% total CPI rate in the future.

These two directions are both possible, but we are not hugely enamoured with them. In the case of the first direction, a shifting of ex-8 items sets a somewhat bad precedent and would raise the issue of when to revisit the issue the next time, and the time after that. It would also create another undesirable break in the series, leading to complaints that the central bank is not dealing with the realities experienced by the average Canadian. In addition, we must not forget that the original ex-8 items were appealing both because they were the most volatile and because they made the most theoretical sense. While they may not be the most volatile anymore, they are still quite volatile, and they retain their theoretical appeal. This is arguably good enough.

In the case of the second direction, it would be highly unorthodox to have a different core CPI and total CPI numerical goal. It would risk creating confusion. A different goal would also require that the Bank of Canada expects the volatile items to appreciate to a disproportionate degree on a permanent basis going forward, and the Bank has given no hint to this effect (indeed, the Bank of Canada's current forecast for flat or falling commodity prices argues that total CPI will rise by slightly less than core CPI in the future).

Option 4: Alternate Core Measures

The Bank of Canada has already tipped its hand as to what alternative types of core inflation measures it is willing to consider. The main candidates are trimmed mean CPI, median CPI, and reweighted mean CPI. Despite their esoteric sounding names, these have taken on an increased significance with some central banks around the world. The Reserve Bank of Australia is an active user, for instance, while two District Fed branches in the U.S. calculate some these measures for the U.S.

The trimmed mean CPI automatically excludes the set of components that have risen the most and the least in the latest time period, leaving behind only the well-behaved components that occupy a middle ground. The reweighted mean CPI assigns a diminished weight to those components that are most volatile and an enhanced weight to those that are least volatile, without outright excluding anything. The median CPI simply identifies that one item for which half of the weighted basket grew less quickly and half grew more quickly.

Each of these measures offers the desirable property of not requiring the arbitrary and permanent exclusion of certain items that the average person still purchases on a regular basis.

A Summer 2006 Bank of Canada Review article compares the relative merits of the alternate core measures to that of the traditional core CPI definition. The conclusion is that – of the three – the reweighted mean CPI measure is clearly best. Indeed, in many ways, it has superior characteristics to the current core CPI definition. We note that it has done a better job of tracking total CPI higher in recent years, and so appears to be less biased recently than core CPI. Even before this, it had a lower mean absolute change than the current core CPI measure (though it had a slightly higher standard deviation). It also appeared to have a superior predictive power for future total CPI, according to the Bank of Canada study.

Does this make the reweighted mean CPI measure a slam dunk decision for the Bank of Canada? Not necessarily. There are several criticisms. First, it is difficult for the average person to understand. Second, and related to this first criticism, though it performs well on an empirical basis, it is unquestionably odd that a component like gasoline – which is 4.9% of CPI – would only receive a 1.3% weighting in the reweighted mean CPI since it is so volatile. This downplaying of gasoline is little different than its

outright exclusion from the traditional core CPI measure. But instead of just downplaying a few items, as the current core CPI measure does, the reweighted mean gives upside-down weightings for *every* component. It is difficult to find one's bearings in such a world. A reweighted mean CPI measure would also be difficult to forecast on a short-term basis because of its complexity. Finally, a reweighted mean CPI measure would be subject to revision, which is an important no-no for inflation measures – they must never be retroactively changed due to the effect this could have upon those on indexed incomes and indexed government obligations.

Even with these negatives, the alternate core CPI measures discussed here do represent viable alternatives to the current core CPI definition, with the reweighted mean CPI definition a leading candidate.

Option 5: Big Thoughts

The final set of alternatives we present represents some “blue skying” on our part.

The Federal Reserve in the U.S. uses the core PCE deflator as its favourite measure of inflation. A PCE deflator offers the attractive quality of not being wed to a fixed basket. Instead, it can flexibly accommodate changes in spending behaviour, and it does not consistently neglect the deflationary influence of new products as the CPI does. Unfortunately, Canada does not have a monthly core PCE deflator series. Statistics Canada would have to create one, which would presumably be a major endeavour. Moreover, the Bank of Canada would have to renegotiate its inflation target to be the total PCE deflator instead of total CPI. And the same old problem would persist, namely what to exclude from the core PCE deflator definition. This is not a likely option.

The Bank of Canada recently released a discussion paper entitled “A Structural VAR Approach to Core Inflation in Canada” that proposes an econometrically-based core inflation measure. It includes oil price growth, output growth, and inflation. By some measures – predictive power of total CPI, in particular – the econometrically-based measure of CPI appears to do a better job than existing measures, though this is not necessarily a huge surprise insofar as an econometric model is always going to find the best fit, whereas existing measures are based as much on theory as on empirical results (making them conceivably more robust when applied to future data). Though this econometric core CPI variable will no doubt be watched

by those at the Bank, it has the serious constraint of requiring regular revisions, and it is even more difficult to explain to the lay person than the aforementioned “Alternate Core Measures”.

The Bank of Canada has made it known that it is conducting studies into the feasibility of pursuing either a lower inflation target or switching over to price-level targeting. This could substantially change the Canadian inflation landscape, especially if price level targeting were to be selected, as the Bank of Canada would be obliged to unwind bouts of above-target inflation with aggressively pursued periods of below-target inflation. Currently, the Bank of Canada must only get the inflation target back to 2%, and can let bygones be bygones. But we set all of these possibilities aside for now, both because there are political obstacles to these sorts of changes, plus because they only become possible in 2011 when the Bank of Canada next renegotiates its mandate with the Department of Finance. They are not a near-term solution.

What is the Bank of Canada Telling Us About Core?

Given that the Bank of Canada is known to be studying the gap between core and total CPI, what can they be expected to find?

In “Evaluating Measures of Core Inflation” (Summer 2006), the Bank of Canada says that “the general conclusion is that CPIX [the current core CPI measure] still satisfies all of the empirical and practical criteria. No core measure significantly outperforms it. Moreover, CPIX is familiar to the public and well accepted.” As of two years ago, core CPI was still king.

Since then, of course, the core CPI measure has developed a small bias. Is this likely to change the Bank of Canada's opinion? It does not seem that way. In a June 19th speech, Governor Carney said “our experience has been that commodity-price inflation has been one of the least persistent forms of inflation. As a consequence, in the pursuit of our 2 per cent target for total CPI, we use our core measure as an operational guide.” In the press conference following the Bank of Canada's latest Monetary Policy Report on June 17th, Governor Carney said that “core is the best predictor of total inflation over time.” The latest Bank of Canada forecast has total inflation and core inflation converging by the end of 2009 at 2.0%. None of this suggests a central bank that has thrown aside the current definition of core CPI, nor one that believes the recent

bias is structural.

A more forward-looking statement came in the June 19th speech, offering another hint of what the Bank of Canada's forthcoming paper on the subject will find: "The Bank will continue to monitor the stability of the relationship between core and total CPI. The Bank will also continue to look at a range of measures to assess the underlying trend of inflation. Considerable judgment must always be applied, and no one measure should be relied on exclusively." It sounds as though any research completed to date elects to retain the current core CPI definition, but emphasizes the importance of factoring in multiple measures, and of continuing to study the gap between core and total CPI.

More philosophically, the Bank appears to still believe that it is necessary to look through commodity price shocks and the like, suggesting it is not likely to revert to an exclusive focus upon total CPI. In a June 30th speech, Governor Carney said that "the commodity-price shock has resulted in inflation rising above target in a number of jurisdictions... a well-designed inflation-targeting regime allows for temporary deviations from target in the face of shocks". While he remained coy on whether he thought the Bank of Canada possessed sufficient flexibility to allow for a temporary deviation, we believe the Bank of Canada's past actions and statements suggests that he does (as an example, recent Bank of Canada statements elected to look through the impact of the currency shock on inflation).

Conclusion: Core CPI to Stay

The Bank of Canada's current definition of core CPI isn't perfect. It may be slightly biased (though this is not absolutely certain as the commodity cycle has yet to fully play out), and it no longer excludes the most volatile components of the CPI. However, we believe the current core CPI definition will be maintained, both because the set of alternatives are not hugely appealing and because the Bank of Canada has not shown any great enthusiasm to shift measures.

Looking at the alternatives to core CPI, none are ideal. Directly targeting total CPI would present a myriad of problems, including massive volatility, and it is not clear that there is any upside insofar as the Bank views commodity price movements as one-time shocks and currently forecasts commodity prices to rise no further. Reverting to a core CPI definition that is simply ex-food and ex-energy has inferior empirical characteristics across the board.

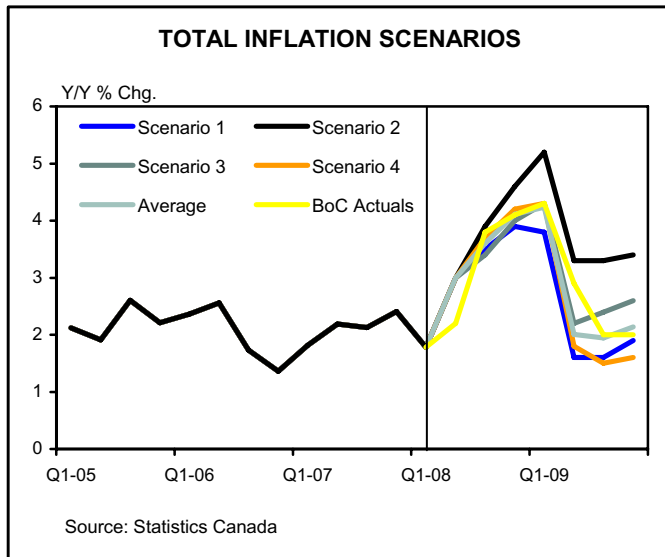
Tweaking the current core CPI definition to exclude different items or to accommodate its slight bias would set a dangerous precedent, loses some of the theoretical appeal of the original exclusions, and would require expectations that commodity prices will continue to outpace core inflation indefinitely. Using an alternate core inflation measure like the reweighted mean CPI is easily the most appealing of the alternatives, though there are a sufficient number of hindrances that inertia is likely to win out and result in the current core CPI definition being retained as the primary operational target. This is not a bad outcome: it would be unwise to change horses midstream, especially when the main point of core CPI is to help the central bank look through volatile episodes just like this one.

This is not to say that other measures of inflation will be ignored, however. Although the Bank of Canada has recently made a point of endorsing core CPI, it has also emphasized that it will continue to monitor other measures closely. In our own analysis, we continue to place by far the heaviest weight upon core CPI, but reserve a modest amount of emphasis for the reweighted mean CPI and total CPI. And, lest we forget, the Bank of Canada has always said that "if a persistent divergence were to occur between the total and the core CPI, policy actions would be taken to meet the targets in terms of the total CPI." So far, the Bank of Canada has not signalled anything in this regard, and given its forecast for total and core CPI, we do not expect this clause to be activated.

The TD Inflation Forecast

This discussion of inflation and the spread between total and core CPI provides a timely backdrop for us to revisit our own inflation forecast. Cognizant of the unusual uncertainty associated with the outlook for both commodity prices and the Canadian dollar, we compute four different scenarios, all of which we view as plausible.

Our forecasting methodology factors in the size of the output gap (the difference between actual economic performance and its potential), inflation expectations, plus the influence of currency movements and commodity shocks. At all times, we assume that for every one percentage point the economy falls below potential, inflation falls by 0.6%. Except in the commodity spike scenarios, inflation expectations are assumed to be slightly above the long-term 2.0% norm, at 2.1% given recent inflation concerns. Except in the commodity spike scenarios, the pass-through from commodity prices to core CPI and total CPI is 0.02



and 0.05, respectively. At all times, the pass-through from the Canada-U.S. exchange rate to core CPI and total CPI is zero for any movement where the Canadian dollar is weaker than the U.S., and 0.05 and 0.10, respectively, when the Canadian dollar is rising and stronger than the U.S (we believe there to be a threshold effect at parity). Except in the case of the Bank of Canada scenario, we assume that potential GDP is just 2.0%, and that the output gap bottoms out at -0.6 in the first half of 2009, before narrowing by year-end. Although 2.0% is clearly lower than the long-term norm, the recent productivity performance has left us dubious that a faster pace can be maintained in 2008 and 2009.

Scenario 1: Base Case

40% Probability

The base case scenario is precisely that – the forecast that best reflects TD’s world view. We view it as the single most likely outcome, though we include other plausible scenarios to get a better sense for where the balance of risks lie.

In addition the assumptions described earlier, the Canadian dollar is assumed to fall steadily to 1.09 (92 U.S. cents) by the end of 2009. The TD Commodity Index (TDCI) is forecast to fall by roughly 7% by the end of 2009 in U.S. dollar terms, and thus to be approximately flat on a Canadian dollar basis.

This scenario can also serve as a stand-in for a flat commodities/flat currency scenario, because we assume there is no pass-through when the currency is softening below parity as in this scenario, and because the Cana-

dian-dollar commodity outlook is almost completely flat.

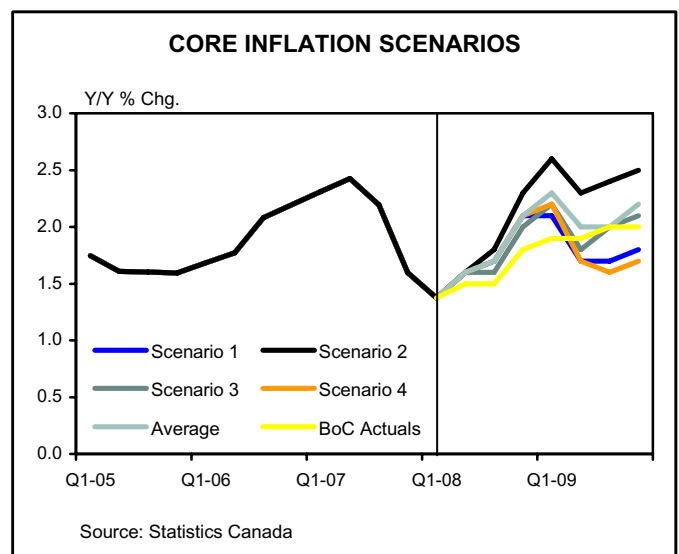
The Base Case scenario creates an outcome wherein core CPI slips slightly above 2% at the end of 2008, primarily due to base effects, but thereafter slides back below, and remains below 2% on a trend basis right through the end of the forecasting horizon, primarily because a vestige of the output gap remains at the end of 2009. Total CPI spikes up to 3.9% at the end of 2008 due to the recent surge in energy prices combined with base effects, but then slips downwards, and also winds up just below 2% at the end of 2009. There is no significant gap between total CPI and core CPI at the end of the scenario.

Scenario 2: Commodity Spike

15% Probability

Scenario 2 involves a commodity spike that is not matched by a currency response. The TDCI rises by 30% by the end of 2009, while the currency remains in the vicinity of parity. Inflation expectations are assumed to edge up throughout this scenario, from 2.1% at the start to 2.3% at the end. Commodity price pass-through is assumed to increase across the scenario, from 0.02 to 0.03 for core CPI, and from 0.05 to 0.07 for total CPI.

The outcome is that core CPI rises steadily to 2.6% Y/Y by Q1 2009, and although it then abates slightly, it remains in the 2.3-2.5% range through to year-end. It is heartening that an across-the-board increase of 30% (including oil at \$170) does not send core CPI through the Bank of Canada’s upper 3% band. For total CPI, inflation peaks at 5.2% Y/Y in Q1 2009, and then eases from there, ending



2009 at 3.4%. This is clearly too high, and in this scenario a wedge remains between core and total CPI.

Scenario 3: Commodity Spike, FX Offset

15% Probability

Scenario 3 involves a commodity spike that is matched by a currency response. The TDCI rises by 30% by the end of 2009, while the Canadian dollar appreciates by about 6% versus the U.S. dollar, to 0.94 USDCAD (\$1.06 U.S.). Inflation expectations are assumed to edge up throughout this scenario, from 2.1% at the start to 2.3% at the end. Commodity price pass-through is assumed to increase across the scenario, from 0.02 to 0.03 for core CPI, and from 0.05 to 0.07 for total CPI.

The currency provides an important offset to the rise in commodity prices, and the damage is thus somewhat contained. Core CPI peaks at 2.2% in early 2009, and ends 2009 essentially on target, at 2.1%. Total CPI remains somewhat too high, peaking at 4.3% in Q1 2009, before abating to 2.6% Y/Y by year-end. There remains a wedge

between core and total CPI at the end of the forecast horizon. Of course, if the Canadian dollar were to rise more substantially, the effect of the commodity prices would be more fully offset, and conceivably even reversed.

Scenario 4: BoC Inputs

30% Probability

Scenario 4 reflects the use of the Bank of Canada's forecasted inputs, but the TD model. Specifically, the Bank of Canada forecasts the Canadian dollar to be at 1.02 (\$0.98 U.S.) through the next few years, for energy prices to track the futures market and be roughly unchanged, and for non-energy commodities to decline in price by 15%. We also assume that potential GDP growth is 2.8% in 2008 and 2.7% in 2009 – in line with past Bank of Canada statements – instead of the 2.0% used in other scenarios. This output gap assumption has the effect of understating inflation in this scenario relative to the other scenarios (or, depending on your point of view, overstating inflation in the other scenarios relative to this one). We also use the Bank

CORE AND TOTAL INFLATION SCENARIOS*

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Average	BoC Actuals**
Prob. Of Occurrence	40%	15%	15%	30%		
Total CPI						
Q208	3.0	3.0	3.0	3.0	3.0	2.2
Q308	3.5	3.9	3.4	3.7	3.6	3.8
Q408	3.9	4.6	4.0	4.2	4.1	4.1
Q109	3.8	5.2	4.3	4.3	4.2	4.3
Q209	1.6	3.3	2.2	1.8	2.0	2.9
Q309	1.6	3.3	2.4	1.5	1.9	2.0
Q409	1.9	3.4	2.6	1.6	2.1	2.0
Core CPI						
Q208	1.6	1.6	1.6	1.6	1.6	1.5
Q308	1.7	1.8	1.6	1.7	1.7	1.5
Q408	2.1	2.3	2.0	2.1	2.1	1.8
Q109	2.1	2.6	2.2	2.2	2.2	1.9
Q209	1.7	2.3	1.8	1.7	1.8	1.9
Q309	1.7	2.4	2.0	1.6	1.8	2.0
Q409	1.8	2.5	2.1	1.7	1.9	2.0

*Figures represent year-over-year % changes in CPI metrics

**Inflation forecast published in Bank of Canada's July Monetary Policy Report Update

Scenario 1: TD model base-case

Scenario 2: 30% Commodity price increase

Scenario 3: 30% commodity price increase with exchange rate appreciation

Scenario 4: TD model forecast using BoC Inputs

of Canada's economic forecast instead of our own, all of which leaves the output gap still substantial at -0.50 at the end of 2009. The Bank of Canada has said it expects the output gap to be closed by mid-2010, and this is consistent with our calculations using these assumptions.

This scenario results in core CPI extremely similar to Scenario 1, though slightly higher in early 2009, and slightly lower at the end of 2009. At the end of 2009, we calculate that core CPI is just 1.7%. For total CPI, inflation peaks at 4.3% in Q1 2009, and falls all the way to 1.6% Y/Y by the end of 2009. There is no gap to speak of between core and total CPI at the end of the forecast (in fact, core CPI is expected to be a smidgen higher than total CPI).

We must emphasize that this does *not* represent the Bank of Canada's inflation forecast. The Bank's formal inflation forecast has both core CPI and total CPI at precisely 2.0% at the end of 2009. This is our own model's forecast, based upon the Bank's inputs. This is not hugely different from our findings, though we prefer our own calculations because it is not clear how inflation can be expected to be as high as 2% at the end of 2009 when the economy is still underperforming, commodity prices are flat to falling, the currency is flat, and inflation expectations are contained.

Weighted Forecast

When we apply the appropriate probabilities to these various scenarios, we wind up with an outcome in which

core CPI edges up to 2.2% by Q1 2009, and then slides back down to 1.9% by the end of 2009. For total CPI, inflation peaks at 4.2% in Q1 2009, and falls back to 2.1% by the end of 2009. These outcomes are as close as one could reasonably hope to the Bank of Canada's inflation target of 2.0%, and reflect an effective closure of the core vs total CPI gap.

Indeed, our own base forecast, the Bank of Canada's formal forecast, and our calculations using Bank of Canada inputs all point to outcomes in which core and total CPI are essentially the same. The key risk to this outcome is if commodity prices continue to rise and the Canadian dollar does not fully keep pace. Insofar as the Bank of Canada does not believe this will happen, core remains appropriate. But if the Bank of Canada were to have a crisis of confidence and to believe that commodity prices were on an unending run, the discussion of core vs total CPI would need to be reopened.

To the extent that these forecasts already incorporate our own assumptions about the level of the overnight rate and the resultant implications for the economy, it is not possible to arrive at a clear conclusion that monetary policy should be more hawkish or dovish. These scenarios were predicated on the belief that the Bank of Canada will not hike rates until well into 2009. We see nothing in them suggesting that this assumption should be revisited, and continue to expect to see the Bank of Canada on hold for quite some time.

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