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## Measurement Biases in the Consumer Price Index

### Introduction

In the past two years there has been extensive study and public debate in the United States on the topic of upward bias in the Consumer Price Index (CPI) as a measure of change in the cost of living and the impacts that such a bias would have on the deficit. Following statements made by Alan Greenspan, chairman of the Federal Reserve Board, in January 1995 to the Budget Committees of Congress, an advisory commission, chaired by Michael Boskin, was set up to study the CPI. The commission has recently presented its final report, entitled “Toward a More Accurate Measure of the Cost of Living”<sup>1</sup> to the Senate Finance Committee. The report concludes that the U.S. CPI will overstate changes in the true cost of living and that the “best estimate of the size of the upward bias looking forward is 1.1 percentage points per year. The range of plausible values is 0.8 to 1.6 percentage points per year.” This note discusses the different types of biases that exist in the CPI and also presents the results from a similar study on the Canadian CPI.

### The Effects of Measurement Biases

At first glance, it might seem strange that so much attention has been focused on a statistical series, albeit an important one. However, if one considers the many uses of the CPI, especially in terms of indexation and its impacts, then it is not so surprising. In both Canada and the United States, there is widespread use of indexation: income tax brackets, pensions, contracts, and so on. It would appear that in Canada the practice of partial indexation rather than full indexation may be more common than in the United States. One can point to examples such as the Canadian personal income tax system, where tax brackets and certain tax credits are increased by the amount by which the annual change in the CPI exceeds 3%. The rationale for this type of partial indexation is not related to any type of bias in the CPI, but rather to the idea that only when price changes are relatively strong are the effects of inflation considered to present a hardship. In fact, for tax years subsequent to 1992, no indexation has been required, as the increase in the CPI has been less than 3%.

In the United States, around one third of federal spending, mostly in retirement programmes, is directly indexed to the CPI. Federal revenues are also affected through the indexing of income tax brackets. Any upward bias in the CPI would have the effect of increasing the deficit from both perspectives. The Congressional Budget Office “estimates that if the change in the CPI overstated the change in the cost of living by an average of 1.1 percentage points per year over the next decade,

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1 “Toward a More Accurate Measure of the Cost of Living”, Final Report to the Senate Finance Committee from the Advisory Commission To Study the Consumer Price Index, December 4, 1996.

this bias would contribute about \$148 billion to the deficit in 2006 and \$691 billion to the national debt by then.”<sup>2</sup>

Upward biases in the CPI would also have an impact on some of the main aggregate measures of economic activity, in particular, real growth and productivity. Real GDP growth would be reduced since many of the CPI component indexes are used to deflate the components of personal expenditure. Other price indexes, which are used for deflating components of GDP, may suffer from similar biases to those in the CPI.

## Types of Bias

As a measure of change in the cost of living, the CPI contains a number of biases, which stem from the definition and the methodology used to construct the CPI. There are four types of bias which contribute to the overall overstatement of the cost of living.

The CPI, as produced by Statistics Canada in this country, and by the Bureau of Labor Statistics in the United States, does not directly measure changes in the cost of living but rather changes in the cost of purchasing a fixed basket of goods and services. However, a true cost of living index would measure changes in the minimum cost of attaining a fixed standard of living. As relative prices change, a cost of living index would measure the price of goods that consumers purchase as they substitute away from relatively more expensive items to relatively less expensive items. By holding the composition of the basket of goods and services fixed, the CPI will overstate increases in the cost of living. The size of this bias is referred to as **commodity substitution bias**.

There are also changes over time in where consumers make their purchases. In recent years there has been strong growth in superstores and discount stores, offering lower prices relative to traditional retail outlets. If the outlets sampled in the production of the CPI are not representative of where consumers are currently making purchases, then there will be **outlet substitution bias** in the CPI. However, not all of the difference in an item’s price between a discount store and a regular store can be attributed to outlet substitution bias. The consumer may be purchasing an item of different quality in the two outlets, if the regular outlet offers a higher level of service or a more convenient location. A discussion of this type of bias follows.

The fixed basket of goods and services, which is used in producing the CPI, is also intended to be fixed in terms of its quality. However, over time, improvements are made to products, both in terms of new features, increased performance, reduced frequency of repair, etc., and

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<sup>2</sup> Ibid.

the observed change in price should be adjusted to remove the effects of the change in quality. In calculating the CPI, adjustments for changes in quality are made for many items, especially consumer durables. If these adjustments underestimate or miss changes in quality, there will be positive **quality bias** in the CPI.

As new products, such as microwaves and compact disc players, are introduced into the market, they typically only enter the CPI basket with a lag. To the extent that new goods and services are missing from the CPI, and their rates of price change are different than the prices of items included in the basket, a **new goods bias** is introduced.

### Estimates of Bias for Canada and the United States

The following table presents estimates of the four types of biases for Canada, as reported by Allan Crawford in a 1993 Bank of Canada study<sup>3</sup>, and for the United States, as reported by the Advisory Committee. Note that the American report presents the average bias, while the Canadian study reports the upper limit for each type of bias. In the United States, the total upward bias in the CPI is estimated to be 1.1 percentage points per year, with a lower limit of 0.8 and an upper limit of 1.6. The upper limit of the upward bias in the Canadian CPI is estimated to be much lower in Canada at 0.5 percentage points.

<b>Estimated Bias in the Consumer Price Index</b> (percentage points per year)		
<b>Type of Bias</b>	<b>Canada</b>	<b>United States</b>
Commodity Substitution	0.2	0.4
Outlet Substitution	0.1	0.1
Quality	0.2	} 0.6
New Goods	0.1	
<b>Total</b>	<b>0.5</b>	<b>1.1</b>
<b>Range</b>		<b>0.8–1.6</b>
Source: Advisory Committee to Study the U.S. CPI Crawford, Allan, <i>Measurement Biases in the Canadian CPI</i>		

The estimate for the upper limit of bias in the Canadian CPI is roughly one third of the upper limit for the U.S. CPI. Despite the fact that the estimates of bias have been produced by different people, there are reasons to believe that the biases in the Canadian CPI could be lower than those in the U.S. CPI. In Canada, the basket is updated more frequently, normally every four years. The weights based on the 1992 Family Expenditures Survey were introduced into the CPI in January

3 Crawford, Allan, "Measurement Biases in the Canadian CPI: A Summary of Evidence", Bank of Canada Review, Summer 1993 and reprinted in The Consumer Price Index, Statistics Canada, Cat. No. 62-001, December 1993.

1995. In the United States the weights are updated every 10 or 11 years, with the basket based on 1982–84 expenditures being introduced in January 1987, and the basket based on 1993–95 expenditures scheduled to be introduced in January 1998. The further away one is from the period to which the basket applies, the greater are the chances for commodity substitution bias and potentially for some of the other types of bias.

In the case of the Canadian CPI, Statistics Canada introduces new goods into the CPI between regular basket updates when warranted by market information. For example, microwaves were added to the CPI in June 1983, in advance of the regular basket revision in January 1985 and compact disc players were added in September 1990, following the basket update of January 1989. The introduction of new goods into the U.S. CPI is likely to be somewhat slower. New goods can enter the CPI between basket changes through the one-fifth of the sample which is replaced through rotation each year.

## **Conclusion**

In the Canadian context it thus appears that the magnitude of the upward bias in the CPI relative to changes in the cost of living is considerably lower than in the United States. The impact of the bias in the CPI on the Canadian deficit and debt is probably also muted by the greater use of partial indexation in this country. However, given the widespread use of the CPI in producing other aggregate statistics, it is important to consider the possible effects of bias in the CPI when using measures of real economic growth, productivity, low income cut-offs and other indicators which incorporate information from the CPI.