

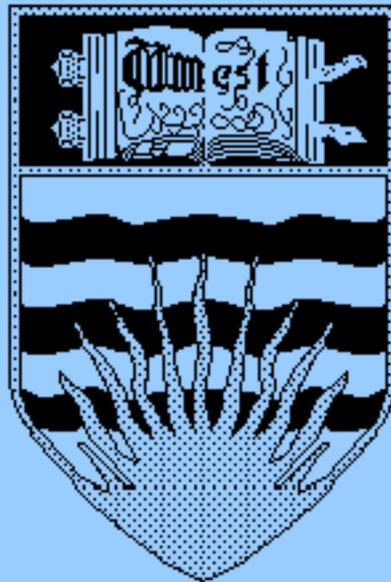
**Comment on CPI Biases**

by

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## Abstract

The paper discusses various sources of bias in the U.S. CPI. Available research indicates that the U.S. Consumer Price Index overstated inflation approximately 1.3 to 1.7% per year during the past decade.

**Key Words:** Consumer price indexes, social cost of living index, commodity and outlet substitution biases, new goods bias.

**JEL Classification Numbers:** C43, C81, E31, O47

# Comment on CPI Biases

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W. Erwin Diewert\*

## 1. Introduction

Jim Klumpner [1996] in a previous article has attacked the analysis of CPI biases presented in the Interim Report to the Senate Finance Committee [1995] from the Advisory Commission to Study the Consumer Price Index. In this comment, I respond to Klumpner's attack.

In section 2 below, I review the available evidence on sources of bias for consumer price indexes and for the U.S. CPI in particular. In section 3, Klumpner's arguments on the first three sources of bias are discussed while sections 4 and 5 respond to Klumpner's analysis of the last two sources of bias. Section 6 concludes.

## 2. What is the Evidence?

“ Very large estimates of CPI bias that range as high as two percentage points appear to result from ignorance about what the CPI actually contains and what the BLS actually does”.

*Jim Klumpner*[1996; 12]

In this section, we review the available evidence on sources of bias for the U.S. CPI.

It should be noted that the words “bias in the CPI” imply that we have a concept of what “true” or “unbiased” consumer price index is. My concept of the “true” index is what the economist Robert Pollak<sup>1</sup> has called the “social cost of living index”. The difference between this concept of the index and the Bureau of Labor Statistics' concept of the CPI can be explained briefly as follows. In the BLS concept, a representative fixed basket of goods and services is priced out every month. The official CPI is proportional to the monthly total cost of this fixed basket of goods and services. This concept does not allow for the possibility that consumers will change their baskets in response to changes in relative prices; that is, normally consumers will purchase smaller quantities of goods whose prices have risen rapidly and they will purchase relatively greater quantities of goods whose prices have risen more slowly or have fallen. The social cost of living index allows for this consumer substitution of cheaper goods for more expensive goods while the current BLS CPI does not. The social cost of living concept can also be adapted to deal with the new goods problem; for an indication of how this can be done, see section 4 below.

The five sources of bias considered in the Interim Report to the Senate Finance Committee [1995] are the same as those considered by Klumpner: (i) substitution bias; (ii) formula or elementary index bias; (iii) outlet substitution bias; (iv) quality adjustment bias or linking bias and (v) new products bias.

*Substitution bias* is the difference between a social cost of living index which allows the basket to change as prices change and the existing fixed basket CPI. However, numerical estimates of the magnitude of this substitution bias have been made at relatively high levels of aggregation.<sup>2</sup> The work of Manser and McDonald [1988] and Aizcorbe and Jackman [1993] suggests that *substitution bias* adds about .2% per year to the U.S. CPI.

*Formula bias or elementary index bias*<sup>3</sup> arises from the use of an inappropriate method for aggregating price quotations at the very lowest level of aggregation. By inappropriate, I mean that there are methods of aggregation that have an upward bias built into them. Reinsdorf and Moulton [1996] found that the non-housing components of the U.S. CPI had a .5% elementary index upward bias from June 1992 to June 1993. However, Armknecht, Moulton and Stewart [1995] found that since 1987, the owner's implicit rent component of the U.S. CPI had a .5% per year upward elementary index bias. Thus for recent years, the evidence from BLS researchers is that the U.S. CPI had an approximate .5% per year overall elementary index bias.

*Outlet substitution bias* is the bias which occurs when consumers shift their purchases from high cost outlets to lower cost outlets for the same commodity. Reinsdorf [1993] found evidence that this source of bias has become important in the U.S. during the 1980's and 1990's although it did not appear to be important in 1960's. The conservative estimates of Reinsdorf [1993] for the U.S. and the estimates of Saglio [1994] for France suggest that outlet substitution bias might amount to .25% to .4% per year in recent years.

*Quality adjustment bias or linking bias* is the bias which can occur when a variety or model of a good is replaced by a new variety. Suppose that a new model appears which is more efficient in some dimension than an existing model. After two or more periods, the Statistical Agency places a price ratio for the new good into the relevant elementary price index, but the absolute decline in price going from the old to new variety is never reflected in the relevant elementary price index. This source of bias was recognized by Griliches [1979; 97], Gordon [1981; 130-133] [1990] [1993] and many others.

Our final source of bias is *new goods bias*. During the past three decades, the number of commodities that consumers can purchase has increased enormously: supermarkets have steadily increased the number of products that they offer each year; large specialty warehouse stores have sprung up that offer tremendous numbers of related commodities for sale; video rental markets have sprung up; cablevision offers increased channels; etc. However, traditional index number theory makes no allowance for this large expansion in consumers' choice sets.<sup>4</sup>

With respect to the last two sources of bias, it is not possible to estimate their aggregate impact with any degree of precision at this stage. I believe that a conservative range of estimates for the *linking bias* and the *new goods bias* in the U.S. CPI in recent years is .35% to .6% per year upward bias.<sup>5</sup>

It is likely that the above sources of bias are approximately additive. Thus adding up the above sources of bias, I believe that the U.S. CPI overstates inflation by approximately 1.3% to 1.7% per year in recent years.

### 3. Klumpner's Evidence on the First Three Sources of Bias

“BLS is confident that there is no outlet bias independent of the formula bias. Indeed, it seems unbelievable that the price division at BLS could remain ignorant of K-mart, Price Club and CompUSA when these firms spend millions of advertising dollars to make certain that the rest of us are aware they exist.”

*Jim Klumpner*[1996; 3]

Klumpner concludes that the commodity substitution bias averages about .2% per year over the course of a decade. This agrees with the best available evidence that we reviewed in the previous section so we have no disagreement here.

On the magnitude of the elementary index or formula bias, Klumpner endorses an estimate between .1% and .3% per year.<sup>6</sup> However, as we saw in the previous section, estimates of this source of bias made by BLS researchers are in the .5% per year range for recent years.

As the quotation at the beginning of this section indicates, Klumpner is asserting that the BLS believes that outlet substitution bias is zero. However, the following quotation by the Commissioner of the Bureau of Labor Statistics indicates that the zero estimate is not so clear cut:

“The outlet substitution effect can arise because consumers are free to substitute where they buy goods and services as well as what they buy. For example, if consumers don't consider the (possibly) lower level of customer service provided by a discount store to be of any consequence, they may shift to such stores and experience no loss of well being. Current CPI procedures would not capture any price decline associated with such a shift. Although it is unclear that there is in fact any bias associated with the CPI's treatment of discount outlets, further research on this issue would be valuable.”

*Katharine Abraham*[1995; 108]

High cost outlets do disappear and are replaced with lower cost outlets. The current BLS methodology attributes the lower average prices that result for consumers *entirely* as

a quality decline. This is clearly wrong for at least some goods. It is reasonable to suppose that at least *some* portion of the lower average prices paid by consumers for homogeneous commodities across outlets is a genuine price decline. Thus it is not that the BLS is ignorant of discount stores that is at issue: it is the way the BLS averages price quotes from high and low cost outlets that is at issue here.<sup>7</sup>

#### 4. Quality Change Bias and New Products Bias

“Most of the differences between economists’ estimates of CPI bias stems from different views about *quality change bias* and *new products bias*. For instance, the Boskin commission’s September report claimed that these two effects probably accounted for about 0.5 percentage point of bias and might account for as much as 1.3 percentage points. I would argue that the effect of these two factors is close to zero.”

*Jim Klumpner* [1996; 4]

Klumpner makes several preliminary arguments to buttress his contention that the new good and quality change bias is close to zero including: (i) new products merely displace other existing products and so the consumer surplus generated by the new products is simply offset by the loss of consumer surplus on existing products; (ii) it is impossible to measure the benefits of new higher quality products because quality is essentially non-quantifiable; (iii) the BLS already makes a serious attempt to adjust for quality change when they believe it to be a problem and (iv) the BLS is limited in how many quality change adjustments that it can undertake due to the high cost of making such adjustments. I totally agree with point (iv), mildly disagree with points (ii) and (iii) (note that they are mutually contradictory) and totally disagree with point (i). With respect to (ii), the work of the BLS and the researchers cited in footnote 5 shows that while it may be difficult to undertake quality adjustments, it is not impossible. With respect to (iii), the cost considerations mentioned in (iv) prevent the BLS from undertaking all of the quality adjustments that it would like to do.

To explain why I disagree with Klumpner’s displacement argument (i), it may be useful to consider Figure 1 below.

## Figure 1

The consumer is assumed to have preferences defined over existing goods  $q_1$  (the horizontal axis) and a new good  $q_2$  (the vertical axis). Three representative indifference curves are labelled by  $u_1$ ,  $u_2$  and  $u_3$ . In period 1, before the new product is introduced, the consumer is at point  $A$  and consumes  $q_1^1$  units of good 1 at price  $p_1^1$ . We have drawn in an imaginary budget line which is just tangent to the  $u_1$  indifferent curve at the point  $A$ . The slope of this budget line is  $-p_1^1/p_2^1$  where  $p_2^1$  is the shadow price or reservation price of the new good that would just induce the consumer to purchase 0 units of the new product, if it were available during period 1. In period 2, the new good is available and the consumer faces the budget constraint  $p_1^2 q_1 + p_2^2 q_2 = \text{income}$  through the point  $B$ . The highest utility level,  $u_3$ , that the consumer can achieve in period 2 is attained at  $C$ . Note that even though purchases of the new good replace purchases of existing products, the consumer benefits from the introduction of the new product. A measure of the benefit of the increased choice set (in terms of units of the existing good) is  $BD$ .<sup>8</sup>

Note that in order to actually calculate the benefit measure  $BD$ , we have to know the consumer's preferences. This is where Hausman [1996] makes a significant contribution: he actually estimates econometrically consumer preferences for breakfast cereals using scanner data. As a possible alternative to Hausman's econometric approach, we could apply the economic approach to index number theory<sup>9</sup> which requires only an estimate of the reservation price  $p_1^1$  in period 1 along with the consumer's observed choices in periods 1 and 2. Unfortunately, the estimation of reservation prices will typically again involve econometric estimation.

The point we are trying to make here is that it is simply not correct to regard the benefits of increased consumer choice to be negligible. However, we concede that it is not easy to measure accurately these benefits of increased choice.

## 5. Arguing From Anecdote

‘Because there hasn't been a comprehensive research effort to adjust a broad range of items in the CPI or to account for newly introduced goods arguments in these areas usually rely on anecdote. The danger in arguing from anecdote, of course, is that an anecdote may seriously mis-represent the more general case. I believe that this is the source of error in the very high estimates for quality adjustment and new product biases of the Boskin commission and others.’

*Jim Klumpner* [1996; 5]

Klumpner's main arguments to support his case that the biases due to the inadequate treatment of quality change are negligible are: (i) the existing studies on the topic cover a rather narrow range of products and hence may not be representative and (ii) the expenditure shares for the “whiz-bang” consumption categories where new products are important are very small. With respect to point (i), I believe that the studies cited in footnote 5 cover enough different components of consumer expenditures and find large enough biases that we can safely say that the problems are not negligible. With respect to point (ii), it is possible for different economists to analyze the same expenditure shares and to come up with very different estimates of the new goods bias: Klumpner is perhaps on one end of the spectrum while Nordhaus [1996] and Nakamura [1995] are on the other end.

Is there any general evidence on the magnitude of the new products bias other than anecdotes? Some general evidence comes from two sources. The first source is the A.C. Nielsen scanner data base. William Hawkes has informed me that the number of U.S. Universal Product Codes has grown from 950,000 in January 1990 to 1,650,000 in September 1995. Some of this increased in products is simply a market penetration phenomenon:

more and more manufacturers are coding their commodities. However, a substantial fraction of the above increase in codes has to represent a genuine increase in consumers' choice sets. A second general source of evidence on the magnitude of the new products problem comes from the records of the BLS itself: each month, approximately 3% of the price quotes of the previous month simply disappear.<sup>10</sup> A substantial fraction of these missing quotes is probably due to temporary inventory shortages and other factors but surely a substantial fraction must be due to the replacement of old goods by newer goods.

Finally, in order to appreciate how choice sets have changed over time, I invite each (older) reader to think about the bundle of goods and services that he or she consumed as a youth. In my own case, when I think back 45 years, there were very few fresh fruits and vegetables available during the winter, there was no margarine, no low fat foods, no imported wines or beers, local beer had sulfite preservatives and there were no microwave meals. There was no effective insulation for houses, no double paned windows, no air conditioning, and no programmable thermostats. Washing machines had labor intensive rollers and clothes were dried on lines. There were no home computers, television sets, compact disks and espresso machines. There were no artificial Christmas trees that could be reused for decades and no in parallel Christmas tree lights that twinkled and changed colors. Light bulbs had to be replaced frequently and were not as energy efficient. Most homes were heated with polluting coal which created dense fogs in Vancouver in the fall for 5 to 10 days per year. Now the use of natural gas heating has eliminated the coal pollution and there are no foggy days. There were no cellular phones and no electronic transmission of information from ones home. Gas guzzling cars required frequent servicing, brakes were poor and tires wore out quickly. Air travel was only for the very rich. Motorized wheelchairs did not exist. Organ transplants and hip joint replacements existed only in science fiction. There were no video rental stores but there were drive in theaters! The point of all of this is to simply indicate that the new products problem is not negligible.

## 6. Conclusion

“The commission’s incorrect ideas about outlet bias and a somewhat higher estimate for formula bias are the inadvertent results of the haste with which the September report was put together. It is unfortunate that the commission had time for only the briefest of briefings from the BLS analysts who work full-time on the CPI.”

*Jim Klumpner*[1996; 3]

As the reader of this comment will have gathered, I find myself in broad agreement with the numbers of the Advisory Commission to Study the Consumer Price index: the

evidence currently available indicates that the U.S. CPI has overstated inflation approximately 1.3 to 1.7% per year during the past decade. I also disagree with the thrust of the above quotation. The Commission members, Michael Boskin, Ellen Dulberger, Robert Gordon, Zvi Griliches and Dale Jorgenson all have a long history of studying price measurement problems and hence there is no need for them to undertake a lengthy series of briefings to be brought up to speed.”

All of the sources of bias discussed in this paper have been around for a long time. Why is there a sudden renewal of interest in the topic on the part of economists?

I think that the renewed interest is due to two factors: (i) BLS economists have been at the forefront of recent research on biases and their studies are very credible and hence are taken seriously and (ii) there is some evidence of a paradigm shift in the economics of the firm: instead of modelling firms as producing increasing amounts of same list of outputs, economists are increasingly modelling firms as specializers that collectively produce smallish amounts of an increasing number of outputs. Thus it has become increasingly important for Statistical Agencies to modify their procedures to deal with a rapidly growing number of commodities rather than simply measuring the prices and quantities of a fixed list of commodities.

Finally, the implications of significant upward biases in consumer price indexes extend far beyond the (very important) entitlement indexation issues discussed by Klumpner: the significant upward biases in price indexes imply significant downward biases in consumption growth, output growth, productivity and real wages. Thus recent U.S. economic performance has been much better than current official statistics indicate.

## Footnotes

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1. See Robert A. Pollak [1981].
2. The most disaggregated estimates are due to Manser and McDonald [1988] who used 101 categories of goods and services and Aizcorbe and Jackman [1993] who used 207 categories of goods and services for 44 U.S. regions of 9108 commodities.
3. I prefer the term “elementary index bias” over “formula bias” since substitution bias is also a form of formula bias. Also, elementary index bias can be viewed as a form of substitution bias, but at lower levels of aggregation.
4. A notable exception to this assertion is Romer [1994]. Note that Marshal [1887; 373], Griliches [1979; 97], Gordon [1981; 130] and Diewert [1987; 779] [1993; 59-63], suggested that the new goods bias could be substantially reduced (but not eliminated) by simply introducing new goods into the pricing basket in a timely fashion. Triplett [1993; 200] termed the subset of the new goods bias caused by delays in introducing new products into the index the *new introduction bias*.
5. Evidence on the magnitude of these sources of bias is contained in Gordon [1990], Trajtenberg [1990], Berndt, Griliches and Rosett [1993], Pakes, Berry and Levinsohn [1993], Griliches and Cockburn [1994], Berndt, Griliches and Rappaport [1995], Hausman [1994] and Nordhaus [1996]. For a more detailed discussion of this evidence, see Diewert [1995a] [1995b].
6.

“Though somewhat uncomfortable with the request, BLS responded that they guessed the formula bias was between 0.1 and 0.3 percentage points, and the budget negotiators have now built this assumption into their baselines as well.”

*Jim Klumpner* [1996; 3]
7. Reinsdorf [1996], using scanner data, showed that outlet substitution bias due to consumers purchasing of goods on sale can be significant as well.
8. This methodology for treating new products is due to Hicks [1940; 114].
9. See Diewert [1980; 498-401].

10. See the BLS [1984; 13].

11. All five members presented testimony on CPI biases to the U.S. Senate Committee on Finance [1995]. Additional references to their measurement research include Boskin, Robinson and Roberts [1989], Dulberger [1989] [1993], Baily and Gordon [1988], Griliches [1961] [1992] [1994], Fisher and Griliches [1995], Jorgenson [1995] and Jorgenson and Slesnick [1983].

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