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THE U.S. CPI AND THE COST-OF-LIVING OBJECTIVE

Invited paper submitted by Bureau of Labor Statistics of the United States of America*

Abstract

The U.S. Consumer Price Index (CPI) has long been, and remains, an index that is guided by the economic theory of the cost-of-living index (COLI). In this paper I discuss the operational implications of this link between the CPI and the COLI objective. The purpose is not to provide a new derivation and explication of the theoretical framework of the CPI. Rather, it is to review how the COLI concept has played a role in past BLS decisions and in the current BLS view with respect to difficult methodological issues.

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I. Introduction

1. The U.S. Consumer Price Index (CPI) has long been, and remains, an index that is guided by the economic theory of the cost-of-living index (COLI). In 1984, the Bureau of Labor Statistics (BLS) *Handbook of Methods* stated that "A unifying conceptual framework for dealing with practical questions that arise in construction of the CPI is provided by the concept of the cost-of-living (COL) index."[1] Similar statements are repeated in subsequent editions of the *Handbook*, through to the most recent 1997 volume.

2. In this paper I discuss the operational implications of this link between the CPI and the COLI objective. The purpose is not to provide a new derivation and explication of the theoretical framework of the CPI. Neither will I attempt to justify the COLI and defend it against criticisms; such a justification has been presented in a recent and authoritative paper by Jack Triplett (2001). Rather, the goal here is to review how the COLI concept has played a role in past BLS decisions and in the current BLS view with respect to difficult methodological issues.

3. The next section of the paper provides a historical summary of official BLS statements about the CPI and the COLI. Section III follows with an overview of how the CPI is related to a conditional COLI. Sections IV, V, and VI present, in chronological order, three important historical case studies: the introduction of rental equivalence in 1983, the incorporation of a geometric mean formula in 1999, and the design of a superlative CPI for release in 2002. In section VII I briefly discuss several other notable past and current methodological questions, and Section VIII concludes.

II. The BLS View of the CPI

4. In this section several citations are presented to show how the BLS has characterized the CPI and its measurement objective. A subsidiary purpose is to demonstrate that official statements have been reasonably consistent since the 1970s, contrary to the frequently-expressed statement that the CPI adopted the COLI concept only in response to outside criticism during the last several years.

5. Here I will avoid the early history of the CPI. As is frequently noted, the index was titled the Cost-of-living Index until 1945,[2] but that predates the modern controversy about the relevance of that theoretical construct.

6. An important milestone was the support for the COLI objective expressed in the 1961 "Stigler Committee" report, which was prepared for the U.S. Government by the National Bureau of Economic Research.[3] The BLS initially reacted negatively, based on the difficulty of estimating a COLI. Commissioner Ewan Clague testified to a subcommittee of the Joint Economic Committee that:[4]

> "There is one very important recommendation [in the report] with which the Bureau of Labor Statistics cannot agree, even with modifications. This is the recommendation that the Consumer Price Index be reoriented gradually toward a 'welfare' or 'constant utility'

> index. We would see some value in having a 'true cost-of-living' or constant utility index if techniques can be developed for defining such an index, and then for compiling it objectively.
>
> "We must emphasize, however, that this is a long-range goal that is now unattainable, may always be unattainable, and at best could be fully attained only after considerable further theoretical and statistical exploration."

7. Notwithstanding the pessimism of this statement, the Bureau lent considerable assistance to such exploration. Notably, research funding was provided during the late 1960s and the 1970s for a large number of papers by Robert Pollak that considerably advanced the theoretical underpinnings of the COLI.[5]

8. Subsequent published statements about the CPI by BLS officials have tended to combine references to the COLI measurement objective with caveats noting the obstacles to achieving that objective. The section in the current *BLS Handbook of Methods* is typical:[6]

> "A unifying framework for dealing with practical questions that arise in construction of the CPI is provided by the concept of the cost-of-living (COL) index … However, the concept is difficult to implement operationally because it holds the standard of living constant, and the living standard must be estimated in some way.
> "The CPI uses a fixed market basket to hold the base-period living standard constant … The CPI provides an approximation to a COL index as a measure of consumption costs."

9. That *Handbook* section cites a 1974 paper by the BLS economist (and later Deputy Associate Commissioner for Prices and Living Conditions) Robert Gillingham. In that paper, which focuses on Pollak's concepts of partial and conditional COLI subindexes, it is

> "… assumed that the primary purpose of the [CPI] is to approximate changes in the cost of living of consumers."[7]

10. The *Handbook of Methods* also references another paper by Robert Gillingham and this author, who was then Chief of the Bureau's Division of Price and Index Number Research, or DPINR. That 1987 paper begins with a somewhat more precise statement about the CPI's interpretation: [8]

> "The U.S. Consumer Price Index (CPI) measures the change over time in the cost of a fixed market basket of goods and services. It can be interpreted as a fixed-weight approximation to a conditional cost-of-living index, where (1) the cost of living is defined as the minimum expenditure necessary to achieve a particular level of satisfaction and (2) the cost is defined to be conditional on all the determinants of the level of satisfaction except current quantities of market goods and services."

11. Over the years, similar published statements have been made by BLS officials ranging from Joel Popkin, then Assistant Commissioner for Prices and Living Conditions, in 1972: [9]

> "Although operationally the present CPI 'is designed to measure the changes in a fixed market basket of consumption goods and services,' it is clear that its conceptual purpose is to reflect changes in the 'true' cost of living."

to Dennis Fixler, economist in (and subsequently Chief of) DPINR, in 1993: [10]

> "The Consumer Price Index (CPI), produced by the Bureau of Labor Statistics, serves as an approximation of an ideal cost-of-living index."

12. Measurement issues in the CPI began to attract considerable public attention during the middle 1990s, culminating in the formation of the Advisory Commission to Study the CPI (the "Boskin Commission"). In April 1995, after the beginning of this controversy, but before the Boskin Commission was formed, the BLS issued a report to the House Budget Committee (HBC). At one point this report contrasts the CPI and COLI, stating that:[11]

> "The Consumer Price Index is designed to measure price change for a fixed market basket of goods and services representing average consumption patterns during a base period. An economic cost-of-living index, on the other hand, would measure the change in the cost of obtaining a fixed level of economic well-being."

13. The surrounding discussion in the report, however, again emphasizes the CPI's close relationship to a COLI, noting, for example, that:

> "One can imagine a family of cost-of-living index concepts that vary with respect to how, and for what, compensation to the consumer is contemplated. Any expenditure-based index, such as the CPI, is only one member of this family and is, thus, a 'subindex' of the general cost-of-living index concept."

14. It is clear from all the above statements that the COLI was the guiding framework for the CPI. In the April 1995 report to the HBC, for example, superlative indexes are treated as issues worthy of research, and the report emphasizes practical, not conceptual, obstacles to their use.

15. Statements by the BLS after the December 1996 Boskin Commission final report may be somewhat more explicit in indicating the Bureau's acceptance of the cost-of-living objective, but in substance they echo previous statements. The BLS paper "Measurement Issues in the Consumer Price Index" indicated:[12]

> "The BLS has for many years used the concept of the cost-of-living index as a framework for making decisions about the CPI and accepts the COLI as the measurement objective for the index … The cost-of-living index approximated by the CPI is a subindex of the all-encompassing cost-of-living concept … "

and in testimony to a Congressional subcommittee in April 1997, Commissioner Katharine Abraham responded to the Boskin Commission's recommendation that the CPI establish a COLI objective by saying:[13]

> "This seems basically right to me. Indeed, the BLS long has said that it operates within a cost-of-living framework in producing the CPI."

16. To summarize, as viewed from within the Bureau, both before and after the Boskin Commission report, the BLS position has been that (i) the COLI provides the framework objective for the CPI, but (ii) the CPI cannot be called a COLI because of limitations of scope, failure to reflect all consumer substitution, and other problems.

III. The CPI's Theoretical Framework

17. Like any price index, the U.S. CPI has numerous uses and must attempt to deal with competing objectives. The CPI's use as a current indicator of inflation is one reason for its monthly publication frequency. For example, because it is used widely as an escalator for government benefits and in private contracts, and as an indexation factor for government bonds, there is a reluctance to revise previously-published data except under extraordinary circumstances. These constraints impose some limits on the CPI's ability to approximate a COLI, as will be noted in section VI below with respect to superlative formulas. Nevertheless, the framework below provides the basic goal of CPI decision-making.

18. As detailed in Gillingham (1974), the CPI is designed to approximate a conditional subindex of the cost of living given by

$$I(P^a, P^b, \psi, s, U) = C(P^a, \psi, s, U) / C(P^b, \psi, s, U)$$

19. In the above expression, C is a conditional cost function[14] defining the expenditure required to achieve the indifference curve s of utility function U given prices P for currently-consumed market goods and services and pre-specified values ψ of all other variables affecting consumer utility. This latter group of variables will include, *inter alia*, future consumption, labor-leisure time allocation, and environmental aspects such as air pollution. Then the index *I* compares the costs of achieving that base indifference curve under the two price regimes P^a and P^b, holding the variables in ψ constant.

20. Based on this specification, there are two reasons why the CPI cannot be said to be a "complete" or "pure" COLI. The first arises from the conditional objective defined above. The model recognizes that consumer welfare in any two periods will depend on many factors other than the prices of market goods. Therefore, deflation of some income measure by the conditional COLI *I* is not sufficient to determine movements in consumer welfare between periods. As noted in the BLS brochure "Understanding the Consumer Price Index: Answers to Some Questions":[15]

> "Both the CPI and a cost-of-living index would reflect changes in the prices of goods and services, such as food and clothing, that are directly purchased in the marketplace; but a complete cost-of-living index would go beyond this to also take into account changes in other governmental or environmental factors that affect consumers' well-being."

21. Pollak (1989, Chapter 9) discusses an unconditional form of the COLI in which the index is formed as the ratio of costs under two price-environment regimes. Both Triplett (2001) and Peter Hill (1999b) discuss intermediate concepts where the index is conditional on only some aspects of the environment, the others being allowed to vary. Given the difficulties of measuring and valuing environmental changes, however, an unconditional or "complete" COLI has not been viewed as an operational concept.

22. Having established that the CPI is designed to approximate the conditional COLI, there still may be problems in specifying the precise nature of what is held constant as a conditioning variable. Some of these questions are raised in section VII below.

23. The second major conceptual limitation of the CPI relative to a complete COLI goal has arisen from its incomplete recognition of consumer substitution behavior. Well-known theorems indicate that a Laspeyres index will be an upper-bound approximation to a corresponding COLI. Although the CPI has never been a true Laspeyres index,[16] it is still likely that the index will overstate movements in the conditional COLI. As stated in the 1997 *Handbook of Methods*, the CPI "… is an index of price change only and does not reflect changes in buying patterns that consumers probably would make to adjust to relative price changes."[17]

24. The BLS has taken steps in recent years to address substitution bias, specifically in order to more closely approximate the conditional COL objective. These decisions are the subject of sections V and VI below.

25. The appropriateness of the COLI objective has been a topic of longstanding controversy. Recent commentaries by respected CPI experts range from strong support by Erwin Diewert (1999) and Triplett (2001) to strong opposition by Ralph Turvey (1999), with Angus Deaton (1998) and Hill (1999a, 1999b) perhaps somewhere in between. Even Pollak, upon whose work many BLS decisions have been based, has expressed reservations[18]:

> "To deal with current concerns about the CPI within the framework of economic theory requires developing the theory of the cost-of-living index under more general assumptions than have thus far been standard."

26. This lack of consensus is mirrored among statistical agencies. Triplett (2001) provides several examples of countries on each side of the issue, and also notes the lack of any reference to the COLI in the 1989 ILO manual on CPI's.[19] (It should be noted, however, that the new version of that manual will discuss COLI theory extensively, without going so far as to endorse the framework.) Finally, both the Australian Bureau of Statistics (1997) and Helen Stott (1998) discuss the lack of agreement among users on the appropriate purpose of the CPI, in Australia and New Zealand, respectively.

27. It is not the purpose of this paper to delineate or extend this debate. I will only note that the arguments over the adoption of the COLI framework have not always been matched by debate over particular operational issues. With respect to some issues, in particular those involving the choice of index number formula, the same decisions have been justified from either perspective. That is, some common ground seems to have been found on some issues of "best practice."

IV. Rental Equivalence

28. On October 27, 1981, the BLS announced its intention to change the way in which it measured the cost of shelter for homeowners in the CPI.[20] Previously, the index's homeownership component had included home purchase prices, contracted mortgage interest costs, property insurance, and other acquisition and maintenance costs incurred by owners. As of January 1983, however, the CPI would employ the rental equivalence approach: changes in homeownership costs would be reflected primarily by changes in market rents, adjusted to represent the characteristics of owner-occupied housing units.[21]

29. The decision to move to rental equivalence was controversial. It was made only after a number of years of study, including the publication of several experimental indexes employing alternative measurement approaches.[22] Among the factors triggering the decision were the enhanced volatility of U.S. housing and financial markets, along with growing problems in acquiring accurate data on mortgage costs and home purchase prices. In particular, the index reflected only long-term mortgages with fixed interest rates, and had no way of dealing with new variable-rate instruments or below-market owner-financed mortgages. These developments made it increasingly difficult for the BLS to construct and defend the prior measurement approach, which had no solid conceptual framework on which to base methodological decisions. Thus, it would be incorrect to argue that the rental equivalence decision was motivated exclusively as a means of moving the CPI closer to a cost-of-living index. At the heart of the decision, however, was the BLS view that the objective of the CPI homeownership component is to measure the cost of consuming the shelter services provided by owner-occupied homes. This view is inherent in the COLI approach.

30. Support for rental equivalence dates back at least to the Stigler Committee, which argued that (1) a true cost-of-living index or "constant-utility index" is the appropriate index for the CPI, (2) the welfare of consumers depends upon the flow of services from durable goods, not upon the stocks acquired in a given period, and therefore (3) successful development of a rental equivalence series would offer the basis for an improved CPI.

31. This same viewpoint is reflected in official BLS publications describing the methodological change. For example, the January 1983 issue of the CPI Detailed Report discusses the decision in the following terms:[23]

> "The change converted the homeownership component from a method that included investment as well as consumption elements, to a flow-of-services approach that measures only the cost of shelter services consumed by homeowners. The flow-of-services approach was implemented using the rental equivalence technique … The flow-of-services approach and the rental equivalence methods were developed directly from the economic theory of consumer price indexes. In the overall conceptual framework for the Consumer Price Index, it is assumed that the consumer's welfare is determined by the flow of consumption services received …"

32. The article's reference to the CPI's conceptual framework cites Gillingham's 1974 paper, mentioned in section II above, which places the CPI in the context of Pollak's COLI theory.

33. As discussed by Triplett (2001), the treatment of owner-occupied housing in CPI's is a central issue in the debate between advocates and opponents of COLI theory. Turvey (1999), for example, presents several arguments against the American inclusion of imputed rental values to represent the user cost of housing. Eurostat rejected the flow-of-services approach in constructing the Harmonized Indices of Consumer Prices, arguing that " … imputed rents are the opportunity costs to owner occupiers of living in their houses rather than a reflection of actual prices faced by them as consumers. These and any other opportunity costs are not regarded as part of inflation."[24] A similar position has been taken by the Australian Bureau of Statistics.[25] Thus, although I again emphasize that operational factors played a critical role in the 1983 BLS decision to change its treatment of homeownership, the COLI framework was an essential factor in the adoption of rental equivalence.

V. The Geometric Mean Formula

34. Serious consideration of the geometric mean at the BLS stemmed from the work on the so-called "formula bias" problem encountered in the statistical behavior of basic CPI indexes. Nevertheless, the geometric mean formula was adopted specifically as a means of moving the CPI closer to a cost-of-living index by reflecting consumer substitution behavior.

35. Formula bias (the term is somewhat unclear and sometimes has led to confusion) is discussed in detail in several BLS papers. Marshall Reinsdorf (1998), Brent Moulton (1993), and Reinsdorf and Moulton (1997), for example, describe BLS sampling procedures and how the computational procedures used prior to 1995 led to upward biases in component CPI indexes.

36. Prior to 1999, all CPI basic indexes employed a modified Laspeyres formula. At the elementary index level, the Laspeyres index requires estimation of quantity weights for individual items, which in CPI procedures are estimated by dividing a "base period expenditure" value by an estimated "base period price." In brief, the formula bias problem arose because when a new item entered the index, the same observed price used as the denominator of the first price change was also used to estimate the base period price. If the item was temporarily low in price in the "link month"—for example, because it was on sale—this would result in a low base-period price and a larger quantity weight. Under reasonable assumptions about price oscillation or "bouncing" around a trend, it would also lead to a higher initial expected price change. The opposite occurred if the price was temporarily above its trend in the link month. The CPI procedure thus introduced a positive correlation between the item's weight and its expected price change in the months following the item's inclusion in the index.

37. Equation (9) of Moulton (1993) demonstrates this problem in the context of a simple logarithmic model of price change and consumer behavior. The equation shows that, in the CPI's (circa 1993) version of the Laspeyres formula, overstatement of movements in a COLI depends both on the true elasticity of consumer demand and on the autocorrelation of price changes. The important point is that the bias is positive even if the true demand elasticity is zero, so long as price changes are negatively correlated over time. That is, even if the Laspeyres formula is consistent with consumer behavior, the CPI would overstate the COLI unless, for example, the current item price provides no information about its future price movements (prices follow a random walk).

38. The geometric mean index avoids this formula bias problem because it does not require quantity weights. At the same time, the BLS recognized that the geometric mean implicitly assumes Cobb-Douglas substitution behavior by consumers. Moulton (1993) concludes by saying that the geometric mean "has many beneficial features" including recognition of consumer substitution behavior, and the paper provides justifications for its use even in an index like the CPI that uses a Laspeyres formula for higher-level aggregation.

39. Thus, adoption of the geometric mean would have been one way that the BLS could have eliminated formula bias in the CPI. BLS simulations, however, indicated that much of the empirical difference between the CPI and a geometric mean index was due not to formula bias per se but to the different implied assumptions about consumer demand elasticity. As a consequence, procedures for a "seasoned" Laspeyres index were implemented in 1995 and 1996. This eliminated formula bias in the modified-Laspeyres CPI, while allowing the BLS time to evaluate the relative accuracy of the geometric mean's Cobb-Douglas demand assumption.[26]

40. Subsequently, the BLS undertook empirical analysis of the geometric mean, not only for research purposes but also with an eye toward implementation in the CPI. For example, the April 1995 report to the HBC made clear that the BLS was investigating the geometric mean, along with other possible formulas for calculating basic indexes, noting that "Within the next year, the Bureau hopes to publish the results of this research with an evaluation of which method is appropriate for the CPI."[27]

41. By early June 1995, the CPI staff had prepared "requirements" documentation providing the technical computer system details for the construction of monthly "production-quality" geometric mean indexes.[28] These became the basis for the development of the experimental CPI-U-XG historical series that was first published in April 1997. In 1998, after extensive analysis and after consultation with index number experts, the BLS announced that the geometric mean would replace the modified Laspeyres formula in the almost 200 CPI categories for which Cobb-Douglas behavior was judged more appropriate than fixed consumption quantities. The modified Laspeyres formula was retained in only 15 categories. Kenneth Dalton et al. (1998) summarize the basis for the BLS decision:

> " … the evidence unambiguously supported the proposition that consumers can, and do, alter their purchasing behavior in response to changes in the array of prices that they confront in the marketplace … the geometric mean estimator can better reflect the effects of such changes in consumer spending …"

42. Thus, the geometric mean decision is an unquestionable example of a BLS decision based on the COLI framework. Nevertheless, it must be recognized that other agencies that reject the COLI have also approved of the geometric mean. Based on results obtained by Szulc (1989) and others, there has been a general recognition that some basic index formulas—in particular the "Carli" or "average of ratios" formula—are affected by statistical problems similar to formula bias and that, again, those problems can be avoided through the use of the geometric mean. Thus, for example, the geometric mean is one of the formulas approved by Eurostat for use in the Harmonized Indices of Consumer Prices.[29]

VI. The BLS Superlative CPI

43. The BLS budget for fiscal year 1998 provided for development of a new CPI that would use a superlative formula to combine the basic item-area index series. The largest component of the budget increase was funding for a nearly 50-percent expansion in the size of the Consumer Expenditure Survey beginning in 1999. This greater sample size was judged necessary in the construction of the superlative CPI. The new index series, which will be a complement, rather than a replacement, for the existing CPI-U and CPI-W, will be published for the first time in 2002.

44. As of this writing, BLS has not announced the details of the superlative index; these details will include, for example, its periodicity, the level of published detail, the month of first publication, and the precise formulas used in its construction. Consequently, at this time there are few published statements that can be cited here. The development of the superlative CPI stands, however, as perhaps the clearest instance of a decision that is based on COLI theory.

45. As noted earlier, the reflection of consumer substitution behavior is inherent in a COLI, and this is the explicit purpose of the superlative CPI. The 1998 budget submission argued that superlative indexes " … reflect the ability of consumers to substitute among goods and services …" and " … are regarded as providing closer approximations to cost-of-living measures than the currently published CPI."[30] BLS interest in this topic is longstanding. Research on econometric estimation of COLI indexes goes back at least as far as Steven Braithwait (1980), and Ana Aizcorbe and Patrick Jackman (1993) was the first of several papers on experimental superlative indexes using CPI data.

46. An alternative to production of a new superlative index would be the inclusion of a superlative formula, or empirical approximation to a superlative formula, in the CPI-U and CPI-W. This was the recommendation of the Boskin Commission and has been recommended by other observers as well.[31] The BLS arguments against the use of a Fisher or other superlative formula have been based on the fact that the CPI-U and CPI-W are in final form when first published. Following standard international practice, the BLS avoids revising those indexes, in large part because of their extensive use in legal contracts. A true superlative formula requires current-period expenditure data, so it would have to be published only with a lag, or else published in preliminary (estimated) form and made subject to revision as the expenditure data become available. With respect to the use of approximating formulas such as the "Lloyd-Moulton" form proposed by Matthew Shapiro and David Wilcox (1997) and supported by Diewert (1998) among others, the BLS has expressed reluctance based primarily on the lack of extensive analysis and testing of such formulas.[32] The development of a true superlative index separate from the CPI-U and CPI-W was judged a superior approach to dealing with consumer substitution across basic CPI categories.

47. Finally, as with the geometric mean, it is the case that the use of superlative formulas has been advocated by some who reject the COLI framework. Turvey (1999, p. 8), for example, argues that "The theory of the true cost-of-living index is not necessary to establish this superiority" of the superlative index.

VII. Selected Additional COLI-related Decisions

48. In this section I briefly review four other methodological issues that have involved the application of COLI theory to CPI practice. It should be noted at the outset that I could have added many more topics to this list. In determining how to handle a particular product or market innovation, BLS typically resorts to consideration of the likely consumer response and the likely impact on consumer welfare, rather than attempting to maintain a fixed market basket for its own sake.[33] The examples discussed below were chosen because each has been the subject of longstanding discussion within and outside BLS, as well as being the topic of a recent or upcoming decisions.

49. *Treatment of Clean Air mandates*. Over the course of the last several decades, governments at all levels in the United States have imposed various product mandates as a means of reducing automobile emissions. The most important of these have been the mandated installation of catalytic converters and other equipment on motor vehicles, and requirements for oxygenated gasoline or other motor fuel formulas.

50. Over most of this period, these mandates have been treated in the CPI as quality improvements. Thus, for example, when new gasoline formulations were imposed in large California cities in 1996, estimates of the costs of meeting these product standards were used to offset the associated gasoline price increases in those areas. This treatment has been controversial, however, and in 1998 the BLS announced that clean air mandates in 1999 and beyond would be treated as price increases; that is, quality adjustments would no longer be made.

51. The logic of the 1998 decision was that the pollution mandates provided no direct benefit to the vehicle or motor fuel purchaser. Although environmental improvements are valued by consumers, the purchaser receives no measurable benefit from the fact that his or her own vehicle produces fewer emissions. An analogous situation would arise if the government imposed a tax on gasoline or on automobile tires, the resulting revenues being used to improve highway quality. The BLS would make no quality adjustment in such a situation.

52. This decision fits the concept of the CPI as a conditional COLI, defined as in section III to include market goods and services and conditional on non-market factors such as air quality.[34]

53. *Treatment of New Goods*. The presence of new, as well as disappearing, goods creates almost intractable economic and statistical problems for statistical agencies, as discussed most recently by Bert Balk (2000) and Jörgen Dalén (2001). I believe the BLS position is consistent with Diewert's statement that:[35]

> " … many believers in the economic approach to index number theory would agree that the Hicksian … reservation price technique is appropriate *in principle*, even though it may be difficult to implement in an objective and reproducible form. However, believers in the 'inflation' index approach to index number theory have tended to restrict their index domains of definition to commodities that are present in both periods … "

54. That is, the U.S. CPI accepts the COLI framework and, in principle, would adjust for the gain in consumer surplus achieved when new goods expand the consumer choice set (or the

welfare loss when goods disappear). At this time, this is largely a theoretical point, however, because the BLS has argued that the techniques for estimating consumer surplus gains—notably those proposed by Jerry Hausman (1997, 1999)—" … are in their infancy, and may never be adaptable for implementation in a large, ongoing price measurement program like the CPI."[36]

55. Given the obstacles to dealing with "new goods bias" in a theoretically complete manner, the recent BLS emphasis has been on improving the timeliness of CPI samples. Walter Lane (2000) discusses several current or potential methods for reflecting new goods more quickly, and the President's budget for fiscal year 2002 includes funding for the BLS to accelerate its resampling procedures for goods and services.

56. *Hedonic Quality Adjustment*. Hedonic models have been employed in the CPI shelter and apparel indexes for more than a decade. Since the beginning of 1998, the BLS has aggressively expanded the CPI's use of hedonic quality adjustment to computers, televisions, and several other products. This expansion recognizes that traditional matched-model methods sometimes can fail to reflect the benefits to consumers of the rapid pace of product improvement, particularly in the area of electronic consumer durables.[37]

57. Although the BLS use of hedonics has been broader than in other statistical agencies, many of which reject the COLI framework, it does not appear that COLI theory has been the major explanation for the difference in strategy. First, the role of hedonic adjustment, or even quality adjustment in general, has not yet been worked out fully in the COLI context. Deaton (1998) argues, for example, that " … it is unclear that a quality-corrected cost-of-living index in a world with many heterogeneous agents is an operational concept." Second, and conversely, Turvey (1999) gives quality adjustment as one example of a problem "where the fruitfulness of cost-of-living theory is not apparent" because the use of hedonic coefficients can be justified without regard to consumption theory. The BLS's relatively aggressive use of hedonics may be attributable to a greater ability to commit the necessary analytical resources, or a greater willingness to rely on statistical modeling.

58. Hedonic quality adjustment is, of course, a very dynamic area of research within the COLI and broader price index literature; three very recent examples are Triplett (2000), Diewert (2001) and Ariel Pakes (2001). The BLS follows this literature closely and will continue to fund hedonic research both within and outside the Bureau.[38] To the extent that new and operationally feasible hedonic methods are developed that are judged to provide closer approximations to a COLI, it is likely that those methods would be adopted in the CPI.

59. *Direct pricing of health insurance.* Private spending on medical care goods and services is extensive in the United States, and medical care comprises about six percent of the CPI. Much of this care is purchased through insurance policies, which often are paid for in full or in part by employers. The BLS currently is testing the possibility of pricing health insurance directly, as opposed to the present practice of pricing it indirectly through the prices of commodities and services covered by insurance policies. In the course of evaluating this multi-faceted issue, it has been necessary to address some questions that involve the specific interpretation and application of the CPI's conditional COLI framework.

60. The existence of insurance policies changes the relationship between the index's excluded "environmental" conditional factors and the prices of market goods purchased by

consumers. The price of insurance, of course, depends on stochastic factors and the ability of insurers to spread risk across a pool of policyholders. For present purposes, however, the key point is that the price of an insurance policy depends critically on the expected utilization of health care, not just on the prices of covered items. This can be illustrated by the onset of a new and costly disease. AIDS, for example, should raise the cost of insurance policies without necessarily changing the price of any particular commodity or service. In this situation, should the CPI show an increase, or should the policy premium be quality-adjusted to reflect the fact that the policy is covering a greater expected quantity of care?

61. This question has been discussed extensively within the BLS and with its advisers, although a decision has not yet been reached.[39] One reasonable view is that because the CPI is designed to be conditional on, *inter alia*, disease incidence, changes in health care utilization should be treated as quality changes in the health insurance index. Note that this would be equivalent to the treatment under the current indirect CPI approach to pricing insured health care, and the approach to pricing uninsured care as well: disease incidence does not affect the index except insofar as the prices of covered items are affected. Thus, the logic would be that the impact of environmental changes on a conditional COLI component series should not, in principle, depend on whether the corresponding good or service is purchased directly or through insurance.[40]

VIII. Concluding Remarks

62. At several points in the foregoing discussion, I have indicated that it is difficult to distinguish clearly the decisions the BLS has made from decisions that might have been made by other statistical agencies that reject the COLI framework. Eurostat has approved the use of the geometric mean formula, for example, and justification for the use of superlative formulas also has been proposed within a "pure price" framework. As Triplett (2001) notes, there has been no clearly-defined alternative to the COLI approach that entails a sharply divergent set of operational procedures. The use of rental equivalence to measure homeownership costs may present the sharpest difference in viewpoints across agencies. Even in that case, however, it might be argued that the BLS decision to adopt rental equivalence was driven as much by operational issues, and the failure of the prior approach, as by the commitment to the COLI objective.

63. On the other hand, I believe that this paper provides convincing evidence that COLI theory has been a crucial factor in the major methodological decisions made by the BLS with respect to the CPI. Some CPI initiatives, such as those designed to improve the timeliness of data collection and sample rotation, have been adopted with little reference to considerations of economic theory; but the most significant design changes have relied on COLI arguments for their justification.

64. Currently, the BLS is actively involved in exploring the implications of COLI theory for index construction. With BLS funding, a panel of the National Academy of Sciences has been studying COLI issues with particular reference to the CPI. The panel is chaired by Charles Schultze, former Chairman of the Council of Economic Advisers, and includes three experts cited in this paper: Angus Deaton, Erwin Diewert, and Robert Pollak.[41] Examples of the topics

that the panel's report is likely to address are the appropriate design of indexes for particular purposes, the treatment of quality change and new goods, and the role of public goods and the environment. The analyses in the report may provide insights into potential further improvements in the methods used to produce the CPI.

65. Finally, it is worth noting that the U.S. Producer Price Index (PPI) also relies on a conceptual framework. In particular, the industry output price indexes, one of the basic sets of indexes of the PPI, are computed as modified Laspeyres indexes, and are viewed by the BLS as approximations to the theoretical concept of a Fixed-Input Output Price Index.[42] Fixler (1998) notes that the PPI's firm-oriented conceptual framework supports the continued practice of making quality adjustments for mandated product changes designed to achieve environmental improvements, in contrast to the decision made in the CPI. This further demonstrates the value of a price index's underlying theoretical basis as a guide to operational decision-making.

NOTES

[1] Bureau of Labor Statistics (1984), p. 4.

[2] See Goldberg and Moye (1985), p. 158.

[3] Price Statistics Review Committee (1961).

[4] U.S. Congress (1961), p. 560.

[5] These papers were later collected and published in Pollak (1989).

[6] Bureau of Labor Statistics (1997), p. 170.

[7] Gillingham (1974), p. 246.

[8] Gillingham and Greenlees (1987), page 775. The 1984 version of the *Handbook* cites an earlier paper by the same authors reporting on an initial phase of their analysis.

[9] Popkin (1972), p. 2.

[10] Fixler (1993), p. 3.

[11] Bureau of Labor Statistics (1995), pp. 17-18.

[12] Bureau of Labor Statistics (1998), p. 4. See also Abraham *et al.* (1998), p. 27.

[13] Abraham (1997), p. 13.

[14] Conditional cost functions and subindexes are defined in Pollak (1989), Chapter 2.

[15] Bureau of Labor Statistics (2000a).

[16] The CPI has usually been referred to as a "modified Laspeyres" index because the base-period expenditure weights are incorporated into the index only with a lag, so that the index relative to the base period cannot be expressed using the Laspeyres formula.

[17] Bureau of Labor Statistics (1997), p. 170.

[18] Pollak (1998), pp. 69-70.

[19] Turvey *et al*. (1989).

[20] See Norwood (1981).

[21] The 1983 implementation date refers to the CPI-U, the CPI for All Urban Consumers. Adoption of the rental equivalence technique was delayed until January 1985 for the other official CPI series, the CPI for Urban Wage Earners and Clerical Workers, or CPI-W. Greater advance notice of such a substantial change was judged appropriate for the CPI-W because of that index's extensive use in multi-year collective bargaining agreements.

[22] Discussions of the theoretical and operational aspects of the decision, and comparisons of simulated indexes, are presented in Bureau of Labor Statistics (1983), Gillingham (1980, 1983) and Gillingham and Lane (1981). Greenlees (1982a, 1982b) discusses other data problems associated with the previous homeownership approach.

[23] Bureau of Labor Statistics (1983), pp. 1-2.

[24] Eurostat (1998), p. 31.

[25] Australian Bureau of Statistics (1997), p.6.

[26] The BLS research on formula bias is summarized in Moulton (1996). See, in particular, the results in McClelland (1998).

[27] BLS (1995), p. 26.

[28] This chronology is included in part to make clear that momentum for the adoption of a geometric mean formula was well underway by the time the Boskin Commission was formed in June 1995.

[29] See Eurostat (1998), p. 19.

[30] U.S. Government (1997).

[31] See, for example, Conference Board (1999), p. 17.

[32] See Bureau of Labor Statistics (1998), p. 13.

[33] Examples mentioned by Brent Moulton are BLS methods for handling aging bias in rental housing, and improvements in the pricing of airline fares and prescription drugs.

[34] For a detailed description of the BLS decision, see Fixler (1998).

[35] Diewert (1999), p. 23.

[36] Abraham *et al.* (1998), p. 33.

[37] See, for example, Abraham *et al.* (1998), p. 31, for the BLS view with respect to this issue.

[38] One example of BLS research on hedonic methodology is Kokoski *et al.* (1998).

[39] The insurance pricing initiative and the associated conceptual issues are detailed in Bureau of Labor Statistics (2000b).

[40] This discussion abstracts from the considerable operational difficulties in observing, and valuing, changes in insurance policy utilization.

[41] The other members of this distinguished panel are Ernst Berndt, Claudia Goldin, Christopher Jencks, Albert Madansky, Van Doorn Ooms, Richard Schmalensee, Norbert Schwartz, and Kirk Wolter,

[42] See Archibald (1977) for a discussion of theoretical output price indexes, and Gousen *et al.* (1986, Chapter 2) for the conceptual basis of the PPI.

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