58TH INTERNATIONAL ATLANTIC ECONOMIC SOCIETY CONFERENCE

CHICAGO, ILLINOIS

7-10 OCTOBER, 2004

CAUSES AND CONSEQUENCES OF BIAS IN THE CONSUMER PRICE INDEX AS A MEASURE OF THE COST OF LIVING[1]

PRESIDENTIAL ADDRESS

by

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Preamble

Like most economists, both when I was an undergraduate and a graduate student, I did not consider the material on price indexes or national income accounting particularly interesting or consequential. Perhaps this was because the people who taught it to me – including a couple of subsequent Nobel Prize winners – were more excited about other research. Once thriving areas of inquiry and considered very important for practicing economists, these subject areas declined for decades in relative importance in academic curricula. Fortunately, important research continued: Erwin Diewert and Bob Pollak on index number theory; Dale Jorgenson's theoretically consistent set of production, income, accumulation and wealth accounts; Zvi Griliches and Sherwin Rosen on hedonics; Jerry Hausman on new products, to name only a few important contributions.

Academic research continued and important research was also done at the Bureau of Labor Statistics (BLS) – by Marshall Reinsdorff, Jack Triplett, Brent Moulton, Paul Armkeknecht and Patrick Jackman, to name a few – and some practical improvements (within the Laspeyres context) were made to the CPI.

Related important work occurred at the Bureau of Economic Analysis (BEA) and other statistical agencies worldwide. For example, sampling was introduced to the CPI in 1978 and the treatment of owner-occupied housing was changed to a rental equivalence basis in 1983. Public policy decisions were made to index major programs that comprised large fractions of both sides of the budget: Social Security benefits in the 1970s and income tax brackets in the 1980s. While I would argue these were valuable policy improvements, they also cost BLS statisticians their innocence. Not surprisingly, occasional errors were made, both by statisticians and politicians, and then corrected. For example, the introduction of sampling – an enormous improvement – was accompanied by an unexpected upward bias of about 0.2 percent per year, subsequently discovered and corrected by BLS. And, of course, initially Social Security benefits were doubly indexed by the political system, and this too was corrected after a brief period. In both cases, of course, the corrections were on a going-forward basis.

While my own research and policy interests were in Public Economics and Macroeconomics, exposure to this and related research on these issues piqued my curiosity in economic statistics. From a cost-benefit analysis point of view, weren't we, as a profession and a society, underinvesting in economic statistics? From curricula, training, and professional rewards to the public funds devoted to government statistics, couldn't some quite valuable improvements be made at pretty low cost? In the 1980s, growing pressure on the public fisc led to increasing constraints on financial resources for the statistical agencies.

When I became CEA chairman in 1989, I decided to see what could be done to improve economic statistics. While it was far from the top of my list of priorities, together with representatives of the statistical agencies, I developed an initiative to improve the quality of statistics. We looked at fundamental issues such as whether to centralize the disparate statistical agencies, whether some government activities should be performed in the private sector, etc. But our main product was a list of priority improvements in the generation of the statistics. President Bush agreed to make our proposals an initiative in his budget, and we sought funds from Congress. That was quite an education as well. About 70% of the requested funds were appropriated, but different agencies were treated quite disparately because of separate appropriations subcommittees. In any event, funding to improve the National Income and Product Accounts (NIPAs) was increased substantially for the first time in a decade.

My next involvement in economic statistics (other than helping get budgets passed) was in 1995-1996 as chairman of a commission on the CPI (henceforth BC, shorthand for the proclivity to name it after me). My colleagues—Ellen Dulberger, Bob Gordon, Zvi Griliches and Dale Jorgenson – and I were asked both to estimate the likely biases in the CPI and to recommend improvements to the BLS and Congress. We examined everything from data collection (we were each deputized and went on price collection site visits) to index number theory to

practical issues (aided by extensive interaction with BLS personnel and others).

We made a dozen recommendations to the BLS, some of which have been

adopted; four to our elected officials, some of which have been adopted; and one

to the economics and statistics profession, which is making some but not enough

progress. Remarkably, statistical agencies around the world have been using

the Commission report as a major input to their own agendas for improvement.

The real social value added certainly exceeded our opportunity costs by a large

amount.

I make this long personal preamble because, as in so many other

examples (the fight every generation over free trade comes readily to mind),

sometimes one has to revisit a subject to push the dialogue, the implementation,

the progress, along.

Introduction

A recent obscure but consequential and startling statistic has led me to

refocus attention on the measurement of the Consumer Price Index and the

implications of mismeasuring inflation for measuring economic progress, indexing

federal outlays and taxes and therefore federal deficits and debt, and important

interpretations of economic data in academic research and its use. The Bureau

of Labor Statistics (BLS), the agency of the Labor Department responsible for

producing and disseminating the Consumer Price Index, has made considerable

progress over the years in improving the CPI. Some of these improvements

have been ongoing, others enacted or accelerated subsequent to the publication of the *Report of the Advisory Commission on the Consumer Price Index* (Boskin et al., 1996). In that report, my colleagues and I demonstrated that, taken as a measure of change in a true cost of living index[2], the change in the Consumer Price Index at that time was overstating inflation by slightly over one percentage point per annum., and had been doing so for some time. Of course, there was a range to our estimates, perhaps it was a little bit smaller or larger. Since that time, BLS has made several important improvements that reduced some measures of the bias, but, as it turns out, our estimates of one important component of the bias appears now to have been substantially underestimated according to the BLS' own subsequent calculations. The new BLS C-CPI-U series implies upper level substitution bias for the last five years was much larger than previously assumed (0.4% or more per year vs. 0.2% or less). Over the last year, the C-CPI-U rose 2.7% vs. 3.2% for the CPI-U. Since its inception in December, 1999, the C-CPI-U has risen on annual average about 240 basis points less rapidly than the regular CPI-U. Similar differences occur for the core C-CPI and core CPI, which remove volatile food and energy components. The annual rates of change for 2000-2004 are shown in Figure 1. For reasons described below, this suggests the Boskin Commission may have had a too-conservative estimate of substitution bias.

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[2] It is widely accepted that a cost-of-living index is the theoretically correct conceptual foundation of measures of inflation for input into monetary policy, making cost-of-living adjustments to government programs and tax rules and measuring economic progress. Indeed, it is difficult to conceive of any other conceptual basis.

Figure 1. A Comparison of Core C-CPI & CPI
(annual % change)
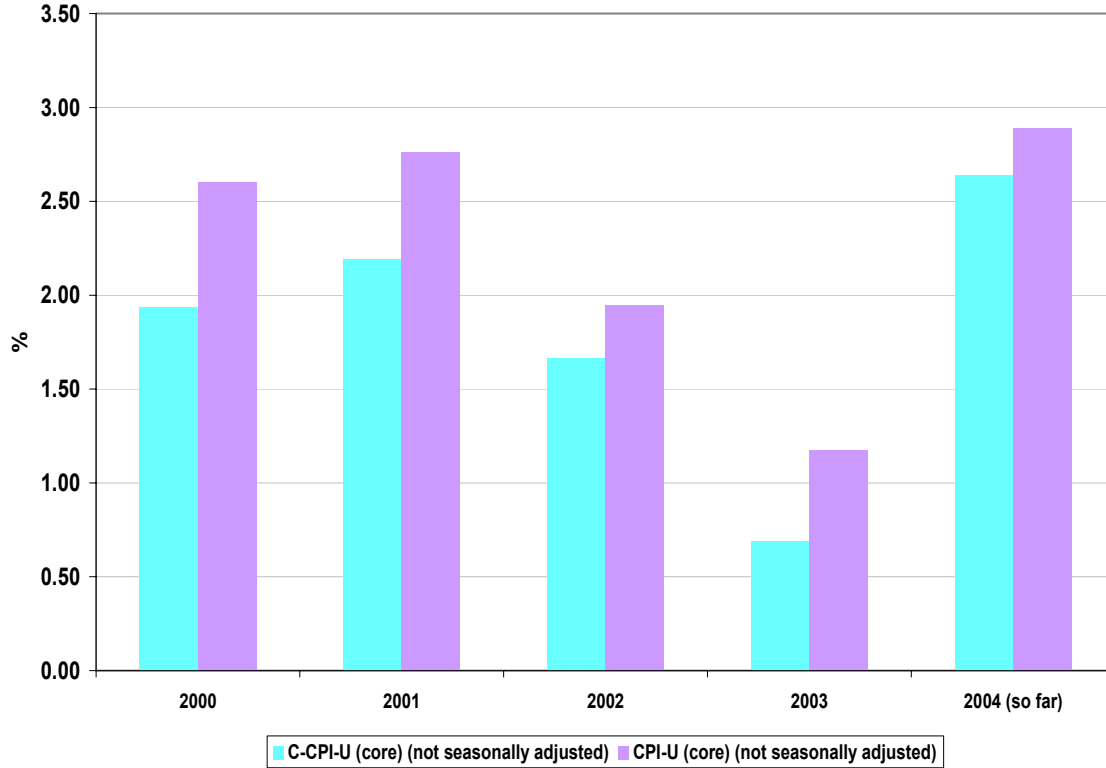
I refer here to what in the jargon is known as "upper-level substitution bias", the traditional price index issue we foist on our introductory or intermediate microeconomics students, during which lecture students' eyes often glaze over. In the construct of the CPI, data on some 70+ thousand prices for separate items are collected and aggregated. How that is done is a complex and instructive, important subject in itself, but I refer the reader to Boskin et al. (1996) for a summary. Upper-level substitution bias refers to the bias in the estimate of the true cost-of-living index created by the use of a fixed base-period weight price

index, called "Laspeyres", that ignores the likelihood of consumer substitution in response to relative price changes. (There is also a lower level substitution bias before the CPI is aggregated to the upper level; but the BLS has made a substantial improvement by moving to geometric means for about 60% of the goods and services at the lower level.) So, for about 200 broader categories of goods and services, the BLS calculates the fixed-weight Laspeyres Index using base period expenditure weights obtained from consumer expenditure surveys.

That a fixed-weight index misses the likely consumer substitution is well known. What is startling is that, in part a response to our Commission's recommendation to calculate a chained Tornqvist Index – a formula that accounts for consumer substitution and falls into a category of indexes called "superlative indexes" because of their desirable properties, including satisfying time reversibility – the BLS now calculates a chained CPI, called the C-CPI-U. This chained Tornqvist has been published for several years and has risen on annual average 43 basis points less than the regular CPI-U per year. Our original estimate of substitution bias was 0.2% or less, based on econometric studies at a much higher level of aggregation and some very preliminary BLS unpublished research. A difference of 40 basis points for years cumulates to a substantively important issue. Even if the larger estimate of upper-level substitution bias proved to be temporary, the ramifications for over-indexing government programs and tax brackets amount to "excess" debt of many billions of dollars annually. The matter was driven home to me, as mentioned above, because over the past year, the C-CPI-U rose over 50bp more slowly than the

CPI-U. In short, given this year's movement in prices, and the assumed consumer substitution, say of chicken for fish, etc., the CPI-U, on the basis of upper level substitution bias ALONE, overstated inflation by 50bp or more.

Just this year, that bias has implications of billions of dollars of increased future outlays and decreased revenue for the federal government. The cumulative bias just from 2000-2004 will amount to hundreds of billions of dollars over the next couple of decades, since the overstatement of inflation gets built into the baseline. The likely substantial future bias for years beyond 2004[3] will make this problem dramatically worse.

It is important to understand how pervasive the use of the Consumer Price Index is in our economy and, indeed, in academic economic research. Of course, other price indexes are available, some of which make important improvements in this dimension relative to the CPI. For example, the BEA's personal consumption expenditures deflator uses a Fisher Ideal Index, an alternative method of adjusting for consumer substitution. Unfortunately, but not to detract from that important effort, it is available only quarterly. Therefore, many people who need monthly data, and especially people who want to measure things on literally a calendar-year basis and therefore want to measure, for example, real stock returns over the year, need monthly data, especially December over December or January over January. Thus many researchers

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[3] Of course, as mentioned above, there is no guarantee that the bias will remain this large; it could change in either direction, in response to relative price dispersion and the response of expenditures to that dispersion in the future.

continue to rely on a quite faulty CPI, faulty from the standpoint of accurately measuring changes in the cost of living for the purposes they have in mind. Let me emphasize that my purpose here is to raise an alarm bell about this practice, push along the debate, and prod us for greater improvements in our price statistics on the one hand, and more care in use of them by economists and policy makers, on the other.

Let me again emphasize that the BLS has made important new improvements that have reduced the bias that would otherwise obtain, and is in the process of making others. Much of the most important work on CPI issues has emanated from the BLS.

My paper proceeds simply as follows: First, I briefly describe the types of biases in the CPI and rough estimates of their current magnitude, concluding that the bias in the CPI is still substantial enough to be a serious public policy and academic research issue, likely being on the order of 80 or 90 basis points. Next, I discuss some of the ramifications of this overestimate of inflation in several areas of economics: for indexing entitlement costs and our tax code, and hence for federal deficits and debt; for measuring real stock returns; and for various measures of economic progress, for example, real earnings and real median income.

I then conclude with some suggestions on the priorities moving forward.

CPI Measurement Bias

Measuring prices and their rate of change accurately is central to almost every economic issue, from the conduct of monetary policy to measuring economic progress over time and across countries to the cost and structure of indexed spending and taxes. While many aspects of the CPI imply a likely upward bias, it is important to realize downward biases can and also do occur; for example, it appears that the shelter component of the CPI may well have been overstated historically (Gordon, 2003). Likewise, it is important that researchers are not just looking for upward biases when attempting to evaluate and improve the CPI.

Why is inflation so hard to measure? Despite numerous improvements that have been made historically and continue to be made by government statisticians in all countries, especially the U.S. Bureau of Labor Statistics (BLS), many of them laboring under inadequate human and financial resource constraints, it is difficult to keep up with the dynamic change in the economy. New products are being introduced all the time, while others leave the market. Many existing products are improved in some objective way – greater energy efficiency, more durability, less maintenance, to name a few, while many more products claim to be "new and improved". Relative prices of different goods and services change frequently, for example, in response to technological and other factors affecting costs and quality, which leads consumers to change their buying

patterns. There are literally hundreds of thousands of goods and services available in rich industrialized modern market economies. A single supermarket may contain 30,000 differently priced items, and a WalMart store over 40,000, so measuring in a single index what happened to prices in a single store can be quite difficult. Doing so for the entire economy is vastly more complex. As we have become richer, demand has increasingly shifted to services away from goods, and to characteristics of goods and services such as enhanced quality, more variety, and greater convenience. Technology and entrepreneurship provide them. But all these factors, plus others, mean that a larger fraction of what is produced and consumed in an economy is harder to measure than decades ago, when a larger fraction of economic activity consisted of easier-to-measure items such as tons of steel and bushels of wheat.

How to obtain information on who is buying what, where, when, why and how in an economy and then to aggregate it into one or a few measures of price change raises a host of complex analytical and practical problems. The mathematics of aggregating changes in the prices of different goods and services are complex and subtle (see Irving Fisher, 1922; Erwin Diewert, 1976). Despite decades of analytical and empirical research, some of it recently done in statistical agencies such as the BLS, the statistical agencies around the world still primarily rely on fixed-weight indexes which do not account for consumer substitution among commodities. Thus, these Laspeyres measures of inflation are inherently upper bounds.

Likewise, there has been a fundamental change in the nature of retailing, perhaps most pronounced in the United States, but spreading virtually everywhere with the advent of superstores, discount chains, and online retailing. The same VCR available for $150 in a local appliance store may be only $120 at Circuit City, or $115 online including shipping. Since price data are collected *within* outlets, the shift of consumers to purchasing from discounters does not show up as a price decline, even though consumers reveal by their purchases that the price decline more than compensates for the potential loss of personal services. Thus, in addition to substitution bias among commodities, there is an outlet substitution bias (see Hausman, [2004] for one example).

Another problem is that price data tend to be collected during the week. In the United States, about 1% of price quotes are collected on weekends, despite the secular trend of an increasing share of purchases made on weekends and holidays (reflecting the increasing prevalence of two-earner couples). Since some outlets emphasize weekend sales, there may be a "when" bias as well as a "what" and a "where" bias. Recent research suggesting that prices rise less rapidly in data collected by scanners rather than price-takers may be partly explained by this phenomenon. Additional bias results from the difficulty of adjusting fully for quality change and the introduction of new products. Economists have known since Hicks (1940) that the introduction of a new product should be dealt with in a cost-of-living index by using its reservation price

and including the consumer surplus attributable to the introduction of the product. Noting this, our commission took the more cautious approach of primarily including estimates of explicit dimensions of quality change and the very late introduction of major new products into the index. In the U.S. CPI, VCRs, microwave ovens, and personal computers, for example, were included a decade or more after they had penetrated the market and their prices had fallen 80 percent or more. Cellular telephones were not included in the U.S. CPI until 1998. Correspondingly, the pace of quality change in some important areas, such as health care and consumer electronics, has been breathtaking, and our statistics are not keeping up.

When economists try to define the change in the cost of living, it is to answer the question, "How much more income will consumers need to be just as well off with the new set of prices as the old?" In addition to the substitution issue raised above, this clearly involves measuring *quality-adjusted* prices. One would not want to count a major improvement in quality that enhances well-being as inflation. The BC estimated the total bias circa 1996 as 1.1%, composed of 0.4% substitution (upper and lower level), 0.1% outlet, and 0.6% new product and quality change. A set of improvements by the BLS –removing the formula bias (not included in the 1.1% estimate), geometric means for 60% of items at the lower level as of 1998, quality adjustments for computers, sample rotation, other quality improvements and faster reweighting combine with an upwardly revised estimate of upper level substitution bias to get us to a current bias of 0.8-

0.9% (excluding a potential 0.1% weighting bias [Lebow and Rudd, 2003]).

Thus, the first 80 or 90 basis points of measured inflation are not really inflation.

Table 1

Estimates of Biases in the CPI-Based Measure of the Cost of Living (Percentage Points Per Annum)

Sources of Bias	Original BC Estimate	Current Estimate
Upper Level Substitution	0.15	0.30 - 0.40
Lower Level Substitution	0.25	small
Outlet Substitution	0.10	0.10
New Products/Quality Change	0.60	0.40
Total	1.10	0.80 - 0.90
Plausible Range	(0.80 - 1.60)	

Source: author's estimates

Understanding Economic Progress

As noted above, the original BC 1996 estimate of the bias from using

changes in the CPI as a measure of the cost of living was about 1.1 percentage

point per year. A technical problem called formula bias, introduced into the CPI

in 1978 and corrected by the BLS early in 1996, added about 0.2 percentage

points per year. Other improvements, net of the larger upper-level substitution

bias, reduce the total bias to about 0.8-0.9% per year. To gain some

appreciation for the potential importance and ramifications of the overstatements,

suppose that the changes in the CPI have overstated changes in the cost of living by 1.1 percentage points from 1973-1995 (ignoring, to be conservative, the 0.2 percentage points attributed to formula bias from 1979-1995) and by 0.8 percentage points since. Note that it is not possible that these rates of bias in recent decades have been "permanent" for time spans of centuries, as back-casting such rates would lead to implausibly low standards of living in the distant past.

Table 2 presents estimates (updated from Boskin and Jorgenson [1997]) of commonly used measures of economic progress: real average hourly and weekly earnings and real median family income, as deflated by the official CPI and by an adjusted cost-of-living index that grows more slowly than the official CPI by the amount of the estimated bias. Instead of falling by about 8 % (hourly) or 15% (weekly), real average earnings have risen about 25 % (-15% vs. +15% for real weekly earnings). Instead of growing 10 %, real median family income increased 25 %, two and a half times as much, from 1988-2002. Clearly, the pace of improvement in living standards has slowed relative to the previous quarter century, but it has neither virtually stagnated nor declined, even relative to the early 1970s. These revised estimates accord more closely with descriptions of living standards in terms of products and services consumed.

Table 2

**Historical Implications Of A 1.1 Percentage Point Upward Bias In The
Cost of Living, 1973 – 1995, 0.8 Percentage Point, 1996-2002(3),
Selected Measures of Economic Progress**

Measure	CPI	Adjusted COLI
Real Average Earnings (1973 – 2003)		
- Hourly	- 7.7%	25.2%
- Weekly	- 15.5%	14.5%
Real Median Incomes (1988 – 2002)	9.9%	25.5%

Source: author's estimates

The national income and product accounts (NIPA) use the component CPI indexes as inputs. In principle, they would be subject to lower-level substitution bias, outlet bias, and much of the quality-change and new-goods bias. The Bureau of Economic Analysis (BEA), the statistical agency responsible for the NIPAs, uses a chained Fisher measure which in principle would eliminate the upper-level substitution bias. The BEA also makes some additional quality adjustments not made by the BLS in producing the CPI component indexes. Thus, the overstatement of inflation carrying over from the CPI to the consumption component of the national income accounts is quite a bit smaller, perhaps less than one-half of one percent.

Since consumption accounts for approximately two-thirds of GDP, taking 0.4% as a reasonable estimate of the bias flowing into the price data in the NIPA

would imply an understatement of the growth of real GDP, as a result of understating the growth of real consumption expenditures of perhaps a quarter of a percentage point per year. While not large, comparisons over very long time spans would need to account for such bias. There undoubtedly are additional and analogous problems raised in the investment-goods price measures, as well as those for government purchases and net exports. But even just relying on the consumption numbers, real GDP would be understated by perhaps a quarter percentage point per year. Even a quarter percentage point per year compounded over a long span of time accumulates to a sizable number. Real GDP, total and per capita, would be about 8 percent higher than the official statistics if such a bias held on average since 1973.

There are numerous other conceptual and measurement issues involved in all of the measures of economic progress. Fringe benefits and bonus payments become more important through time, rendering nominal average hourly earnings less relevant than a broader measure of compensation. Compositional effects change the size, age, and other characteristics of the median family.

It is not just across time that economic progress or conditions are compared, but also across countries. While that raises another set of issues, it is important to understand that the basic problems described in Boskin et al. (1996) affect the statistics of every country. While some countries have made progress

in ameliorating some of these problems in some areas (e.g., Statistics Canada

with the movement to geometric means at the lowest level of aggregation

removes some of the substitution bias), in other dimensions the American

statistical system is far ahead of most other countries. For example, the

widespread sampling done in the United States to collect price statistics

undoubtedly gets some quality-change and new-product bias that is not picked

up in other countries. Thus, the rates of real GDP growth, inflation, productivity

growth, real wage growth, real family-income growth, and analogous measures

are all misstated in virtually every country, to varying degrees, and these

measurement issues and problems should be borne in mind when such

comparisons are made. It should also be borne in mind that there are numerous

other important differences between the U.S. NIPAs and those of other countries.

Measuring Real Returns to Stocks and Bonds

Table 3 presents historical data on real returns to stocks, bonds, and other

financial instruments, as well as measured inflation, over several sub-periods for

the last two centuries , taken from Siegel (2002) and Ibbotson (2002).

TABLE 3

**Compound Annual Real Returns
by Type of Instrument (1802-2001)
(%)**

Period	Stock (arithmetic mean)	Stocks	Bonds	Bills	Gold	Inflation[1]	Equity premium
1802-2001*	8.4	6.9	3.5	2.9	0.0	1.4	3.4
1802-1870*		7.0	4.8	5.1	0.2	0.1	2.2
1871-1925*		6.6	3.7	3.2	-0.8	0.6	2.9
1926-2001*		6.9	2.2	0.7	0.4	3.1	4.7
1946-2001*		7.1	1.3	0.6	-0.3	4.1	5.8
1926-2003**		7.4	2.4	0.7	--	3.0	5.4

Sources: *Siegel 2002;   **Ibbotson, 2003

[1] N.B. Inflation measured as change in the official CPI, and therefore overstated considerably, and real returns understated considerably, in recent decades

The long-run average of about 7% real returns to stock is impressively stable over two centuries of remarkable economic and demographic change – several depressions, numerous recessions, an almost-doubling of life expectancy, world wars, etc. Of course, these averages suppress the substantial short-run variation in real returns – the standard deviation of real stock returns is more than twice the mean. These data include the poor returns in the Great Depression and the 1970s, the strong returns in the 1980s and the spectacular returns of the late 1990s, as well as the years of poor equity returns starting this decade, which would reduce the postwar average closer to 7%. The long-run real return to government bonds, which are not nearly so stable over the longer run, averaged about 2.3% real. The invaluable Siegel and Ibbotson measures are careful estimates of nominal returns; unfortunately, they overstate historical

inflation and understate real returns because the change in the official consumer

price index (CPI) is generally used as the measure of inflation. In contrast to the

care in measuring nominal returns, the change in the official CPI is just assumed

to measure inflation correctly. The CPI was created around World War I. As

noted above, in recent decades, it has overstated inflation by about 1.1% per

year (Boskin, et al., 1996; 1997; 1998) because of several types of bias in its

computation. The size of the bias for earlier periods is not known, but likely it

was also sizeable. Important improvements by the BLS in the last few years

have reduced the overall upward bias, by my rough estimate to about 80-90bp; a

recent study (Lebow and Rudd, 2003) concludes it is 87bp. A more accurate

inflation measure would thus substantially increase all the measures of real

returns (for stocks and bonds), by more than 100 basis points in recent

decades[4]. Just using a CPI series consistent with current, as opposed to mid-

1990s, BLS procedures would raise the estimate of real returns for recent

decades by 40-50bp.[5]

Unfortunately, these valuable data are used in all sorts of analyses without

the slightest indication that they could be misleading. For example, finance

theory implies that, when investment comes out of retained earnings which

produce a rate of return equal to the discount rate, the reciprocal of the P:E ratio

equals the rate of return. Given the historical long-term P:E ratio of just under

15, this also fits well with the 7% real return estimates. However, if real returns in

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[4] Of course, it would correspondingly decrease the inflation estimate.
[5] See Stewart and Reed (1999)

fact have been perhaps 8% for several decades; this raises several important issues for finance economists.

Priorities Moving Forward

The CPI serves, and should serve, many purposes. For example, it is used to measure consumer inflation on a monthly basis; to make cost-of-living adjustments in Social Security, the income tax brackets and other programs; to provide price data as input to the NIPAs (although BEA now uses its own upper-level weights and methods to construct its indexes). Because of uses made of the CPI, the BLS must be sensitive to the needs of the consumers of its statistics. Those groups may have very different priorities for improvements with respect to such issues as the scope of the index, the acceptability of revisions, etc.

A useful way to organize one's thoughts on the CPI is to ask the basic questions: What price data should be collected? How? Where? How Often? Whose prices? What methodology should be used to aggregate them? How many indexes? For what purposes? Answering each of these questions involves a series of conceptual, methodological and practical considerations. Our commission and a subsequent National Academy of Sciences Panel (NASP, 2002) chaired by Charles Schultze, came to similar conclusions, with one notable exception.

First, the CPI ought to approximate a true cost of living index (COLI). For most of the uses of the CPI, from making monetary policy to cost-of-living adjustments in government programs and tax rules to measuring economic progress in many dimensions, it is hard to imagine not at least starting with a cost-of-living concept. Further, my own long interaction with the Executive and Legislative branch policy makers in this area suggests they did indeed have and still have a cost-of-living concept in mind in indexing the tax brackets and benefit programs.

Next, it would be desirable to greatly expand our knowledge of prices conditional on household characteristics. Currently, for example, the only way to study how the CPI changes differ by groups is limited to different expenditure weights. We simply do not know if the prices paid differ, for example because of geographic concentration, prevalence of discounts, differential proclivity to buy new or improved products, etc. and whether there have been any trends in any (potential) differences.

Next, the BLS should explore moving toward a flow of durable services approach, (although NASP pointed to some difficulties with the capital gains in the user cost approach). Leaving out real capital gains in the user cost may avoid some practical oddities, but for a full evaluation of economic well-being, real capital gains need to be included. If my house goes up in real value, it will indeed cost me more (implicitly) to rent it to myself, but I may well be better off. If

we leave the real capital gains out of the price index, we ought to think twice about that component of a COLA to a wealthy home-owner financed by payroll taxes on young renters! The recent paper by Bajari, et al. (2002) suggests that a conceptually proper treatment of housing can be quite consequential, and that current methods appear to include a substantial upward bias[6].

Two related issues involve the treatment of insurance and of saving. Resources devoted to these purposes constitute current purchases of claims to goods in different states of the world and at future times. It would be interesting to explore the implications, perhaps in a separate index, of including changes in the forward price of future consumption.

Next, it would be desirable to expand the use of hedonics beyond price adjustment, to account for explicit quality change. The BLS is in fact making some progress here.

Closely related to quality change is the issue of new goods. Historically, BLS has at times entered new products into the index very late, after their prices have fallen appreciably. An important recent example is cellular telephony. We stressed the biases due to new products and quality change. We did not recommend specific procedures to deal with these issues, but stressed their importance as well as difficulty. Since Hicks (1940), there has been a standard

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[6] Recall the discussion above about likely downward bias for other reasons historically in the shelter component of the CPI.

analytical economics treatment of new products in evaluating real income. Hausman (1998) and others have developed econometric techniques to implement the virtual price concept.

The NASP explicitly recommended against imputing virtual price reductions for new goods into the CPI. This is perhaps NASP's most intellectually controversial recommendation. As noted above, the BC left the specific method for dealing with the new product bias unspecified. I agree that there are important issues that must be weighed before incorporating virtual price reduction for new products into the CPI. But NASP would have been more consistent in spirit to the rest of its excellent report by adding "at this time" to their recommendation. Their suggestion of a separate experimental index is sound and similar in spirit to that of BC. Of course, the more frequent BLS updating should help reduce the incidence of major long-lived omissions.

Finally, and returning to my point about the recent differences in the increase in the CPI and chained CPI, it would be appropriate to adopt a superlative index for cost-of-living adjustments (and, if necessary, to reconcile the COLAs retroactively). The BC made a separate recommendation to Congress and the President (but not to BLS) to decide what, if anything, to do about any of the biases, including the substitution bias the superlative index tries to redress. I agree with the explicit NASP recommendation to move to a superlative index now.

The CPI Commission made several data collection recommendations. These include use of scanner data, which despite their problems have the advantage of not only sample size but actual transaction prices as opposed to prices of goods on shelves, racks or other displays. For example, the widely reported growing tendency of consumers to shop after rather than before Christmas to take advantage of discounts is difficult to measure accurately with current procedures. Finally, more work on outlets is badly needed. Casual empiricism certainly suggests a growing role of discount outlets (see Hausman, 2004 for a specific example of outlet bias).

Let me emphasize that BLS has made many improvements, some similar to our recommendations, and that more are under way. Our original estimate of an upward bias of about 1.1% per year would likely be slightly lower now, as BLS has made several important improvements, e.g. considerable use of geometric means at the lower level. So my current estimate would be 0.8-0.9% per annum. BLS itself estimates that the CPI would have increased 45bp or so less rapidly from 1978-2001 just if current methods had been used (Stewart and Reed, 1999), quite aside from remaining biases. That simple fact is immensely consequential. These improvements alone will result in a national debt one-half trillion dollars smaller, due to lower COLAs in the income tax brackets, Social Security and other programs within a decade. They are part of the reason why measured CPI inflation has fallen. To repeat, economists and others using time-

series data on everything from real returns on equities to real earnings are not

comparing apples to apples, whatever other measurement issues they confront.

Most importantly to social welfare, this suggests that delays in improving

an unrevised index are enormously consequential. Irving Fisher, perhaps the

greatest American economist of the first half of the 20th century, in his classic *The

Making of Index Numbers* in 1922, said his entire life's work would have been

worth while if it but led to the replacement of arithmetic with geometric index

number formulas! Three-quarters of a century later, we have finally started using

geometric means in about three-fifths of the lower-level data and have an

experimental superlative index at the upper level. While I would be the first to

applaud any statistical agency for care in evaluating, experimenting with and

adopting new techniques, the consequences of having adopted such formulas on

the 50th rather than the 75th anniversary of Fisher's work would have been

enormous, amounting to over a trillion dollars of lower federal debt as a result of

reduced overindexing of outlays and income taxes from the inaccurate CPI.

Explicitly, adopting a superlative index by the 10th anniversary of our Commission

report in 2006 rather than further delay could likewise have immense desirable

effects on the accuracy of our data and, because they are used to index some

outlays and the income tax, federal deficits and debt.

These consequences are the most important reason to reiterate the BC

recommendations for more attention to be paid by economists and statisticians to

training in data collection, analysis and interpretation, with far more attention to these matters in the standard curriculum and more emphasis on measurement and sampling issues in the training of economists and statisticians. I repeat all the explicit calls by BC (and NASP) for strengthening the ties between professionals in government and their academic and business colleagues. If we collectively can assist the statistical agencies to improve our economic statistics, there will be a large social value added: more accurate COLAs, lower deficits and debt, better information for the FED in its conduct of monetary policy and, most importantly, better assessments of economic conditions and progress by our citizens, not to mention economists.

Perhaps our Commission recommendations would not have received so much attention had the BC not highlighted just how consequential the (mis)-measurement of prices was likely to be. Indeed, that is the most important lesson of the work of the BC, the NASP Report, and the renaissance of interest in these very practical issues. Economists and statisticians in and out of government will contribute as much or more social value-added here as in virtually any other area of economics. While perhaps regretting their lost innocence, those working on such government statistics hopefully will be more than adequately compensated by their increased relevance.

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