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# Getting Prices Right: What Should Be Done?

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The theory of price indexes is usually left to specialists, but when a suspicion that something has gone wrong is coupled with the possibility of large political and fiscal benefits from fixing it, the topic can move into the limelight. I suspect that much of the profession, like me, is now prepared to believe that, in some sense, the rate of growth of the Consumer Price Index likely overstates the rate of increase of the cost of living, suitably defined, provided enough emphasis is laid on the ''in some sense'' and ''suitably defined.'' However, it is unclear whether there are any sound measures that the Bureau of Labor Statistics can adopt to improve the Consumer Price Index that: a) are not already in process; b) will not require large increases in funding; and c) will do much to improve matters in the short run. Indeed, it is impossible not to be impressed by the intellectual quality and cogency of the contributions to the debate by economists in the Bureau of Labor Statistics (for example, Moulton, 1996; Moulton and Moses, 1997; Bureau of Labor Statistics, 1997).

I begin my comments with the vexed issue of quality, focusing on the problems of using behavior to measure the impact of quality change on the cost of living, and on the difficulties of separating taste change on the one hand from quality change on the other. I then move to the (less controversial) topic of substitution bias, and argue that, while there are good arguments for updating weights more frequently and for using different kinds of indexes from those currently employed, there should be no presumption that these improvements will lead to a decrease in the measured rate of inflation. The Boskin Commission's first and overarching recommendation, that the Bureau of Labor Statistics should establish a cost-of-living

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index as its objective in measuring consumer prices, taken by them as essentially obvious, is a contentious proposition that requires serious argument. In fact, it is unclear that a quality-corrected cost-of-living index in a world with many heterogenous agents is an operational concept. I argue that a major problem is not the Consumer Price Index itself, but what it is used for; it is foolish to index benefits thoughtlessly and mechanically to a concept that is hard to define and harder to measure. I conclude by arguing that more resources be devoted to the Consumer Expenditure Survey, something that would benefit not only the CPI, but also other important areas of public policy.

## Quality

How a price index should handle quality changes and new goods is the largest and most intellectually challenging issue separating the Bureau of Labor Statistics from the Boskin Committee. Because manufacturers often couple price changes and quality changes—Moulton and Moses (1997, p. 337) calculate that more than half of 1995's inflation rate of 2.16 percent was attributable to the 4 percent of goods that were replaced by new models or varieties—it is impossible to measure inflation without making judgments about changes in quality. Yet it is precisely the Boskin report's arbitrary (if reasonable) judgements about quality that are the most disturbing part of their analysis. It is true that, if one had to stake one's life (but not one's reputation!) on the right number, it is better to pick something that seems roughly right, than to stick to something that is exactly wrong. But it is surely not seriously intended that the Bureau of Labor Statistics do the same. The difficulties that the agency has faced in its own defense in the current debate would have been many times magnified (and rightly so) had the Commissioner had to defend in public testimony the sort of fragmentary research estimates on which the Boskin Commission based its conclusions. While it is clearly possible to do better, given time and resources, it will not happen quickly, and there are some formidable difficulties.

As one example, consider the innovative research by Hausman (1997a,b) who estimates that consumers received very large benefits from the introduction of Honey Cinnamon Cheerios and of cellular telephones (also see Moulton and Moses, 1997, p. 321, for a recalculation of the cellphone estimates excluding business usage). The benefits of such new goods will frequently be missed by the routine practice of the Bureau of Labor Statistics of linking the price change of the old good to the price change of the new good, without making any explicit adjustment for quality (or to put it another way, while implicitly assuming that quality differences are captured by the difference in price between the two goods when one replaces the other). Hausman's calculations, by contrast, require (at least) the estimation of a price elasticity. The benefits from a new good are positively related to the expenditure on it, and inversely related to its price elasticity because a new good with few substitutes is inherently more valuable. But we are now in a different

world from that traditionally inhabited by statistical agencies. No longer can we calculate a price index by collecting data on quantities and prices, and combining them. Instead, we must measure behavioral responses, an inherently more difficult and controversial task. Indeed, Bresnahan (1997) makes a plausible case that Hausman's results on the Cheerios are driven by an implausible identification assumption, and the identification of the cellphone results could also be questioned. This is not to criticize Hausman's work, but rather to emphasize the difficulty of credible identification in general and, beyond that, whether we are prepared to embroil the monthly announcements of the Consumer Price Index in professional controversies about the validity of instruments, the plausibility of covariance restrictions, and the usefulness of natural experiments.

But the practical difficulties of making quality corrections are only the beginning; the analytical basis for such adjustments can be challenged even in principle. A useful way to think about quality is provided by Fisher and Shell's (1971) ''simple repackaging'' model (see also Griliches and Fisher, 1997). According to this, quality works by scaling up or down the ''goodness'' of goods, so that ''effective quantity'' is quantity multiplied by quality; one gallon of gasoline will now do what two gallons used to do, or one day in hospital now will yield the same benefit as five days a decade ago. New goods can be thought of as having always been present, but at a quality and price that made no one want to buy them. More formally, if $q_i$ is the quantity of good $i$, and $z_i$ is its quality, consumer utility is then written in terms of the $n$ goods as

$$u = v(z_1 q_1, z_2 q_2, \ldots, z_n q_n).$$

Note that the $z$'s are not directly observed, but can be thought of as (hedonic) functions of observed characteristics, either of the directly associated good—gasoline is formulated to give more miles to the gallon—or of other goods—a gallon of gas does more than it used to because of the improved fuel-efficiency of automobile engines. Within this framework, an improvement in quality does two things: it reduces demand, because consumers need less quantity to do the same job, and it acts like a price reduction, because the same ''effective'' quantity costs less. This can be formalized by working out the demand functions associated with the utility function. If the consumer has total expenditure $x$ and faces prices $p_1, \ldots, p_n$, the demand functions are (for example, Deaton and Muellbauer, 1980, p. 197, 261)

$$q_i = (1/z_i)\, g_i(x, p_1/z_1, p_2/z_2, \ldots, p_n/z_n).$$

Demand is directly reduced by enhanced quality, but indirectly stimulated by the reduction in effective prices.

In a world without quality change, the cost of living depends on prices and on the level of living. When quality augments quantity, the prices in the cost-of-living calculation must be replaced by the ''effective'' prices obtained by dividing each price by its associated quality. For example, if one gallon of gas does what two used

to do, the price of gas that goes into the cost of living is 65 cents, not $1.30. The minimum cost of obtaining utility $u$ is then given by the expression

$$c(u, p_1/z_1, p_2/z_2, \ldots, p_n/z_n),$$

and the ''true'' cost-of-living index number between any two periods, taking into account both price and quality change, is given by the ratios of the cost of achieving a fixed utility level in the two periods.

This method of quality adjustment is about as straightforward and coherent as can be imagined. The issue is whether, given what we can observe—the quantities that people buy according to their demand equations, and the prices and the characteristics of goods that determine the qualities $z$—it is possible to work back to the qualities themselves, so that we can calculate the cost of living and the quality-corrected cost-of-living index. Unfortunately, the general answer is no. For example, consider the situation where all goods experience an identical increase in quality, and in which preferences are homothetic (so that gains in income do not shift marginal rates of substitution between goods or the pattern of demand). In such a case, quality improvements increase utility—in fact, they shift all consumers to higher indifference curves—but they do not alter anyone's choice of goods. The quality change is precisely equivalent to consumers becoming more efficient as ''utility machines;'' they are better off, but there is no way of observing the fact, nor of testing any arbitrary assertion about their welfare. A second and more extreme example is where preferences are such (Cobb-Douglas) that the shares of the budget are fixed numbers, no matter what happens to prices and incomes. As is easily checked from the demand equation formula, in this case the reduction in need from the quality improvement is exactly offset by the substitution towards the good caused by the fall in the ''effective'' price. With such preferences, no change in quality has any observable consequence for the purchase of any commodity. Of course, these examples are extreme and artificial, and most quality changes will affect observable behavior to some extent. Nevertheless, the examples are sufficient to illustrate that there will always be some welfare consequences of quality change that leave no trace in the empirical evidence, a general point that is readily documented in more realistic cases. Calculations of quality corrections from empirical analysis are necessarily incomplete, so that we shall never be able to eliminate assertions about quality completely.

I suspect that most economists are made uncomfortable by suggestions that the Consumer Price Index ought to be reduced to reflect increasing life expectancy or falling crime rates, and that they would be even more so if the CPI were adjusted to reflect people's efficiencies as utility machines. It is certainly possible to think about tastes in a way that would make us at least consider adjusting the cost-of-living for changes in tastes; a conversion to religious asceticism or the spread of vegetarianism are examples. But if we are uncomfortable about using taste-correction in the CPI, then we must be equally uncomfortable with quality correction, unless we can convince ourselves that we can tell the difference between changes in quality and changes in tastes.

Of course, there is typically more information available than I admitted to the above discussion and in some cases it will be possible to infer some quality adjustments by direct observation of the characteristics of the good. One example is Nordhaus's (1997) study of the falling cost of illumination. The Bureau of Labor Statistics makes (less dramatic) calculations along these lines whenever new varieties and models replace old ones. But for a true cost-of-living index, we are not interested in the effect of technical change on technological or mechanical efficiency, but on how these changes affect the cost of achieving a constant level of welfare, which is a very different thing. The reduction in the cost of lumens does not give us much of a handle even on the cost of doing those things that involve light, let alone on the cost of living (Hulten, 1997).

## Substitution Effects and Superlative Indexes

As currently constructed, the Consumer Price Index is a ''modified'' Laspeyres index in which a fixed bundle is priced out at the two sets of prices being compared, and the ratio of the two costs is the index. The Laspeyres index can also be thought of as a weighted average of the ratios of individual prices in the two periods, where the weights are equal to the shares of the budget devoted to each good in the base period. In a Laspeyres index proper, the fixed bundle is the actual bundle in the base period; in the modified Laspeyres index used by the Bureau of Labor Statistics, the fixed bundle comes from several years before either of the two prices. Currently the bundle used by the BLS comes from averaging data from the Consumer Expenditure Survey over the years 1982 to 1984, and so is some 13 years old, which is as old as it ever gets.

Many have argued that the current modified Laspeyres index should be replaced by a ''superlative'' index (Diewert, 1976), in which the weights applied to the price ratios include information from both current and past expenditure patterns. Laspeyres indices have the advantage of being easily explained, at least in principle, which enhances their legitimacy in public discussion and policy-making, but they risk overstating the rate of inflation by ignoring consumers' substitution away from more expensive goods as relative prices change. It is this substitution bias that superlative indexes are designed to eliminate, at least under ideal conditions. But because superlative indexes need current information on expenditures, they are operationally infeasible in real time, and the Boskin Commission recommended that the Bureau of Labor Statistics replace the current Consumer Price Index by a ''trailing'' index, in which the weights are an average of the most recent available data. This procedure would also have the (unarguable) advantage of keeping the weights up to date, so that we would not again get into the current situation where the basket being priced is 13 years old.

The desirability of using less venerable weights is hardly in dispute, though there are cost implications for the Consumer Expenditure Survey from which the weights are obtained. It is also not true—either theoretically or empirically—that

the older the weights, the greater the overstatement in the measured rate of inflation (Shapiro and Wilcox, 1996; Greenlees, 1997). It is also naïve to suppose that a trailing index will grow less rapidly than the current Consumer Price Index. First, Diewert's (1976) results about superlative indexes do not apply to trailing indices, whose weights do not capture the substitution that has taken place in response to the price change, and whose properties are therefore likely to replicate those of the Laspeyres index from which the Commission is trying to escape. We need results, not on the superiority of an *infeasible* index—we already have that with the true cost-of-living index!—but on the superiority of a *feasible* index (but see Shapiro and Wilcox, 1996, for steps in this direction). Second, it is far from clear that the assumptions that justify the performance of superlative indexes are realized in practice. For example, the rate of inflation according to the (superlative) Törnqvist index is obtained by weighting the rate of growth of individual prices by their shares in the budget, averaged over the base and current periods. This turns out to be exactly what we want for a single utility-maximizing consumer whose preferences have exactly the right functional form. But we know rather little about whether consumers maximize utility at all, let alone whether they do so instantaneously or take time to adapt to price changes. We do know that there are many consumers, not one, and that, even if each behaves as we like to suppose, we cannot represent their behavior or their welfare by that of a single representative agent. So that while it is true that, when calculated on aggregate data, the Törnqvist index grows less rapidly than did the current Consumer Price Index, we should be wary of citing this as evidence that the Törnqvist index handles substitution bias better than the modified Laspeyres index that is currently in use.

## Income Effects and Heterogeneity

The Laspeyres-style index that is used by the Bureau of Labor Statistics takes for its quantity weights the *aggregate* consumption of each good obtained from the Consumer Expenditure Survey. This aggregate Laspeyres index is a weighted average of the corresponding individual (or household) Laspeyres indices, where the weights are the share of each individual (or household) in aggregate consumption. But why should we want to weight each household in the ''social'' cost-of-living index by its share in aggregate expenditure? Why should the rich count more in the Consumer Price Index than the poor? To ignore the differences in the cost-of-living across people, and to claim—if only by omission—that ''the'' cost of living index exists, is to ignore the fact that the CPI is what Prais (1959) called, in recognition of its bias towards the rich, a ''plutocratic'' index, and which he contrasted to the democratic index, defined as a simple average of the price indexes for each individual or household, weighted equally rather than by income. The democratic index is readily calculated in practice; instead of weighting the individual price ratios by the shares of each good in *aggregate* expenditure, as in the Laspeyres, we weight them by the average of each household's expenditure shares. Under the

assumption that the shares of the budget for each good are linearly related to the logarithm of total expenditure, and using the Consumer Expenditure Survey for 1990, I calculate that the household for which the CPI weights are correct lies at the 75th percentile of the expenditure distribution (see Muellbauer, 1977, for the theoretical basis for these results). The widening inequality in family income and expenditure that has taken place since 1990 will have raised this position still further.

These distributional issues have probably not been very important in practice over the last two or three decades, because relative prices in the United States have not moved by very much over that time, or at least have not diverged in ways that are correlated with the variation in consumption patterns across income groups. Thus, the true growth in the cost of living for a Consumer Price Index-representative household at the 75th percentile of the income distribution has been much the same as that for a median or poor household. The most important relative price divergence is the rapid rise in the relative price of medical care, which almost everyone agrees is badly measured, and which is mainly an issue for the elderly, not the poor. Even so, three points should be noted.

First, there is no guarantee that future changes in prices faced by households across the income distribution will continue to be similar. Indeed, Kuznets (1966) and others have documented the historical tendency for the price of food to rise relative to the price of manufactures as income grows, a trend that disfavors the poor. In Britain in 1975–76, when the inflation rate was around 15 percent, the rate for the poor was two points higher than that for the rich (Deaton and Muellbauer, 1980, Table 7.1); similar, more recent differences are documented by Crawford (1996). If the Consumer Price Index is not sufficiently flexible to allow inflation rates to vary across the income distribution, we have a flaw in our statistical system that will one day become a serious issue.

Second, the bias in the Consumer Price Index from ignoring quality effects is surely related to income, in spite of the denials by Boskin and his coauthors in this issue. The welfare benefits of exogenous increases in quality are in proportion to the quantity of the good consumed, so that the benefits of quality upgrading and of new goods will only be distributionally neutral if the affected goods are neither luxuries nor necessities. While it is true that advances in the technology of consumption have benefitted people in all parts of the income distribution, it is hard to believe that many of the relevant goods are not luxuries. When new goods are consumed disproportionately by the rich, whose price indexes are weighted in the CPI according to their incomes, the quality-corrected plutocratic index can provide a very poor measure of prices for the average consumer. Moreover, in the hypothetical case where the introduction of new models consumed by the wealthy is accompanied by price increases in existing brands, it is possible for a (plutocratic) quality-corrected CPI to fall when the cost-of-living is rising on average (Erickson, 1997). Even for food, where the Commission makes much of increased availability of varieties, my guess would be that the improvements have taken place disproportionately in grocery stores more heavily patronized by wealthier clients.

Third, some issues of heterogeneity go beyond differences in income. For example, the assumption of identical preferences is useless for evaluating the benefits of new technologies in medicine. Not everyone will benefit from advances in heart or cataract surgery, which means that the reduction in the cost of living associated with such advances is different for different people, so that once again it makes no sense to talk about ''the'' cost-of-living index (Griliches and Cockburn, 1994). It is all very well to suggest that the CPI should move closer to a true cost-of-living index, but it would be wise to discuss whose cost of living we are talking about.

Perhaps the Boskin Commission, along with many others in the economics profession, has been too quick to embrace the cost-of-living approach and to discard the older axiomatic or ''test'' approach particularly associated with the work of Irving Fisher. Given that the cost-of-living basis is so conspicuously unsuitable as a guide for construction of the Consumer Price Index, perhaps we would do better by compiling a list of properties that we want from a CPI, and test the available indices against them. This view has been well put by Pollak (1980) who writes, ''As a framework for constructing indexes for particular households, the preference approach is unlikely to be displaced by a revival of the test approach. However, as a framework for constructing group indexes, the axiomatic approach deserves more attention than it has thus far received, since the advantages of the preference approach are greatly attenuated when we move from household to group indexes.''

## Uses of the Consumer Price Index

If the Consumer Price Index is so hard to measure, because of the impossibility of making quality corrections, and because there is no well-defined cost-of-living index to which it should correspond, then perhaps our government should be more careful about its use. For example, if indexing Social Security and other payments to the CPI is problematic because the CPI doesn't correspond to the cost-of-living indexation that Congress had in mind, then perhaps there are better things on which to index. For example, Griliches (1996) and Krueger (1997) argue for indexing Social Security payments to wages or to consumption, rather than to prices, which would require the elderly to bear some of the exogenous aggregate uncertainty faced by the economy, while allowing them to enjoy some of the benefits of exogenous productivity growth. A recent panel of the National Academy of Sciences argued that rather than indexing the poverty line to the CPI, it might better be set as a fraction of median expenditure on a subset of ''necessary'' consumption expenditures, including food, clothing, and shelter (NRC, 1995). If this proposal were adopted, the problems with the CPI would become irrelevant for counting the poor, and for the myriad programs that are presently indexed to the poverty line.

Of course, taking Social Security and poverty out of the debate would not remove the Consumer Price Index from the firing line; the stagnation of real median wages, the performance of the economy, the extent of the productivity slowdown, and the conduct of macroeconomic policy are all affected by the measurement of inflation.

But a much more cautious use of the CPI for indexing would be desirable in its own right and would limit the adverse consequences of its mismeasurement.

## On the Consumer Expenditure Survey

A major constraint to improving the quality of the Consumer Price Index is the condition of the Consumer Expenditure Survey. The sample size of the Consumer Expenditure Survey is only about 7,000 households per year, compared with the 50,000 households in the two major income surveys, the Survey of Income and Program Participation (SIPP) and the Current Population Survey (CPS). The small sample size makes it difficult to derive reliable price indexes for separate demographic groups, or for people at different levels of living. Although the Bureau of Labor Statistics estimates inflation rates by region, the changes are all given with regard to a common base year, when all regions are treated as having a cost of living arbitrarily set at 100, so these inflation estimates cannot be used to compare the cost of living across different cities or regions. When the National Academy of Sciences panel considered how to improve U.S. poverty statistics, it did not consider a switch to a consumption-based measure, not because of any lack of intellectual arguments, but because the Consumer Expenditure Survey as it stands is an inadequate basis for a detailed regional and demographic profile of poverty. I would therefore like to endorse in the strongest terms the Boskin Commission's recommendation that the survey be expanded.

A larger Consumer Expenditure Survey would fill other important gaps in the statistical system. It is not necessary to subscribe to the permanent income or lifecycle hypothesis to believe that consumption, rather than income, is the better indicator of household living standards, or to recognize that households take steps to smooth consumption over time. The Consumer Expenditure Survey is the only survey that gathers data on both income and consumption, and which therefore permits the calculation of saving (albeit with a great deal of measurement error). Most economic theories of saving are theories of individual or household behavior, and cannot be tested without adequate data on household saving, data that do not exist. Indeed, the saving data in the Consumer Expenditure Survey do not match trends in the aggregate macroeconomic data so that we cannot research the microeconomic basis of the decline in household saving, surely one of the major public policy issues of the day.

The Bureau of Labor Statistics should not carry the blame for the state of the Consumer Expenditure Survey, but substantial improvements in the survey are necessary if we are to have a better Consumer Price Index.

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