

## **THE CPI AND BEYOND: ISSUES OF CONCEPT AND MEASUREMENT**

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It is an honor for me to speak here today on this occasion. I knew Shirley Kallek as a member of the AEA Census Advisory Committee and interacted with her on a number of occasions. She had a real commitment not only to getting the numbers right but also to collecting relevant numbers. It is in this spirit that I want to talk to you today about issues surrounding the current CPI debate.

The discussion about the CPI and the potential biases in it has suddenly heated up. It is interesting to ask what is so new about it? Why now? After all, almost all of the questions discussed today were already raised at least 35 years ago in the Stigler report (NBER 1961). Moreover, for many years statistical agencies beat back successfully attacks by various academic barbarians who questioned the correctness of their output. This is not the place to speculate at length about the political economy and sociology of this topic and on the reasons for this change (see Triplett 1990 for one such discussion). Suffice it to say that it came about as a confluence of a number of forces: 1. Continuous contributions by academics and also researchers inside government agencies on this topic, both theoretical and empirical. Especially noteworthy have been the works (in alphabetical order) of Diewert, Dulberger, Gordon, Pollak, Reinsdorf, Rosen, and Triplett. 2. The retirement of the old leadership in these agencies and the rise of a new and differently trained generation there. 3. The indefensibility of the position that denied that there was a problem in the face of a rapidly changing technological environment. For example, it ultimately became ridiculous to claim that computer prices were not changing and keep them fixed at 1.00, which finally forced BEA in to doing "something," i.e. hedonics, about computer prices in the NIPA in 1986. And 4, the discovery by politicians that "fixing the CPI" may provide a "free lunch" in the budget deficit battle. Three recent milestones on this road were, first, the publication of a series of articles by BLS researchers in 1993, in the Monthly Labor Review, which pointed out (and admitted?) to a series of problems in the CPI as it is currently computed; second, the public suggestion, early last year, by the Chairman of the Board of Governors of the Federal Reserve Board, Alan Greenspan, that the budget deficit problem could be alleviated by recognizing the

potential biases in the CPI; third, this "free lunch" idea got the politicians excited, hearings were held and a "Commission," of which I am a member, was appointed by the Finance Committee of the U.S. Senate to examine this range of issues, with the hope that it will give them a "number" and a fig leaf, to do what they otherwise had little stomach for doing: reduce the growth of entitlements and raise taxes. It should be clear that I am speaking here today as an individual expressing my own opinions, for which the Commission is not responsible, and which are not necessarily going to be reflected in its final report. After all, I am only one of five members, and the final report will undergo much review and criticism from various bodies, both inside and outside the statistical agencies.

The potential attractiveness to politicians of "fixing the CPI" can be seen from Chart 1 which shows the impact of a slower growth in the CPI, by 1 percent per year, on the growth of entitlements, taxes, and the deficit. By the year 2005, the impact on the projected deficit would reach close to \$140 billions per year. As the late Senator Dirksen used to say: "a billion here, and a billion there, and soon you are talking about real money!"

Last June our Commission issued an Interim Report whose main conclusions are summarized in Table 1. Its best (guess)estimate was that the estimated growth in the CPI was upward biased by close to 1.5 percent per year in the recent past, but that about a third of it, 0.5 percent, is likely to be eliminated in the near future as the BLS corrects some of its procedures. The remaining biases consist of 0.2 to 0.4 percent due to the "substitution bias," i.e. the use of a "fixed-basket" Laspeyres formula in a changing world, and 0.7 or more percent due to the non- or incomplete accounting for the rapidly changing assortment of outlets, qualities, and new goods and services. These numbers have been recently reviewed and recomputed by Shapiro and Wilcox (1996). Their overall number is somewhat lower (1.1 vs 1.5), but our estimate fits very comfortably within their estimated range of uncertainty on these matters. (See Figure 2) The Commission is also trying to "improve" these numbers as it moves towards its "final report," though it is unlikely that it will be able to whittle down significantly the range of uncertainty surrounding such estimates.

In what follows I will leave behind the more technical aspects of CPI measurement, such as the substitution and formula biases, which are now reasonably well understood and where we know, at least in principle, how to fix them. I will focus instead on the bigger and more controversial new goods and quality change biases. The latter also manifests itself as the appearance of new items (and

the disappearance of old) and creates the same kind of a problem as new "goods" within the framework of current CPI procedures. There are two problems here, which I will call: "too late," and "too particular." The current index is based on 1982-84 weights and will not be revised until 1997, at which point it will be again 4 years out of date! In particular, a new good which does not fit an existing stratum definition will not appear in the index at least until the next full 10-year revision. Thus, neither the PC or the VCR were in the CPI before 1987, even though they came to the market in serious numbers about a decade earlier and experienced enormous price declines in the interim. The VCR was falling in price by about 6% per year (unadjusted for quality) between 1978-87, and only by 3% per year thereafter. PC prices, quality adjusted, were falling by about 30% per year during the same period. Moreover, once inside, a chosen model is not changed until it is rotated out (on average after 3 years in the sample--or is it 5 years in steady state?) or disappears and has to be replaced. If "old" items had the same price history as new ones, this wouldn't matter, but for many (most?) durable goods and also some services (such as restaurants), providers whose market share is declining do not reduce their prices accordingly, but rather exit. Hence, their observed price history is not representative of a more inclusive "average" price history. Also, the current rotation policy will miss a whole generation of items whose turnover is rapid, as in computer models, and underweight those models that it will catch, since they will not get full weight until they are at least 5 years old!

But the big problem is that the new models are rarely compared to the old. Since the CPI does not use hedonics for PC's, it has no way to evaluate and incorporate the implicit price decline that happened from the appearance, successively, of the 386, 486, and Pentium PC models. All of that is "linked out," since old models, by the time they have entered the index, do not decline much more, but rather disappear!

This is not just a problem for fancy technological items such as cellular phones and satellite dishes, but also for the treatment of grapes and raspberries from Chile in January, the impact of Walmart, of new bakeries, and new sources (and types) of fish made possible by the decline in real transport costs and trade barriers. Also, until this year, the "too particular" objection applied to the treatment of generic drugs which were considered entirely new commodities, and neither the CPI or the PPI reflected the large price declines experienced by consumers as they switched to these cheaper and, as certified by the FDA, functionally equivalent alternatives. An example of such developments in the market for Cephalexin (a

particular, but widely used antibiotic) is given in Figures 3 and 4 (taken from Griliches and Cockburn, 1994).

Figure 3 shows a typical price history for generic drug entrants in the 1980's: entry at about half-price, no significant price response by the incumbent, and a subsequent further decline in generic prices as the result of further entry by additional manufacturers. It also illustrates different possible aggregate views of this history: the average price, which treats the different versions of this pill as equivalent, the (earlier) "BLS" view that results from a belated introduction of generics with too little weight, and a Tornquist-type index which would introduce them as soon as possible, but still make no direct price comparisons.

Figure 4 shows that reasonable approaches to direct comparison of the old and new versions, labeled Paasche (u) and Paasche (ud), move the resulting indexes further down, about half-way between the "just-in-time" Tornquist version, and the direct comparison (a pill is a pill) average price version.

There is also the perennial problem of measuring the price (and output) of consumer services. The basic fact about most services is that the consumer participates directly in their "production," spending his own time on traveling, standing in line at the bank or supermarket check-out counter, or waiting for an operation to happen and then waiting to recover from it. Hence the full price to him of consuming a commodity or service includes not only its purchase price but also the value of the time required to acquire and "enjoy" it (Becker 1965). Without a much more explicit accounting for consumer time, we will not be able really to improve our measures of service quality or evaluate the contribution of such major innovations as ATM's (automatic teller machines) or laparoscopic surgery. But detailed data collection on consumer time use (and its quality!) is still in its infancy. (See Griliches 1992 and Oi 1996 for more discussion of some of these issues.)

One of the most problematic measurement areas is the "price of health." The current procedures are badly biased, resulting in serious upward biases in the CPI, at least until the last few years, when service quality experienced by consumers at "equivalent" insurance prices may have started to decline. Several recent studies point to the first part of this conclusion: Cutler and McClellan (forthcoming) examined the cost of treating heart attack episodes and concluded that most of the increase in cost came from an increase in the quantity of inputs used in the health sector, from additional new procedures, and not primarily from a rise in factor prices. (See also

Fuchs 1996 for additional discussion.) Shapiro and Wilcox (1996) have initiated a study of cataract surgery, which shows a sharp reduction in inputs used (primarily hospital services) per cataract surgery. Nothing in the current procedures or in the proposed revisions to them for the 1998 CPI revision will eliminate such biases. But more importantly, neither study is able to estimate the implicit gains in healthiness, consumer surplus, and the associated implicit declines in the "real" price of health per constant quality unit. My guess is that these have been quite large and would dwarf the other estimated sources of bias in the CPI.

The problem of quality change and new goods is very extensive and may be growing worse. It has been reported (see Diewert 1996) that the number of distinct UPCs (Universal Product Codes) used in various scanner check-out procedures, grew from 950,000 in the beginning of 1990 to 1,650,000 by September 1995. The turnover of "models" has also become faster. In the PC market, the average life of a "model" declined from about 3 years to less than a year, between two studies of the PC market in which I participated recently (Berndt and Griliches 1993 and Berndt, Griliches, and Rappaport 1995). Neither the standard CPI procedures, even if accelerated, or hedonic regression methods, can reflect fully all the gains from such extensions in the range of choices experienced by consumers or from the appearance of entirely new goods and services. This fact has been recognized and explored in recent studies by Trajtenberg (1990), Feenstra (1994), and Hausman (1996) who try, each in his own way, to estimate the consumer surplus generated by the entry of an entirely new commodities and show that the effect can be quite large. Unfortunately, I do not believe that these methodologies are ready yet for the "prime time" of routine calculations in the CPI. But such considerations taken together lead me to believe that the combined quality-change new-goods bias may, in fact, be significantly higher than has been estimated by the Commission.

To counterbalance this conclusion, I have been looking for quantifiable examples of new "bads," but with little success to date. In terms of air quality and pollution our environment has probably improved rather than deteriorated in the last couple of decades. Most of the "old" goods that have disappeared do not seem to have been lamented very much and some of them, such as long playing (33rpm) records are still being made, though at a much higher price. While the fear of crime has clearly risen, victimization surveys are ambiguous about whether actual incidence has increased significantly. The only thing that is clear to me is that the recent attempts by HMO's to control escalating health costs, admirable as they might be on their

own merits, are being experienced by many consumers as a deterioration in the expected quality of medical services.

I will not discuss how the CPI could be improved in the intermediate run. That is a most important issue that the Commission is currently grappling with. But I do want to comment briefly on three major questions that to my mind have not been discussed adequately in the recent literature (including the Interim Report of the Commission): 1. Who is the "representative" consumer? How representative is she really? 2. What is "living" and what should be included in its "cost"? What is the "income" that it should be compared to? And 3. What should be "indexed" and how?

A major problem for the conceptual model of the CPI is its reliance on the representative or average-consumer paradigm. But consumers are very heterogeneous, with widely different tastes. A study of quality change, of the gains from the introduction of new products (and the losses from the disappearance of "old" products) forces us to pay direct attention to such taste, income, and opportunity differences, something that we are ill equipped to do. (See Fisher and Griliches 1995 and Griliches and Cockburn 1994 for more discussion of such issues.) There are two basic points to come out from such considerations: 1. We may need to distinguish between different groups of consumers in making our "bias" computations. Not all of them may be "us," have our tastes. 2. "Quality" is rarely a sharply defined concept, to which we can attribute a fixed valuation. A particular new product will be valued differently by different people, and this valuation will change over time, as knowledge spreads, complementary inputs are developed, and as its use spreads to lower-value activities. Thus, how it is evaluated depends crucially on the time at which it is introduced into the index, and a full, correct evaluation of its role is impossible without a more-or-less complete history which would allow us to integrate the area under the revealed demand curve for it.

The main group of "others" that has been singled out in recent discussions are the retired elderly. Of course, we all will be these "others," sooner or later. As of the moment, I believe that the biases we discussed apply to them also, or to say it differently, I doubt that their "true" CPI has risen faster. If anything, it is likely to have gone in the opposite direction. The elderly are "beneficiaries" of two flaws in the current CPI, one of concept and the other of measurement. The first is the treatment of home ownership as "rent equivalence" in the CPI. That is a useful approximation but it does not go further and include the resulting capital gains in the definition of income to be indexed. In other words, homeowners are hedged against housing

price inflation and there is no reason to "compensate" them for such price rises. (The total effect of this objection is muddled somewhat by the fact that the current rent-equivalence concept includes maintenance and repair costs within its definition, which would still be there if pure ownership costs were eliminated from it.) The other main component where their consumption weights are higher, medical care, is the area with much quality change, many new goods (by-passes, hip-replacements, Prozac, Zantac, and many others), and almost no adjustment for it in the official indexes. Nevertheless, the elderly may have a case, but it is outside the current concept of the CPI.

Some of the problem can be seen in the treatment of taxes and fringe benefits. Currently, if my employer reduces his contribution to my health plan, this will not show up as a rise in medical insurance prices to me. It will result in an increase in my expenditures which will only show up as an increase in the weight of medical insurance payments in the next CPI revision. But in fact, I had a decline in my real wage, though the data may show an increase in my "real consumption," as my expenditures rise and they are not "deflated" away. Similarly, a rise in Medicare expenditures may lead to a rise in Medicare premiums, which are treated as a tax rather than as a price. This too would not show up in the CPI even though it would lead to a decline in the real income of Medicare recipients. It is tempting to advocate that all such fringe benefits and services-in-kind be imputed to total consumption, but finding appropriate prices for them will not be an easy task.

The health area raises a variety of conundrums. Consider an unanticipated "break-through" that allows one to live another 6 months, aware but largely immobile, at a cost of, say, \$2000 per day.

We are better off, since we now have an option we didn't have before. We could decline it, but we (and our children) are unlikely to be willing to do so. We will follow this technological imperative, remain alive, and feel and be impoverished at the same time! Even if much of it is paid by insurance, all of the various health options available today to the elderly have put significant strains on their budgets. Of course, the alternative is worse, but it is not inconsistent of them to complain about the "rising cost of living," which does rise with age, even if the CPI is not rising, since it is defined for an average, unchanging, unaging consumer unit.

We can formalize this point by considering the expenditure function for a particular consumer unit  $i$  at time  $t$ :

$$C_{it} = C(p_t, e_{it}, E_t, u_{it})$$

which solves for the optimal expenditure level  $C_{it}$ , given the prices  $p_t$ , the individual unit's "environment" levels  $e_{it}$  (such as age, number of children, and stock of durable assets), the general state of the socio-economic environment  $E_t$  (such as weather, in-kind transfers, crime, and potential epidemics), given the optimized utility level  $u_{it}$ . An individual's price of living index for period 2 which would bring the individual  $i$  back to his utility level in period one, can be written as the ratio of two expenditure functions

$$I_{21}(u=u_1) = C(p_2, e_1, E_1, u_1) / C(p_1, e_1, E_1, u_1)$$

where the numerator in the right-side fraction asks what expenditure would be necessary in period 2 to achieve the same utility level as in period 1, holding both the individual and the aggregate environments constant. (The individual index  $i$  is suppressed in the above formula for visual and typographic ease.) Especially, it would remain unchanged if the only thing that is changing is the age of the individuals in the consumer unit, their health status, the number of children, or the amount of health care inputs delivered to the unit "for free" by the public sector. This is a counterfactual calculation, since no unit is likely to remain the same over time, at least as far as its age is concerned. A cost of living index would not hold the  $e$ 's constant, but allow them to change also, asking what is the minimal expenditure necessary to achieve last period's utility levels under today's prices and environment:

$$COL_{21}(u_1) = C(p_2, e_2, E_2, u_1) / C(p_1, e_1, E_1, u_1)$$

An even more complicated concept would measure the present value of all future utilities and would allow explicitly for expected capital gains and losses on assets and future entitlements. The reason why we do not use this form of the cost of living form of the index is because we are computing the price index for the average consumer unit, assumed to be unchanging over time, in either age or number. We do not include some of the individual environmental changes in the definition of the index, such as "normal" life cycle events, because we assume that they can be anticipated (at least on average) and do not require a general compensation mechanism, though individual social entitlement formulae may depend on them. Nor do we include macro events such as changes in crime levels or the appearance of AIDS, since there is no way in which we could compensate everybody for them. But when an individual complains that his cost of living is rising faster than the CPI, he may be telling the truth even though our aggregate computation is also right!

We have to be sensitive, therefore, to the fact that the CPI is only one component in the measurement of our standard-of-living. For a complete accounting we need estimates of total consumer expenditures and the associated uses of time, including imputations of various in-kind services; estimates of total incomes, including a valuation of fringe benefits; estimates of asset accumulation and the associated capital gains and losses; and also, and that is the most difficult, estimates of changes in our environment, physical, economic, and social. Many of our expenditures, including some of the health expenditures discussed above, may not be producing net increases in utility but rather responding to certain deteriorations in the environment, such as rising crime, or new diseases. All of this is, of course, too heavy a burden to bear for one measuring instrument such as the CPI, but it is worth bearing in mind both what it does do well and what it cannot do given our current state of knowledge as we hand out "grades" to it.

Finally, a few words about indexing. In principle, private contracts could be indexed to anything, even to CPI 1%, as long as the parties freely agree to it. They would still be exposed, however, to some "basis risk," i.e., that the relevant concept for them does not move exactly as the index formula that they have settled on. But when we, as a society, decide to index a certain stream of payments, we need to be clearer as to why and how we are doing it. The simplest rationale is to compensate for monetary inflation, where those on nominal contracts may be losing while others in society are gaining. This is a redistribution argument, where we, who are receiving "flexible" wages, tax ourselves to compensate those whose pensions have been fixed in nominal terms. The point that I am making is that in such a context there are "gainers" who have something to give up to the "losers." But many changes in the CPI are not of this form. Consider an OPEC-induced rise in energy prices. This is an external tax imposed on our economy. We are all poorer for it. There is no way in which all of us can be compensated for it. Moreover, it is not clear that one group, say the elderly, are more deserving and should be fully compensated for it. That would imply that the real income of the rest of the population should fall even further! Why shouldn't the burden of such changes be shared somehow?

In short, what should be used in such compensation arrangements is a price index based on the domestic value-added components of the various consumption goods. In fact, I would suggest the median-wage (including fringe benefits), or average nominal per-capita income as a more appropriate concept for these purposes than the CPI.

The other point I want to make is that the discussion has concentrated on the impact of the CPI on the rate of growth in entitlements, not on their levels. But the fundamental question to be asked is are the levels right. Adjusting rates of growth will not get us, necessarily, to the right levels. What is the minimum safety-net level that we want to protect the elderly or the disabled? Is the current level too high or too low? Only after we have answered such harder questions, does it make sense to worry about whether the escalation formula is distorting these levels. The particular formula used may have first-order budget implications, but in terms of what is the right social policy to pursue, it is a distinctly second-order question.

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