

COL Indexes and Inflation Indexes

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The purpose of this note to raise three questions, or discussion points, about COL indexes where some clarification appears to be needed. They are conceptual rather than technical and mainly concern the domain of a COL index. While the note was prompted by Jack Triplett's paper for the Ottawa Group and contains some comments on his paper, it raises issues of wider concern which do not seem to be satisfactorily resolved in the existing literature on COL indexes.

The three points raised in this note relate to:

- the domain of a COL index and the role of non-price factors on welfare comparisons,
- the treatment of the inputs into, and outputs from, household production,
- the treatment of 'completely new' goods.

I would appreciate knowing the Ottawa Group's views on these points which seem important for defining a theoretically acceptable and policy relevant COL index. The note is selective in the topics treated and is not meant to be a comprehensive treatment of the subject of COL indexes and inflation indexes.

What is a price index and when is a COL index a price index?

Triplett, pp. 3,4 states : "The cost of living index is a price index that measures the change in consumption costs required to maintain a constant standard of living; the index may be conditional on other variables that are also held constant." Others have used similar definitions. When defined so broadly, the COL index must be interpreted as including changes in consumption costs that would be required to compensate for changes in welfare caused by factors other changes in the prices of consumption goods. Pollak (1989) defines the COL index as: "the ratio of the minimum expenditures required to attain a particular indifference curve under two price regimes."¹ There are subtle differences between this definition and Triplett's as Pollak's contains an explicit reference to two different price regimes while it is clear that not only the utility level but *preferences* remain unchanged. There is at least an innuendo to the effect that the only differences between the two situations being compared are in their price regimes.

Triplett's definition states that the COL is a particular kind of price index that is identified by the clause "that measures ... living". There must therefore be a prior concept of what is a price index and this is missing from Triplett's definition. Defining a price index, except in the most general terms, is not so easy however. It is rather like defining an inflation index, a problem which has perplexed some experts.

A COL index is the ratio of two expenditures in much the same way as a Laspeyres price index. At a conceptual level, the striking difference between the two indexes is that, whereas in an index such as the Laspeyres only the prices differ between the sets of expenditures, in the COL index the quantities also differ. Moreover, at least one of the two sets of quantities in a COL index must be hypothetical. The quantities are generally not the same in the two situations in a COL index because a cost minimising consumer must adjust the relative quantities if relative prices differ between the two situations. Given that

¹ Robert A. Pollack, *The Theory of the Cost-of-Living Index*, Oxford University Press. New York and Oxford, 1989, p.6.

the quantities vary as well as the prices, it is not intuitively obvious why a COL must necessarily be a *price* index. Could there be circumstances in which only the quantities vary in a COL index?

Triplett on p.26 invokes an old example of such circumstances in which the consumption of heating oil has to rise in an unusually severe winter to maintain the standard of living (warmth). It can be argued, and Triplett does so, that this must count as inflation because the standard of living has not risen even though expenditures have increased. However, a situation in which inflation is attributable to changes in quantities while prices do not change suggests that the word 'inflation' is being used to mean something very different from what not only the layman but economists understand by the term.

This type of example can be very confusing to many users who may not be experts in COL theory. Triplett goes on to argue that it would be wrong to say that there is no inflation because this would imply that real (deflated) consumption in the national accounts can increase even when there is no increase in the standard of living. However, not only does real consumption patently increase (we are considering an unambiguous increase in the consumption of a single homogeneous product, heating oil) but *households are better off as result of consuming more rather less fuel*. When external factors like the weather change, the effects of changes in the consumption of goods and services on welfare have to be judged *other things being equal*. The appropriate welfare comparison associated with a COL index is between the actual situation with the bad weather and *the hypothetical situation, also with bad weather*, in which households consume the same amount of fuel as in the earlier period.

There are two proper COL indexes that can be compiled in this situation, based as usual on either the earlier or the later period. If the preferences of the later period are used (when the weather is exceptionally cold), the comparison is between the actual expenditures in the later period and the *hypothetical* expenditures that *would* have been made at the prices of the earlier period using the preferences of the later period (which reflect the cold weather). If by assumption the two sets of prices are the same, the COL must be unity with unchanged preferences. The same result is obtained, of course, if the first period is used as base.

Deflating by the true COL index of unity means that, in the example, real (deflated) consumption does increase *over time*. Moreover, the increased consumption does lead to a higher level of utility than *would hypothetically be* the case *if* less fuel were consumed in the later period, even though the positive effects on welfare derived from the increased consumption are cancelled out by the negative effects of the bad weather. A COL comparison always involves comparisons with hypothetical situations.

At the risk of a slight digression, it is worth noting that same problems and confusions, arises with GDP measurement where they lead to woeful misinterpretations of the welfare significance of changes in GDP, i.e., changes in production. I have argued (in the 1993 SNA in fact) that the consequence of a natural disaster such as an earthquake or hurricane, may be to cause GDP to rise, at least in the short run, if the need to repair the damage generates so much extra production that it exceeds any loss in production caused by the destruction of fixed assets. This possibility is often dismissed either as outright absurd or as demonstrating the deficiencies of GDP, because the community remains worse off after the disaster, notwithstanding the increased production. In order to assess the *welfare benefits from production*, however, the question is not whether people are better or worse *over time* but whether they are better off in the later period with the additional goods and services provided by the increased production than they *would be* without them. Simple comparisons *over time* of the effects of changes in production, or consumption, on welfare are only valid if the external conditions do not change.

Similar considerations apply to so-called 'defensive' consumption expenditures by households. Suppose expenditures increase to combat increased pollution or an increased crime rate. The relevant measure of the *benefits from the increased consumption* must be defined analogously to the COL index as defined by Pollak. It should be defined as the difference between the actual utility level in the later period and the hypothetical utility level that would be attained, using the preferences of the later period, with the quantities of the earlier period. Of course, a similar measure can be defined using the earlier period as base. Using such a measure, households are better off with the increased defensive expenditures than they

would be without them, irrespectively of the extent to which their welfare has deteriorated over time as a result of the increased pollution or crime.

These kinds of arguments apply even to mundane expenditures on food and drink. Those who wish to argue that defensive expenditures do not increase welfare because welfare may actually have fallen over time would presumably have to argue that no welfare is derived from consuming food and drink because each morning when we get up we are no better off than in the previous morning despite all the food and drink swallowed in between. Food is merely a defensive expenditure to combat the effects of increasing hunger over time.

Reverting to Triplett's example, his argument that increased consumption of fuel oil increases inflation seems a bit 'tongue in cheek' as it comes in the middle of a discussion of COL subindexes. He continues on p.27: "One might want to produce a COL subindex *conditional* on the base period's weather (the concept of conditional subindex is attributable to Pollak, 1989). In this case, the unusually cold winter does not affect the *conditional* COL subindex that holds the environment constant. Even though the unusual weather conditions raise, in some sense, the cost of living, they do not raise the COL subindex that we want to measure, which is a conditional COL index. The COL subindex that holds the environment constant is probably the COL concept that is most useful for an anti-inflation policy." The last sentence, with which I agree, seems a bit of an understatement.

The point at issue, however, is not simply that there are alternative COL indexes to choose from, but that *some of the broader COL indexes are not price indexes*. In the example, the broader COL index including the effects of the weather is an index which includes the effects of non-price factors, whereas the conditional index only measures the effects of any price changes. A hierarchy of COL indexes of ascending generality may be envisaged, starting with subsets of consumption goods through to all consumption goods plus a whole range of non-price factors. However, as soon as the COL index is extended to include non-price factors it ceases to be a price index but a mongrel index measuring the combined effects of non-price factors as well as prices on the cost of maintaining a certain level of welfare. Such an index is far from being an ideal price index and is *totally unsuitable* as a deflator for expenditures on goods and services.

The Boskin report² touched on these issues. On pp. 72, 73 of section B of part VII on '*Broader Considerations on the Quality of Life*' the authors note that in addition to the benefits derived from new goods "The largest effect [on the quality of life] may come from the change in our physical, social, and economic environment which impose on us higher expenditures necessary to keep with our previously achieved utility levels." They go on to observe correctly but cautiously: "It is not clear, however, whether events such as a colder winter, the appearance of AIDS, or a rise in the crime rate should be included in the definition of a *price* index. [Their emphasis] A change in expenditures due to an unanticipated change in weather should raise the price index only to the extent that energy prices go up, not quantities consumed." It is a pity that they were not more emphatic. Their subsequent discussion seems to have left some confusion as to whether the Boskin report does, or does not, recommend including factors such as the weather, the crime rate or even Sadam Hussein in the CPI.

To avoid misunderstanding, it must be emphasised that it is not being suggested that broader indexes of the cost of living should not be defined or calculated, or that they are improper or uninteresting. On the contrary, they may be of considerable economic, historical, social and political interest, but they should not be classified and used as price indexes if they measure the combined effects of price changes and changes in other factors.

² Advisory Commission to Study The Consumer Price Index (Boskin Report), 1996. *Toward a More Accurate Measure of the Cost of Living*, Final Report, Washington, Dec. 4, 1996.

What provides utility?

There is another area in which the definition of a COL requires further clarification and precision. From what is utility derived? Households do not consume many of the goods and services they purchase directly but use them to produce other goods or services from which they derive utility. In a recent stimulating and important paper, Nordhaus³ has used light as a case study. Households purchase items such as lamps, electric fixtures and fittings, light bulbs and electricity to produce light which is the product they actually consume directly. There are many other similar examples, of course, including even mundane foodstuffs such as flour, sugar, tea and coffee, meat and vegetables, etc. which households use (again together with electricity and other goods) to produce meals and drinks. (On the other hand, there also remain many items purchased by households that they do consume directly and from which they derive immediate benefits, including most services, such as transportation, communication, health and education services.) The light example is striking because Nordhaus provides a plausible case for arguing that the price of light, measured in lumens, has fallen absolutely (at least in US dollars) and dramatically over the last two centuries as a result of major inventions, discoveries and ‘tectonic’ improvements in the technology of producing light.

The question that arises is whether goods and services that are essentially *inputs* into the production of other goods and services should be treated in a COL as if they provided utility directly. In principle, a COL should include the shadow, or imputed, prices, of the outputs from these processes of production and not the prices of the inputs. It is the outputs, not the inputs, that provide utility to consumers. This is not a trivial technical distinction because Nordhaus has shown that in one case at least – light - the price movements of the inputs and the outputs may diverge enormously. In practice, it would not be feasible to replace all the observed input prices by shadow output prices in a CPI without resorting to a considerable amount of speculative econometrics which users interested in the measurement of changes in actual prices might view with some scepticism. There is need to clarify exactly how this issue is to be dealt with in a COL index.

In any case, there remains both a need and a demand for a price index covering the ‘mixed’ flow of goods and services that households actually purchase, either to satisfy their wants directly or to use to produce other goods and services which satisfy their needs or wants. *These are the items on which households actually spend their money incomes and to which the budget constraint actually applies.* Households themselves attach considerable importance to changes in their prices. Economic theory and index number theory have to provide a satisfactory guidelines for partitioning the ‘mixed’ flow of goods and services into its price and quantity components, whether or not the result provides a good approximation to some COL. Households react to changes in relative prices in the same way whether the goods are inputs into the production of ‘final’ consumption goods or whether they are already final when purchased. Economic theory is still needed to explain and interpret the behaviour of different kinds of indexes such as Laspeyres and Paasche relating to such mixed flows.

New goods

Another question on which clarification is needed is whether the appearance of *completely new* goods developed as result of major scientific discoveries and inventions should be treated as lowering a price index. Nordhaus also discusses this question. There can be little doubt that only part, and possibly the minor part, of the improvement in the standard of living over the last two centuries has come from consuming more and more of the same kinds of goods and services. As Nordhaus argues, probably most of big increases in welfare are attributable to major inventions such as electricity, the electric light bulb, the telephone, the motor car, aeroplanes, jet engines, antibiotics and other new drugs, television, the microchip, PCs and so on. By definition of a *completely new* good, when it first appears it is not simply a repackaging of characteristics possessed by previously existing goods but possesses properties that were previously not available or not even known or imagined.

³ William D. Nordhaus, “Do Real-Output and Real Wage Measures Capture Reality? The History of Lighting Suggests Not”, in *Economics of New Goods*, 1997.

The treatment of these completely new goods raises interesting and important matters of principle and definition. If a COL is defined as measuring the change in the cost of maintaining the utility derived from the consumption of goods and services purchased by households for the (direct or indirect) satisfaction of their personal needs and wants, then the introduction a completely new good, in itself, tends to reduce the COL, and in some cases significantly so. The first appearance of the good, the enlargement of consumers' choice, lowers the COL in itself. In addition, of course, there may subsequently be reductions in the price of a new good *after* it has been first introduced. As CPIs do not even attempt to capture the welfare gain associated with appearance of a *completely new* good (as distinct from a new good which is simply a repackaging of existing characteristics), there is no doubt that they tend to overestimate the increase in the COL as just defined.

However, the question still remains whether a COL defined in this way is what a statistical office should be aiming to measure when compiling a CPI. An alternative argument is to treat major scientific discoveries and inventions as factors which impact on a broadly defined COL but lie outside the scope of a COL index which is intended to be a price index : i.e., to measure the effects of price changes on the COL. They may be treated in the same way as factors such the weather or the crime rate which were described earlier as non-price factors. From the point of view of users interested in inflation (i.e. price changes) the relevant COL may be defined to exclude the impact on welfare resulting from the introduction of a completely new good *on the grounds that the welfare benefit does not stem from a price reduction but from advances in knowledge and technology.*

This is a controversial topic. The conventional counter argument is that a price can be associated with a completely new good before it appears, namely the hypothetical demand reservation price - the lowest price that would reduce demand to zero. This must be higher than the price charged for a completely new good when it first appears (assuming some of the good is actually bought) so that a price reduction does occur. However, analysts and policy makers concerned about the general price level are not likely to be interested in purely hypothetical price reductions which do not actually occur, which cannot be estimated and which have no bearing on the demand for money.

Those who wish to argue for the including the welfare gains from new goods within the scope of a COL index cannot be allowed to occupy the theoretical high ground by contending that this is what economic theory requires. Economic theory does not dictate the domain of an index and it is not true that broadly defined (and heterogeneous) COL indexes are *inherently* superior to narrower (and more homogeneous) COL indexes. The domain depends on the intended use of the index. Most users of consumer price indexes are not interested in changes in a COL which are attributable to factors such as climatic changes, political events, or even scientific and technological progress. They are interested in changes in the cost of living attributable to changes in the prices of goods and services actually purchased by households.

The issue is all about the domain of a COL index and the index's relevance and usefulness for different purposes. Broadly defined COL indexes are not to be preferred to narrower indexes as a matter of principle, as though comprehensive measures of changes in the cost of living that capture the effects of anything and everything that changes over time are the only measures of any interest or value from an economic point of view. One serious problem is that if broadly defined COL indexes are selected as yardsticks to judge existing price indexes, the credibility of the latter may be damaged unjustifiably and unnecessarily if the impression is created that they have substantial biases because they do not capture the effects of factors which they are not designed to measure and which ought not to be covered by price indexes anyway.

On the other hand, a COL index whose domain is suitably defined by restricting it to measuring the effects of *price changes* on the cost of living must, virtually by definition, constitute a theoretical price index of considerable analytical interest and policy relevance which many users and statistical offices may wish to set as their theoretical norm. However, there still may be many issues on which no consensus may exist about the precise domain of such a COL index, for example with regard to new goods, or the imputed prices of goods and services produced for own consumption, which are issues that in my view still remain controversial.