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ARE CONSUMER PRICE INDICES SUITABLE FOR DEFLATING GDP?

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ARE CONSUMER PRICE INDICES SUITABLE FOR DEFLATING GDP?

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Abstract

This paper looks at the approach to price and volume measures in the System of National Accounts 1993, including the conceptual framework and the approach to practical issues. It goes on to consider how these relate to developments in consumer prices indices, and in particular to the cost of living approach, taking the United Kingdom Retail Prices index as an example. It concludes that, insofar as a cost of living index measures the cost of a particular level of welfare rather than of consumption, it is not an appropriate family of price indices for deflating components of GDP.

Are consumer price indices suitable for deflating GDP?

1. Summary

1. The report of the Boskin Commission in the United States has stimulated a number of countries, including the United Kingdom, to review the principles and practices underlying their consumer price indices (CPI). The issues have been addressed in a number of papers, including Hill (1997) and Triplett (1999). In the United Kingdom there is currently an extensive research programme into aspects of the UK CPI, which has generated discussion about whether it should be regarded as a cost of living index (COLI), at least in its theoretical framework. In addition, the development of the Harmonised Index of Consumer Prices (HICP) for EU countries has provided an additional family of price indices with somewhat different properties. While there continues to be animated debate among price statisticians, less attention tends to be focused on the consequences of this debate for the deflation of GDP. This paper aims to take a first step towards remedying this.

2. Broadly, a cost of living index is defined as the ratio of the minimum expenditures required to attain a particular indifference curve under two price regimes. In contrast, the UK CPI is regarded purely as an index of price changes in a closely defined basket of goods and services.

3. Some of the alternative approaches to constructing a CPI, either postulated or actually realised in the HICP, can have a significant impact on the individual indices used for deflation and hence on GDP growth rates. However the needs of national accountants are, understandably, not the highest priority of consumer price statisticians. Nevertheless good information about the rate of growth of the economy and the rate of inflation are both important for the purposes of economic policy. The onus by default is on national accountants to ensure that CPIs are fit for our purposes. This paper looks at the recommendations of the System of National Accounts 1993 (SNA93) in respect of the measurement of volumes, and the implications for the use of CPIs as a family of deflators in the National Accounts. These are considered in the light of possible developments in CPIs, giving examples from United Kingdom practice.
2. Introduction: UK national accounts’ use of CPIs

4. In the UK national accounts the components of the Retail Prices Index (RPI - the UK CPI) at a detailed level are used extensively in compiling constant price GDP, mainly to deflate much of household consumption expenditure, but also in the production approach to GDP, for instance to deflate those services which are mainly consumer services. In addition the all-items index is used where no suitable deflator is available, for instance in the deflation of value added by the UK Lottery. As a result the conceptual basis of the RPI is an important issue for national accountants.

5. Furthermore there is a tendency to restrict consideration of the theoretical framework for CPI indices to its use in providing deflators for household expenditure. In the context of UK practice this is too limited an approach. Where both production and expenditure approaches are brought together to provide a single estimate of GDP volume, the construction of price indices as deflators should allow for consistency and coherence across both approaches, taking into account the different price bases of expenditure and production deflators. In the case of the UK, this consistency is implied at present, but will become an explicit requirement when constant price supply and use tables are used to derive a single estimate of GDP volume.

3. Deflation: an imprecise art

6. Before reviewing the advice given in SNA93 about the measurement of volumes and prices, it is worth remembering what Keynes had to say about “real output” and “the general price level”:

(their) proper place … lies within the field of historical and statistical description ... for which perfect precision...is neither usual or necessary. To say that net output today is greater, but the price level lower, that ten years ago or one year ago, is a proposition of a similar character to the statement that Queen Victoria was a better queen but not a happier woman than Queen Elizabeth - a proposition not without meaning and not without interest, but unsuitable as material for the differential calculus.

*The General Theory of Employment, Interest and Money* 1936

7. Accepting that “perfect precision” is not possible, national accountants nevertheless need a set of principles for deriving constant price estimates. With this in mind we turn to what SNA93 says.

4. SNA93: Concepts of volume

8. The introduction to SNA93 make it clear that there is a distinction between the volume of consumption of a good or service and the utility to be derived from it:

1.76 In a market economy, the prices used to value different goods and services should reflect not only their relative costs of production but also the relative benefits or utilities to be derived from using them for production or consumption. This establishes the link between changes in aggregate production and consumption and changes in welfare. However, changes in the volume of consumption, for example, are not the same as changes in welfare. The distinction between the quantity of some good or service and the utility derived from consuming it is clear enough at the level of an individual good or service. For example, the quantity of sugar consumed by households is measured in physical units. It is measured quite independently of any utility that the households may, or may not, derive from consuming it.

9. The SNA goes on to say that although some aggregates “can be useful indicators of changes in both economic activity and welfare, the calculation of such aggregates is not the main reason for compiling
national accounts. The SNA …. is a multi-purpose system designed to meet the requirements of different kinds of users: governments, businesses, research institutes, universities, the press and the general public. No single user, or group of users, can take priority over all others. (1.82)"

10. Chapter 16 of the SNA – Price and volume measures – gives more detail on practice in constructing price indices but does not provide an explicit statement of the underlying concepts. Some examples are given below:

- A volume index is defined as an average of the proportionate changes in the quantities of a specified set of goods or services between two periods of time (16.11).

- In the discussion of quality change over time, the SNA says: “In principle the price relatives that enter into the calculation of inter-temporal price indices should measure pure price changes ….” (16.118)

11. None of these discussions provides a complete description of the conceptual basis of volume measures. Nowhere do they refer to changes in utility, or standard of living. Elsewhere there are some references to consumer preferences or standard of living, but these are found in specific contexts:

- A summary of “ The economic theoretic approach to index numbers” (16.21-30) is used in the context of a discussion of index form, to draw the general conclusion that a symmetric index that assigns equal weight to the two situations being compared is to be preferred to a non-symmetric index. In this context it is clear that some strong assumptions have to be made to support the argument that a symmetric index is preferable.

- In the discussion of purchasing power parities (PPPs) (16.78) they are described as being used “to compare … standards of living”

12. As the sample of statements given above shows, SNA93 does not give a clear steer towards a consistent conceptual framework for measuring volumes, though the concept in the first bullet point in paragraph 4.3 is the one that recurs throughout the manual.

5. Constant price supply and use tables

13. The discussion in SNA Chapter 15 “Supply and use tables and input output” make it clear that SNA93 regards the best way of measuring the volume of GDP to be through a system of constant price supply and use tables:

15.172 Input-output as a framework for price and volume measures is considered a most complete environment for accurate constant-price calculation. Input-output tables at constant prices form part of the whole statistical system of price and quantity index numbers.

14. What is not discussed is that in order to compile reliable constant price supply and use tables there must be consistency and coherence between the deflators used for say household final consumption expenditure on goods and services; the production and imports of those goods and services, and the taxes and margins earned by wholesale and retail distribution activities.

15. Some of the changes which might be needed to bring the UK RPI closer to a COLI might be difficult to justify within a constant price supply and use framework. These changes affect household final consumption expenditure but it could be difficult to apply some concepts to production. To do so would for example result in there no longer being a clear methodology for estimating margins at constant prices. In this context the traditional RPI “price change” approach (see Section 8) seems intuitively more appropriate.
6. Index construction

16. Annually chained Fisher indices are recommended by SNA93 as the preferred measure of price and volume movements in the accounts. This recommendation is backed by the consideration of the economic theoretic approach to index numbers referred to above. However chained Laspeyres volume indices and chained Paasche price indices are said to provide acceptable alternatives (16.23-26 and 16.73). Fisher volume indices lack the property of additivity, which is so useful in an accounting framework, whereas annually-chained Laspeyres volume indices are additive, at least in the prices of the previous year.

17. In passing, it should be noted that the SNA’s advocacy of Fisher indices is at variance with its emphasis on supply and use tables, which require additivity of components, in particular to deduce value added at constant prices by double deflation.

18. The SNA seems to make the assumption that all price observations are aggregated using weights:

16.116 When there is price variation for the same quality of good or service, the price relatives used for index number calculation should be defined as the ratio of the weighted average price of that good or service in the two periods, the weights being the relative quantities sold at each price.…

19. This is the procedure adopted in the UK in constructing PPIs. However in the construction of a CPI there is usually a lower level of aggregation in which unweighted price observations for a single item in a stratum are combined using some form of simple average (eg arithmetic or geometric means). These averages are usually called “elementary aggregates”. The index construction procedure (the type of average used) leads to an implicit assumption about weighting and substitution.

7. Summary of SNA93 concepts

20. In summary the SNA approach to deflation is:

- GDP is primarily a measure of value added
- Changes in volume are not the same as changes in welfare
- As input-output provides the most complete framework for constant price calculations, it follows that deflation of other approaches to GDP should be consistent with the approach to deflating value-added.

8. The principles underlying a consumer price index

21. There are two economic approaches to defining a CPI:

- a set of axioms which define desirable properties for a CPI, of which the best known are Fisher (1922) and Diewert (1995)
- the theoretical framework provided by consumer preference theory

22. A set of axioms will help to define index form, but cannot resolve the numerous conceptual and practical issues that arise in the construction of a CPI. Consumer preference theory provides more help with broad principles, but cannot provide answers to practical problems without making restrictive and sometimes unrealistic assumptions.

23. In the UK, the approach has been to regard the RPI as an index of price changes. Responsibility for the way in which the index is defined is held by the Chancellor of the Exchequer who normally
convenes an Advisory Committee (RPIAC) when there is a need to consider issues of substance affecting the index. The RPIAC has consistently said that the RPI is an index of price changes and not an index of changes in the standard of living. In the light of the above it has rejected the use of consumer preference theory as a theoretical framework, believing that an index of price changes is more appropriate for the main uses of the RPI.

24. The HICP has a broadly similar approach to the UK RPI, being defined as a “pure price index”. Most countries define their CPI on a similar basis. On the other hand, the Boskin Commission, in the context of the US CPI, said that a consumer price index “is a comparison of the minimum expenditure required to achieve the same level of wellbeing (also known as welfare, utility, standard of living) across two different sets of prices”. The United States approach is to regard the COLI concept as providing a unifying framework for dealing with price index problems.

9. Applying SNA principles (16.105-129) in practice

25. The next section of this paper looks at how the guidance in SNA93 discussed above applies to two of the issues being considered in relation to the UK RPI: the treatment of discounts and quality change.

26. A number of issues are considered in Chapter 16 of the SNA under the heading “The treatment of differences and changes in quality” (16.105-129). There is a discussion of the factors which can lead to price differentiation among similar goods - location, timing, conditions of sale etc. Where these factors vary, it can be argued that there is market equilibrium, so that price differences reflect real differences in quality. However this proposition implies that purchasers are well-informed and free to choose between goods and services offered at different prices. Where this is not the case sellers may practise price discrimination, so that different prices do not reflect differences in quality.

27. The SNA recognises the difficulty of distinguishing price discrimination from genuine quality differences, and offers the advice that, in doubt, it is preferable to assume that price differences reflect quality differences (16.117)

Discounts

28. The SNA advice is particularly relevant in the case of discounts. If sellers of a particular type of good or service become more ready to offer a discount, or buyers become more likely to demand one (all other conditions of sale remaining the same), then it is quite clear from Chapter 16 that this should be regarded as a price reduction. In practice it can be difficult to follow this advice. “Three for the price of two” is not a universal price reduction, because not everyone is able to benefit; it would apply only to the extent of the take-up, and a reduction in the take-up would be reflected as a price increase. At present the information required to apply this to the RPI is not available. For some kinds of outlets and items (eg sales very large supermarkets whose prices are collected centrally) it should be possible to get guidance on the broad level of discounting which could be quite straightforward to apply; on the other hand there might well be much more market sensitivity about reporting changes in discount levels, which is what counts for measuring price and volume changes.

Changes in quality over time (16.118 - 129)

29. The SNA emphasises the importance of accounting for quality change over time, and discusses a number of approaches:

- using a period when both qualities are in the market to splice two series together
- using producer costs to estimate the extent of the quality change
- using hedonic regression to estimate the effect of changing quality.
30. No particular approach is recommended as superior, and the discussion concentrates on observable and measurable differences; the concept of the utility of the change to the consumer, and the possible difference between producer cost and user value, are not considered. The hedonic approach is described as being appropriate for goods and services whose prices depend mainly on a few basic characteristics, and for which sufficient numbers of different models, or qualities, are on sale on the market at the same time.

31. The essential problem is the subjective nature of perceptions of quality. This makes it difficult, if not impossible, to derive quantitative estimates about consumer views on quality from observable behaviour, particularly across groups of countries. The assumption that hedonic estimation will provide an answer seems a heroic one: in practice it can be difficult to get stable and meaningful parameters even for the most simple hedonic model.

32. Further, user perceptions of quality of the same good may well depend on which sector of the economy the users belong to. For instance corporate users who buy new upgraded PCs may be able to exploit their advanced capabilities to a greater extent than household users; does that mean that different models of quality change should apply, or does quality refer to the technical specification? At first sight it would seem sensible to use the differing concepts of quality which are in some sense applicable to each market. On reflection however, it is clear that in a constant price supply and use framework, this leads to balancing problems. The differences in quality for say household consumers, corporate investors and domestic producers would have to be balanced either through adjusting deflators, which negates the work done to obtain an appropriate deflator for each component of supply and demand, or by adjusting margin activities, in which case it is difficult to justify the changes having any relevance to wholesaling or retailing activities. In an input-output framework, where consistency of deflation is required, the pragmatic approach would seem to be to adopt some sort of “average” view of quality.

33. In fact, although a considerable amount has been written about quality adjustment, we are a long way from having satisfactory methods in place. Perhaps the best that can be done is to agree a harmonised, albeit arbitrary, approach to these issues.

10. COLI issues raised in the UK RPI research programme

34. As mentioned in the introduction, the issue of whether the UK RPI should be a COLI has been raised in the context of the research programme. Some of the features of a COLI are considered below in the context of the deflation of GDP.

External factors

35. A definition of a COLI that took into account external factors such as changes in noise levels or crime rates, including the need to make extra purchases such as double glazing or extra security precautions would move away from national accounts principles, as is clear from the SNA93 introduction (eg 1.77). Triplett makes a useful distinction between the wider COLI concept and the “domain of consumption” of the CPI, which could be defined as the subset of the COLI which restricts consumption to goods and services sold on the market.

36. He goes on to consider whether an increase in consumption due to some unusually adverse factor (eg a particularly cold winter) should raises welfare or the cost of living, and suggests the use of a conditional COLI which holds the environment constant at base year levels – something that sounds very like a Laspeyres concept.
Frequency of updating weights

37. Annual updating of weights is ideal for national accounts volumes. More frequent updating, which might be desirable in a COLI approach, is discouraged because of the possibility of index “drift” (SNA93 16.47-49).

Treatment of durables

38. Durable goods yield their benefits over a period of time, not at the point of purchase, and this ought to be reflected in a COLI. However SNA93 states explicitly that the consumption of durable goods is not to be treated in the accounts as if they are used up over a period of time (SNA93 9.93-94). The only part of household expenditure where this approach is recommended is housing, where a rental value is imputed for owner-occupied housing. There is of course no distinction in principle between housing and other goods which are used up over a period of time; the national accounts rule is merely a distinction which the majority of NSIs find relatively simple to apply in practice. Triplett’s approach seems to be to regard rental values for durables as ideal and to incorporate them in CPIs as progress is made in measuring them. This would clearly cause problems for national accountants.

Formulae for elementary aggregates

39. The SNA93 advice (16.116, see Section 4 above) seems to be that all aggregation of prices should be weighted, an approach which is used for instance in the UK Producer Price Indices (PPIs). However is common for CPIs to have a lower, unweighted level of aggregation, as in practice the weights required to aggregate consumer prices at the level of outlets are rarely available.

40. In order to calculate price change for unweighted aggregates it is necessary to use an averaging formula. HICP accepts two formulae: the ratio of arithmetic means of prices in the two periods under consideration, or the geometric mean; but bans the use of the arithmetic mean of price relatives. For the UK RPI, a major issue is whether to adopt the HICP standard, and replace the use of the arithmetic mean of relative price changes by the geometric mean.

41. From a national accounts viewpoint, there are a number of concerns about the formulae used for elementary aggregates:

- Consistency with SNA93 advice
- Consistency with other deflators
- Economic assumptions underlying the formulae used
- The practical impact of changing formulae

42. The debate about which formulae to use is as much practical as conceptual. The geometric mean implies a price elasticity of demand of 1; the ratio of averages and average of relatives both imply zero elasticity. For most items the truth probably lies somewhere in between. But the real problem arises from the very large differences for some products between price indices calculated using these two formulae, difference which are somewhat larger in the UK than elsewhere in the EU. In these cases, the suspicion is that the differences arise at least in part from UK price collection or index construction practices. For instance, the product being sampled may be so broadly specified that the elasticity of demand implied by the geometric mean is inappropriate. A full debate on relevance for deflator purposes ought to involve investigation of substitution effects in practice. As noted above (para. 9.3), this may prove difficult.
11. Using the CPI in the deflation of GDP: Conclusions

43. This paper is intended to raise issues rather than provide definitive answers. Some tentative conclusions from a national accounts viewpoint are as follows:

- SNA93 makes a clear distinction between volume of consumption and of welfare. Insofar as a COLI measures the cost of a particular level of welfare rather than of consumption, it is not an appropriate family of price indices for deflating components of GDP. The measure produced by deflating household final consumption expenditure by the components of COLI may be of interest in its own right, but it does not sit happily within GDP, which primarily measures production. Keynes reminds us that the pursuit of yet more refined concepts may be neither practical nor desirable.

- Conflicting demands on CPIs may lead to developments which are at variance with SNA93 concepts. The HICP offers some countries an alternative set of deflators but the application of its harmonised rules may have different impacts in different countries because of variations in underlying national practices. Moreover, national accountants have even less influence over the HICP than they do over national CPIs. In these circumstances national accountants need to be aware of, and participate in, debates about developments in CPIs.

- SNA93 does not give unambiguous guidance about the conceptual basis of price and volume indices, which has led to some apparent conflict in recommendations (for instance between the use of Fisher indices and constant price supply and use tables)

- In developing methodologies for compiling GDP at constant prices, national accountants have to balance demands form the many uses to which the data are put, of which the monitoring of real changes in household expenditure is only a part.
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