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SYSTEM OF PRICE INDICES AND SUPPORTING FRAMEWORKS*

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Abstract

Price indices serve many different purposes and their definition, coverage and construction depends on the precise use for which they are being constructed. Once constructed however their use is frequently extended to other areas. For example, a consumer price index may be designed as an inflation target, a measure of price stability or a compensation index, but may also be used as a deflator. Usually the original use will determine which particular agents the index covers, which range of goods and services are covered and the way in which prices are measured and the index constructed. However key economic concepts such as productivity and welfare are residuals derived by subtracting a series from a first deflated number. Inappropriate use of price indices will render such measures meaningless.

This paper reviews the systems of price indices and the supporting frameworks which facilitate the process of identifying and defining in statistical terms user needs for price indices and making best use of all the prices collected. Whilst the paper considers price indices in general its focus is on consumer price indices.

Keywords: International Standards; Conceptual Frameworks; Practical constraints; Consumer Price Indices; Laspeyres; Cost-of Living Indices; SNA1993; Social Accounting Matrices; Stage of Processing Framework; Stage of Production Framework; deflators.

I. INTRODUCTION

1. The UN Manuals on Consumer Price Indices and Producer Price Indices¹ provide a comprehensive overview of the conceptual and theoretical issues associated with consumer and producer price indices and translate these into the available options for practical measurement, the latter being constrained in large part by the lack of up-to-date and relevant data. The two manuals were developed in parallel taking advantage of the latest research into index number theory and practice and are essentially based on the same underlying economic and statistical theory. The Manual on Consumer Price Indices also acted as a catalyst for the new ILO Resolution on Consumer Prices Indices, which was passed in 2003².

2. The challenge of statistical offices is fourfold: to identify user needs; to conceptualise user needs in terms of economic theory; to translate the underlying concept into statistical measurement terms following the fundamental principles of price index measurement; to construct the indices so defined and evaluate them against purpose.

3. This paper provides compilers with guidance on the issues which arise and the processes that can be used to meet these challenges. It also illustrates the conflicts that can arise in meeting different demands and in being forced to make practical compromises. It also attempts to resolve some of those conflicts.

II. DISENTANGLING THE DIFFERENT ISSUES

4. Meeting the challenges in a systematic way is a complex multi-dimensional process involving a sequence of inter-related activities. The approach described here differentiates

between underlying conceptual frameworks used to define different methods of index compilation, in follow up to the identification of different user needs, and higher-level frameworks designed to identify gaps in the provision of price indices which can then be compared with user needs. Both help facilitate an understanding of the relationships between different indices and also help to facilitate coherence and statistical integration. They compliment one another and together provide a systematic approach to the delivery of a coherent family of price indices.

High-level Frameworks

5. Most countries publish a range of price indices but these tend to be presented separately as specialised, stand-alone measures. This rather haphazard approach can constrain the use made of the large volume of price data that is collected on an ongoing basis and restricts the analytical value which could be enhanced by drawing together the different series and presenting them as a system or “family” of price indices in a coherent statistical framework. The use of such frameworks also facilitates the examination of the relationships between different price inflation measures and can help analysts in their understanding and interpretation of inflationary signals. By identifying gaps, these frameworks can also accommodate future developments in the field of price statistics.

6. The system of National Accounts provides the basic guidelines for building such frameworks, covering as it does all major economic activity including, most particularly, production and consumption and intermediate outputs. In theory it also provides a methodology for developing and extending the core system to meet specialised needs whilst maintaining consistency of approach, both in concepts and practical measurement, and coherence in terms of the definition, classification and measurement of flows and stocks of goods and services. The underlying tool which facilitates this is the construction of Social Accounting Matrices.

Social Accounting Matrices

7. Social Accounting Matrices (SAMs) have been built in many forms but are all essentially a matrix presentation of SNA accounts. They have been the subject of a long-established literature among both economists and statisticians. SAMs first appeared in the official statistics literature in the 1968 SNA and most recently the 1993 SNA³. They have the potential to provide a powerful and flexible framework for a systematic and integrated approach to national accounts at the appropriate level and type of disaggregation. The power of SAMs is in the fact that their design and construction is not standardised but can be adapted to be most suitable for the purpose, for example the process of production or use of products. Similarly, they can be constructed according to classification by purpose for satellite accounts and facilitate the identification of the appropriate deflators for different sectors such as health. SAMs also provide a generic structured approach to the identification of data gaps and coherence issues relating to economic data including families of price indices. The generic approach associated with SAMs underlies the stage of processing framework described. A review of the available literature would suggest that in general SAMs still remain to be exploited to their full potential by the statistical community.

Stage of Processing Framework

8. US statistician Joel Popkin has argued that a “Stage of Processing” framework has a useful role to play in informing policy formation and can also provide the basis for systematically analysing the build-up of inflationary pressures in the economy and for tracking relationships between price developments in particular sectors⁴. From a compiler’s point of view it also provides a useful tool for identifying gaps in available price index series and a focal point for investigating coherence in index construction.

9. The first step in constructing such a framework is to divide the entire economic process into distinct stages:

- (a) **Rest of the world;**
- (b) **Production:** split into broad categories such as agriculture and manufacturing (and further sub-divided into primary, intermediate and final production);
- (c) **Final demand:** separated into private final consumption, government consumption, capital purchases and exports.

10. The main series of price indices are then grouped according to coverage. For the UK this is as follows:

- (a) Consumers expenditure (the Retail Prices Index [RPI], Consumer Prices Index [CPI] (Harmonised Index of Consumer Prices [HICP]) and the Index of Consumer Prices [ICP] component of the previously published Final Expenditure Prices Index [FEPI]⁵);
- (b) Other elements of Final Demand (the Index of Government Prices [IGP] and Index of Investment Prices [IIP] components of the FEPI);
- (c) Inputs into and outputs from the manufacturing sector (the Producer Prices Index [PPI]);
- (d) Trade price indices.

11. The results are shown at Annex 1.

12. The PPIs and the trade price indices each cover a particular segment of economic activity. The PPIs are stand-alone, industry-based net sector indices⁶ relating to materials used in production and articles produced, while the trade price indices relate to imported and exported goods. PPIs are also published on a gross basis. The net sector basis means that transactions between establishments classified to the same industry sector are out-of-scope⁷.

13. In theory for all significant transfers of goods and services from one part of the economy to another, there should be a representative price index (based on directly-measured prices) that reflects the changing level of prices for all such goods (or services). The source of the goods/services is shown down the left side of the table; the destination is shown along the top of the table.

14. For instance, the prices charged by the manufacturing sector for consumer goods sold to the retail/wholesale sector are reflected in the PPIs (Producer Price Indices). The prices charged by the retail sector for consumer goods sold to private consumers are reflected in the RPI (and also by the ICP and the HICP).

15. Across the top of the table are the buyers, classified into two broad groups: intermediate demand and final demand. Most sectors of production are involved in both buying inputs and selling output - so they appear in the table both as buyers and as sellers.
16. In practice, in some cells transactions from seller to buyer will be insignificant and these are denoted by a dash. For instance, there are unlikely to be any imported consumer goods feeding into the construction sector as intermediate demand.
17. The shaded cells represent significant transactions in the economy for which there are no relevant price indices. For instance, in the bottom right-hand corner the grey cell denotes the fact that services sold to rest of the world are significant - but that there is no published price index. Where published indices do exist, the name (or acronym) of the index is given. For instance, the sale of finished goods by retailers to private final consumption is measured by three different price indices - the RPI, the ICP (a component of the previously published FEPI⁸) and the HICP.
18. The treatment of other sectors is as follows:
- (a) **Retail/Wholesale.** Retail and wholesale distribution is shown as a distinct component of the production process and each is shown separately under intermediate demand⁹.
 - (b) **Services.** This is presented as a single category but warrants a further breakdown in view of its increasing weight- for instance into financial services, healthcare, transportation, telecommunications, computer network services.
 - (c) **Rest of the World (RoW).** This appears as a supplier of goods but it does not appear within the intermediate stage activities as a consumer as it plays no part in economic activity within the UK. It does, however, appear under "Final Demand", reflecting exports from the UK.
 - (d) **Other indices.** This consists of Agricultural Price Indices (published by DEFRA) and the Building Costs Indices and Construction Input and Output Price Indices (published by ODPM).
19. The practical advantages of such an approach can clearly be illustrated:
- (a) The associated table of inflation rates can be used for analytical purposes and help inform economic policy.
 - (b) Aggregate price indices (and inflation rates) for each row and for each column may be computed to produce inflation rates for different sectors¹⁰.
 - (c) Possible enhancements to currently published indices can be identified¹¹.
 - (d) Potentially more major gaps can be identified¹².
 - (e) Issues relating to statistical integration and coherence and can be identified. For example, issues relating to coherence in concepts and practical measurement arise when combining rows and columns.
20. The current value of the transfers for each cell would help identify the relative importance of the "gaps". An attempt was made in the UK to do this by referring to the supply-use balances

at current prices. However, this had only limited success due to fundamental differences between the Stage of Processing framework and the aggregated combined use I/O matrix.¹³

21. Furthermore, even if data were available to populate the framework a number of other issues, which could seriously limit the practical usefulness of such an approach, would need to be confronted, most particularly, the limitations of forecasting. The most compelling requirement of analysts is an early forecast of consumer price inflation. It is the final stage in the process - 'retailing' - that can have the most significant effect on the level of final inflation. But one of the biggest determining factors impacting on the latter is retailers' margins, which are determined by a number of imponderables (chiefly consumer demand and the "feel good factor").

22. Finally, and perhaps most problematic from an analytical viewpoint, the Stage of Processing Framework at Annex 1 is restricted to flow prices and ignores altogether asset prices and issues related to pricing a large stock of assets from transactions involving a few flows. These omissions can significantly undermine the value of the framework in solving conceptual and practical issues relating to understanding the analytical and economic relationship between asset prices and flows.

23. In summary within the limitations of the available data (which can be significant) such a framework can be used not just for analysis but also for assessing priorities for further work on price index development including filling gaps, strengthening existing indices or improving coherence and statistical integration. The case for further developing a framework is a strong one but a view needs to be taken on whether to develop an alternative framework based on Supply-Use tables (despite its limitations for this purpose) or to develop data sources which meet the requirements of a Stage of Processing framework. Also a number of other issues would need to be addressed in developing such a framework including the need for a facility to resolve the relationship between asset prices and flows.

Lower-level Frameworks

24. Higher-level frameworks can be usefully supplemented by lower-level frameworks but it is interesting to note that, like the higher level frameworks, the development of these lower-level frameworks has followed rather than lead index development. Moreover, they can be conceptually, or in approach, rather different from the higher-level frameworks making for limited synergy although still useful in providing structures for enhancing analysis and for the identification of outstanding data requirements.

Stage of Production Framework: digging down deeper into PPIs

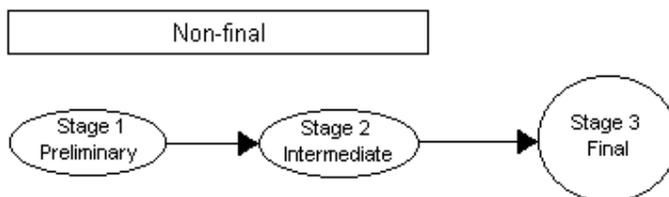
25. The Australian Bureau of Statistics (ABS) have taken the above approach one stage further to a lower level of detail by applying a Stage of Production Framework to Producer Price Index development, in a strategic move to supersede industry-based indices, and as an aid to the analysis of inflation. The indices generated cover both domestically produced and imported commodities, individually and in aggregate, and provide an alternative breakdown of existing ABS producer price indices. Basic prices form the basis of the price indices¹⁴.

26. Under the stage of production concept commodity flows are categorised sequentially according to their destination along the production chain following an input-output approach, the

primary classification being between final and non-final commodities where:

- (a) **Final commodities** are those destined for final consumption, capital formation or export.
- (b) **Non-final commodities** are those that flow into inter-mediate consumption before further processing.

27. In practice and in order to assist analysis, as non-final commodities can flow into the production of both final and other non-final commodities, the non-final commodity flows can be further divided between preliminary commodities and intermediate commodities making three stages of production as illustrated below. Separate indices at each stage represent domestic production and imports and a further analysis of the final stage into capital goods, consumer goods and exports is possible. The three stages are not additive.



28. Under this model, “first stage intermediate goods” are used in the production of “second stage intermediate goods”. In turn “second stage intermediate goods” flow into the production of “final goods”. For each of the three stages, separate indices will be presented for domestic production and imports. The “final goods” will be further split into capital goods, consumer goods and exports.

29. The difference between this and the more traditional approach is illustrated below for Bauxite production.

30. In the first row below, bauxite production is classified as Stage 1 production because it is then used as input into the (Stage 2) production of alumina, which is then used as an input into the (Stage 3) production of aluminium. This is the final stage of production because the aluminium is then exported i.e. it passes to Final Demand.

31. In the second row the production of the bauxite is categorised as Stage 2 production because it then feeds into the Stage 3 production of alumina which itself is exported. In the third row the bauxite itself is exported, so this bauxite production is classified as Stage 3 production.

32. Further stages could be introduced. For instance, the aluminium in the example above could then have been used in the production of window frames - which in turn could then have been used in house construction- making five production stages. A judgement needs to be made about the point at which further stages add very little analytical value because of the relatively small production involved.

Preliminary	Intermediate	Final	Final	
<u>Stage 1</u>	<u>Stage 2</u>		<u>Stage 3</u>	<u>Demand</u>

Bauxite	Alumina	Aluminium.	Export
	Bauxite	Alumina	Consumption
		Bauxite	Capital Formation

33. As with the Stage of Processing Framework, the Stage of Production Framework provides both a powerful analytical tool and a method of identifying data gaps and issues relating to statistical coherence and integration, but it is even more challenging because of the potential data requirements, which are due in large part to the more detailed level at which the analysis is undertaken. Such a detailed analysis also raises additional challenges. In particular:

- (a) In the bauxite example, the classification of stages of production may seem rather arbitrary. For instance, the production of bauxite will be exactly the same whether the bauxite is eventually classified as Stage 1 or Stage 2 or Stage 3. Indeed, at the point of production the identity of the buyer (and therefore the destination of the bauxite) may well be unknown.
- (b) Imports could also feed into Stages 1,2 or 3 (or straight to final demand)- once again depending on how many subsequent stages of production will follow before the product eventually passes to final demand. Also although imports can be a source of inflationary pressure it is unclear whether they should be included conceptually and certainly their inclusion potentially raises issues of coherence in inter-country comparisons. The same applies to exports. A further discussion takes place below in an international context.
- (c) The inclusion of services, which should be covered but where data is often limited or of questionable quality. Similarly for construction prices¹⁵.
- (d) The classification of flows is not unique. For example, whilst the ABS has adopted a transaction flow approach that assigns a commodity to a stage based on the proximity of its use in final demand there are alternatives. For instance some other countries with less open economies than Australia use **degree of fabrication** or **principal destination** approaches where commodities are allocated to only one stage. But this would be problematic in an Australian context where, for instance, commodities such as wheat, wool, and iron ore are exported in large volumes as well as being further processed locally. The allocation of such commodities to a single stage would necessarily be arbitrary.
- (e) The issue of timing. The bauxite involved in producing aluminium in time t is not the same as the bauxite being mined and imported at time t and may have a different price. A framework which shows current prices may be useful for analysing expectation but will not show the current values. Instinctively this is resolvable via the careful treatment of stocks and holding gains but this is left out of Popkin's framework.

34. Some of the practical limitations are shared in varying degrees with other price indices, including consumer price indices where practical solutions to the measurement of some services continue to evolve.

35. The relative analytical advantages of this further de-layering compared with the Stage of Processing Framework relates to the ability to split the value of commodity transactions across stages, and including imports and domestic production, thereby providing a stronger PPI-CPI

linkage compared with the situation where the total value of a commodity is restricted to a single stage and where coverage is confined to domestic production only. The drawback associated with the latter was apparent when the UK Office for National Statistics attempted unsuccessfully to model the relationship between producer prices and retail prices based on an analysis of those sectors where the evidence indicated that domestic production dominated¹⁶.

Theoretical Frameworks for Consumer price indices

36. Consumer price indices aim to measure either the rate of price inflation of goods and services experienced by households or changes in their cost-of-living¹⁷ although in practice most consumer price indices (CPIs) published by National Statistical Institutes measure neither one nor the other. Thus most published CPIs are somewhere along the continuum between a pure price index¹⁸ and a cost-of-living index (COLI)¹⁹. This reflects four things:

- (a) The evolution of CPIs, which in large part began as compensation indices, where the latter were formed in the context of socio-economic policies prevailing at a particular point in time in the past.
- (b) The more limited appreciation in National Statistical Institutes, in the early years, of index number theory and the underlying economic concepts of CPIs²⁰. This restricted discussion, particularly of conceptual issues, and it is only over recent years that there has been a closer alignment between theory and practice and a more rigorous and critical evaluation of outputs²¹.
- (c) Practical limitations of measurement. These limitations have become less restrictive with the increase in computer power and data.
- (d) A lack of informed debate with users. The latter are becoming more expert in consumer price indices and more demanding with increased expectations.

37. Against this background, a clear conceptual basis for an index is important as is an understanding of the compromises made during compilation. The conceptual basis provides the benchmark for evaluation against the measurement goal of what is published in practice.

38. The theoretical framework for CPIs is essentially based on *economic theory relating to consumer behaviour*. Many references in the plentiful literature on consumer price indices argue that an advantage of a COLI over a COGI is that the former is supported by economic theory (i.e. the behaviour of the individual in the market place), implying that the latter is not. Economic theory can be used to support both a COGI and a COLI- one at a macro-level and one at a micro-level- and both supplement one another. Thus:

- (a) A COGI measures the inflationary pressures in the economy from price developments in the retail sector. It represents one of many sectors, albeit an important one, in the *Stage of Processing Framework*.
- (b) A COLI measures the expenditure required by a household to maintain their standard of living or utility. Putting aside the definition of utility and whether the COLI is unconstrained or constrained²², it is an index constructed from the viewpoint of the individual consumer and has its foundation in *micro-economics* and the theory of individual consumer behaviour. Unlike a COGI, it takes into account the substitutions consumers make when faced by relative changes in prices

either between different goods and services or between different outlets and suppliers.

Other price indices

39. The lack of a strategic approach to the development of price indices and the over reliance on evolution rather than a systematic application of frameworks is also evident in other price indices produced by statistical offices, most notably house price indices. Similarly, there has been a deficiency in the development and production of deflators. This manifests itself in the generally poor state of the available statistics amongst statistical offices which make up the international statistical community.

40. House Price Indices. There is an urgent need for a conceptual framework based on a systematic analysis of user requirements. Such a framework can then be applied in the context of individual national circumstances, including domestic demand for statistics and the availability of the latter as a by-product of the legal process for the sale and purchase of real estate, to identify suitable data sources and corresponding data gaps. The systematic analysis associated with such a framework can also be used for the formulation of standardised meta-data and in the longer-term to inform progress towards a coherent family of price indicators in a national context and greater international comparability in statistics on real estate prices. A systematic analysis of user requirements for statistics on house prices may take the form of a series of questions reflecting the different reason why users may want information on house prices. For instance, whether an index of house prices is to be used as one of a suite of general macroeconomic indicators, as an input into the measurement of consumer price inflation, as an element in the calculation of household wealth or as a direct input into an analysis of lenders' exposure. Such an analysis can then be transformed into a statistical user requirement and an associated conceptual framework by expressing the needs in statistical terms and identifying the common linkages and corresponding relationships at a micro and macro level.

41. A first attempt at the preliminary stages of such an exercise was undertaken in the context of an IMF sponsored seminar on real estate prices and financial stability indicators, which took place in Washington in 2003. The results are re-produced for illustrative purposes in Diagram A. It is based on an initial but systematic analysis of user requirements, in a UK context, expressed in statistical terms. It is an over-simplification of the actual situation but nevertheless bring to the fore four points relevant to the future strategic development of house price indices in the UK:

- (a) A family of house price indices is needed to meet user needs.
- (b) The development of a coherent family of house price indices that are fit for purpose is reliant on an appropriate framework as its starting point.
- (c) To facilitate cross-country comparisons such a framework needs to have international recognition.
- (d) The availability of data sets may constrain the capability of a statistical agency to populate the framework in its entirety or to produce outputs to fit precisely within the framework but the latter provides the basis for an evaluation of existing indices.

42. Deflators. The needs of national accountants are, understandably, not always the highest

priority for consumer price statisticians. Also, the literature on National Accounts deflation is relatively much younger and less developed than that on consumer price indices and this increases the challenges that national accountants face in articulating their needs. The lack of progress in developing a methodology for deflators is illustrated by the limited attention given to constant price estimation in the SNA93²³ where only about 25 pages are given over to this subject. Similarly, the Eurostat handbook on Price and Volume Measures in National Accounts²⁴, whilst providing useful guidance on an industry by industry basis, goes no further in offering advice on a conceptual framework for deflators than recommending in general terms an Supply-Use approach. In particular there is little generic guidance about when and where it is safe to use price indices to deflate a series they were not designed for. This lack of guidance from the international statistical agencies is particularly odd given the fact that most economic modeling is expressed in constant price terms. It may be assumed that a lot of practical work has been carried out by individual researchers but it has never been properly systemised. This would not be a major concern if it wasn't for the fact that alternative approaches to constructing a price index can have a significant impact on the individual indices used for deflation and hence on GDP growth rates²⁵. Thus the recommendations of the System of National Accounts 1993 (SNA93) in respect of the measurement of volumes, insofar as they are prescriptive, have practical as well as theoretical implications for the use of CPIs as a family of deflators in the National Accounts. This extends beyond the provision of deflators for household expenditure. This is because the construction of price indices for deflators should allow for consistency and coherence across both production and expenditure approaches to GDP since the approaches are brought together to provide a single estimate of GDP volume. Thus the construction of price indices as deflators should allow for consistency and coherence across both approaches²⁶. PPIs and CPIs are used which need to be consistent with the system of national accounts. An examination of the issues leads to some tentative pointers to matters which need to be resolved:

- (a) 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.
- (b) SNA93 does not give unambiguous guidance about the conceptual basis of price and volume indices. In consequence there are apparent conflicts in recommendations (for instance, between the use of Fisher indices and constant price supply and use tables).
- (c) Conflicting demands on compilers of CPIs can invariably lead to developments which are at variance with SNA93 concepts.

43. The latter bullet point indicates a need not only for closer working between index compilers and national accountants, but also for further conceptual thinking, which re-enforces the need for more international work and guidance. Whilst the technical debate on price indices has moved on, there has been a limited discussion in recent years on deflators.

44. Perhaps the most pertinent question relates to the choice between arithmetic and geometric means which may not be an academic one. For instance, in the UK over the last year this has accounted for an average difference of 0.5 percentage points in the annual inflation rate

between the main domestic measure of inflation, the RPI (which uses arithmetic means) and the lower CPI used for the inflation target for the Bank of England Monetary policy Committee (which uses a geometric mean).

45. 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”.

46. 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 un-weighted price observations for a single item in a stratum are combined into elementary aggregates using some form of simple arithmetic or geometric mean. The index construction procedure- the type of average used- leads to an implicit assumption about weighting and substitution, namely arithmetic means assume an elasticity of substitution of zero and a geometric mean an elasticity of substitution on one. Thus, there is a conceptual issue to be resolved which has a numerical impact on the deflation of GDP²⁷.

III. IMPLICATIONS FOR PRODUCERS OF PRICE INDICES AND POSSIBLE WAYS FORWARD

47. Against this background it is legitimate to ask about the scope for a more systematic approach to the production of price indices by national statistical offices, facilitated by greater debate amongst the international statistical community of price statisticians and more communication with users including national accountants about the construction of deflators.

48. The common thread in the above discussions is the system of national accounts and it is not surprising that the common chapter of the UN technical manuals on consumer price indices and producer price indices entitled “The system of Price Statistics”, takes SNA 1993 as its starting point. This and associated chapters are addressed both to compilers and to users and in the view of the author of this paper, are core to the successful and systematic development of coherent and fit-for-purpose price indices and deflators. But their usefulness is constrained by the limited advice and guidelines in SNA 1993 and the lack of discussion and analysis of the practical implications of the resulting choices users may be forced to make, the latter involving the use of price indices for purposes they have not been designed for. Neither is a great deal of advice offered on how to minimise the problems which arise when such choices need to be made.

49. This leads to the following conclusions:

- (a) A co-ordinated approach to the systematic application of frameworks for the development of price indices is long overdue and is a major reason for the current lack of availability and international comparability between the different indices produced by different countries.
- (b) The systematic application of such frameworks within a country provides a powerful tool for moving to a more relevant family of indices, filling gaps and

addressing issues relating to lack of coherence between different indices within the family. Such frameworks provide a powerful tool for evaluating the performance of statistical offices.

- (c) Common methodologies where appropriate between different indices, including between CPIs and PPIs, in common methods and sources of quality adjustment for instance, would be an added bonus.

50. At the level of a national statistical office this can be facilitated by a much more structured approach to index construction which would be part of the compilation of a longer-term development plan for price indices. The Stage of Processing Framework would form the underlying framework for identifying gaps in the family of price indices which would then be the subject of a consultation exercise with users as part of a prioritisation exercise for future work. Other lower-level frameworks such as the Stage of Production Framework, the continuum between a COGI and a COLI (the macro versus micro-economic framework for CPIs), the need for sub-indices for more detailed analysis and the needs of national accountants for deflators would further inform prioritisation at a lower level. This process would in effect provide a decision tree for the optimisation of statistical outputs in terms of which indices are produced and coherence in their construction.

51. But there is a limit to the progress which individual countries can make without more considered and detailed international guidance. In the latter context, perhaps the most pressing issues that need to be taken forward are:

- (a) A more effective exploitation of specialised Social Accounting Matrices to provide all engrossing frameworks for the delivery of customised and integrated systems for economic analysis and for the clarification of conceptual issues and the identification of data linkages and gaps.
- (b) A fuller articulation of the conceptual and measurement issues relating to deflators in national accounts.

52. It would be helpful if both issues could be addressed by the current mini-review of SNA 1993.

53. This would also subsequently lead to a corresponding expansion of the relevant generic chapters in the UN manuals on consumer and producer price indices.

NOTES

¹ ILO/IMF/OECD/UNECE/Eurostat/The World Bank: *Consumer price index manual: Theory and practice* Geneva, International Labour Office, 2004 and ILO/IMF/OECD/UNECE/Eurostat/The World Bank: *Producer price index manual* Washington, International Monetary Fund, 2004.

² Resolution concerning consumer price indices, adopted by the Seventeenth International Conference of Labour Statisticians, 2003.

³ See 1993 System of National Accounts, chapter XX, for most recent reference.

⁴ It has been argued that there is a tension between Stage of Processing, which is essentially driven by economists needs, and National accountant's Supply and Use frameworks, which are essentially driven by measurement needs. This can be resolved by the flexibility and generic approach provided by Social Accounting Matrices (SAMs). See also footnote 13.

⁵ Published in the UK as an experimental index but subsequently discontinued due to difficulties in obtaining adequate estimates of the prices of Government services.

⁶ The principal advantage of the net sector approach is that it avoids the distorting effects that result from multiple counting of transaction prices as commodities flow through different production processes, as would occur under a "gross sector" approach. However, while conceptually valid these net sector measures are incomplete in terms of coverage of the targeted sectors of the economy because they exclude many intra-sector transactions.

⁷ For example, sales of sugar to the soft drinks industry are not included in the manufacturing net sector index for the output of the Food, Beverages and Tobacco Manufacturing Subdivision because establishments producing sugar are classified to the same industry as those producing soft drink.

⁸ The Final Expenditure Price Index (FEPI) was a wider measure of inflation which was published by ONS on an experimental series. It consisted of three components: consumers' expenditure; capital expenditure (investment); government expenditure. It was withdrawn because of problems with input data relating to Government and public sector productivity. These problems later led to the setting up of the Centre for the Measurement of Government Activity.

⁹ The function of the retail sector is to buy from manufacturers and sell to private consumers. Although that part of the wholesale sector that supplies small retailers is in decline, the sector also covers import/export agents - hence the shaded cell from retail/wholesale (consumer goods and capital goods) to retail. Other transactions within this block of the table reflect recurrent purchases by industry from the retail/wholesale sector - e.g. stationary supplies. As noted above, the wholesale sector is perhaps not as significant now as it once was, because of the increasing dominance of major supermarket chains and high-street stores who buy direct from the manufacturer. Nevertheless the sector still accounts for about £50bn per annum, so a Wholesale Price Index would be a significant element in an analysis of inflation.

¹⁰ For instance, an average for the first row (imports of raw materials and fuels) might be determined by combining together the different component price indices (i.e. the indices reflecting imports of raw materials into agriculture, manufacturing the wholesale trade and re-export). For imports, such indices would be constructed using gross weights because an import can only enter the economy once. Similarly, the row total for the production of consumer goods by the manufacturing sector would be determined by combining the price indices for those cells in the row which have significant inputs from this part of the production process. The cell covering output to the retail sector is likely to have the greatest contribution to the row total. Net weights might be more appropriate for determining the row average. Using the same approach, input price indices for each sector of the economy can be computed by calculating average price indices for each column.

¹¹ For instance, in the UK an overall input price index for the agricultural sector already exists - though, as the table shows, it could be further enhanced by including the additional costs of business services and labour costs.

¹² In the UK the most obvious gaps (not in order of importance) are: imports of services; imports of capital goods; imports of finished intermediate goods; imports of consumer goods; wholesale prices; exports of services; export prices charged by wholesalers (i.e. export agents); re-exports.

¹³ Fundamental differences between the Stage of Processing framework and the aggregated combined use I/O matrix are shown below. The second and third points can limit the usefulness and relevance of the I/O matrix for the analysis of inflation but may be considered particularly relevant for issues relating to the construction of deflators:

- The Stage of Processing framework assumes a breakdown of output from each sector of the economy into raw materials, semi-manufactured goods, finished intermediate goods, consumer goods and capital goods. The I/O table refers to the total value of products flowing from one sector of the economy to another as intermediate demand. In the UK it is currently not possible to split these figures into raw materials, semi-manufactured goods and finished intermediate goods. To do so would require a significant increase in the range of data collected and a rise in compliance costs.
- The I/O matrix does not identify imports as a separate phase of economic activity. The I/O table simply identifies the total flow of products (inclusive of imports) to intermediate demand whilst in contrast the Stage of Processing framework lists the supply of goods and services from the Rest of the World to (a) Intermediate Demand and (b) Final Demand.
- The category "wholesale and retail trade" in the I/O table does not include retail and wholesale distribution margins - which are implicitly included within the figures (but are available separately if required). For example the SOP framework looks at the flow of products from manufacturing to retail as one stage in the economic cycle. Transfers from retail to private final consumption are then presented as a second stage. In the I/O table both stages are subsumed within the flow from "Manufacturing" to "Consumers Expenditure", reflecting the total value

paid by consumers for manufactured products and therefore comprises (a) the manufacturing output value (including the value of imported consumer goods) (b) wholesale and retail distribution margins and (c) final taxes.

¹⁴ The valuation basis of the “stage of production” price indices produced by ABS is at basic prices. The indices mainly based on a reclassification of prices collected under traditional producer and international trade price index collections from producers, importers and exporters.

¹⁵ ABS index coverage is currently limited to the output of the following ANZSIC classes: 4111 House construction; 4112 Residential building construction (not specified else-where); 4113 Non-residential building construction; 4121 Road and bridge construction. For reasons of data availability the House construction indexes are lagged one quarter.

¹⁶ This relates to unpublished work where the ONS attempted to model the relationship between producer and retail inflation in an effort to pick up early warning of future trends in retail prices. Other issues which confounded such an analysis included lack of detailed information on distribution costs and profit margins.

¹⁷ The expenditure required by a household in order to maintain their standard of living or utility.

¹⁸ Essentially a theoretical construct involving no expenditure weights.

¹⁹ The Schultze Panel refers to the traditional fixed-weight basket CPI being a cost of goods index (COGI), where “goods” includes services and the continuum is between a COGI and a COLI. Schultze & Mackie 2001 *Panel on Conceptual, Measurement, and Other Statistical Issues in Developing Cost-of-Living Indexes*. Committee on National Statistics, National Research Council.

²⁰ But note that forty years ago the Stigler Committee evaluated the difference between the US CPI and a cost-of-living index and recommended that the Bureau of Labor Statistics moved more towards the latter.

²¹ Two most recent milestones which have contributed to what may be judged a watershed in the understanding of CPIs are the publication of 1) the Boskin Report et al 1996, *Final Report of the Commission to Study the Consumer Price Index*, US Senate, Committee on Finance and 2) the UN Manual ILO et al 2004, *The Consumer price index manual: Theory and Practice*, Geneva International Labour Office. The former, an in-depth critical review of the US CPI, raised a number of generic issues about the practical compilation of CPIs which resulted in a significant number of National Statistical Institutes reviewing their index production. The latter consolidated this work and drew together in a comprehensive and coherent way the corresponding theoretical background. Many of the chapter authors were members of the UN Ottawa Group on Consumer Prices and the manual provided a major input into the updating of the 2003 ILO resolution on consumer price indices.

²² This essentially relates to the domain of an index.

²³ SNA93, Chapter XVI Price and Volume measures.

²⁴ Handbook on Price and Volume measures in the National Accounts. Luxembourg: Office for Official Publications of the European Communities, 2001.

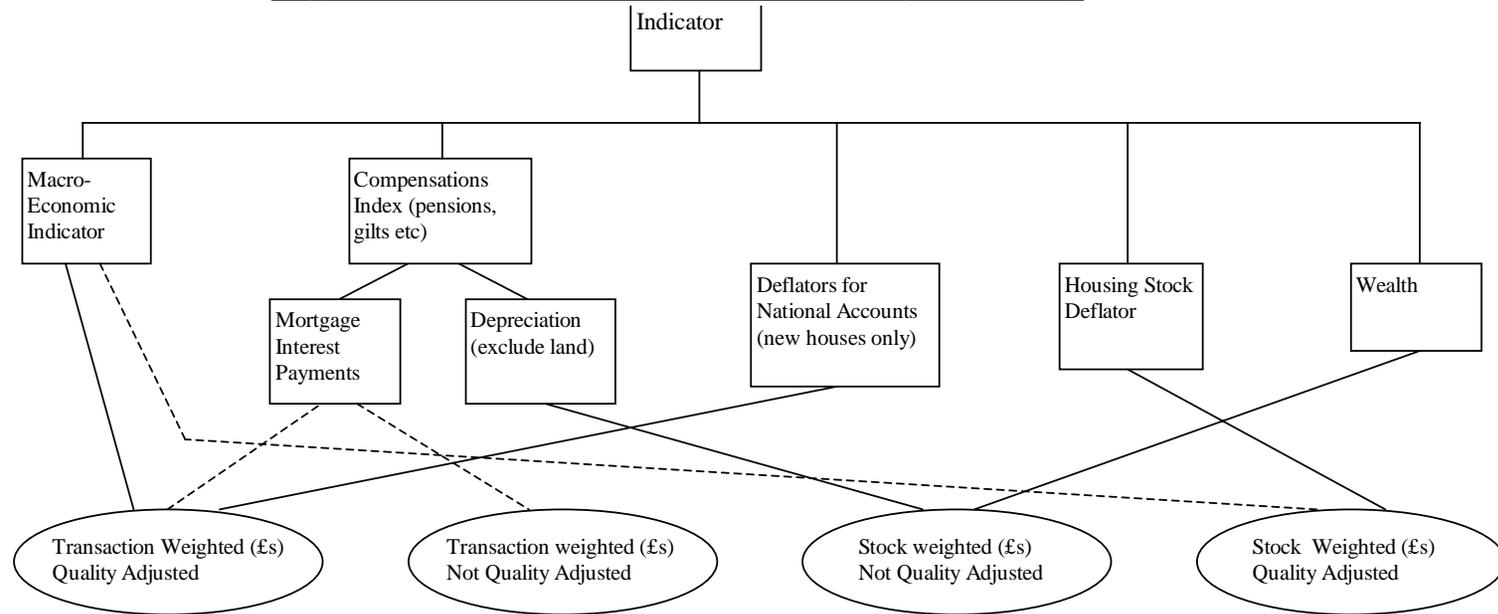
²⁵ For instance, in the UK national accounts the components of the Retail Prices Index (RPI) at a detailed level are used extensively in compiling constant price GDP, mainly to deflate much of household consumption expenditure, but also in the production approach to GDP, for instance to deflate those 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.

²⁶ 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.

²⁷ Other conceptual issues arise in connection with outlet substitution, quality change and discounts, and the treatment of housing.

Diagram A: Derivation of the Primary House Price Indices (illustrative only)



Notes:

1. For depreciation and National Accounts deflators (to deflate the GFCF housing stock value) land should be excluded from the acquisition value.
2. Land should also be excluded from a macro-economic indicator restricted to household consumption.
3. A calculation of mortgage interest payments would require the use of a number of historical indices to estimate mortgage outlay at time of purchase and should include separate information on re-financing.
4. Only basic house price indices are covered in this table, not derivatives used in subsequent calculations. For example, the UK Retail Prices Index's treatment of owner-occupier housing costs, which is based on its historical roots in a compensation index, is essentially based on a mixture of the payments and user cost approaches although the RPI itself can be considered an acquisitions index. Under the *acquisition* approach the total value of all goods and services delivered during a given period, whether or not they were wholly paid for during the period, is taken into account. With *payments*, the total payments made for goods and services during a given period, whether or not they were delivered, is taken into account. Finally, *user cost (or consumption)* considers the total value of all goods and services consumed during a given period. The distinction between the three approaches is particularly important for purchases financed by some form of credit, notably houses, which are acquired at a certain point of time, used over a considerable number of years, and paid for, at least partly, some time after they were acquired, possibly in a series of instalments. The RPI mortgage interest payments calculation uses a mix/quality adjusted transaction-weighted index to provide an historical profile of past houses purchases.
5. Depreciation can be thought of as the costs of major repairs and renovations, with minor maintenance and decorating costs covered elsewhere in the index. In the UK it is priced using a smoothed house price index.
6. The treatment of mortgage payments in a compensation index depends on what the owner-occupier is being compensated for. For example, whether the historical calculation to estimate current levels of mortgage debt should include the change in profile of houses acquired over the years.
7. Clearly, in reality in some instances the primary calculation is unlikely to involve a single house price index. For instance, the calculation of wealth where separate price indices may be used to up-rate the prices of separate sectors of the housing stock (e.g. apartments in Central London, detached houses in rural areas of Scotland) for subsequent summation to produce a total value for the UK.

