The Ottawa Group After 30 Years

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Introduction

- **The Ottawa Group on Price Indices (also known as the United Nations International Working Group on Price Indices) had its first meeting in Ottawa on October 31- November 2, 1994. The present meeting is the 18th meeting of the Group and it is also taking place in Ottawa.**
- **Here is what the Ottawa Group website has to say about the purpose of the Group:**

"The focus of the Group is on applied research, particularly in the area of consumer price indices. The Group examines advantages and disadvantages of various concepts, methods and procedures in the context of realistic operational environments, supported by concrete examples whenever possible. Participants are specialists and practitioners who work for, or are advisers to, statistical agencies in different countries or international organisations. The Group meets about every two years."

Introduction

- **The Ottawa Group website has also posted almost all of the papers (540) and presentation slides that were presented at the 18 meetings.**
- **This is an extremely valuable source of materials on the theory and practice of Consumer Price Index construction.**
- **Over the years, Statistics Canada and the Australian Bureau of Statistics have maintained this website.**
- **Maintenance of the website has been turned over to Carsten Boldsen at the UNECE in Geneva.**

How Did the Ottawa Group Start?

- **It seems that Paul Armknecht (Bureau of Labor Statistics), Bert Balk (Statistics Netherlands) and Bohdan Schultz (Statistics Canada) were having a beer after a meeting of the Joint UNECE/ILO group on Consumer Price Indices which meets in Geneva every two years.**
- **They collectively thought that it would be useful to have more theoretical meetings on CPI theory and practice.**
- **Bohdan (who was Head of Consumer Price Index Research at Statistics Canada) went back to his boss, Jacob Ryten, and suggested that Statistics Canada convene a meeting in Ottawa that would discuss CPI problems.**
- **Jacob agreed and thus the first meeting of this new group was convened in Ottawa in 1994.**
- **I have been fortunate enough to attend all of the Ottawa Group Meetings except the meeting in Washington.**

An Overview

- **The first meeting of the Ottawa Group will be discussed in some detail in section 4 below.**
- **Setting the stage: A review of alternative approaches to index number theory in section 2 that were available to Statistical Offices in 1994.**
- **Section 3 reviews the 1989 ILO Manual on the CPI which outlined existing "practical" advice to CPI compilers. This Manual was largely written by Ralph Turvey.**
- **The Ottawa Group participants were very influential in producing the 2004 *Consumer Price Index Manual*. Section 5 will discuss this Manual and note some problems with the advice in this document.**
- **Section 6 discusses the last CPI Manual which came out in 2020.**
- **Section 7 looks ahead at possible future developments.**
- **Appendix A explains a consumer demand approach to the construction of practical price indexes that can deal with the chain drift problem as well as the problem of quality adjustment.**

2. Approaches to Index Number Theory in 1994

- **In 1994, there were four main approaches to bilateral index number theory that could be used by price statisticians if price and quantity data on the same products were available for two periods:**
- **Basket Approaches;**
- **Stochastic Approaches;**
- **Test or Axiomatic Approaches and**
- **Economic Approaches.**
- **To summarize the results, the Fisher index $P_F(p^0,p^t,q^0,q^t)$ emerges as a "best" choice of formula using the basket, test and economic approaches and the Törnqvist-Theil index, $P_T(p^0,p^t,q^0,q^t)$ emerges as a "best" choice using the stochastic and economic approaches.**
- **Diewert (1978) suggested that in most situations, it would not matter which of these two indexes was used since he showed that these two indexes approximated each other to the second order around a point where $p^0 = p^t$ and $q^0 = q^t$.**

2. Approaches to Index Number Theory in 1994:
Index Number Theory when Only Price Information is Available

- **The approaches to index number theory that could be used when *only* price information is available are the *stochastic approach* and the *test approach*.**
- **The basket approach cannot be used because without quantity information, there are no baskets.**
- **The economic approach requires information on prices and quantities.**
- **The big 3 elementary index number formulae that NSO's were using at the first stage of aggregation when only price information was available were the Carli, Dutot and Jevons formulae.**
- **All 3 of these indexes arise in the context of the stochastic approach to index number theory. But how can we differentiate between them to find out which formula is "best"?**

2. Approaches to Index Number Theory in 1994:
Index Number Theory when Only Price Information is Available

- **The stochastic approach cannot tell us which formula is "best" but the test approach does indicate that Jevons is best.**
- **The Carli index does not satisfy the Time Reversal Test and in fact, violates this test with an upward bias.**
- **The Dutot index does not satisfy Fisher's (1922) Commensurability Test; i.e., it is not invariant to changes in the units of measurement.**
- **Dalén (1992) initiated a more systematic analysis of the test approach to elementary indexes and ended up endorsing the Jevons index because it satisfied more tests than the Carli and Dutio indexes.**
- **In particular, the Jevons index satisfies the following Circularity Test (10) and the weaker Multiperiod Identity Test (11):**

(10) $P(p^1,p^2)P(p^2,p^3) = P(p^1,p^3)$;

(11) $P(p^1,p^2)P(p^2,p^3)P(p^3,p^1) = 1$.

2. Approaches to Index Number Theory in 1994:
Index Number Theory when Only Price Information is Available

- **Another motivation for the use of the Jevons formula when only prices were available came from the empirical investigations of Bohdan Szulc (Schultz).**
- **Szulc (1983; 552-554) found that the upward bias that accumulated from the use of chained Carli indexes could be very high in situations where prices "bounce" to use his terminology.**
- **Thus Statistics Canada was one of the first Statistical Agencies to switch from the use of the Carli formula to the Dutot and Jevons formula for elementary indexes.**
- **The above material gives a brief summary of index number *theory* as it existed in 1994.**
- **There is one major problem with the above theory: it directly or implicitly assumes that the underlying prices and quantities, p_{tn} and q_{tn}, are positive.**
- **This means that price ratios of the form p_{tn}/p_{1t} always exist as finite numbers and this enables the above theories applied to comparisons of prices between any two periods to be based on the use of these matched prices.**

3. The 1989 Turvey Consumer Price Indices Manual

- **In 1989, The International Labour Organization (ILO) published *Consumer Price Indices: An ILO Manual* written primarily by Ralph Turvey (1989), who was the Director of the Labour Information and Statistics Department at the ILO in Geneva.**
- **In addition to Turvey's main text, there are 8 Appendices in this very useful book.**
- **Appendices 2 to 8 are articles that are reprinted from the ILO Bulletin of Labour Statistics.**
- **We find it convenient to review two of these Appendices before reviewing the main Manual: Appendices 1 and 7.**

3. The 1989 Turvey Consumer Price Indices Manual : Appendix 1

- **Appendix 1 has the title "Resolution concerning consumer price indices". This document was a Resolution made by the Fourteenth International Conference of Labour Statisticians, which met at the ILO Headquarters in Geneva, October 28 to November 6, 1987.**
- **The Resolution was intended to provide principles and methods in order to construct a CPI as well as guide lines and standards that are generally accepted as constituting good statistical practice. Here is a statement on the general purpose and structure of the index:**
- **"The purpose of a consumer price index is to measure changes over time in the general level of prices of goods and services that a reference population acquire, use or pay for consumption. A consumer price index is estimated as a series of summary measures of the period-to-period proportional change in the prices of a fixed set of consumer goods and services of constant quantity and characteristics, acquired, used or paid for by the reference population. Each summary measure is constructed as a weighted average of a large number of elementary aggregate indices. Each of the elementary aggregate indices is estimated using a sample of prices for a defined set of goods and services obtained in, or by residents of, a specific region from a given set of outlets or other sources of consumption goods and services."**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 1

- **The exact nature of the aggregate weights is not spelled out in detail in the above quotation.**
- **Note that product prices are expected to come from retail outlets rather than from actual household expenditures.**
- **The Resolution recognized that weights may not be available at the elementary level but if they are available, they should be used.**
- **The precise functional form that should be used to aggregate prices at the elementary level was not spelled out but there was a preference for the use of geometric means.**
- **The Resolution described the type of weights that should be used at higher stages of aggregation as follows:**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 1

- **"In deriving the weights of the elementary aggregates, a household expenditure survey is usually the main source of data. As far as resources permit, such surveys should be representative of household size, income level, regional location, socio-economic group and any other factors which may have a bearing on household expenditure patterns. The period of the survey should be a normal one (or temporary abnormalities should be adjusted in determining the weighting pattern) and should preferably cover a whole year if seasonal variations in expenditure patterns are important." Turvey (1989; 126).**
- **The important points to note in the above description of weights is that they should be *annual* weights.**
- **Thus annual weights should be used that are *representative* for monthly (or quarterly) purchases of consumer goods and services made by households.**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 1

- **Some possible problems emerge from the above description of ILO CPI methodology:**
- **There is a probable lack of weighting at the elementary level.**
- **Monthly prices will mainly be collected by retail outlet surveys but expenditures and expenditure weights will mainly be collected by different household surveys and the resulting surveys may be inconsistent.**
- **The existence of strongly seasonal products (products that are only available at certain seasons of the year) is not consistent with the use of annual weights.**
- **Of course, at the time of the writing of the Turvey Manual, scanner data was just beginning to come into existence and so price statisticians faced with the task of constructing a CPI were limited in what they could do with the resources at hand.**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 1

- **Here is what the Resolution had to say about the frequency for changing the upper level weights:**
- **"The weights should be examined periodically, and particularly if economic circumstances have changed significantly, to ascertain whether they still reflect current expenditure or consumption patterns. The weights should be revised or adjusted if the review shows that this is not the case. In any case, they should be revised at least once every ten years." Turvey (1989; 126).**
- **The Resolution recognized that there was a problem with disappearing products. The proposed solution to a disappearing product price was to replace it with the price of a similar product. Of course, this is somewhat problematic.**
- **We turn now to Bohdan Schultz's (Szulc) Appendix 7 which was actually published in 1987.**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 7

- **Appendix 7 has the title "Price indices below the basic aggregation level".**
- **Szulc on pages 167-168 of the Turvey Manual lays out the basic methodology for representing a Lowe index using annual expenditure weights for a past reference year "a" and monthly elementary price indexes for say N categories of goods and services.**
- **He explained how past year annual expenditure shares can be price updated to make the CPI into a Lowe index.**
- **Since this methodology is still used today, I explained it in the main text in some detail.**
- **Szulc goes on to describe explicit formulae for constructing elementary indexes or micro-indices using his terminology. He introduced this topic with the following paragraph:**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 7

- **“There is an abundant literature, both theoretical and descriptive, on the computation of consumer price indices above the basic aggregation level, but little is written about their derivation below that level. In this respect, the index makers resemble those chefs who only allow their dishes to be presented to patrons at a certain stage of preparation, without showing how they have been mixed and simmered in the kitchen. The reserve in explaining these details does not imply that the meals are unhealthy or tasteless, and a similar conclusion holds for price indices. On the other hand, the early stages of preparation do impact on final results and are of interest, at least to some specialists.” Turvey (1989; 170-171).**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 7

- On pages 171-172, Szulc derives 6 elementary indexes that measure price change between periods 0 and 1. As usual, let the positive price vectors for N products in period t be $p^t \equiv [p_{t1},\ldots,p_{tN}]$ for t = 0,1. His first approach to exhibiting useful elementary indexes works by first defining *price levels* for periods 0 and 1. Thus define the period t Arithmetic, Geometric and Harmonic *price levels*, P_A^t, P_G^t and P_H^t, as follows:

(19) $P_A^t \equiv \Sigma_{n=1}^N (p_{tn}/N)$; $P_G^t \equiv (\Pi_{n=1}^N p_{tn})^{1/N}$;

$P_H^t \equiv [\Sigma_{n=1}^N (1/N)(p_{tn})^{-1}]^{-1}$; t = 0,1.

- The corresponding price indexes between periods 0 and 1, $P_A(p^0,p^1)$, $P_G(p^0,p^1)$ and $P_H(p^0,p^1)$, are defined as ratios of the above price levels:

(20) $P_A(p^0,p^1) \equiv P_A^1/P_A^0$; $P_G(p^0,p^1) \equiv P_G^1/P_G^0$

and $P_H(p^0,p^1) \equiv P_H^1/P_H^0$.

3. 1989 Turvey Consumer Price Indices Manual : Appendix 7

- **In his second approach to the derivation of elementary indexes, he took the arithmetic, geometric mean of the N price ratios directly in order to define $P_A^*(p^0,p^1)$, $P_G^*(p^0,p^1)$ and $P_H^*(p^0,p^1)$:**

(21) $$P_A^*(p^0,p^1) \equiv \Sigma_{n=1}^N (1/N)(p_{1n}/p_{0n}) ;$$

$$P_G^*(p^0,p^1) \equiv (\Pi_{n=1}^N (p_{1n}/p_{0n})^{1/N} ;$$

$$P_H^*(p^0,p^1) \equiv [\Sigma_{n=1}^N (1/N)(p_{1n}/p_{0n})^{-1}]^{-1}.$$

- **Szulc showed that $P_G(p^0,p^1) = P_G^*(p^0,p^1)$, which in turn is equal to the Jevons index $P_J(p^0,p^1)$ defined by (4) above. Note also that $P_A(p^0,p^1)$ is equal to the Dutot index $P_D(p^0,p^1)$ defined earlier by (9) and $P_A^*(p^0,p^1)$ is equal to the Carli index $P_C(p^0,p^1)$ defined earlier by (2). Szulc also showed that:**

(22) $$P_A^*(p^0,p^1) \geq P_G^*(p^0,p^1) \geq P_H^*(p^0,p^1).$$

- **See Turvey (1989; 173). The inequality follows from an inequality in Hardy, Littlewood and Polya (1934; 26).**

3. 1989 Turvey Consumer Price Indices Manual : Appendix 7

- **Szulc made the following observations about the properties of the 5 elementary indexes that he considered above:**
- **The Dutot index perhaps gives too much weight to higher priced products and becomes problematic if the products being aggregated are heterogeneous.**
- **The Carli index is likely to give a higher measure of price change than the other indexes and he noted that the upward bias in a chained Carli index could be quite spectacular if prices "bounced".**
- **He liked the fact that the Dutot and Jevons indexes were transitive; i.e., they satisfied the circularity test (10) above.**
- **He noted that Canada mostly used a chained Dutot index because it "has a long tradition and is considered to be more easily understood by the general public than other transitive index formulae, such as the ratios of equi-weighted harmonic or geometric mean prices. The reasons for using this particular transitive micro-index formula are not that strong, though, and in future discussions other factors might be taken into account as well."**
- **This completes our discussion of Appendices 1 and 7 of the Turvey CPI Manual. We turn now to a discussion of the main text in this Manual.**

3. 1989 Turvey Consumer Price Indices Manual

- **Turvey explained the purpose of his Manual as follows:**
- **“This manual is aimed at practising statisticians who have to construct or revise a consumer price index (CPI). It reflects the international resolution on the subject, reprinted in Appendix 1, but goes beyond it in discussing matters of detail which could not be covered in such a brief document. It is also designed to help the users of consumer price indices, including students of economics, who need to learn about the problems and limitations of these indices. Finally, it is addressed to governments which need to know about the resources required by their statisticians to produce a reliable index.”**
- **If we change the first two words in the above quotation to: “This paper …”, then the last two sentences in the resulting paragraph pretty much explain why I wrote this paper.**

3. 1989 Turvey Consumer Price Indices Manual

- **Here is another quote from the Turvey Manual:**
- **The manual deals with the practice of consumer price index numbers and does not attempt to survey the academic literature on the subject. Much of that extensive and fascinating literature is irrelevant for the purposes of this manual. One reason is that no compiler of a consumer price index, whether it be monthly or quarterly, can hope to obtain new weights more than once a year at the most, and the data used to compute new weights always refer to the past rather than to the present, whereas much of the literature deals with other types of index." Turvey (1989; 1).**
- **Turvey is quite correct to note that much of index number theory appeared to be irrelevant in 1989 because traditional index number theory assumed that current price and quantity data were available to the price statistician whereas this is not the case when the official statistician is asked to produce an up to date Consumer Price Index when real time quantity (or value data) were simply not available to the statistician.**

3. 1989 Turvey Consumer Price Indices Manual

- **This lack of quantity situation started to change in the 1980s when retail outlets started to record all product sales electronically and they were able to store this transactions data.**
- **It took time for price statisticians to realize that the academic index number theory that assumed the availability of price and quantity data was no longer irrelevant.**
- **It also took time for private companies to realize that it was a good thing for them to contribute their scanner data to national statistical agencies so that more accurate price indexes could be produced.**

- **Turvey (1989; 4-8) discussed the various purposes that a CPI could be used for:**

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- **Turvey (1989; 8) noted several reasons why a CPI could differ from a national accounts price deflator for household consumption.**
- **Turvey discussed the *national* (or permanent resident) versus the *domestic perspective* for a consumer price index as indicated in the following quotation:**
- **"Sales in a region or purchases by its residents? The households within any region may make some of their purchases outside that region and some of the household purchases made within the region may be made by households resident outside the region. In either case, there will be a difference between observing the prices paid within the region and the prices paid by residents of the region. This raises questions concerning both the purposes of the index, the subject of this chapter, and about the sampling aspects of index construction, discussed in a later chapter." Turvey (1989; 10).**

3. 1989 Turvey Consumer Price Indices Manual

- **Here is what Turvey had to say about the inclusion of household production of consumer goods and services:**
- **"No one doubts that for a number of purposes the addition of the imputed value of any own-account production and of any income in kind should be added to a measure of money income or consumption to obtain a measure of total income or consumption. It may also be useful to include a measure of the value of government services provided free. If a deflator for such a total measure is required, then this deflator should obviously include the imputed prices of these imputed values. But when the sales to be deflated or the incomes to be deflated, evaluated or determined include no value imputations, then the price index should not include them either. Hence, whether or not to include imputed items should depend on what is the most important purpose for which the consumer price index is to be used." Turvey (1989; 12).**
- **The above paragraph raises an important reason for having separate indexes: one that is largely free of imputations that central banks could use to monitor domestic household inflation and another that would use imputations in order to better measure actual household consumption.**

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- **Turvey (1989; 12-13) discussed some of the problems associated with several categories of "difficult to measure" goods and services like insurance and financial services. With respect to property insurance, he discussed the gross premiums versus the net premiums (premiums paid less the value of claims) approaches in some detail. This is an important issue which has not been settled.**
- **Turvey discussed the problems associated with matching *payments* for items of household consumption to their *use.***
- **"Consumption expenditure can be conceived and measured in three ways which it is important to distinguish. The recommendation defines them as follows:**
- **Acquisition indicates that the total value of all goods and services delivered during a given period, irrespective of whether they were wholly paid for or not during the period, should be taken into account.**
- **Use indicates that the total value of all goods and services actually consumed during a given period should be taken into account.**
- **Payment indicates that the total payments made for goods and services during a given period, without regard to whether they were delivered or not, should be taken into account." Turvey (1989; 15-16).**

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- **Turvey (1989; 16-24) addressed the problems associated with measuring the price of Owner Occupied Housing (OOH) in a CPI. His discussion is excellent. After defining three broad approaches to this measurement problem, he presents the following menu of seven alternative treatments of OOH:**
- **"Formulating the three questions previously listed in more detail now yields the following set of more specific, alternative questions.**
- **(A) Net acquisitions. What is the change through time in the total purchase value of a sample of new owner-occupied dwellings similar to the new owner-occupied dwellings acquired by consumers in the reference period?**
- **(Bl) User cost (1). What is the change through time in the mortgage interest and conventional depreciation at replacement cost in respect of a sample of owner-occupied dwellings similar to consumers' owner-occupied dwellings in the reference period?**
- **(B2) User cost (2). What is the change through time in the opportunity cost of the invested capital value, plus depreciation, less accruing capital gains, in respect of a sample of owner-occupied dwellings similar to consumers' owner-occupied dwellings in the reference period?**

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- **(B3) User cost (3). What is the change through time in the estimated rental value of a sample of owner-occupied dwellings similar to consumers' owner-occupied dwellings in the reference period?**
- **(CI) Payment (1). What is the change through time in the cash outlays on down payments on purchases, mortgage interest and repayments in respect of a sample of owner-occupied dwellings similar to consumers' owner-occupied dwellings in the reference period?**
- **(C2) Payment (2). What is the change through time in the cash outlays on mortgage interest and repayments in respect of a sample of owner-occupied dwellings similar to consumers' owner-occupied dwellings in the reference period?**
- **(C3) Payment (3). What is the change through time in the cash outlays on mortgage interest, excluding repayment elements, in respect of a sample of owner-occupied dwellings similar to consumers' owner-occupied dwellings in the reference period?" Turvey (1989; 17-19).**

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- **Turvey recognized that the purpose of the index would determine which approach to pricing OOH should be chosen.**
- **For example, a CPI that central bankers could use to measure general inflation might want use the acquisitions approach due to its apparent lack of use of imputations, national income accounts might to use a user cost approach and governments might want to use a payments approach to index pensions and transfer payments to households.**
- **On page 22, Turvey lists the data requirements for implementing each of his seven approaches.**
- **My one reservation about Turvey's discussion is that he did not decompose the user cost of OOH into structure and land components. Depreciation applies to the structure part of the property but not to the land part.**
- **Turvey's discussion of OOH is in general excellent. This section of the Turvey Manual makes a strong case for having more than one CPI to serve different purposes.**

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- **The acquisitions approach when applied to housing is not straightforward.**
- **The problem is that housing property consists of a structure and a plot of land that the structure sits on.**
- **A sale of a house with a structure which is not new between households simply cancels out and should not affect the overall CPI.**
- **Thus the acquisitions approach should concentrate on the sales of properties which have a *new structure* on the land plot.**
- **But if the seller of the property is also a household, then the land part of property value should also not affect the overall CPI.**
- **Thus the price statistician must make an *imputation* to decompose the purchase price of the property into its land and structure components.**
- **The European Economic Union's Harmonized Index of Consumer Prices (HICP) uses the acquisitions approach and it has struggled with the problem of how to deal with OOH.**
- **The solution thus far has been to exclude OOH from the HICP.**

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- **Turvey argued that consumer durables should be treated in the same way that OOH is treated in the index:**
- **"If these arguments are not accepted, the case for treating consumer durables and owner-occupied dwellings, as far as practicable, in the same way is a strong one." Turvey (1989; 25).**
- **Turvey addressed the following question: Should the index relate to a point in time or a period?**
- **"This choice is evidently more important with a quarterly index than with a monthly one, though, as in the rest of this manual, the exposition runs in terms of a monthly index. If used for deflating income, expenditure or sales, the index should obviously relate to the period of time to which the money flow in question relates. For economic analysis, where the index will be used in conjunction with other economic statistics, most of which relate to a period rather than to a point in time, it seems appropriate that the consumer price index should do the same." Turvey (1989; 25).**
- **Turvey went on to indicate that practical considerations would often force price statisticians to collect prices at a point in time.**

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- **On pages 80-82, Turvey describes the key features of a hedonic regression, where the price of a product is regressed on its price determining characteristics. He noted that the use of hedonic regressions was particularly important for constructing property price indexes.**
- **Turvey's comments on the good performance of geometric means is worth quoting:**
- **"In view of this superiority, it is not surprising that many statisticians regard the use of geometric means as the best solution. Why, then, are they so seldom used? One reason is that they make the calculations difficult, but this argument loses its validity once computers are used for calculating the index. A second reason is that it may be feared that their use is too difficult to explain to users of the index. But most indices have features which are difficult to explain, and in any case, the degree of complexity that is acceptable is growing, through time, in most countries. Statisticians should have the courage of their convictions." Turvey (1989; 90-92).**
- **We now turn to the first Ottawa Group meeting (on slide 32)!**

4. The First Ottawa Group Meeting

- **The first Meeting of the Ottawa Group took place in Ottawa over October 31 to November 2, 1994. Jacob Ryten of Statistics Canada, the Chair of the Meeting, provided an introduction to the Meeting.:**
- **"In opening the session, the Chair explained that the purpose of this working group is to bring together an independent forum of specialists from different countries to exchange ideas on crucial problems of measuring price change and to propose concrete solutions. The choice of the proposed topics for discussion originated from a long-standing debate about possible bias in the CPI. In the seventies, while inflation was relatively high, it was commonly believed that there was a downward bias in the CPI. At that time, media reported that the CPI was really too low and that actual inflation should have been higher. In fact, the 1982 Conference on Price Level Measurement organised by Statistics Canada, dealt indirectly with this issue. In recent years the debate on bias has re-emerged, however, notwithstanding that the inflation is low, it is now believed, at least in North America, that the bias is upward and that inflation is overestimated. Proper discussion of this complex issue cannot be done without addressing several detailed questions such as: the sampling error of the CPI, the treatment of substitution of goods, the index formula and the formula aggregation at the macro level. To make significant progress on these issues, it was agreed that the discussion for this first meeting should be devoted to only two main issues: the micro level aggregation and its macro effects, and how to detect and estimate the bias of the consumer price index." Ottawa Group (1994; 2).**

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- **Bohdan Schultz's paper at the 1982 Statistics Canada Conference showed that at the elementary index level of aggregation, the use of the chained Carli formula could lead to tremendous upward bias if prices were volatile and of course, at the macro level, a fixed basket type index is subject to possible (upward) substitution bias. Thus there was a need to devise methods to either measure these potential biases or to mitigate them.**
- **Ryten concluded his opening remarks by listing some related research areas that the meeting participants should address:**
- **Relevance of the CPI as an indicator of the Cost of Living Index,**
- **Harmonisation of European price indices,**
- **Importance of agreeing on definition and concept of cost of living vs. fixed basket,**
- **Defining a wider measurement of inflation (ex. whole economy price index),**
- **Need for another economic approach to monitor inflation." Ottawa Group (1994; 2).**
- **The European Union's HICP was under construction at this time and there was a need for Europeans to decide on their harmonized strategy.**

4. The First Ottawa Group Meeting

- **In the text of my paper, I comment on all of the papers presented at this first meeting of the Ottawa Group. Due to time limitations, in this presentation, I will cover only selected papers.**
- **Paper 2, by Paul Armknecht, Brent Moulton and Kenneth Stewart (1994), summarized the efforts of the U.S. Bureau of Labor Statistics (BLS) to reduce possible bias at the lowest level of aggregation where only price information is available and at higher levels of aggregation when expenditure information is also available. The authors refer to the very important research of Marshall Reinsdorf (1993) who compared the trends in US average prices for relatively homogeneous product groups with the corresponding trends in official BLS price indexes for the various product groups. Reinsdorf found that the official indexes increased substantially faster than the average price indexes. For example, he found that the official index for food showed average annual increases during the 1980's of 4.2% per year while the weighted mean of average prices grew at only 2.1% per year. He attributed these differences to *outlet substitution bias*; i.e., the effects of consumers shifting their purchases from higher cost outlets to lower cost outlets. It turned out that the bias Reinsdorf observed was not due to outlet substitution bias. It was later discovered by Moulton (1993), Reinsdorf and Moulton (1997) and Reinsdorf (1998) that the bias was due to *elementary formula bias*; i.e., the use of the Carli formula at the elementary level. Greenlees later noted this early BLS research ultimately led to the use of the Jevons formula at the elementary level.**

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- **Paper 3 was authored by Sellwood (1994). This paper is very interesting for a number of reasons:**
- **It provided insight into the formation of Eurostat's Harmonized Index of Consumer Prices (HICP). Sellwood suggested that the main use of the HICP should be to measure inflation across the member countries in the European Union in a way that would be useful to Central Banks. He argued that *imputed* prices for Owner Occupied Housing and Household Production should not appear in a HICP. Since the purpose of a national CPI might be different from the Central Bank perspective, Sellwood suggested that the HICP would be a supplement to national CPIs rather than a replacement.**
- **The main purpose of the paper was to give guidance to the HICP on whether to use the Carli or Dutot formula at the elementary level. Sellwood initially thought that once the purpose of the index (what is to be estimated) was known, then it would become clear whether Carli or Dutot would be the preferred choice. However, he noted that this strategy did not prove to be successful.**
- **He noted that the Dutot index gave too much weight to higher priced items and that this seemed to be a conclusive argument in favour of the Carli index. Thus he appealed to the test approach to bilateral indexes in coming out in favour of Carli over Dutot. But one could counter that the Dutot index satisfies the circularity and time reversal tests whereas the Carli fails both tests. However, Sellwood's support for the Carli index was not strong.**

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- **Sellwood was very doubtful about the use of the economic approach to the construction of a CPI.**
- **"The classical model of a consumer maximising utility by applying a rational decision process to balance costs and benefits seems remote from common experience." Sellwood (1994; 3).**
- **For a discussion of HICP methodology, see Diewert (2002).**
- **It is interesting that Sellwood referred to the work of Dalén (1994) who was also doing research on the methodology for the HICP. We will review this paper by Dalén shortly. Dalén made a strong case for the use of the Jevons formula but Sellwood did not even mention the Jevons index as an alternative elementary index.**

Paper 4 was authored by Bohdan Schultz (Szulc) (1994).

- **This very important paper followed up on his earlier papers, Szulc (1983) (1987) but in the present paper, he used Statistics Canada monthly micro data for over 50 commodities, collected from December 1988 to January 1994 in the province of Ontario.**
- **He found the same upward bias in the Carli index and recommended changing to the use of the Jevons formula at the elementary level.**
- **Schultz noted that both the Dutot and Jevons formula satisfied the Transitivity (or Circularity) Test and he noted that there was no systematic difference between the two formulae using his Ontario data set. However, there was concern that the Dutot formula gave too much weight to products that had high prices.**

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- **Paper 6 was authored by Jörgen Dalén (1994). This paper and the earlier paper by Dalén (1992) are very important for two reasons:**
- **Dalén derived easy to understand numerical relationships between the various elementary index number formulae and**
- **Carruthers, Sellwood and Ward (1980) and Dalén (1992) developed useful approximate formula which could explain why there were systematic differences between the five elementary index number formulae that are defined in the paper.**
- **Basically, these approximations allow us to measure the distance between the three indexes which appear in the inequalities $P_H^*(p^0,p^1) \leq P_J(p^0,p^1) \leq P_C(p^0,p^1)$ and the above authors showed that to the accuracy of various second order Taylor series approximations, $P_J(p^0,p^1) \approx P_{CSWD}(p^0,p^1) \approx P_D(p^0,p^1)$.**
- **Finally, Dalén (1992) initiated the *test approach to elementary indexes* by looking at eight different tests that could be applied to a bilateral elementary index. The Jevons index ended up satisfying all of these tests.**

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Paper 8 was authored by Alain Saglio (1994).

- **This paper made use of two years of scanner data collected by the Nielsen Corporation on sales of chocolate bars in France.**
- **Saglio computed an index of average prices and compared it to a corresponding Laspeyres index. He found that the average price index decreased 1.6% per year while the Laspeyres index decreased only 0.2% per year.**
- **He attributed the difference between the two indexes to substitution effects; French households switched to lower cost outlets and brands and the Laspeyres index was not able to pick up these substitution effects.**
- **This paper introduced *scanner data* to the Ottawa Group of statisticians.**
- **With the advent of scanner data, it became possible to compute elementary indexes that utilize price and quantity information.**
- **One implication of the existence of scanner data was that the Turvey CPI Manual needed an update to accommodate this new source of information.**
- **Of course, it turned out that the use of scanner data led to new problems.**

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- **There were two room documents which were published in the proceedings of the conference and listed on the Ottawa Group website.**
- **The room document by Carruthers, Sellwood and Ward (1994) has already been referred to in the discussion of Dalén's paper and it is a reprint of their 1980 journal article. These authors provided useful approximations to the differences between the various elementary indexes used in practice.**
- **The second room document was Diewert (1995a). This paper covered the following five topics associated with the use of elementary indexes:**
- **The use of unit values at the very first stage of aggregation;**
- **The statistics literature on the properties of the various elementary indexes used in practice;**
- **The test approach to elementary indexes;**
- **Rough estimates of the possible biases in a CPI and**
- **The implications of scanner data for elementary indexes.**

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- **Following Walsh (1901; 96) and Davies (1924; 183), Diewert (1995a; 22) advocated the use of unit values to represent the prices that would be used in an elementary index number formula.**
- **The companion quantity to the unit value price of a product is the total quantity purchased during the period by the group of consumers in scope for the index.**
- **Of course, in order to compute a unit value for a narrowly defined product, it is necessary to have price and quantity data for the transactions in scope for the product.**
- **This ties in with the last topic: the availability of scanner data means that one can now use a superlative index (or other target index that depends on prices and quantities) as a target index at the elementary level.**
- **If the transactions in scope for the index were taken from retail outlets, then Diewert, like Saglio, arguedI for the use of shop specific unit values.**
- **But he realized that determining the scope of a unit value was not a straightforward choice:**

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- **"However, if individual outlet data on transactions were not available or were considered to be too detailed, then unit values for a homogeneous commodity over all outlets in a market area might form the lowest level of aggregation. Some further discussion on the concept of a unit value for a homogeneous commodity seems warranted. Saglio (1994) noted that the unit value or average price of a homogeneous commodity could be distinguished by: (i) its point of purchase (outlet effect); (ii) the various competing brands or product lines of the commodity that are being sold at an outlet; e.g., Cadbury versus Hershey chocolate bars (brand effect) and (iii) the various package sizes at which the commodity is sold (packaging effect). Thus finely classifying unit values on the basis of outlets, brands and packages should in principle be done, if the requisite data were available. However, it may turn out that empirically, some of this fineness of classification is not required." Diewert (1995a; 22).**
- **Ivancic and Fox addressed the aggregation over unit values issue by running a weighted time product dummy hedonic regression over different product and store outlet classifications of the data. They summarized their results using Australian scanner data as follows:**

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- **"A hedonic regression framework is used to test for item homogeneity across four supermarket chains and across stores within each of these supermarket chains. We find empirical support for the aggregation of prices across stores which belong to the same supermarket chain. Support was also found for the aggregation of prices across three of the four supermarket chains." Ivancic and Fox (2011a; 1).**
- **Their basic idea is useful in terms of the recent literature on how to cluster scanner data.**
- **For example, suppose we have data on a product for a number of periods and we wish to cluster the data into more homogeneous sub-product groupings.**
- **We could run a time product hedonic regression and then look at the magnitudes of the product quality parameters.**
- **Products could be classified into subgroups depending on the magnitudes of their product parameters.**
- **If price and quantity data were available, then a weighted time product dummy regression should be run.**

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- **Diewert asked: how will statistical agencies access scanner data from retailers?**
- **"In general, firms now process information on their costs and sales using computers so that summary information is available to managers on a monthly basis. Detailed information on prices and quantities could be extracted from this information base in many cases. In some cases, firms might be persuaded to provide information on prices and quantities to the Statistical Agency instead of filling out numerous forms."**
- **"The existence of private firms compiling detailed price and quantity information leads to an interesting dilemma for Statistical Agencies: (i) should the Agency buy the data from the information processing firm or (ii) should the Agency set up its own information processing subsidiary to compete against the private firm? Silver (1995) points out that the first alternative will lead to a loss of control by the Statistical Agency in its data collection activities. However, alternative (ii) may lead to charges that the Agency is providing unfair competition to the private sector. More public discussion on these issues seems to be required. However, it is clear that eventually, Statistical Agencies will be forced to join the electronic highway in one form or another." Diewert (1995a; 24).**

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- **Jacob Ryten in his closing remarks noted the need to have further meetings of the Ottawa Group and he provided the following list of ten topics that could be discussed in future meetings:**
- **How to establish price indices for difficult areas such as insurance and gambling fees payable to a state agent.**
- **Product quality adjustment and the use of hedonic methods.**
- **The necessary steps for the harmonization of CPI.**
- **Clarifying concepts (e.g. What is a cost of living index?).**
- **Treatment of new products and outlets in price indices.**
- **Treatment of durable goods in the CPI.**
- **Index formulae at macro level, including the linking problem.**
- **Organization and techniques related to price surveys.**
- **Linkage between temporal and spatial price comparisons.**
- **Problem of seasonality and price indices.**
- **Measurement of inflation."**
- **These topics are still with us today!**

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- **Diewert (1995a; 6-16) extended Dalén's (1992) *axiomatic* or *test approach to elementary indexes*.**
- **He took on board the tests that Dalén studied and added additional tests that were counterparts to Diewert's (1992) list of 20 tests that were satisfied by the Fisher index. These tests were for a bilateral price index of the form $P(p^0,p^1,q^0,q^1)$ and thus not all of them applied to a bilateral price index of the form $P(p^0,p^1)$.**
- **In the end, Diewert (1994; 6-16) showed that the Jevons index $P_J(p^0,p^1)$ satisfied some 16 tests and the Dutot index $P_D(p^0,p^1)$ satisfied 15 of the 16 tests; the Dutot index failed the invariance to changes in the units of measurement test.**
- **Diewert summarized the available evidence on bias estimates as follows:**
- **"Summarizing the empirical evidence reviewed in this section and the previous one, we see that it is likely that in recent years, a typical official CPI has a .2% per year commodity substitution bias, a .25% per year outlet substitution bias, a linking bias of perhaps .1% per year and a new goods bias of at least .25% per year; i.e., an upward bias of at least .8% per year. If the Statistical Agency is also making use of a biased elementary price index formula, this will add an additional upward bias to the official index. The reader will note that all of the 5 above sources of bias were regarded as being additive, an assumption which is probably approximately correct." Diewert (1995a; 35).**
- **These bias estimates were very similar to the bias estimates made by the Boskin Commission in 1996 which is not surprising since we were drawing on the same available studies on bias that were available at the time.**

5. The First Ottawa Group CPI Manual

- **The need for a revised CPI Manual was recognized by members of the Ottawa Group in 1998:**
- **"In September 1998 a meeting of international organisations was convened to discuss the possibility of updating a manual on the compilation of CPI. This meeting agreed that such a manual should be developed. As part of the process and as a member of the newly formed Inter-secretariat Working Group on Price Statistics (IWGPS), the OECD undertook to co-ordinate and maintain the chapter outline for the new manual on CPI. This document represents the latest version of the CPI manual outline." Obst (1999).**
- **However, it took six years before the *Consumer Price Index Manual: Theory and Practice* was finally finished in 2004.**
- **The editor of the 2004 Manual was Peter Hill. Here is a listing of the chapters and their authors:**
- **Preface: Peter Hill, Paul Armknecht and W. Erwin Diewert**
- **Reader's guide: Peter Hill**
- **1 An introduction to consumer price index methodology: Peter Hill**
- **2 Uses of consumer price indices: Peter Hill**
- **3 Concepts and scope: Peter Hill and Fenella Maitland-Smith**

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- **4 Expenditure weights and their sources: Valentina Stoevska and Carsten Boldsen**
- **5 Sampling: Jorgen Dalen, A. Sylvester Young and Bert Balk**
- **6 Price collection: David Fenwick**
- **7 Adjusting for quality change: Mick Silver**
- **8 Item substitution, sample space and new products: Mick Silver**
- **9 Calculating consumer price indices in practice: Carsten Boldsen and Peter Hill**
- **10 Some special cases: Keith Woolford, David Fenwick**
- **11 Errors and bias: John Greenlees and Bert Balk**
- **12 Organization and management: David Fenwick**
- **13 Publication, dissemination and user relations: Tom Griffin**
- **14 The system of price statistics Kimberly Zieschang**
- **15 Basic index number theory: W. Erwin Diewert**
- **16 The axiomatic and stochastic approaches to index number theory: W. Erwin Diewert**

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- **17 The economic approach to index number theory: The single-household case: W. Erwin Diewert**
- **18 The economic approach to index number theory: The many-household case: W. Erwin Diewert**
- **19 Price indices using an artificial data set: W. Erwin Diewert**
- **20 Elementary indices: W. Erwin Diewert**
- **21 Quality change and hedonics: Mick Silver**
- **22 The treatment of seasonal products: W. Erwin Diewert**
- **23 Durables and user costs: W. Erwin Diewert .**

- **The theoretical chapters in the 2004 Manual simply reflected the state of index number theory in 1994 that was covered in sections 2-4 above with some additional detail.**
- **Thus the Turvey Manual touched on methods for dealing with quality change by discussing hedonic regressions but Chapter 21 looked at methods for dealing with quality change in more systematic fashion.**

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- **Similarly, The Turvey Manual discussed the treatment of seasonal products and user costs for housing but Chapters 22 and 23 discussed these topics in much more detail.**
- **In Chapter 22, the use of Rolling Year Mudgett-Stone indexes and the use of year over year monthly indexes (with month specific weights) was suggested as providing checks on the seasonal product components of the official month to month CPI.**
- **However, the Chapter ended up on a pessimistic note with the following conclusion on dealing with strongly seasonal products in a month to month CPI:**
- **"It is evident that more research needs to be carried out on the problems associated with the index number treatment of seasonal commodities. There is, as yet, no consensus on what is best practice in this area." ILO/IMF/OECD/UNECE/Eurostat/The World Bank (2004; 417).**

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- **Chapter 23 on the treatment of durable goods in general (and of Owner Occupied Housing in particular) provided a more comprehensive treatment of possible approaches to the treatment of durable goods than was provided in the Turvey Manual.**
- **In particular, the 2004 Manual noted that the user cost for a dwelling unit should be decomposed into separate user cost terms for the land and structure components of the property.**
- **Chapter 23 also noted that the acquisitions approach would tend to give a much smaller weight to OOH than the user cost and rental equivalence approaches.**
- **Both Manuals came to the conclusion that more than one approach to the treatment of OOH was required in order to address different purposes for a CPI.**
- **However, it is interesting that National Statistical Offices have not provided alternative indexes for OOH on regular basis.**
- **We now fast forward to the most recent Ottawa Group Manuals.**

6. The Recent Ottawa Group CPI Manuals

- **After the publication of the 2004 CPI Manual, some problems with the advice in this Manual started to emerge.**
- **The problem of choosing between fixed base or direct indexes versus chained indexes was discussed in the 2004 Manual:**
- **"Hill (1993; 388), drawing on the earlier research of Szulc (1983) and Hill (1988; 136–137), noted that it is not appropriate to use the chain system when prices oscillate or bounce. This phenomenon can occur in the context of regular seasonal fluctuations or in the context of price wars. However, in the context of roughly monotonically changing prices and quantities, Hill (1993; 389) recommended the use of chained symmetrically weighted indices (see paragraphs 15.18 to 15.32). The Fisher and Walsh indices are examples of symmetrically weighted indices." ILO/IMF/OECD/UNECE/Eurostat/The World Bank (2004; 281).**
- **The 2004 Manual went on to give some further guidance on this topic:**

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- **"It is possible to be a little more precise about the conditions under which to chain or not to chain. Basically, chaining is advisable if the prices and quantities pertaining to adjacent periods are *more similar* than the prices and quantities of more distant periods, since this strategy will lead to a narrowing of the spread between the Paasche and Laspeyres indices at each link. Of course, one needs a measure of how similar are the prices and quantities pertaining to two periods. The similarity measures could be relative ones or absolute ones. In the case of absolute comparisons, two vectors of the same dimension are similar if they are identical and dissimilar otherwise. In the case of relative comparisons, two vectors are similar if they are proportional and dissimilar if they are non-proportional. Once a similarity measure has been defined, the prices and quantities of each period can be compared to each other using this measure, and a "tree" or path that links all of the observations can be constructed where the most similar observations are compared with each other using a bilateral index number formula." ILO/IMF/OECD/UNECE/Eurostat/The World Bank (2004; 281).**
- **The 2004 Manual referred to a 2002 discussion paper by Diewert for explicit measures of absolute and relative price dissimilarity. Normally, prices in adjacent periods would tend to be the most similar, so in practice, it was thought that chaining would normally be "best".**

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- **Ivancic and Fox questioned the above advice in a 2011 Ottawa Group paper:**
- **"Chaining is used in index number construction to update weights and link new items into an index. However, chained indexes can suffer from, sometimes substantial, drift. The Consumer Price Index Manual (ILO, 2004) recommends the use of dissimilarity indexes to determine when chaining is appropriate. This study provides the first empirical application of dissimilarity indexes in this context. We find that dissimilarity indexes do not appear to be sufficient to resolve the issue of when to chain." Ivancic and Fox (2011b; 1).**
- **Of course, it was well known that chaining a Carli, Laspeyres or Paasche index often resulted in massive chain drift if prices "bounce".**
- **Ivancic and Fox used superlative indexes to do the bilateral linking.**
- **The amount of chain drift in using superlative chained indexes was thought to be small.**
- **They summarized their empirical results as follows:**

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- **"The ILO (2004) states that chaining is appropriate when 'the prices and quantities pertaining to adjacent periods are more similar than the prices and quantities of more distant periods' (p. 281). Results are presented in tables 1 and 2. We find that when the chained dissimilarity indexes are compared with their direct counterparts there are very few circumstances — in total only 9 out of 76 — where both the direct price and quantity dissimilarity indexes are less than the chained price and quantity dissimilarity indexes. Chaining was found to be appropriate in the majority of cases — 47 out of 76 cases. In the remaining 20 cases there was no clear evidence on the issue of chaining." Ivancic and Fox (2011b; 5).**
- **For their data set, chaining was appropriate for 47 out of 76 cases, satisfactory for 20 cases and not satisfactory for 9 cases. Their results indicated that chaining superlative indexes could lead to chain drift in some cases.**

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- **The Ivancic and Fox 2011 paper indicated that chaining superlative indexes could lead to chain drift in some cases.**
- **A very important prior paper appeared in Kevin Fox's Economic Measurement Workshop in 2008 by Jan de Haan (2008).**
- **He showed that the chain drift problem could be a big one, even if superlative indexes were used to perform the bilateral links.**
- **The scanner data he used were based on a sample of more than 100 supermarkets that belonged to one of the largest supermarket chains in the Netherlands.**
- **His data set contained weekly observations on turnover and quantities sold for hundreds of detergents and covered the period week 1 in 2005 to week 35 in 2008 (191 weeks).**

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- **The average number of matched products in each consecutive two week period was 53 and the range of matched products varied between 43 and 63.**
- **The range of product price variation and the corresponding changes in sales of the products was shocking.**
- **Figure 1a in his paper plotted the price of Product XXX Tablets over the 191 weeks and Figure 1b plotted the corresponding weekly quantities sold.**
- **The "normal" price of Product XXX was about 6.5 Euros.**
- **The product went on sale for 12 of the 191 weeks with a sale price that was approximately one half of the regular price.**
- **As the price went down, the sales of Product XXX went from virtually 0 to over 3000 for 7 of the 12 weeks that XXX Tablets went on sale.**

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- **The stockpiling problem that Triplett (2003) identified was a real problem!**
- **Needless to say, the chain drift problem with the Dutch data set was massive: de Haan showed that the chained Fisher and chained Törnqvist indexes ended up in week 191 at 4.95% and 7.43% of the week 1 value of these indexes.**
- **The chained Jevons index using bilateral matched products at each link ended up at 76.65% of the week 1 index level.**
- **Typically the chain drift that results from the use of a chained superlative index will be downward as was the case with de Haan's data.**
- **Downward chain drift occurs due to purchasers stockpiling goods when they are on sale.**
- **But upward chain drift can also occur. Feenstra and Shapiro (2003) found upward chain drift in the Törnqvist formula using a scanner data set.**
- **Persons (1928; 100-105) had an extensive discussion of the chain drift problem with the Fisher index and he gave a numerical example on page 102 of his paper that showed how upward chain drift could occur.**

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- **De Haan discussed several methods that he thought could be applied to reduce the chain drift problem. The simplest method is to simply increase the length of the period:**
- **Another obvious solution to the chain drift problem is to use a fixed base.**
- **However, it turns out that for many elementary strata (like detergents), there is a rapid turnover of new and disappearing products.**
- **Thus as time goes on, there are fewer and fewer product matches of current period prices with the corresponding base period prices and thus the resulting fixed base index becomes more unreliable.**
- **This is the *de Haan problem*: how to find an index number formula that is free from chain drift (i.e., satisfies the circularity test) but also can deal with the problem of product churn and missing prices.**

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- **A possible solution to the de Haan problem emerged in the Ottawa Group paper by Ivancic, Fox and Diewert (2009).**
- **These authors suggested the use of a multilateral index over a window of consecutive periods. Within the window, the indexes satisfy the circularity test and as a result, there can be no chain drift within the window of time periods.**
- **Ivancic, Fox and Diewert suggested the use of two multilateral indexes, the GEKS index and the Weighted Time Product Dummy index.**
- **Balk (1980; 70) suggested the use of other multilateral indexes in the time series context but his paper was not picked up by others.**
- **The multilateral methods described above have a property that is troublesome: if a product is present in only one period of the window of T observations, then it has no effect on the resulting price levels.**
- **This means that new products entering the marketplace in period T have no effect on multilateral indexes that are based on the use of matched product prices.**
- **This property holds for the TPD, WTPD and GK price levels.**
- **We address this problem in Appendix A.**

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- **Ivancic, Fox and Diewert (2009) (2011) offered the following solution to the chain drift problem that affected monthly superlative indexes: choose a window length of 13 months (so that strongly seasonal products enter the indexes) and compute a GEKS multilateral index for the initial 13 months..**
- **When the data for month 14 become available, compute a new set of GEKS multilateral price levels for months 2 to 14.**
- **Use the ratio of the month 14 price level to the month 13 price level to update the month 13 level of the permanent index.**
- **When the month 15 data become available, compute a new set of GEKS multilateral price levels for months 3 to 15. Use the ratio of the month 15 price level to the month 14 price level to update the month 14 level of the permanent index.**
- **This is their *Rolling Window GEKS methodology*. They compared their RWGEKS index with the GEKS index that was constructed over the entire 15 month data period and found little difference between the two indexes.**
- **However, the paper by Fox, Levell and O'Connell (2024) presented at this meeting indicates that when the Rolling Window Method is used over longer time periods, some chain drift still seems to be present. .**

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- **Ivancic, Diewert and Fox (2011) suggested that the movement of the rolling window indexes for the last two periods in the new window be linked to the last index value generated by the previous window.**
- **However Krsinich (2016) suggested that the movement of the indexes generated by the new window be linked to the previous window index value for the second period in the previous window. Krsinich called this a *window splice* as opposed to the IDF *movement splice*.**
- **De Haan (2015; 27) suggested that perhaps the linking period should be in the middle of the old window which the Australian Bureau of Statistics (2016; 12) termed a *half splice*.**
- **Ivancic, Diewert and Fox (2011; 33) suggested that the *geometric average* of all links for the last period in the new window to the observations in the old window could be used as the linking factor. Diewert and Fox (2021) looked at these alternative linking strategies *Average* or *mean linking* seems to be the safest strategy from a statistical point of view.**
- **Another strategy would be to use an *ever expanding window* suggested by Diewert and Shimizu (2024) at this meeting. This strategy is also pursued in Appendix A of this paper.**

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- **In order to deal with the availability of scanner data and the associated chain drift problem that could sometimes occur using chained superlative indexes, it became clear that the 2004 CPI Manual needed to be updated.**
- **Thus in 2015, work began on an updated Manual which appeared in 2020: *Consumer Price Index Manual: Concepts and Methods 2020*.**
- **The editor of this new manual was Brian Graf and the lead institution was the IMF. The purpose of the 2020 Manual was explained as follows:**
- **"The Manual is intended for the benefit of agencies that compile CPIs, as well as users of CPI data. It explains in some detail the methods that are recommended for use to calculate a CPI. A separate companion publication, *Consumer Price Index Theory*, explains the underlying economic and statistical theory on which the methods are based."**

  IMF/ILO/UNECE/Eurostat/OECD/The World Bank (2020; xi).
- **The companion Theory Manual has not been finalized due to the rapid pace of new CPI theoretical research, which has led to revisions which incorporate the new research.**
- **Draft chapters of the CPI Theory Manual are available on the IMF CPI website.**

6. The Recent Ottawa Group CPI Manuals

- **The 2020 CPI Manual was intended as an updated version of the 2004 CPI Manual with the addition of some new chapters:**
- **"The current Manual represents an update of the 2004 Manual published by the International Labour Organization (ILO). Individual authors were recruited to review and update each chapter. Some chapters required extensive updating and rewriting, while others needed only minimal updating from the 2004 version of the manual. Two new chapters have been added on scanner data and updating Consumer Price Index (CPI) weights. … The Manual benefited from the experience of several experts responsible for updating the individual chapters. The authors included: Paul Armknecht, IMF (Retired); Corinne Becker, Swiss FSO; David Fenwick, UK ONS (Retired); Jan de Haan, Statistics Netherlands; Brian Graf, IMF, editor of the Manual; Claude Lamboray, Eurostat; Maria Mantcheva, IMF (Retired); Valentina Stoevska, ILO; Marcel van Kints, ABS; Mick Silver, IMF (Retired); and Jan Walschots, Statistics Netherlands (Retired). The Manual has also benefited from valuable contributions by many other experts who served as primary reviewers for individual chapters, including: Badria Al-Aadi, NCSI (Oman); Carsten Boldsen, UNECE; Rob Cage, Bureau of Labor Statistics (United States); Barra Casey, CSO (Ireland); Ronald Johnson, Expert (external reviewer); Patrick Kelly, Statistics South Africa; Brent Moulton, Expert (external reviewer); Ragnhild Nygaard, Statistics Norway; Niall O'Hanlon, IMF; Federico Polidoro, ISTAT (Italy); Rafael Posse, INEGI (Mexico); Yunita Rusanti (BPS-Statistics Indonesia); and V. Thuy, GSO (Vietnam)."**

  IMF/ILO/UNECE/Eurostat/OECD/The World Bank (2020; xv).
- **Many regular Ottawa Group contributors are in the above list.**

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- **There are 14 chapters and 7 Appendices in the 2020 Manual. Most of the chapters follow up on similar chapters in the 2004 Manual but Chapter 10 on Scanner Data is a valuable entirely new chapter. This chapter, written by Jan de Haan, also covers the use of multilateral indexes.**
- **Here is a listing of the seven Appendices which also contain new material:**
- **The Harmonised Index of Consumer Prices (European Union);**
- **Classification of Individual Consumption According to Purpose (COICOP 1999);**
- **Classification of Individual Consumption According to Purpose (COICOP 2018);**
- **Resolution Concerning Consumer Price Indices Adopted by the Seventeenth International Conference of Labour Statisticians;**
- **Spatial Comparisons of Consumer Prices, Purchasing Power Parities and International Comparisons;**
- **Some Basic Index Number Formulas and**
- **The Consumer Price Index Research Agenda.**

7. Looking Ahead

- **Appendix 7 of the 2020 CPI Manual has an excellent listing of research topics that Ottawa Group researchers could (and should) focus on for the future:**
- **Scanner data;**
- **Web scraped prices;**
- **Price updating of expenditure weights;**
- **The use of administrative data to form indexes;**
- **Plutocratic versus democratic weighting of households;**
- **The use of credit card data to form household specific price indexes;**
- **Calculating elementary indexes using expenditure weights;**
- **Quality adjustment;**
- **The treatment of seasonal products;**
- **The use of target price indices for the CPI;**
- **On the choice of formula for calculating higher level price Indices;**
- **The use of long-term and short-term Links;**
- **Retrospective Calculations of Superlative Price Indexes;**

7. Looking Ahead

- **Consumer price indexes for different groups and geographic areas;**
- **Measuring "hard to measure" services;**
- **Insurance and financial services;**
- **Owner Occupied Housing;**
- **Digitalization;**
- **Well being and sustainability.**

It can be seen that many of the topics listed above were already flagged in the Turvey CPI Manual as areas that required further research.

- **The 2020 CPI Manual concluded with the following observations on the problems of measuring welfare when there are free goods and services:**
- **"The issue of a CPI for measuring economic wellbeing is not restricted to the effects of digitalization, but also includes further discussion on the coverage of the CPI and the treatment of different types of goods and services provided for free, potentially including public goods and services such as education, health, safety, or parks. The issue relates to the discussion of cost of goods indices versus cost of living indices, and conditional versus unconditional cost of living indices, where additional experiences and guidance would be useful. It may be useful to invite experts from other areas of official statistics to discuss measuring welfare and economic well-being." IMF/ILO/UNECE/Eurostat /OECD/The World Bank (2020; 458).**

7. Looking Ahead

- **Diewert (2001) had the opportunity to speculate on "the shape of things to come at statistical agencies". He speculated that:**
- **Firms will submit price and quantity data on their sales of consumer products to the NSO via the internet. This has come to pass.**
- **Diewert was less sanguine about NSOs obtaining price and quantity data directly from households. However, some market research firms have persuaded a sample of households to provide their data on household purchases to these firms, who in turn have made their data available to researchers and NSOs (at a price). The problem with these credit and debit card data on household purchases is that there is *no specific product code* to go together with the purchases; the product categories are highly aggregated. However, some current household specific information on prices and quantities is better than no information.**
- **Diewert (2001; 108) noted that web scraping of prices would lead to more accurate CPIs. In particular, information on used durable goods (like cars) would lead to better information on consumer durable depreciation rates and hence facilitate the user cost approach to the treatment of durable purchases.**

7. Looking Ahead

- **Diewert thought that it would be likely that statistical agencies would produce families of indexes. In particular, he thought that NSOs would produce at least 2 CPIs: (i) a Nonrevisable CPI and (ii) A Revisable CPI. He also thought that different CPIs would be produced to suit different purposes. For the most part, this prediction has not come about.**
- **Diewert (2001; 108-109) also thought that the existence of strongly seasonal products would lead NSOs to produce at least two indexes for seasonal product strata: one index that focussed on year over year price change in the same month (this index would use seasonal baskets) and another index that would attempt to measure month to month price change. This prediction has also not materialized.**
- **Diewert (2001; 111) thought that many of the unresolved problems associated with the use of hedonic regression models would be solved. This seems to be the case; see Triplett (2004) and section 2 of Diewert and Shimizu (2024).**
- **Finally, Diewert speculated that once information on households' allocation of time became available, many theoretical innovations in modeling the behavior of households would be incorporated into the design of consumer price indexes.**

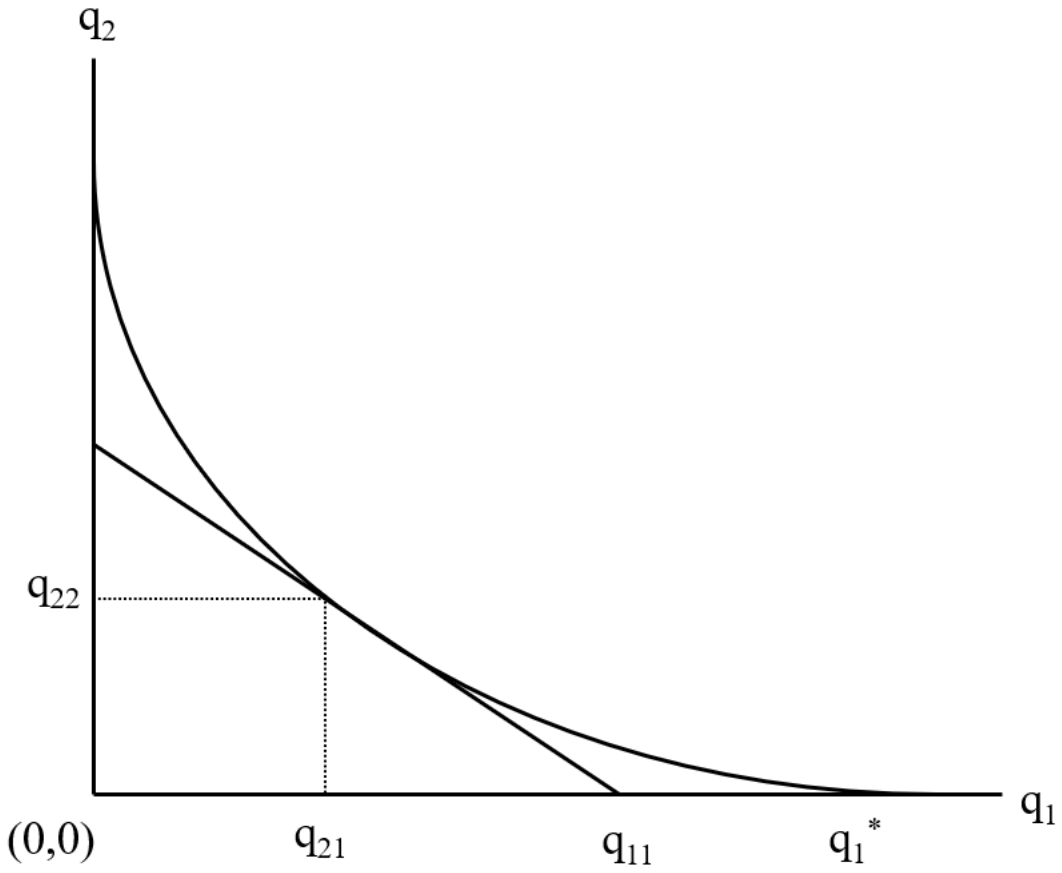
7. Looking Ahead

- **Finally, Diewert speculated that once information on households' allocation of time became available, many theoretical innovations in modeling the behavior of households would be incorporated into the design of consumer price indexes. Three possible innovations were singled out.**
- **(i) *Implementation of Becker's (1965) theory of the allocation of time*.**
- **Some progress has been made in implementing and extending Becker's framework; see Schreyer and Diewert (2014) and Diewert, Fox and Schreyer (2017) and the references in these papers. Note that incorporating the time constraint into standard consumer theory will enable us to better value the contribution of free goods and services to improving the standard of living of households.**
- **(ii) *Implementation of an extended version of Becker's model to cover household nonmarket production*.**
- **(iii) *Implementation of an extended version of Becker's model to medical economics*.**
- **It can be seen that obtaining information on the household allocation of time is the key to improving the measurement of the cost of living and household welfare.**
- **However, progress in implementing household time surveys has been slow and it will probably continue to be slow.**
- **The basic problem is that it is not conceptually simple to measure the household allocation of time across various activities**.

Appendix: The Consumer Demand Approach to the Construction of Multiperiod Indexes

- **I do not have time to spell out the details of this approach.**
- **It turns out that implementing a simplified approach of the Diewert and Feenstra (2017) (2022) approach to the estimation of reservation prices is not more complicated than calculating GK price indexes or running a Time Product Dummy regression.**
- **The key idea is to estimate the consumer's utility function rather than the dual unit cost function. It turns out that the cost or expenditure approach to the estimation of consumer preferences is not workable when there are missing products in some periods. But the estimation of direct utility functions (as in forming GK indexes) is perfectly workable.**
- **When a product is not available during a period, the quantity consumed is 0 and this can be observed. The corresponding reservation price cannot be observed. It is this fact that makes the direct estimation of utility functions possible.**
- **On the following slide, I want to convince you that it is not possible to estimate a nonlinear indifference curve for a consumer that is making a choice between an always available product and a new product.**

Appendix: The Consumer Demand Approach to the Construction of Multiperiod Indexes



Appendix: The Consumer Demand Approach to the Construction of Multiperiod Indexes

- **In period 1, only product 1 is available.**
- **The consumer has a budget equal to $e^1 > 0$ in period 1 to spend on products in this category but only product 1 is available.**
- **The price of product 1 in period 1 is $p_{11} > 0$.**
- **The consumer purchases $q_{11} = e^1/p_{11}$ units of product 1 in period 1.**
- **In period 2, a new product 2 appears in this category. The consumer has e^2 to spend on the two products in period 2 and faces the budget constraint, $p_{21}q_1 + p_{22}q_2 = e^2$.**
- **For simplicity, we assume that the period 2 budget e^2 is equal to e^1 and the price of product 1 in period 2, p_{21}, is equal to its price in period 1 so that $p_{21} = p_{11}$.**
- **Thus the consumer *could* choose to purchase the same amount of product 1 in period 2 as was chosen in period 1; i.e., the consumer could choose $q_1 = q_{11}$ and $q_2 = 0$ in period 2.**
- **But in period 2, the consumer is not limited to the period 1 choice: any point on the budget line that starts at q_{11} is a feasible period 2 consumption combination.**
- **The curved line that is tangent to the budget line at the point (q_{21},q_{22}) is the highest indifference curve that is also on the consumer's budget line so the point $(q_{21}.q_{22})$ in Figure 1 is the utility maximizing choice for the consumer in period 2.**

Appendix: The Consumer Demand Approach to the Construction of Multiperiod Indexes

- **If preferences are linear, then the observed budget line would also be the highest attainable indifference curve for the consumer and q_1^* would coincide with $q_{11} = q_{21}$ and there would be no bias.**
- **But typically, preferences are not linear and so the linear utility function model leads to a quantity index that is too low and the corresponding price index has an upward new product bias in the period when the new product first appears.**
- **This is a fundamental problem that arises for all linear utility function models, including GK indexes, bilateral superlative indexes that rely on matched product prices and their multilateral extensions that use matched bilateral superlative indexes as building blocks and hedonic regression models that use time dummy variables.**
- **In order to obtain an estimate for the consumer's curved indifference curve, we have to wait until the period 3 data are available, assuming that products 1 and 2 are both available in period 3 and the relative price of products 1 and 2 has changed in period 3.**