

# Telecommunication services

**Moderator:** Erwin Diewert, University of British Columbia.

## Summary of session

The papers presented in this session highlight the challenges that rapid change in technology, the rapid uptake by consumers of telecommunications technology, changes in regulatory environments, the intense market competition and wide range of pricing regimes applying to telecommunication services have created for price statisticians in most countries. In a sense all the practical problems that can occur in price index construction are inherent in these commodities: new and disappearing goods; new and disappearing respondents; quality change, and measuring the quantum of services consumed (it is not only the number of households using the service, but also their intensity of use).

In some countries the market has changed from one which was tightly regulated, often with only one or a minimal number of suppliers with price controls, to a market that is more open to new competitors and minimal price controls. There are at least three special features of the pricing regimes that raise problems for price measurement. First, many telecommunication services are sold jointly with the goods – buy a plan and get the mobile phone at a nominal price. Second, plans or service charges are often sold with a specified life so that it is possible to have consumers on both old plans (no longer available) and current plans. Third, many of the charges are of a flat rate kind up to a specified level of usage – the effective price thus falls as usage approaches the specified level. In order to construct appropriate prices and to get up to date information to compile weights requires extensive information from service providers (or regulators in some cases). This is not always forthcoming (even with legal enforcement). The main problems with telecommunications pricing that the papers identified are summarized below.

### (i) Traditional sampling techniques break down

Telecommunications providers typically offer monthly plans that last one to two years. Using traditional sampling techniques, the statistical agency samples these plans and follows them until they expire. However, typically a plan has a fixed price for its life so no price change is shown in the sample of prices. When a plan dies, it is replaced by a new plan, which is linked in to show no price change in the index. In the papers presented, there were several examples of telecommunications price indexes which were essentially flat over the past 5 years when in most countries, fixed line telecommunications prices per minute of use were falling around 3 to 5 percent per year and mobile telephone prices per minute of use were falling at 5 to 15 percent per year. Thus the traditional sampling techniques lead to a serious upward bias. Telecommunications services are typically 2 to 4 percent of household budgetary expenditures. Assuming an expenditure share of 3 percent and assuming that the price of telecommunications services is dropping by 7 percent per year leads to an overall bias in the consumer price index of about .2 percentage points per year if traditional sampling techniques are used. This is a big enough bias to concern central bankers.

### (ii) Quantity weights that are fixed for 5 or more years are unsatisfactory

Many statistical agencies have used a fixed consumption basket or Laspeyres type index where the basket is left unchanged for 5 or more years. This creates a severe problem if the weights for individual telecommunications elementary aggregates are also held fixed for this period. For example in the case of mobile telephone services over the last 5 years, the

household expenditure share has grown from perhaps 5 percent of telephone expenditures to about 50 percent. Given the fact that the price of mobile telephone services has been dropping at a much faster rate than the price for fixed line services, this means *that a price index based on a more recent basket will show a much greater rate of price decline than the index based on a five year old basket*. (A similar problem arises with consumer products that make heavy use of computer chips such as laptop computers, video cameras, etc.). Solutions to this problem are:

- More rapid updates of expenditure baskets (preferably annually or every two years).
- The use of midyear formulae; see the paper presented by Okamoto (2001) at this conference and the paper by Schultz<sup>1</sup>
- The use of the Lloyd-Moulton formula<sup>2</sup>

(iii) The problem of quality change is often neglected

The quality change problem in telecommunications has several dimensions:

- Mobile phone services are improving from a technical point of view but it is difficult to quantify these quality improvements.
- The paper by Fixler, Greenlees and Lane highlighted the problem of quality adjusting for *network effects*; i.e., as more people have access to the internet, internet services such as email become more valuable.
- Related to the above point is the problem of quantifying the substitution of email for traditional letters delivered by postal services. It is clear that households are substituting emails for the more expensive traditional letters and the average cost per message delivered has dramatically dropped. However, this drop in communication services will not be picked up anywhere in the system of price statistics. The problem is similar to the *price of light problem* studied by Nordhaus<sup>3</sup> (1997): over time, new methods of delivering lumens were developed that had the effect of dramatically decreasing the price per lumen. However, because the means of light delivery changed over time, each new method of delivery was linked into the consumer price index to show no change in the relevant CPI component. Similar

---

<sup>1</sup> Schultz, B. (1999), "Effects of Using Various Macro-Index Formulae in Longitudinal Price and Volume Comparisons: Canadian Empirical Studies", pp. 236-249 in *Proceedings of the Fourth Meeting of the International Working Group on Price Indices*, W. Lane (ed.), U.S. Department of Labor, Washington D.C.: The Bureau of Labor Statistics.

<sup>2</sup> See Shapiro, M.D. and D.W. Wilcox (1997), "Alternative Strategies for Aggregating Prices in the CPI", *Federal Reserve Bank of St. Louis Review* 79:3, 113-125, and Diewert, W.E. (1998), "Index Number Issues in the Consumer Price Index", *The Journal of Economic Perspectives*, Vol. 12:1, 47-58.

<sup>3</sup> Nordhaus, W.D. (1997), "Do Real Output and Real Wage Measures Capture Reality? the History of Lighting Suggests Not", pp. 29-66 in *The Economics of New Goods*, T.F. Bresnahan and R.J. Gordon (eds.), Studies in Income and Wealth Volume 58, Chicago: The University of Chicago Press.

substitution problems arise with the delivery of music, newspapers and other entertainment services over the internet.

- A final quality change problem arises due to the fact that the various telecommunication ‘plans’ are constantly changing in their characteristics. Thus it is difficult to compare a new plan with an older one. A specific problem is the fact that some mobile phone service plans offer ‘free’ equipment.

### **Three main approaches to pricing telecommunication services:**

#### (i) The use of hedonic techniques

Perhaps the least demanding approach is to take a sample of prices of representative goods and services and then use hedonic techniques to adjust for quality change (e.g. Yu). It may be best to run separate hedonic regressions for prepaid cards and for monthly plans since it is difficult to make these two types of service comparable.

#### (ii) The use of detailed unit values

Another approach is to compile consumer profiles representing a variety of users (low intensity to high intensity) of the various telecommunication services and to apply appropriate pricing plans to each profile. This is essentially a stratified unit value approach. Lacroix and Magnien propose this method in France, with the use of transition probabilities to capture households switching between plans and companies.

#### (iii) Use of the bill method

A third method is to model the prices charged based on sets of bills, whether these are a sample of actual bills or hypothetical accounts constructed to represent typical types of customers. The appropriate plan could again be the one that produces the lowest cost, one that is comparable to the plan the household was on when sampled; see the paper by Beuerlein.

Many issues were raised in discussions. At the aggregate level it was appropriate that all types of communications, at least telecommunications, should be in a commodity group which would then break down into the various subcomponents. It was important that weights, especially at the lower level of the index (like within total communications) be updated frequently to keep pace with consumption patterns. In the case of the modified laspeyres index, weights should also represent what might be expected into the future.

The bill method (the third method above) was generally accepted as the preferred way to go, and offered some improvements over unit value based indexes. However, there were some issues associated with the bill method that needed to be addressed. For example for phone calls, how many households were on the most cost efficient plan for their usage and the households were locked into plans for a year or more and might need to be priced even when no longer available to new customers. The Australian experience was that when new phone plans were introduced they were aimed at increasing consumption of telephone services and companies often approached customers offering the new plans so that old plans soon died out.

The depth of data required for the profiles and bills approaches and the resources to handle the data was substantial. It was noted that in Germany, where consumer profiles were used, one person was required full time to collect the necessary data requirements. The complicated nature of pricing required information on the time calls are made, the length of time of the call, the destination of the call, discounts that applied on the total bill, etc. In addition, information is required on market shares of the companies. Profiles (and bills) would need to be updated, preferably annually.

It was noted that use of matched samples would not be an appropriate method for incorporating new plans. The prices of plans generally would not change for the life of the plan. Thus matching plans would typically result in an index showing no price change. Rather quality adjustments would need to be made to new plans (essentially a replacement with overlap). In the case of goods, such as computers, the prices of old models tend to fall as or before they are replaced by new models and in these cases the difference between the price of the old and new model may approximate the quality difference.

In concept the unit value approach had some appeal as a way of adjusting for quality change. However, in the case of internet charges there was then a problem of pricing 'unlimited' time plans.

### **Recommendations for statistical agencies**

The accurate measurement of price change for telecommunication services is complicated. There are difficulties in defining the quantum that is consumed, in determining appropriate prices for those quantum and in adjusting for quality change. The current thinking of price statisticians is that use of profiles and samples of accounts are the best methods. However, the data requirements and resources needed to establish and maintain these approaches are substantial and co-operation of the service providers is essential. What is certain is that traditional sampling methods are not appropriate in this sector.