<u>Costing mobile telephone calls: the use of constrained user profiles</u>

Adrian Ball (Head of CPI Methodology and Research Branch) and David Fenwick (Director, Consumer Prices and General Inflation Division), *Office for National Statistics, 1 Drummond Gate, London SW1V 2QQ, United Kingdom.*

<u>Abstract</u>

The traditional tariff approach to the costing of mobile telephone calls fails to take into account the full range of package options available to consumers over the life of the "fixed" basket. Selecting packages at random and applying them to the most appropriate user profile has the effect of missing important price changes and also suffers from a number of other measurement weaknesses. The analogous situation for non-services is where there are two identical tins of baked beans standing side by side on the shelf in the same shop and the price collector prices the most expensive although we know that in reality the customer will buy the cheapest. The method proposed in this paper samples profiles and then selects for pricing the appropriate package from each service provider. It assumes a rational consumer who has perfect knowledge but this assumption is more realistic than the alternative of the ill-informed laggard, particularly in telecommunications in the UK where unit cost information is readily available and where at points in time customers can transfer from one tariff to another free of charge."

Key words: fixed basket, services, tariffs, price change, constrained consumer profiles.

1.0 Background

Mobile telephone charges have become a significant part of household expenditure in the UK and have been incorporated into the Consumer Price Index since 1998.

The measurement of the prices charged for telecommunications services and the construction of an associated price index is fraught with difficulty because of two particular factors:

- There can be two prices co-existing for the same service delivered by the same service provider. These two prices co-exist when a new tariff is introduced without the previous being withdrawn.
- The opportunity to change tariff and service provider is often constrained by the existence of signed contracts that commit the buyer to a particular tariff and particular service provider over a minimum period.

These difficulties are in addition to the generic problems relating to the construction of price indices for services- the latter ranging from the definition of the service provided and the identification and valuation of any change in the service, to conceptual issues about the timing of delivery and the relative merits of the three main approaches to price measurement and which is most appropriate: acquisition, payments and user costs (or consumption)[1].

The solution adopted until recently by the UK Office for National Statistics has been to take a "tariff" approach that prices those call charges that would be experienced by typical "users" on selected tariffs. A sample of major suppliers is drawn and a price index is calculated for each of these suppliers and an overall price index for mobile telephones is calculated by weighting together the individual price indices for the selected suppliers using revenue figures provided by the industry regulator. The individual supplier-specific price indices consist of weighted averages of separate indices for pre-pay and contract telephones, weighted according to the number of customers using the two-types of package in each of the individual companies (revenue figures are unavailable at this level). These separate indices are constructed by measuring the changing cost of the most "popular" package for each of five customer profiles[2].

The drawbacks of this approach are threefold:

- The initial sampling of packages directly from each of the selected service providers in reality can be problematic because of difficulties in identifying the most appropriate package to price and it also severely restricts the coverage of the sample which then becomes over-reliant on the pricing of a relatively small selection of packages. This is particularly problematic when, as in the case of mobile telephone, there is a fast changing and exceptionally diverse range of packages on offer to the customer. Past experience has shown that the resulting price index can be relatively volatile and unrepresentative of the price changes observed more generally in the mobile telephone market.
- The resulting index quickly becomes unrepresentative as it continues to price packages that in reality few customers use. It follows packages for as long as

---

1

- ***Acquisition –*** 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
- ***Payment*** - the total payments made for goods and services during a given period, whether or not they were delivered, is taken into account
- ***User cost (or consumption)*** – the total value of all goods and services consumed during a given period is taken into account.

The distinction is particularly important for purchases financed by some form of credit, notably major durable goods and housing, 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. It also is an issue for services where payment and delivery do not coincide. The usual approach is to take the price at the time the right to use the service is acquired and the service is available under the terms of the contract of sale.

2 Five different types of user profile are priced for both pre-pay and contract customers. The user profiles are based on research commissioned by the industry regulator OFTEL. These cover volume of usage- ranging from "low" to "high" volume- time of call (peak, off-peak, weekend), and destination (local, national, own network, other network),. Only one type of user profile is priced for a particular contract or prepay package; the allocation of a user profile to a particular package is done subjectively. The index for a particular package/user profile is derived from the changing cost of the average monthly bill; this is calculated taking account f line rentals, (for contract customers), calls (by time of day and destination) and text message. When two packages are priced for a particular supplier, the resulting indices are weighted together to form a single index for the supplier, using weights according to the proportion of subscribers with the relevant user profile.

they are available and ignores, for instance, the fact that some packages may be closed to new customers. This also adds to lack of representiveness.

- The resulting index doesn't take into account the reduced prices people pay from exchanging one tariff for another even when this does not involve a transfer to a different service provider and does not entail a change of service.

These problems are further accentuated by the lack of detailed expenditure data on the different packages provided by each service provider. This forces the use of (un-weighted) elementary indices at a higher level than would be ideal for the accuracy of the index.

It is against this background that the ONS investigated alternative solutions.

There are two main alternatives to the tariff approach described above:

- **The "average bill" method.** This method tracks the change in the average bill, expressed in unit cost terms, of all or a representative sample of users. The latter is stratified as appropriate by user profiles to ensure a broad range of users. In effect the resulting index would reflect a) changes in usage and b) changes in service providers. Such an index is not consistent with the fixed basket approach underlying the RPI and HICP because it reflects changes in consumption as well as price. In practice it can also be ruled out in the UK because of lack of access to detailed data from the telephone companies and the resources that would be required to quality assure it.
- **The "user profile" method**. This method tracks the change in the average bill, expressed in unit cost terms, for a selection of fixed profiles relating to use, which are then weighted together by expenditure shares to construct an overall price index. This method does not raise the same conceptual issues that are associated with the "average bill" method and the data requirements are less daunting.

It is the "user profile" method that ONS decided to explore in more detail. It essentially reverses the sampling procedures underlying the "tariff" approach by sampling user profiles and then selecting from each service provider the appropriate packages based on cost to the user.

The attractions of this approach from a practical viewpoint are threefold:

- The availability of explicit expenditure weights for different users profiles that can be used to construct appropriately weighted indices. ONS has ready access to expenditure data from OFTEL, the regulatory authority, on 21 detailed user profiles.
- Easier identification of the "appropriate" package from each supplier for each user profile – all other things being equal this is taken as the cheapest. The subjective element associated with the current method is eliminated and the new method is more transparent.
- Broader coverage through the costing of each user profile for each supplier and a better balanced sample through the use of expenditure information.

The "user profile" method also has a number of other advantages relating to fundamental issues of concept and measurement:

- **Product definition.** The measurement of service prices offers a particular challenge because of the difficulty in identifying discrete service elements. For example, in the case of mobile phone services, is the purchase most appropriately defined in terms of the individual package available from a particular company or in terms of the number of call minutes purchased? The methodology previously used by ONS took as its starting point the former and sampled mobile phone packages much in the same way as for goods. But from an alternative viewpoint, customers can be said to be buying calls and the text messages that they are making, with prices set by the packages, rather than buying packages as such. A logical conclusion of this approach is that the price index should take account of consumer substitution between packages, particular where this occurs within the same service provider.
- **Fixed basket concept.** If customers can be said to be buying calls and the text messages that they are making, with prices set by the packages then it follows that under the terms of a fixed basket it is the user profiles that should remain fixed throughout the year

The logical conclusion is that the construction of the price index should be based on the tracking of the unit cost of calls for fixed customer profiles but allowing some substitution between packages.

In following this approach practical considerations arise in relation to the sampling of the packages used to price each user profile and the circumstances under which substitution between packages should be incorporated:

- **Sampling of packages.** It can be argued that as customers will normally be expected to select the cheapest package for their anticipated usage it should be the latter that provides the basis for the pricing of the initial package at the point of chain linking. Whether in practice this is done across the whole market or separately within each service provider depends on the availability of data, although clearly there is a preference for the latter as this effectively increases the sample size by re-computing prices for each customer profile across each of the individual service providers. The latter is the approach which is available and has been adopted in the UK- detailed tariffs and explicit expenditure weights for the four mobile telephone companies (Vodaphone, O2, Orange and T-Mobile) facilitates the calculation of individual company indices and weighted averages to produce an overall index. Thus, the most economical package was priced within each company for each customer profile.

- **Substitution between packages.** Clearly account needs to be taken of any restrictions on the movement between packages imposed by the type of contract a customer has with the mobile phone service provider. In the UK there are two main types of contract:

    - **Pay as You go**. Under this arrangement the customer pays for the handset. The latter is locked to the network of a particular service

provider, usually at a discount. Other than that there is no formal contract with the service provider and customers are free to move from one package to another package offered by the same service provider without a financial penalty, though changing provider will cost money as the customer will need to buy a new handset. There is no line rental but call costs are higher.
  - **Monthly contract**. Under this arrangement there is a formal contract with the service provider- normally for a minimum 12 month period- where a handset is provided free of charge and a monthly fee is paid to cover line rental and some call costs. In general call costs are lower than for Pay as You go to reflect the forward commitment.

Clearly different computations will need to carried out to reflect the different opportunities customers have for moving from one package to another as dictated by the particular circumstances and constraints associated with each type of contract. In particular, "Pay as you Go" customers are free to change without financial penalty between packages within a service provider (usually by making a phone call to request a change) whilst monthly contract customers will face a financial penalty if they switch service provider before the end of the 12 month minimum contract period. These differences were addressed by specifying different rules for computation as follows:

- **Pay as You Go**
  - Users are free to change package as they wish;
  - It is costly to swap between service providers, as this would involve the purchase of a new handset.

In this case, taking a rational consumer as the basis for monthly comparisons, it would seem appropriate to allow each user profile to switch freely between packages, picking up the cheapest available each month. However, this movement should be restricted to the same service provider as in reality customers are unable to move service providers without financial penalty. Therefore, for each profile, we select the cheapest package available for each service provider in each month, and calculate an index for each combination. These are then weighted together over the profile to give a PAYG index for each company.

- **Monthly contract**
  - In the UK market it is more difficult for monthly contract customers to move between packages, even within the same service provider.
  - This is because the cost of the handset provided is largely offset against the monthly bill, and the companies require the user to be on a contract for a year to ensure that they recoup the cost of the hardware.

In these circumstances it is not appropriate to allow all users to move to the lowest package available to them each month.

The appropriate approach is to select the cheapest package available to each user profile at the point of chain linking in January. Users are then divided into 12 cohorts reflecting the proportions that we would expect would be due to renew contracts in each of the following 12 months. The 1st cohort is then assumed to look for a new cheapest package in February, simulating those whose 12 month contract comes to an end in that month. The other groups continue on the package selected in January, as they are still looked into it. In March, it is assumed that the second cohort selects a new cheapest package, with the first cohort continuing on the package selected in February, and the rest on the package selected in January.

This continues throughout the year, with one cohort re-selecting the cheapest package each month, and the rest carrying on with the package they were on in the previous month.

As for PAYG, the indices produced are weighted together to produce an overall monthly contract for each company.

Final Indices

Price indices and then computed for each service provider by weighting the two contract types together by sales weights. The final price index for all service providers is a weighted average of the individual indices for each service provider, with weights based on expenditure shares.