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Approaches to measuring telecommunications services for the CPI

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1. Introduction

Accurately measuring price changes in telecommunication services is complex. Some of the issues driving the complexity are the short life-cycle of the carriers' products; re-selling of identical products by competing carriers at different prices; complexity of the pricing structures leading to poor decision making by consumers; the "includes and excludes" on mobile phone plans; and bundling of different services. The CPI Manual (2004) lists four approaches to measuring services: matched samples of specifications; unit values; customer profiles; and sample of bills. However, the current trends in telephony with added value, free minutes, and unlimited calls or downloads included for a single price make it very difficult to measure the price and volume change consistently each period. The ABS is currently evaluating approaches to measurement of prices based on samples of households' telephone bills collected directly from the telephone companies.

2. Telephony pricing in Australia

The Australian fixed-line telecommunications market is tightly regulated under the Federal Trade Practices Act, and state and territory fair-trading legislation. If a phone company wishes to increase its prices or make other changes which are detrimental to their customers' interests, advance notice and an opportunity to sever the contract (without penalty) must be provided to the customer. As this is an expensive process, telecommunications companies prefer to change product prices by introducing new plans into the marketplace and encouraging their customers to shift to them.

Mobile telephony is much less regulated compared to fixed-line plans. Some mobile plans allow for the customer to be placed automatically onto a new contract on the same conditions when the old contract expires. Handsets are often included as part of a mobile package. As handsets deteriorate, become dated or obsolete, hardware replacement is the main driver for a customer to make a new arrangement, which often means acceptance of a new mobile plan.

Australian customers may bring their old handsets to their new mobile carrier; buy a new handset outright; or purchase a new handset with an interest-free loan. In the last case the monthly repayments for the phone component are spread over the life of the mobile contract and additional expenditure for the handset may be required in addition to the minimum monthly spending commitment of the chosen plan. Therefore it is possible to separate the financing arrangements for the handsets from the plan's call charges.

The current practice in the Australian CPI is to use matched samples of specifications based on representative items. The main problem is that this conventional approach may miss price changes due to the introduction of new plans or changes to the specifications. For example, if the specifications have call durations in whole minutes as in the examples in the international manual, they will miss price increases effected by the companies changing their charging blocks from one-second intervals to thirty-second intervals.

3. Possible approaches

The ABS is evaluating a few approaches to the measurement of prices based on samples of households' telephone bills collected directly from the telephone companies. These telephone bills are a rich source of behavioural information and may be used in three ways to measure price changes of telecommunication services.

The first two ways use the bills to create sophisticated usage profiles (notional quantities) or lists of real transactions which are then priced using publicly available price schedules. The last way is to use the bills to calculate unit values.

3.1 Approach 1 - Using phone bills to create usage profiles

Usage profiles were created by segmenting a time-series of bills into calendar years, by type of service (e.g. fixed-line, post-paid mobile). Transactions were then grouped together to form a range of average usage profiles with weighting information attached to each. Further analysis was also done on the frequency distributions of transaction types in each year by service type to analyse the changing behavioural patterns over time such as the increased internet usage by smart phones.

3.2 Approach 2 - Calculating price changes directly from the call records on the phone bills

Obtaining a sample of telephone bills with individual telephonic transactions -- quantities – allows the statistical agency to re-price these bills each period using the latest pricing information. However, when the existing plan ceases or becomes unrepresentative the choice of replacement plan has a direct effect on the final price change. One option is to assume that each consumer is rational and would pick the cheapest plan. However, even for high usage profiles they are often still better on the cheaper plans rather than the more expensive. In reality, people are locked into higher plans for a set period of time or do not pick the best plan for their needs.

The ABS, however, has found that using the bills directly to estimate price changes in telecommunication services, although theoretically attractive, is complex in practice. The process is data intensive and some of the variables in the files are difficult to interpret without considerable assistance from the telephone company's billing experts. Additionally, to provide the data to the ABS, considerable effort is required from the telecommunication companies to undertake the data mining to provide the billing system samples.

Although the price schedules (*Standard Forms of Agreement* as they are usually known in Australia) are available in the public domain, they are often difficult to locate on the carriers' web sites. Information about the changing shares of the many plans is available from the telephone companies but it is commercially sensitive and access must be negotiated. Obtaining this information is crucial in order to allow shifts in plan shares to influence the average prices. Revenue information from the carriers is also required to weight together the various service types, and to calculate the relative importance of each carrier.

In order to price these bills, both the pricing plans and the bills were classified into high, medium, and low activity. The pricing plans were classified according to definitions set by the providers (see table 1 below). To classify the bills into high, medium and low-activity bills a variety of approaches were considered including carrying forward the plan identifiers shown on

the bills. An alternative approach was developed to run a mid-range plan over all the bills and then sort by annual expenditure into one of the three activity classifications. The high, medium and low shares are fixed for the life of each sample, and when the sample is refreshed and the shares are changed the series are spliced together, preventing price effects from flowing through to the index.

Table 1 Mobile phone expenditure structure

	Quantity – telephonic transactions (activity)	**Price – Usage plans**
High	Profiles/bills	Plans (H prices)
Medium	Profiles/bills	Plans (M prices)
Low	Profiles/bills	Plans (L prices)

After this preliminary work has been done we commence running the plan prices over the bills. We decided that the best way to do this is to run the first of the high-usage plans (H1 prices) over ALL of the high-activity bills; then run the second of the high-usage plans (H2 prices) over exactly the same set of high-activity bills; and so on for all remaining high-usage plans. Then we run each of the medium-usage plans (the M prices) over all of the medium-activity bills; and finally each of the low-usage plans (L prices) over all of the low-activity bills. Having done this the final step is to weight together the prices using confidential information from the carriers about the changing plan shares. We do this because phone companies tend to increase their prices by changing their plans. Consumers can choose to accept the new plans or move to other plans -- or indeed other carriers -- which better suit their consumption patterns. In changing plans they face different prices. Consequently we propose to re-weight the prices continually according to the proportion of consumers on each of the plans. Thus as plans grow in importance so does their influence on the overall average price. We believe that this will result is a smoother, more plausible series which reflects the reality of today's market for telecommunication services. We ask for the plan shares based on the 'number of services in operation', and do the weighting group by group.

As the bills that we have collected are merely quantity data we propose to re-use them by applying to them the prices charged by other carriers for the same services. Thus, for example, a call to a mobile appearing on a fixed-line bill may be priced both as an off-net call by a customer of one carrier and an on-net call by a customer of another carrier. This approach allows us to price the main carriers using the one set of bills. Of course, this assumes that consumers' calling patterns are similar irrespective of their chosen carrier. We have discussed this assumption with the carriers. They thought that the customers of the bigger carriers have similar calling patterns but the customers of the smaller carriers belong to different demographic groups and so exhibit different behaviour. It was noted using post-paid mobile bills to price prepaid mobile services would be inappropriate, as there are large behavioural differences between these two groups of customers.

To reduce complexity, the experimental estimates use the one set of bills for all periods. However, it is desirable to re-sample the bills annually to reflect changing consumption patterns arising from the carriers offering new products, and changing the relative prices of existing products. Furthermore the prices should be re-weighted based on the shifting market shares of the carriers themselves.

3.3 Approach 3 - Using real time phone bills to calculate unit values

The ABS receives daily a continuous electronic feed of the transactions accruing on the sampled accounts. The presence of transaction-level expenditure information means that there

is potential to use the bills data to construct unit prices, controlling for the changing composition of the sample over time using regression modelling. This is currently being investigated. If feasible, it would be a very efficient way of constructing price movements but would require careful thought about the nature of the sample, and its representativeness over time and across carriers.

The ideal is to calculate average prices for tightly defined goods or services that are the same from one period to another. Thus with supermarkets' scanner data we prepare unit values for goods defined by their barcode (EAN or SKU). With phone services the equivalent of the barcode is a *product billing identifier* (or similarly named variable) which precisely defines the service being provided. But these identifiers are apt to change fairly frequently, and so the ABS has decided to define the service using a combination of other variables such as type of service (fixed or mobile); type of call (e.g. local, long distance); duration and destination of call if applicable for charging purposes; and type of plan.

4. Assessment of these approaches

Because the bill data used by the ABS are collected under the *Census and Statistics Act* we are constrained in what we may present in a public forum such as this. However, we hope that these new methods outlined will produce a better result than matched samples reflecting the increasing services provided by the plans.

Using the bills directly to measure price change is a rigorous method because the quantities that are used in the calculations are the call types, durations, and destinations observed in the real world. But it is both labour and data intensive, and would be difficult to implement in practice.

Using the bills indirectly by creating customer profiles from them seems likely to provide good estimates of price change with less effort. We are empirically testing at what level of detail the consumer profiles start to align with the direct bills approach in terms of estimated price change, and the number and type of profiles that are needed to achieve an acceptable result. However, deciding what set of pricing plans to apply to the customer profiles needs further research.

Lastly, using the full richness in the dataset to calculate fine-level unit values shows great promise, and may turn out to be the best of the three options we are investigating.

Once the ABS has decided how best to price the main service types we will consider how to price pre-paid phone cards and VOIP services.

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