

## Summary of A. J. Daly Presentation for RA Seminar

### *Consumer Surplus to Cellular Mobile Phone Users*

The Brief required estimates to be made of consumer surplus based on Stated Preference (SP) interviews with mobile phone users. Three measures of consumer surplus were identified:

- MCS, Marshallian, ordinary or uncompensated consumer surplus;
- CV, Compensating Variation; and a further Hicksian measure
- EV, Equivalent Variation.

Two other measures, Compensating and Equivalent Surplus, were rejected on the grounds that that the issue of indivisibility was not relevant in the context of a probability model.

The three measures that were adopted were to be measured insofar as they are different. Usually, when income elasticity is positive, CV is larger than MCS which in turn is larger than EV. When there is no income elasticity, all three are equal. Apart from the SP data, the Brief required CV and EV measures to be derived from direct questioning.

The three measures can be derived by integrating with respect to price under the demand curve. Therefore the objective of the SP study is to derive demand curves, explicitly up to the point where respondents are persuaded to abandon their mobile phones. To keep the study reasonably simple, we designed the survey so that changes in usage of the phone were excluded, respondents had only the all-or-nothing options of present usage or no mobile phone.

Telephone surveys were used, asking a number of key background questions tailored for the business and private markets, followed by the SP exercises themselves and the EV and CV questions. The SP was done in two experiments, a 'within product' exercise comparing mobile phones of different prices and characteristics and a 'between product' exercise comparing a mobile phone of given price and characteristics with the best alternative to the mobile phone suggested by the respondent. This structure was adopted to optimise the response to questions and to allow several phone characteristics to be introduced to further improve response. Cost levels presented for mobile phones were presented up to relatively high levels to induce respondents to consider abandoning their phones. The results of the direct EV and CV questions were not always satisfactory, up to 1/3 of the respondents giving replies that could not be used.

Modelling was based on the SP responses and represented the choice between two alternatives (i.e. two mobile phones or one mobile phone and the best alternative) as based on indirect utility functions. Differences in the utility functions are translated into predicted choice probabilities by the use of the logit function. Maximum likelihood estimation of the unknown parameters of these utility functions allowed us to find a good explanation of the data, modelling jointly across the 'within' and 'between' experiments. The 'Jack-knife' procedure was used to correct for correlations between the responses of each individual. The best models contained cost sensitivity dependent on usage, phone service characteristics such as internet connection and network congestion, together with socio-economic variables such as

the respondent's time as a mobile phone user, age and SEG or in the business market the size of the company.

In view of the practical and theoretical importance of income in the model careful tests were made of a series of income and cost variables. However, it was concluded that the best models did not represent mobile phone ownership as dependent on income.

When income is not present in the model,  $MCS = CV = EV$  and these can be calculated by a simple integral, in logit models the 'logsum' formula. Procedures were prepared, but not carried through, for the much more complicated situation when income is present in the model. In aggregate, relatively simple formulae can be applied. In disaggregate models, however, an aggregation problem arises and complicated procedures due to McFadden (or Karlström) must be used.

The calculated CS based on the models and (where possible) stated CV and EV figures were compared, indicating good agreement and indeed little dependence on income but a significant influence of usage. Usage, however, does not appear to depend on income. Because of the generally good agreement, the difficulty in using all of the stated CV and EV values and the better support given by the literature to modelled values, the use of the modelled values was recommended.

The results indicated an average CS of £ 47 per month in the business sector, £ 16 per month in the private sector, with error margins of about  $\pm 25\%$  in each case.