

**Bounded Rationality and Consumer Research:
Lessons From a Study of Choices of Mobile Phone Service Contracts**

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Abstract

This paper draws lessons about the allocation of resources to research aimed at studying the efficiency of consumer decision making in complex, fast-moving markets. These lessons emerged during research involving a large-sample survey of choices of mobile phone service plans by Australian consumers. In this kind of market, researchers will run into difficulties in collecting and evaluating data, and market conditions will not stand still while they address these problems. It is even possible that what seems suboptimal to researchers will sometimes actually be highly appropriate choice for consumers. The paper concludes by advocating the use of simpler methods to approximate the prevalence of decision-making inefficiency—such as collaborative work with owners of websites that try to assist consumers—as knowledge of optimal choices is not essential for understanding the sources of inefficiency or devising methods by which better choices might be made.

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“Kiss Telecom is an exciting new mobile phone company that removes the confusion from today's mobile phone market. ... We believe that you shouldn't need a University degree to choose a mobile plan”

(<http://www.kisstelecom.com.au/>, visited 23 September 2011)

Introduction

The recent explosion of interest in behavioural economics has not been accompanied by analysis of the relative costs and benefits of rival approaches to studying how people actually make their decisions and the quality of the decisions they make. Behaviour may be studied in a variety of ways, such as:

- Large-sample survey-based inquiries;
- The elicitation and analysis of verbal protocols from small numbers of subjects actually engaging in decision making (see Ericsson and Simon, 1993);
- Experimental approaches, in the field or laboratory;
- The ethnographic/anthropological approach of extended observations and/or close-up interactions (see Lavoie, 1990).

Some methods may be more appropriate for some kinds of market context than for others, so funding agencies and researchers need to ensure that projects attempting to understand behaviour in a particular context are built around the appropriate method or methods. This paper aims to contribute to better matching between contexts and methods of behavioural research by highlighting the challenges involved in making a large-sample survey-based study work in a

complex and fast-moving context. To illustrate the key issues, we share our experiences from research on the Australian market for mobile (cell) phone connection services.

The choice between mobile phone connection plans presents consumers with challenges that do not exist in the simple, static ‘apples versus oranges’ examples that economists use when introducing the theory of rational choice to their students. In Australia, at the end of 2010, consumers faced choices between 398 post-paid plans (459 including bundled plans) and 423 pre-paid plans offered by 52 providers. Many of these plans entailed extensive legalistic ‘fine print’. A study by Harrison *et al.* (2011) has shown how consumers in this sector find the process of choosing to be both exhausting and distressing; it is a cause of fear and dread. Disappointment is common: in each of the financial years from 2008–9 through to 2010–11, Australia’s Telecommunications Industry Ombudsman (TIO) received well over 100,000 complaints about mobile phone services (TIO, 2011, Xavier, 2011).

In a report commissioned by the Australian Communications and Media Authority, Xavier (2011) used behavioural economics to explain in theoretical terms why consumers find this sector so problematic. However, despite the extent of consumer dissatisfaction and the possibility that providers are engaging in a ‘confusopoly’ strategy via product proliferation and the complexity of their offers, the extent to which consumer choices are suboptimal in this context remains an open question. If consumers are making significant mistakes in this market, there is also the question of what kinds of policies might enhance their welfare.

We sought to answer these questions via a multiple methods project funded by an Australian Research Council Discovery Grant.¹ Clearly, if one is concerned with consumer welfare, this is a context in which there is a strong case for taking *some* kind of behavioural approach to studying how consumers try to cope and how successful they are. But the question of the relative efficiency of alternative research methods in this kind of context also needed to be addressed and that is why we opted for a multiple methods strategy. The project's first phase entailed a large-sample survey of mobile phone users along with the construction and programming of a spreadsheet that included details of all the available plans. The spreadsheet was developed to make it possible to compare each survey respondent's costs when using their chosen service plans versus the costs for the best plan that matches their usage profiles. Later phases involve protocol analysis and extensive use of experimental economics to study how consumers make their choices and how different information environments affect the accuracy of their choices.

This paper focuses purely on methodological issues and does not report what we found in the project's first phase regarding the quality of choices in this context. (For details of where the results are published, see the project's website at <http://mobilechoice.economics.uq.edu.au/>.) It is structured as follows. Section 1 examines how behavioural welfare economics differs from the traditional approach to welfare economics. Section 2 considers how non-price aspects of products complicate the researcher's task. Section 3 shows how factors other than the research budget presented barriers to gathering

¹ DP1093840 (2010–2013) 'A study of consumers' competence when choosing between complex mobile phone contracts and the regulatory implications of their coping strategies'

information about behaviour, while section 4 reveals some of the challenges faced by the researchers when gathering data about mobile phone service products. Section 5 shows how our ability to calculate optimal choices was compromised by the Schumpeterian competitive processes at work in the market. Section 6 considers simplifications that were necessary to make the calculating spreadsheet work and the difficulties entailed in knowing whether it had been programmed correctly. Section 7 offers concluding reflections.

1. Behavioural welfare economics

Prior to the emergence of behavioural economics, welfare economists focused on the consequences of mismatches between actual prices and shadow prices (i.e., prices that properly reflected opportunity costs). This enabled them to analyse the distribution of consumer and producer surplus and the extent of deadweight losses. Welfare economists assumed that consumers and producers were acting optimally in the situations they faced. However, in 1966 Harvey Leibenstein raised the possibility that consumers fare less well than they might have done because firms deliver less value for money than would have been possible had they been better managed and more aware of technological possibilities. He called this problem 'X-inefficiency', emphasizing that, if costs were higher than they needed to be, economists had probably been underestimating the deadweight losses ('allocative inefficiency') that resulted from monopolistic prices distortions. However, like other leading lights in the initial wave of behavioural economists such as Simon (1957, 1959) and Cyert and March (1963), Leibenstein focused on choices within organizations. He did not extend his argument to take account of the possibility that consumers, too, could be

using suboptimal decision-making methods that caused them to fail to switch to cheaper suppliers. Their inertia could account for persistent pricing dispersions and enable some firms to maintain prices well above those to be expected in a competitive market.

It was only with the new wave of behavioural economics, led by Thaler (1980) and inspired by the work on heuristics and biases by psychologists such as Kahneman and Tversky (1979; also Kahneman, Slovic and Tversky, eds, 1982), that the issue of consumer competence began to receive significant attention within economics (Sent, 2004). However, it was satirist Scott Adams (1997) who coined the term ‘confusopoly’, acknowledging the trouble that modern consumers have dealing with an abundance of choice deviously created by suppliers. Lawyers Hanson and Kysar (1999a, 1999b) then raised a major welfare implication of the heuristics and biases literature, namely, the possibility that firms might be able to devise strategies to manipulate consumer choices by exploiting these increasingly widely-known shortcomings of consumer decision-making processes. Though seemingly largely unaware of this literature, industrial economists (notably Waterson, 2003) started to sense that it was a mistake to approach competition policy by studying only what firms were doing rather than also seeking to understand how consumers reached their decisions.

These themes were brought together in Earl’s (2007) contribution to a memorial volume for Leibenstein in which he argued the case for recognizing the X-inefficiency of consumers as well as of firms. However, unlike the new wave of behavioural economists who focus on distorted perceptions and preferences as causes of departures from rationality, Earl also recognized a key implication of the use of simple decision rules for coping with situations of bounded rationality:

some simple rules may actually be very efficient devices for taking decisions. This idea had been proposed by Winter (1964) in the old wave of behavioural writings on business behaviour and had been reinvented in the context of consumer behaviour by Gigerenzer and Goldstein (1996). It implies that economists should not jump to *a priori* conclusions about how well consumers may be faring within the particular market context.

On the one hand, consumers who face complicated, dynamic, information-rich decision environments and whose decision making is constrained by shortages of time and finite cognitive capacities seem likely to make mistakes in gathering and processing information. Much may go wrong:

- Their search strategies may leave them completely unaware of superior products.
- They may have trouble making sense of what the products offer, or the meaning of the 'fine print' associated with particular deals.
- They may experience problems in aggregating information about different characteristics of products to compute overall values for each of their options and end up using simplifying, non-compensatory decision rules that may produce intransitive rankings (Tversky, 1969).
- Their finite short-term memory capacity may limit the number of things that they can keep in mind whilst choosing—according to Miller (1956), the typical number is seven, plus or minus two.
- Their cognitive processes generally may be prey to a large number of dysfunctional heuristics and biases.

- If they try to outsource their choices, it may simply be a case of ‘the blind leading the blind’.

On the other hand, however, the scale of their errors might actually be far less than we might expect after reflecting on possible sources of bounded rationality. It is not simply that consumers might employ ‘fast and frugal decision rules’ (Gigerenzer and Goldstein, 1996; Gigerenzer, Todd and the ABC Research Group, 1999). They might also make use of a relatively efficient ‘market for preferences’ (Earl and Potts, 2004) by incurring the costs of calling upon expert inputs from their social networks or market institutions such as websites that enable them to discover and compare rival products. Some consumers might even have read popular ‘self improvement’ books on how to avoid decision errors (such as those by Belsky and Gilovich (1999) and Gigerenzer (2002)) and make use of advice contained therein.

Given the latter possibilities, it might even be the case that consumers typically do not display significant X-inefficiency and that, even though they do not actually choose in the manner envisaged in rational choice theory, they behave pretty much ‘as if’ they are acting with global rationality (cf. Friedman, 1953) and hence do not need to be protected by regulatory authorities. This could apply even in contexts where consumers express frustration about their choice experiences and find the strategies of suppliers exasperating. But, then again, consumption X-inefficiency might be significant and the pessimism of Hanson and Kysar might be justified. To make pronouncements about consumer welfare and uncover policy implications in a particular context, we must

therefore study their behaviour and find out how well they are doing in that context.

For a behavioural approach to provide any insight into consumer welfare, there is a reflexive issue that needs to be addressed and which lies at the core of the study reported in this paper: the researchers studying the behaviour of boundedly rational consumers are themselves mere human beings who may have found it challenging to be consumers in the context in question. They will only be able to make judgments about the quality of consumers' decisions if they can to some degree overcome the barriers faced by those whose behaviour they are studying. For research funding authorities, the key issue is whether the extent to which the researchers are likely to be able to do this justifies the funding they are requesting.

We began the mobile phone service choice project believing that we could largely escape the problems that beset consumers in this context:

- Whereas many consumers may not be super-smart and may only spend a very limited time gathering information, a team of highly-trained researchers may be able to spend hundreds of hours gathering information about the same choice problem.
- Whereas consumers may mainly try to process information in their heads, a team of researchers may have it processed by computers that do not run out of memory capacity or make processing errors.
- And, whereas ordinary consumers may be unaware that their cognitive processes are being shaped by heuristics and biases, researchers who know

about human cognitive shortcomings can apply that knowledge in order to avoid falling into similar traps.

We ended up with a far clearer idea of just how challenging a problem this context presents for consumers and what they would need to be able to do to solve it in a fully rational manner. However, despite throwing considerable resources and expertise at the problem, we ultimately remained partly beset by the same kinds of challenges that ordinary consumers face.

This is not to say that bounded rationality and search costs necessarily make it impossible for researchers to make pronouncements about the quality of decision making by consumers. To the extent that researchers can push back the constraints that ordinary consumers face on gathering and processing information, they may be able to give some kind of 'best-practice' assessment of which products consumers should select if they have particular sets of requirements. This would be analogous to efficiency and productivity analysts gathering data about inputs and outputs in a particular industry and using the techniques described in works such as Coelli *et al.* (2005) to identify the industry's current efficiency frontiers and then label as 'X-inefficient' the firms operating inside it. However, compared with the analysis of the efficiency and productivity of firms, the analysis of the efficiency of consumer decision-making turns out to be more obviously riddled with problems that necessitate caution in any subsequent pronouncements and policy recommendations.

2. The nature of the product: price and non-price dimensions

At first sight, mobile phone service products seem to present an unusually convenient area for research into the efficiency of consumer choices because they can be thought of as bundles of a small number of sub-products (calls, SMS messages, etc.) each of which has a price attached. The total cost of the bundle can readily be calculated if we know the prices of each service and the consumer's pattern of use. The researcher does not have to devise means for breaking each product up into a set of characteristics (as advocated by Lancaster, 1966), or deal with products with dozens of features, some of which are listed in manufacturers' specification sheets and others that are highly subjective—as with style, taste or fragrance—and where researchers' tastes may be different from those of some consumers. It thus sounds as though it should be much easier to work out how far consumers are making mistakes in their choices of mobile phone plans than in context involving products that offer many outputs to which no monetary units are attached.

We ranked mobile phone service plans for each sampled consumer on the basis of their predicted annual cost. This enabled us to focus on the difference between what the consumers in our sample were paying and what they might have paid by making a 'best-practice' choice. However, this was an approximation, for there are several areas in which mobile phone services do not readily reduce to monetary units. Some of these areas pose an 'experience good' problem (Nelson, 1970) for both consumers and researchers in that *ex ante* it is impossible to know what the quality of the service would be. Thus, in calculating the 'optimal' plan for a consumer, we did not attempt to build in any information about service reliability (which during 2010–11 proved to be a major issue for customers relying on the Vodafone network), convenience of the provider's

website (such as in respect of recharging pre-paid services or finding out past usage), the range of downloadable material or the quality of service provided by the provider's call centre. We were able to rule out products that offered no coverage where a sampled subject lived, but we did not try to undertake any calculations about the probability of a subject being able to obtain access to services if they went beyond their home postcode area.

3. Bounded rationality and market research

Economists have historically tended to be hostile to survey-based research on the basis that respondents might behave deviously in giving their answers, possibly after trying to work out what the researchers were hoping the answers would be. (However, they forget about this possibility when working with published statistics, whose supposedly objective data actually result from people filling in surveys.) Such a view treats survey respondents as self-serving optimizers. We were more inclined to trust that, having volunteered to participate, our respondents would try to answer honestly. However, we soon ran into the implications of their bounded rationality as a constraint on what we could learn about the impact of bounded rationality on the quality of their choices.

The calculations we were able to make were approximations even regarding services with observable prices, for some aspects of the plans were left out because difficulties in gathering information from consumers led us not to collect certain kinds of information about the products. Even a 'best-practice' attempt to find out how much more cheaply our respondents might have purchased the services that they used required much more detailed questions

about their ways of life than we could accommodate in our survey. The survey's potential length was increased yet further because our study was not merely trying to understand the extent of consumption X-inefficiency in this context but also the drivers of efficiency differences between different types of consumers. Hence the survey needed to include questions designed to find out how subjects differed in the ways they reached their choices of mobile phone service products, and in their willingness to switch between these products.

It would have been possible for us to commission a much lengthier online survey than we actually used, at the cost of having less money available for research assistance and then undertaking more of the work ourselves. However, on the strong advice from ORU, the company we had selected to administer the survey, we edited our questionnaire down until it could be completed in around 25 minutes. This advice was emphatic: anything longer than this would not merely involve costs of participation inducements paid to subjects escalating, at an increasing rate; it would also produce much less reliable data due to increased respondent fatigue. As well as limiting the total number of questions we might ask, ORU's advice deterred us from asking time-consuming questions requiring reflection (for example about possible changes in patterns of use over the next few years) or any need to pause to find information (for example, to check which model mobile phone they used or retrieve past phone bills).

Some indication of the complexity of the inquiries we ideally would like to have made, and of what we were practically limited to doing, can be seen in the following examples.

Price sensitivity

In principle, market research tools might be used to find out different usage rates at different sets of relative prices against the backdrop of the consumer's way of life. Consumers clearly do substitute between making calls, sending text messages, using Internet services such as Facebook and Skype, or simply delaying communicating at all until they can speak to the other person face-to-face. To compute optimal choices we needed to be able to infer each subject's demand system for the differently priced mobile phone services—not merely for domestic and international calls, SMS, MMS and data but also for their willingness to pay for different performance levels in terms of attributes such as geographical coverage, access to media download services, call centre response times and helpfulness, and so on.

In practice, we asked no questions designed to elicit demand systems for individuals and only sought information about average monthly rates of service use within each subject's existing plan. We were therefore unable to consider whether switching to a different plan with different internal relative prices would change relative usage rates for the various services. Hence we were unable to compute the impact that substitution of this kind would have on the predicted expenditure for that plan. This means that our results are more accurate regarding whether respondents chose the wrong level of service within a family of plans, than regarding their errors when choosing between different kinds of plans within a company or between plans of rival companies with different relative prices.

It is a sign of our own bounded rationality as researchers that we had been through several drafts of the questionnaire debating the wording of the

questions on typical rates of use of various services before any of us realized that we had not even been thinking of trying to ask questions to derive information about the demand functions for these services. We were implicitly viewing consumers as creatures of habit rather than substitution-focused agents who responded to market incentives. But, in practical terms, we could do no more than this and it meant we were limited to trying to find out how much more cheaply members of our sample might have purchased the mix of services that they accessed with their current contracts.

International services

Although our survey included questions about the respondents' usage rates for international SMS and MMS services, the questions we asked regarding international phone calls were very limited, covering their frequency in general terms and whether or not respondents used services such as Skype on their mobiles or different SIM cards to make these calls. The latter were aimed more at getting a proxy for 'savvy' consumers who might be more likely also to make better choices of services for domestic use. We asked subjects neither about which countries they called nor about the extent to which they intended to make use of international roaming services, and where, over the next year or two.

We were therefore largely proceeding 'as if' our subjects' mobile phone costs were unaffected by international mobile phone calls. Fortunately, the vast majority of subjects fitted this approximation. It saved us from including an extra question or two with long pull-down menus listing 160+ countries, though its main advantage was in reducing our own information gathering, data entry and programming costs. For assessments of some subjects, this simplification could

be highly misleading. An example would be a person who mainly is a very low user but who does travel overseas every now and then and incurs the bulk of his or her call charges for the year by calling home via international roaming: such a person might rationally be opting for a plan that is not optimal for domestic calls because the plan that is optimal for domestic use offers no international roaming facility.

It needs to be added that even roaming within Australia was too problematic to include though ideally we should have included questions about it: some providers who use the Optus or Vodafone networks charge higher rates for calls that their customers make beyond the coverage of these networks, where they are routed through the larger Telstra network.

Usage variance

The ranking of mobile phone service products may depend dramatically on the extent of variance in the consumer's need to use these services. This is because many service products (such as plans based around 'caps' with particular amounts of 'included value') involve different pricing regimes applying depending on how much use the customer has already made of the service within the billing period. Clearly, one might ask consumers questions to uncover the variance in their monthly spending with their current plan but they may have trouble recalling what their bills have been. While they may vividly remember bills that were way over minimum monthly charges on their current 'cap' plan, they may have little idea about how close they had come to hitting their 'included value' limits on months when they did not exceed this figure.

Even if consumers can recall their past spending patterns in detail, these may not be a good guide to future variance. Some consumer may anticipate changes in their circumstances over the planning period and factor this into their choices of service plan. Some of these changes could be due to factors that previously were drivers of variance in their use of mobile telecommunications services. For example, they may be intending to settle into a job after several months of overseas roaming, or a family member whose illness had lately triggered many phone calls may now have recovered or passed away.

Some consumers, however, may make erroneous choices of mobile phone service plans because they have little idea about the extent of variance they might experience in their need to use mobile telecommunications services over the next couple of years. For example, someone who normally is not a major user of these services might have recently embarked upon the use of online dating sites to find a new partner. While their search is in process, they might increase spectacularly their use of their mobile phones in order to coordinate their 'dates', but once they have found 'the one', their usage rates might fall to previous levels. Whether or not they ought to be on a different phone plan will depend crucially on how long the search process takes. When they settle on a new partner the optimal choice of plan may need to be worked out jointly with the partner so as to enjoy free on-network calls. It might even depend on whether and when they change their car, since if they switch to a vehicle with Bluetooth capabilities they may no longer miss calls while driving and hence have fewer message retrieval calls, whose prices vary between providers.

Researchers trying to infer optimal choices in this context ideally should model what usage variance the consumers *ought* to be expecting given their

particular kinds of demographic and lifestyle characteristics. To derive these 'rational expectations', researchers might ask consumers questions about their intentions and hopes during the next year or two and then engage in research about the probabilities of their hopes being realized.. For example, we might have attempted to find out the probability distribution for success in forming new relationships at particular speeds via online dating. But proposing to quiz subjects about their private lives might have prevented ethical clearance and if such questions had been approved making use of the additional data would have required a far wider range of lifestyle research than we had resources to undertake. Moreover, aggregate probability data would often poorly approximate what individuals with particular capabilities should expect regarding hoped-for changes of circumstances. In any case, a questionnaire that tried to uncover subjects' expected main reasons for using their mobile phones and their probability distributions for these uses would have been unreasonably complicated.

In practice, we only had space to ask about subjects' typical monthly spending and usage rates of products on their current service plan, and the biggest bill they could recall receiving over the preceding twelve months. But we remained determined not to abandon our hopes of taking account of variance, given the difficulty many consumers have in making sense of 'cap'-based plans, and their concern about unexpectedly large bills. As a basic measure of vulnerability, we could plug the answers about 'typical monthly usage' of various services from those who used 'cap'-based plans into the parameters of their chosen plan and see what percentage of their plan's 'included value' they might typically use. Better still, we were able to simulate their vulnerability statistically

by examining the impact on their bills of a series of random draws from both normally and rightward-skewed distributions around their monthly mean usage rates. This was a very cost-effective solution to our data problem and we believe it insulated us from the risks of respondent succumbing to heuristics and biases if asked to report on or estimate their usage variability.

Bundling

We asked our respondents questions about the set of telecommunications technologies they used, which ones came from the same provider as their mobile phone service, and whether they received a discount for bundling their mobile phone service with another kind of service that their provider offered. However, we did not take up their time by asking how much they saved via bundling as we expected to be able to infer this from the providers' websites. In many cases this was indeed possible, as bundling discounts were of fixed amounts, but it turned out that some companies offered bundling discounts as a percentage of the total bill for the bundled services. In such cases, all we could do was to assume that the fraction of the total bill that came from mobile phone use was the inverse of the number of services that were bundled together and then infer the discount via the answer given for the typical monthly outlay on mobile phone services.

4. Gathering and interpreting information on rival products

When we started to compile a database of Australian mobile phone plans we had a strong sense that Australian consumers face much more complex choices in this area than their counterparts in, North America, the UK and New Zealand, but

we had no idea that their choice set was quite as enormous as it turned out to be. First, we had to find out who the providers were.

By law, any firm that supplies telecommunications services to small businesses and consumers in Australia is required to join the Telecommunications Industry Ombudsman (TIO), the independent agency that handles customer complaints. A list of TIO members seemed the obvious starting point in our attempt to build a comprehensive list of providers. However, with TIO membership running to well over 1500 firms and its website's list not classifying them according to which kinds of telecommunications services they offered, a global search of its membership list to find links to provider websites seemed something worth avoiding.

The natural alternative starting point was to try to find a website of the kind that a consumer might use if venturing into the 'market for preferences', that listed plans and their details and provided a plan ranking service. The most comprehensive example of such a service appeared to be the mobiles section of www.phonechoice.com.au, whose list of available plans runs (as of 29 September 2011) to 38 screens and contains sixteen columns of data about each plan. This website allows consumers to input details of their monthly usage patterns and will calculate and display the twenty cheapest options. Given this, an obvious question is why we bothered to compile our own spreadsheet of details of available plans with a view to programming it to work out rankings of plans for the consumers who provided us with their usage data.

With a lower budget, we might indeed have relied upon this market institution and investigated the X-inefficiency of sampled consumers by obtaining from them the data it requests and then comparing its

recommendations with their actual choices. However, there were several reasons why it seemed at the time to be a good idea to make a substantial investment in compiling and programming our own version:

- At the time we designed the project, the Phonechoice website did not allow consumers to seek rankings of products on the basis of detailed information about their typical patterns of usage; rather, it offered rankings based upon which of four broad category of 'average user' (low, medium, high, and university student) the consumer thought best matched their own pattern of usage. We wanted to get a finer-grained view of how efficiently our respondents were choosing.
- The Phonechoice website only provides results for the top twenty cheapest plans for any given user profile, whereas respondents' actual plans might be outside the top twenty. It would thus be difficult to gauge the extent of mismatch between respondents' reported typical monthly expenditure and what their reported usage rates implied, or to discern anything about clustering of plans.
- Though the Phonechoice website eventually supplemented its original four-stereotypes bill estimation service by introduced a bill estimating service for individual user patterns, it continued only allow to consumers to input their typical monthly usage. Our statistical approach to dealing with usage variance would have been unworkable if we had to enter all the data and record the results manually for 24 months' worth of random draws for each of the distributions for each respondent. Moreover, having results limited to

the top twenty plans could have proved problematic if plans moved in and out of the top twenty for each user under different usage rates.

- The Phonechoice website ignored international service use completely and the impact of ‘add-ons’ that some plans offer.
- We did not know how complete or up to date the Phonechoice website was. If any plans were missing these would need to be recorded and programmed separately.
- If we could construct a better database and calculating engine, we would be able to glean some indication of how well the Phonechoice website served consumers as a market institution (though because of the market flux discussed in section 5, this was an area in which we were over-optimistic).
- Even if we limited ourselves to using the Phonechoice dataset, we would still need to programme our own calculating engine to check the accuracy of the Phonechoice rankings (for example, whether Phonechoice were actually taking account of add-on option offered by some plans despite not listing them). We also needed our own calculating engine for doing simulation work regarding the reliability of a variety of reasonable-looking decision rules and for trawling the set of plans to discover completely dominated plans and plans that would only ever be chosen by consumers with peculiar usage profiles that were unlike any of those in our sample and which might indicate attempts to overload consumers with pointless options.

Thus although the Phonechoice website provided a convenient starting point in building our database, we continued periodically to undertake Google searches to see if any additional providers could be found. Quite a number, such as SEQ

Community Telco, Locall Australis, Koscom and Southern Cross Telco, were discovered this way, in some cases beyond the 25th page of Google's search results. With hindsight, a further case for constructing our own database became apparent: the impossibility of downloading the Phonechoice website would have caused major problems for our work the longer we needed to use it, due to plans being introduced, amended or discontinued (see further, section 5).

Getting details of plans from the providers often proved very time-consuming, or even impossible, when we wanted to go beyond (or merely confirm) the data listed at the Phonechoice website. We thus began to get a very clear idea of what consumers were up against. For a few companies (notably Koscom, Simplicity and TPG) it was not obvious even whether their plans were pre-paid or post paid and these firms had to be called or emailed to get clarification. TPG claimed on their website that their plans were neither pre-paid nor post-paid but when we called them we were advised that they considered their plans to be post-paid. Telstra, the largest provider, organizes its retail shops on a franchise model but was unable to offer McDonald's-like consistency of service: for example, when we asked staff at Telstra's Indooroopilly store for a paper copy of their plans we were told that these were only available online, yet an inquiry at Telstra's Toowong store regarding how to find some of their plan details online was addressed via a paper copy instead of showing us how to navigate to the appropriate pages on the firm's website.

It prove particularly difficult to compile details of costs relating to message-bank flag-fall and message retrieval, international SMS and MMS and, in some cases, which network the smaller companies were using (which we need to know in order to determine geographical coverage). Many hours were spent

calling the providers because their websites failed to give the required information, being left 'on hold' for long periods, being advised they would call back when they had found the information and then having to email to remind them without going through the whole process again. With smaller companies, our calls were answered by representatives who were often very poorly trained, even to the extent of not knowing what the term 'flag-fall' meant. Many were unable to provide a simple answer regarding international messaging charges: for example, People Telecom advised that they could not supply rates for international messaging since these varied depending on the country and were charged from overseas, while the representative at Simplicity could not find details at her office and resorted to looking at the firm's website where, like us, she was unable to find them. Possibly the most extreme case was Green Mobile, whose representative refused to supply rates for these services unless we provided a Green Mobile customer number.

In building the database the problem was not merely that of collecting information but also making sense of it. Information obtained from service providers' websites often proved very difficult for us to decipher so, as consumers might do, we asked questions at providers' retail outlets or via their call centres. If we were not convinced by the answers given, we asked the question again on another day to another representative of the company in question and were prone to receive a different answer. Optus, one of the largest providers, proved particularly exasperating because of the enormous variety of its plans, complex add-ons and inconsistent advice. For example, at the Toowong Optus store we were initially advised that their pre-paid top-up 'Optus2Optus Pre-Paid Messaging Money' was used for call time and not SMS. A second Optus

representative at this store said, on a different day, that it was for SMS only as we eventually were able to confirm in the 'terms and conditions'. Likewise, we first were advised at the Toowong Optus store that the Optus pre-paid top-up 'Revup Friends \$30 Pre-paid money' was for calling customers with the exact same plan as the caller, but this advice was contradicted by another member of staff on a subsequent inquiry at the same store. When asking what made the 'Revup Bonus' and 'My Credit' additions different, this Optus store advised us that, in fact, they were the same thing. Most infuriating of all were the Optus 'Dollar Days' plans, which we found very hard to articulate to each other, let alone programme into the spreadsheet.

5. The Schumpeterian aspect of the mobile phone service market

The survey for the project was administered online to a nationwide representative sample of 1018 subjects in November 2010. By that time we had obtained details of the products offered by all of the main providers and a large number of minor players. Further minor players continued to be discovered into early 2011 and respondents who used these would have therefore had to click 'other' and type the names in rather than use the pull-down menus of providers and plans at various points in the questionnaire. (Of the 1018 respondents, 931 listed their plan as one from the pull-down menu.) However, there was a very good reason for running the survey before we were sure we had a complete list of providers and products: the set of products on offer kept changing. If we delayed running the survey, the data that we had already gathered on existing products would become increasingly out of date.

This constant flux is a sign of Schumpeterian ‘creative destruction’ (Schumpeter, 1943/1992) and is a consequence of the low set-up costs in this sector. For an incumbent provider, offering a new product may involve nothing more than reprogramming parts of its usage-logging system and developing some new website material. For new players, entry requires negotiation of a wholesale deal for network access and capacity volume, programming the systems for usage logging and billing (if post-paid products are offered) and establishing a website, after which no further costs will necessarily be sunk into marketing. This means that new ruses for attracting consumers can readily be tried or copied from rivals. In short, this market can be viewed as if it is hotly contested in the sense of Baumol, Panzar and Willig (1982) despite its lack of transparency to users and the major fixed costs of towers and other infrastructure for companies that opt to invest in their own network capacity. It Some of the innovative service ploys are affected by even more obviously technology-based aspects of Schumpeterian competition, namely, the constantly changing set, and characteristics of, the phones that may be bundled with service plans.

Schumpeterian competition makes this market a nightmare for researchers, for it is practically impossible to be confident that one’s data about available products are up to date at a particular point in time. Unless changes in product offerings are conspicuously promoted, the researchers have to keep checking provider websites to see if there have been any changes to the set of offerings or to the terms and conditions of existing offerings. With hundreds of different plans and dozens of different models of phone being offered, this is an impossible task. Mergers of large providers, as happened with Vodafone and 3

(Hutchison), and the adoption of new brand names by some of the smaller players, added to the need to be constantly alert.

We became aware of the flux in the market even before we had discovered all the providers. While we were entering data it was necessary to revisit some providers' websites to check particular details and this often revealed that things had changed. With the end-of-year holiday season approaching, it was necessary to get the survey implemented no later than November before panel members started going away, or delay it until we were some way into the 2011. If the providers unleashed a flood of changes to their offerings in the New Year, then the data entry work so far done on the spreadsheet would have to be thoroughly checked, which would be tantamount to starting from scratch. Because of this, we opted to freeze the choice point for the project as approximately the end of 2011 and run the survey in November. During December 2010, rather than continuing with data entry, we set about trying to store all of the relevant website pages in offline form or, where this proved problematic (for example, due to pages that involves Flash components), by taking screen shots. Given that the data were saved in this way up to six weeks after the survey or, with some of the last companies to be discovered, as much as a month or more into 2011, the set of products for which we compiled data must differ in some respects from the choice set that consumers would have faced, if fully informed, at the time of our survey.

The information that we captured by these means only covered the service plans; it did not include details of which phones were available for each phone-included post-paid plan nor any extra monthly charges that would be incurred (or reductions in 'included value' would occur) if a particular phone

were selected. With major companies each offering a couple of dozen phones and, for any given phone, charging different add-on amounts for different plans, we had neither the time to capture all the relevant web-pages nor the resources then to programme phone-related charges for specific handsets into our calculating engine. To take account of all the handset options would, in effect, have caused massive growth in the total number of plans, yet handsets had to be taken account of one way or another in order to compare plans on a 'like with like' basis when they vary not merely in terms of monthly outlay but in whether or not they included a phone and in the quality of the phone. We attempted to approximate the extent to which differences in monthly costs of rival plans were being driven by differences regarding handsets by estimating typical monthly costs for a number of broad categories of handsets based on typical prices for outright purchase, divided by the number of months covered by the service contract.

Even the estimation of simple rules such as the cost of a typical low-end or high-end 'smart-phone' was bedevilled by Schumpeterian complications. Flux in the prices of handsets may have been more dramatic than in the prices of connection services during the period in which we were collecting our data, for this was the period in which the prices of 'smart-phones' collapsed spectacularly and many of them went from being provided at significant additional monthly fees to '\$0 upfront': for example, a Nokia E71 had a recommended retail price of AU\$709 in August 2008 but by the time of our survey in late 2010 it was commonly being supplied unlocked for AU\$249 and could sometimes be found for as little as AU\$119 in locked form, though its locked price was normally AU\$179–199. This could mean that some of our respondents, with recently

signed contracts, were getting the phone at '\$0 upfront', whereas others, who were well into 24 month contracts, might have been paying as much as \$15-20 extra each month for an identical handset on an otherwise identical plan.

The extent of the fall in prices of handsets caused an unexpected problem for our attempts to find out how far our survey respondents typically spent beyond their 'cap' amount if they were on post-paid contracts. We had asked them what their typically monthly bill was from their mobile phone service provider but had tried to keep matters simple by not asking them to recall how much of their bill was the cost, if any, of their handset. This would have been easy to approximate, had phone costs been stable, from charges for typically classes of handsets combined with respondents' answers to questions about how far they were into their contracts and what category of phone, if any, came with their service. However, with the collapsing prices of handsets, we needed rules of thumb for typical prices of our various categories of handsets at various points in the two years leading up to our survey. Without access to superseded web-pages or 'junk mail' catalogues that listed handset deals offered by phone companies, it becomes necessary to use approximating ruses such as trying to find dated online reviews of handsets that listed their recommended retail prices (RRPs) and then applying a rule about the relationship between typical RRP's and prices actually charged. The obvious lesson here is that, compared with research based on traditional hard-copy archived data, research that uses data from online sources may be biased by categories of data differing in the extent to which they are ephemeral.

The flux in the mobile phone service environment poses a further complication for what we can claim about the efficiency of consumer choices in

this context. As Colton (1993) realized, working out whether to switch between telecommunications service plans requires not merely information about the providers' current set of offers but also conjectures about the set of offers that may become available over the contract duration period of plans that are currently being offered. We did not ask our respondents what their conjectures were regarding innovation and new entry by mobile phone service providers, and neither did we set out to find out what 20:20 hindsight during 2011 and 2012 implied for optimal choices of plans of up to 24 months duration around the end of 2010. Consequently, we may be in danger of overestimating the inefficiency of consumers in our sample who recognized that better deals might be on the way. Our spreadsheet can do calculations that would overwhelm ordinary consumers but it takes no account of how the market may change in future, something that consumers may try to deal with via quite simple option-preserving strategies.

Consider the situation in which there is a chance that better offerings will become available within the coming year or two and there are exit costs for both a consumer's current inefficient plan and for what our spreadsheet computes to be this consumer's 'best-practice' plan of those currently available. Here, it no longer follows that the current 'best-practice' plan suggested by our spreadsheet is the one that this consumer should have favoured. Rather, the optimal strategy might be to stick with the current 'inefficient' plan or, if exit costs from the current plan are low, switch to a more efficient plans that is not current 'best-practice' but has no exit penalty (for example, a pre-paid plan). The present cost penalty incurred to reduce the risk of being locked in by a new exit fee can be seen as a kind of option payment: by running an 'inefficient' plan for several months

and then switching, the consumer may avoid paying exit penalties that would exceed the cost savings on the 'best practice' plan during that period.

This is particularly likely to be an issue where service plans include a handset and consumers are thinking of extending their use of mobile communications services in coming months. For example, it may make no sense to choose the optimal iPhone plan today if one expects that in a few months time much cheaper phones will become available that offer the iPhone features that one wants. In the meantime it may pay to soldier on with what one presently has.

As researchers, we might have tried to deal with this by asking our survey respondents how they saw their future opportunity sets and their intended future use of mobile telecommunications services. However, the limited length of the questionnaire precluded this, leaving us stuck with the 'subjective opportunity cost' problem raised by Buchanan (1969) and contributors to Buchanan and Thirlby (eds) (1973): we cannot make welfare judgements if we cannot fully observe opportunity costs. If we had been able to include questions to overcome this problem our own task would then have been far more complicated since our data set of possible choices would need also to include options that became available in the next year or two after the survey.

The issues discussed in this section are analogous to those raised, in the context of firms, in the debate between Winter (1964, 1971) and Day (1967) about the possible convergence of satisficing behaviour to optimal behaviour and which kinds of behaviour would be selected by the competitive forces of the market. Winter maintained that firms that happen to have selected simple decision rules that enabled them to take decisions rapidly might outperform those that seek to optimize. The latter would diligently gather and process

information before reaching decisions but, by the time they have worked out what to do, the market could have changed yet further and their new strategy could be out of date. Day maintained that, via iterative adjustments to decision rules, the satisficing firms would eventually stumble upon optimal choices and hence the surviving firms would ultimately be optimizing even if all the firms that had been trying to calculate optimal choices had been forced out of business. However, Winter retorted that Day's argument would not hold in a Schumpeterian environment of continual change, so the survivors might simply be those who happened to be using efficient decision rules. In essence we were trying to operate like Winter's optimizing firms and ran into the problem of getting months behind actual consumers as we tried to gather all the relevant information and process it, and we were continually foiled by new entry and new competitive ploys among suppliers. Actual consumers might pay more than necessary because they cut short their decision processes, but at least they have the time to use their phones and 'get a life'. Moreover, some consumers may be using very efficient 'fast and frugal rules'. Consumers who tried, as we did, to work out optimal choices in this context would find it very time consuming and ultimately impossible, and they would get left behind in processes of social competition.

6. The calculating engine

The data gathering problems that we experienced and the complexity of the phone companies' products forced us to make a number of simplifications when constructing the spreadsheet for ranking products by their cost for individuals' usage profiles.

In some cases, the plans were perfectly clear but we had been unable—or had not realized we might need—to ask our survey respondents questions necessary for relating their usage to the terms of the plans. This was not merely in respect of issues such as usage variance or international calls considered in section 3 of this paper, but also in respect of more fine-grained details of mobile phone usage. For example, Go Talk customers receive a 10 per cent bonus on their pre-paid recharges if they recharge via the Internet but we had not thought to ask about recharging method in our survey and therefore we had to leave this out. The providers whose plans we had looked at by the time the questionnaire was finalized had not seemed to distinguish between peak and off-peak charges for calls, so we had not sought to ask respondents to make such distinctions in specifying their typical patterns of usage. However, we later discovered that the peak/off-peak distinction was not yet completely dead as far mobile phones were concerned: one of the small players, People Telecom, offered free calls between People Telecom phones between 7pm and 7am and we made the assumption that half of the on-net calls are made during this time.

The fact that we had not asked our respondents how many days per month they typically used their phones to make use of outgoing services or for uploading data gave rise to a problem with the Optus ‘Dollar Days’ options, for here a customer buys a block of credits with an overall expiry date but individual day-long credits only get used up on days where the customer makes an outgoing call, sends a message or uses the Internet. With no information about the number of days per month in which our survey respondents used their phones, we assumed that they used them on half the days in the month when we calculated what their usage rates would cost them under this plan.

In cases where data had proved impossible to extract from the phone companies, we adopted the rule that we would act as if they did not provide the service for which they would not provide data. We then recorded \$100,000 at the pertinent cell in the spreadsheet so that if this was a service actually used by a consumer in our survey, then the plan in question would come out at the bottom of the ranking that was generated when we ran that consumer's usage profile. We did this even where we knew the service was offered but no price data had been extracted, as with international SMS and MMS services where the providers charged differently for different destinations and refused to provide details unless we specified to which countries these messages would be sent. Clearly, in this sort of case we could have got a better approximation by specifying a representative handful of countries and then averaging the charges.

These data issues aside, the programming of the spreadsheet generally could be seen as an area in which, by applying time and expertise, we could do calculations that would have overloaded ordinary consumers. However, there was one respect in which we still had to worry about our own bounded rationality, namely, the possibility that mistakes had been made during the programming of the spreadsheet. This was more likely with the pre-paid service plans since they had far more variation in format and via the 'add-ons' they offered. Post-paid plans for a given company tended to have common formats, differing in the monthly 'cap' minimum outlay and 'included value', which meant that pro forma programming codes could be used more often.

When we first tried the pre-paid module of the spreadsheet, by inputting a typical low-use profile, the results looked plausible until we scrolled to the lowest ranked plans and saw, at the very bottom, annual outlays of over

\$200,000 despite the plans not including any '\$100,000' cells of the kind explained previously. Clearly, these plans twas wrongly programmed! Further testing of the spreadsheet produced some less dramatic results that did not look quite right and turned out indeed to involve minor programming errors. However, beyond these cases it became increasingly apparent that we might fail to discover other errors without closely revisiting all the programming code as well as checking for data entry errors, for there could be mistakes that resulted in plausible looking predicted outlays for some plans that were actually incorrect, leading to erroneous rankings. At some point, however, we had to satisfice, calling a halt to the testing process and treating the spreadsheet as if it were now a sufficiently reliable black box.

7. Conclusion

The research reported in this paper provides some sobering lessons about the difficulties of taking a behavioural approach to consumer welfare in decision-making contexts that are complex and fast-moving. If the opportunity costs of search and deliberation are as considerable as they are in the case of mobile phone service plans, then it may make little more sense for researchers to throw a lot of resources at the task of uncovering optimal choices than it does for consumers to do so. Both groups must satisfice—the former to reach any research findings, the latter to get on with having the lives that their mobile phones are intended to enhance.

It is in precisely these contexts that we may expect to see firms trying to earn profits by creating market institutions, such as websites, that simplify the decision process for consumers. Such firms may be able to pour far more

resources into providing these aids to choice than are available even to research teams that succeed in winning large grants (for example, see at <http://www.billmonitor.com/the-team.html> the scale of the team at billmonitor.com, the first UK mobile phone service choice website to win official approval from the industry regulator, Ofcom, and which was ‘invented by mathematicians in Oxford’). Given this, an important question for the allocation of resources to analyse decision making in such contexts is whether there is likely to be a social return for academic research that seeks to do better than such institutions at working out what it would have been optimal for particular consumers to choose.

In the project reported in this paper, the central problem was that of gathering data and interpreting it, rather than programming its use. It took months to gather data about what seemed to be more peripheral aspects of mobile phone service plans in order to produce a more thorough calculating engine than the one available at the Phonechoice.com.au website. While we needed to have such a tool for certain aspects of our project, it is debatable whether we were wise to invest considerable resources in building a more comprehensive database, rather than simply cloning what Phonechoice had compiled. We might even have been able to avoid much of the programming costs by forming a research partnership with Phonechoice and applying for an Australian Research Council Linkage Grant, instead of our standalone Discovery Grant, to enable us to employ its calculating engine to study the efficiency of choices by our large sample of subject and test the efficiency of a variety of simple search rules as proxies for its more complex programming. As it was, we were not even able to get a firm idea of the marginal benefits we had achieved

with our more elaborate spreadsheet and calculating engine. Ours was frozen in time around the end of 2010 but there is no 'legacy' version of Phonechoice's website as it stood at that point. For a variety of reasons, it was well into 2011 before we were in a position to input the usage profiles of our survey respondents and record what Phonechoice's top-ranking recommendations were in each case. By then, Phonechoice could have taken account of many changes in the set of available plans.

Issues regarding product data are not the only reasons for limiting the investment of resources in trying to get as close as possible to being able to work out the extent of consumers' decision-making inefficiency. There was also the basic problem of finite memory and attentive capacity limiting how much could be learnt about consumers' preferences, behaviour patterns and choices via detailed surveys. The latter could only be circumvented by the kind of up-close anthropological method advocated by Lavoie (1990), which would preclude getting data from a statistically-useful sample. However, while researchers must therefore satisfice in the face of Buchanan's 'subjective opportunity cost problem', precise knowledge of optimal choices is not essential for understanding the sources of inefficiency or devising methods by which better choices might be made.

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