

Elusive Optima:
Behavioural Welfare Economics in Complex Dynamic Markets

by

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Abstract

This paper examines methodological issues that arise when studying the efficiency of consumer decision making in the context of fast-changing, complex environments via demand-side data gathered using large-sample surveys and the construction of a comprehensive database covering the details of available products. It draws lessons from a project that studied choices of mobile phone service plans by Australian consumers and focuses on how bounded rationality of the researchers interferes with discovering the extent to which boundedly rational consumers waste their money, and whether or not they may be wise to try to cope with the choice problem by outsourcing their decisions to market institutions such as product comparison websites. The paper ends by considering how a behavioural approach to welfare economics might proceed in the absence of optima to serve as reference points.

Keywords: Welfare economics; behavioural economics; survey methods; mobile phone services; Schumpeterian competition

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1. Introduction

This paper is unconventional in that it discusses a well-funded research project on consumer behaviour that was undertaken by its authors but does not report any results from the project. These results will be reported in subsequent articles. Here, instead, we seek to make a humble offering towards filling the gap that Vernon Smith (2008, p. 21) identified when he wrote that '[a] missing chapter in the study of bounded rationality is its application to understanding and accepting with a little humility the severe limitations it imposes on our own professional development of economic theory.' Thus instead of making bold claims for novel findings, this paper has a somewhat confessional tone and its focus is on the challenges posed by modern decision environments characterized by rapid technological change and increasing proliferation and complexity of products. Such environments make life difficult not merely for consumers but also for economists trying to understand how efficiently markets are working and trying to design policies to enhance consumer welfare. The paper discusses these challenges in a context that exemplifies this kind of choice environment, namely, the Australian market for mobile (cell) phone service contracts. From this experience, we draw lessons that apply to conducting welfare analysis in other fast changing and/or complex consumer environments, such as supermarkets, choosing superannuation funds, household electronics products, and tourist accommodation in large cities.

The choice between mobile phone connection plans is particularly challenging in Australia due to the sheer number of options available, the complexity of the pricing

strategies employed, and the prevalence of extensive legalistic ‘fine print’.¹ Consumers find these choices exhausting and distressing (Harrison *et al.*, 2011) and apparently more complex than decisions involving health insurance and superannuation choices (Fear, 2008). 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). However, despite the scale 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 were suboptimal in this context remained an open question. If consumers were making significant mistakes in this market, there was also the question of what kinds of policies might enhance their welfare.

Our study of the Australian mobile phone service market was designed as a multi-methods project. The idea was that it would not merely contribute towards designing new consumer protection policies but also towards being able to provide recommendations about cost-effective ways of undertaking future studies in behavioural welfare economics in similar kinds of contexts. We describe here only the first phase of our project, the goal of which was to evaluate the prevalence and magnitude of consumer errors in choosing mobile phone service plans, as measured by the difference between what consumers actually paid and the lowest price available for

¹ In November 2010, there were over 50 providers of mobile phone services, offering over 800 different types of plan with a roughly equal split between pre- and post-paid options. These are plans that do not include a phone handset as part of the deal. Once phone handset options are included (for postpaid) the number of options increases exponentially.

a service that would have met their requirements.² To do this, we collected data from two sources. The first set came from the mobile phone service providers and enabled us to construct and program a spreadsheet that included details of all the available mobile phone service plans. The second source of data was a large sample survey of the general Australian population from which we obtained information about usage profiles and current plan choices. The spreadsheet made it possible to compare each survey respondent's costs when using their chosen service plan versus the costs for the best available plan in terms of their usage profiles.

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

- Whereas many consumers may lack the necessary skills (e.g. literacy) and may only spend a very limited time gathering information, our highly-trained research team had enough resources 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.

² Later phases of the project focus more on understanding the processes that consumers employ in complex decision-making environments in order to better inform policy. These phases employed different methods: the controlled environment of an experimental economics laboratory and small-sample verbal protocol analysis using methods pioneered by Ericsson and Simon (1993).

We therefore initially presumed we were in a position to make ‘best-practice’ assessments of what consumers ought to have been doing and then draw inferences about how much money they had been wasting. However, we soon ran into the implications of their (and our own) bounded rationality as a constraint on what we could learn about the impact of bounded rationality on the quality of their choices. While we certainly ended up with a far clearer idea of just how challenging the choice of a mobile phone service contract is for consumers and what they would need to be able to do to solve it in a fully rational manner, 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 rest of the paper is structured as follows. Section 2 elaborates the nature of the problem that underpins the paper and the literature pertinent to it. Thereafter, the sequence of material parallels the steps of the decision-making process. Section 3 describes the challenges of identifying the available set of mobile phone service plans, while Section 4 explores the problem of characterizing these plans in the face of their complexity, contractual fine-print, and often opaque or missing information. In Section 5, we discuss how bounded rationality limited our ability to estimate consumer preferences, even if merely approximated by their usage patterns, via a survey. Section 6 considers the challenges of programming the calculating engine to deal with the final stage of the choice problem by finding the best (cheapest) mobile service option for each consumer, given his or her preferences. Having demonstrated the incredible complexity of the choice problem facing both consumers and researchers, which was far more than we anticipated when beginning the project, we briefly discuss in Section 7 the rationality of strategies that consumers may use to cope with the problem, such as outsourcing their choices to the ‘market for preferences’ (Earl and Potts, 2004) or the

use of decision rules. We conclude in section 8 by reflecting on what a behavioural approach to welfare economics can hope to do, and which research methods may be appropriate, if it has to abandon the idea of an optimal reference point.

2. Welfare economics from the behavioural standpoint

From the perspective of traditional microeconomic models of consumer behaviour, complex choice environments are not problematic and an expanding choice set only presents an opportunity. Such models keep things simple for economic theorists by presume consumers are not constrained by finite comprehension and computation skills, so complexity poses no problems. However, a large behavioural economics literature suggests that consumers are susceptible to a wide variety of decision-making heuristics and biases that may result in behaviour at odds with what is considered optimal from the standpoint of rational choice theory (Kahneman, Slovic and Tversky, 1982; Conlisk 1996/2001; Hanson and Kysar, 1999a; DellaVigna, 2009; Kahneman, 2011). Welfare may also be compromised by the wider issue of bounded rationality, associated with problems of gathering and processing information (Simon, 1957, 1959): many real-world choice environments are so complex that the chances of finding the optimal strategy and identifying it as such are limited.

If optimal choices are elusive, consumers may take an easier approach, selecting something that looks adequate for their purposes because it has a familiar brand and/or is the product favoured by other people who seem to be in similar circumstances. Sub-optimal behaviour may involve simply taking the default option of continuing with the supplier they have been using so far or extending their use of a supplier into a new context (for example, from landline phone service to broadband and/or mobile phone service). Failure to switch to cheaper suppliers might also result from hyperbolic

discounting whereby the prospective costs of gathering relevant information and implementing changes are weighted with far higher discount factors than are used for subsequent benefits (Ainslie, 1992; O'Donoghue and Rabin, 1999).

Sub-optimal decision processes may increase the vulnerability of consumers to suppliers' attempts to manipulate their choices (Hanson and Kysar, 1999b; Ellison, 2006; Gabaix and Laibson, 2006). This has led to calls for policy interventions to correct the mistakes that consumers make. Suggested interventions are 'nudges' (Thaler and Sustein, 2008) to deter default-driven choices (Waterson, 2003), information policies such as contract disclosure, and even limiting freedom of choice, which may be welfare enhancing if consumers lack self-control.

The type of welfare analysis required for these modern contexts is clearly very different from that envisaged by traditional welfare economists who viewed consumers as fully rational economic agents with preferences that obey the Von Neumann–Morgenstern axioms (classic sources include Bator, 1957; de Graaff, 1957; and Mishan, 1960). They focused upon the impact of alternative pricing regimes, such as price floors and monopoly prices, on the achievable level of utility and consumer surplus. Their analysis was conducted in terms of representative consumers and was set up in a way that obviated any need to find out what consumer preferences actually were. Indeed, consumers were always optimizing within the bounds of the constraints they faced.

If there are major barriers to optimization, actual behaviour needs to be studied to determine how well consumers are doing compared with how they might be doing, and why, and hence to inform policy interventions. This is especially necessary where the welfare implications of a policy interventions are theoretically unclear because it could benefit some consumers at the expense of others (DellaVigna and Malmendier, 2004; Gabaix and Laibson, 2006). It is here that the methodological challenge at the

heart of this paper arises: if consumers may fail to make optimal choices because of their human failings relative to the idealized agents of traditional economic models, it might also be the case that economists, who are likewise mere humans, could be unable to discover what consumers ideally ought to be doing in a particular context. There might then be no reference point of optimality against which to assess the need for policy intervention. Moreover, if optimal choices are elusive, economists may need to be particularly careful to avoid wasting scarce research resources trying to find them.

3. Identification of available products

One reason consumers may make suboptimal choices is that their search strategies fail to uncover the best options. In a static environment, ignorance of optimal products could arise due to search being confined to a domain that does not contain the optimal product or, if the product is in the domain being searched, asking the wrong questions or not pursuing the search far enough. For example, consumers searching for a mobile phone plan might only inquire at providers' stores in their local shopping mall rather than searching online, or if they do search online might employ restrictive search terms, fail to explore all relevant information, or fail to discover some providers altogether by not digging down far enough in the search results.

Exactly the same problems plague economic researchers. An obvious starting point in our project was to locate a comprehensive list of all providers in Australia. The Telecommunications Industry Ombudsman (TIO) provides a list of its members, which comprise all firms supplying telecommunications services to small businesses and consumers. However, this list was of limited usefulness because it contained over 1500 firms did not classify them by the service offered. We therefore looked for consumer websites that help consumers to choose a plan. The most comprehensive example of

such a service appeared to be the mobiles section of www.phonechoice.com.au. But this could only be a starting point, as we did not know how complete or up to date it was, and it omitted some aspects of the plans such as international services and ‘add-ons’.

Instead, additional providers were located via periodic Google searches, with some providers located beyond the 25th page of Google’s search results! By the time of our survey, we had identified 52 providers, together offering 398 post-paid plans (459 including bundled plans) and 423 pre-paid plans. This does not include all the variations of plans that arise due to choice being allowed for handsets where these are included as part of a plan, often with differences in upfront charges. Given that the larger providers were offering upwards of twenty alternative handsets, the total number of plans effectively on offer numbered many thousands.³

Using this approach, we compiled a comprehensive list of providers offering services in Australia. Since the choice sets of consumers in remote locations are limited to providers with coverage in their area, we compiled a list of providers with coverage in each postal code area and matched this to the postal code of the respondent. The best plan was then computed from those available in the respondent’s location.⁴

A dynamic perspective adds a very different complexion to the nature of the search problem. Errors may be made because, in the time that elapses while search is taking place, new products come on to the market or the specifications of existing products are changed as part of a Schumpeterian process of ‘creative destruction’ (Schumpeter, 1943). In some markets, the pace of change may be manageable for

³ However, we did not attempt to compile information regarding the details of handsets available for each plan, as the exponential growth in available options was beyond even our abilities. We describe in Section 5 how we modified the calculating engine to try to account for the possible inclusion of handsets in postpaid options.

⁴ It is worth noting that because Australia is heavily urbanized those with access to only one provider were few.

consumers: with cars, for example, manufacturers promote their new models heavily at the time of their launch and the risk of buying an about-to-be-discontinued model without the benefit of a 'run out' price can be reduced by using the motoring press as a source of market intelligence. Mobile phone service products present a much bigger challenge. The sheer number on offer, and the subtle differences between them, means that discovering new offers or changes in terms on existing plans is like trying to find the proverbial needle in a haystack. There may be no promotion of the new deal, and no way of getting market intelligence about where or when new deals are imminent. Whilst the consumer or researcher is checking one provider's products, another provider, checked not long before, may be changing its offers. It is even possible to be caught out by a provider changing its offerings while one is checking calculations based on details downloaded only hours earlier—we discovered this the hard way!

If consumers or researchers are trying to gather and evaluate a comprehensive database in such a market, finite search and processing speeds make it impossible to be fully up to date with information about what is available. The consumer simply *has* to stop the search process at some point if a choice is ever to be made. In our study, we made the decision to freeze the data on available plans by creating an offline archive of the providers' websites around the time of our survey.

4. Characterization of the products that have been discovered

Even if consumers succeed in assembling a list of possible choices that includes the product or bundle that would be optimal for them, they may fail to select it if they have trouble gathering and deciphering information about the products they have discovered. Although some aspects of mobile phone services are experience goods, such as mobile coverage and service reliability, accessibility and helpfulness of call centre

staff, and the quality of downloaded services over the duration of any contract, these products should be easier to characterize than, say, consumer durables, because their searchable aspects are essentially prices for different service components (call connection fees, charges per block of time for calls, and so on), rather than different product features. In practice, however, consumers and researchers may both find it very difficult to get this information and interpret it correctly.

For example, it was not obvious from the websites of some of the smaller companies even whether their plans were pre-paid or post-paid and such firms had to be called or emailed to get clarification. It was particularly difficult, and sometimes impossible, to compile details of costs relating to message-bank retrievals, international SMS and MMS and, in some cases, which network the smaller companies were using (which we needed to know in order to determine geographical coverage). Many hours were spent calling providers regarding missing information on their websites, 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. Customer service representatives were often poorly trained, particularly with smaller providers, even to the extent of not knowing what the term 'flag-fall' meant.⁵ 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 Simpliciti 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

⁵ We now realize that since 'flag-fall' has been a distinctive Australian expression, this problem may have been a consequence of providers using overseas call centres with non-Australian staff, who might have better understood the term 'connection fee'.

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. In an attempt to decipher information obtained from service providers' websites, we asked questions at their retail outlets or via their call centres, as consumers would do. If unconvinced by the answer, we asked the question again on another day to another representative of the company in question and were prone to receive a different answer. Even the largest providers, with retail shops, were often unable to answer questions of clarification or, worse still, gave conflicting answers depending on the location or person being asked. Optus, the second largest provider, proved particularly exasperating because of the enormous variety of its plans, complex add-ons and inconsistent advice: most infuriating of all were its 'Dollar Days' plans, which we found very hard to articulate to each other, let alone program into the spreadsheet.⁶

5. Estimating consumer preferences

The task of working out an optimal choice in a particular context goes well beyond the challenge of discovering and accurately characterizing a set of products that is complete or happens to include the one that would be optimal for the consumer in question. The consumer also needs to be able to assess how well each option performs in respect to his or her requirements. In this section, we discuss the challenges in assessing consumer preferences and their expected usage of phone services, focussing on the limitations of survey research involving boundedly rational respondents. We then

⁶ The 'Dollar Days' plans are based on the idea that some consumers do not use their mobile phone services every day. Hence consumers buy blocks of days of service that have an overall expiry date attached to them. A day from a block is only put into use if the purchaser initiates a call, sends a message or uses the Internet; incoming calls do not trigger their use.

discuss several aspects of mobile phone services that are particularly challenging to assess: uncertainty of use, price responsiveness, and bundling of services.

To estimate consumer preferences we asked questions about consumers' mobile phone usage patterns as part of a broader survey questionnaire that also asked about how they chose their plan, past switching behaviour, and various demographic characteristics, including questions to elicit information about their financial literacy. The aim was not merely to understand how much money consumers were wasting in this context but also the drivers of differences between consumers in this respect.

Economists have tended to be sceptical about survey-based research on the basis that respondents might not take the questions seriously or may behave strategically in giving their answers, although the latter seems unlikely in our context. To enhance the reliability of our survey responses we followed best practice (as set out by Dillman, 2009) as well as the advice of the experienced survey company we contracted, when designing both the length and wording of the questions. For example, rather than asking for distributions of usage we asked for typical monthly usage, and the survey length was constrained to a maximum of 25 minutes to minimize respondent fatigue. These constraints meant we could ask consumers neither about every, potentially relevant, detail of their usage nor time-consuming questions requiring reflection or any need to pause to find information.⁷ While these limitations may lessen the precision of our computations, the benefit is enhanced reliability.

One area in which we collected less information than we might have done was the use of international services. Although our survey included questions about the

⁷ Information from past bills would have been especially useful and the fact that bills are often now stored at providers' websites removes the problem that paper bills may have been thrown away. However, calling up online bills would have been likely to cause delays, not merely during downloading but also due to respondents having trouble remembering their passwords. Moreover, if postpaid customers had been asked to provide data from their actual bills there would have been issues of comparability with pre-paid customers who do not receive bills as such.

respondents' usage rates for international SMS and MMS services, the questions we asked regarding international phone calls were very limited, covering their overall frequency 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. The reasons for this were mainly pragmatic; as call costs typically vary according to the country being called, we would have required additional questions with long pull-down menus listing 160+ countries, though its main advantage was in reducing our own information gathering, data entry and programming costs. We also anticipated, correctly so, that very few respondents use such services, so such omissions are inconsequential for most respondents. Nevertheless, for some subjects, this omission could be highly misleading especially with respect to the use of global roaming services.⁸

A particularly challenging aspect of the consumer's choice problem is dealing with uncertainty. In the mobile services market there are numerous dimensions to this uncertainty, beginning with uncertainty about the rate at which consumers may want to use particular services and about whether these will actually be available (as with service coverage in particular locations). Where consumers have to commit themselves to durable products or service contracts that run for many months, it may be difficult for them to know how much use they will actually make of the various capabilities to

⁸ Since we know whether or not each respondent makes international calls we can include a flag to this effect. But we do not know whether they use international roaming services if actually overseas. The latter may not be insignificant. For example, a very low user may travel overseas occasionally and incur 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.

which they obtain access. This is particularly so if the consumer is new to the class of product and needs to get accustomed to using it, if the consumer's lifestyle has elements that are hard to predict, or if service options might evolve in unanticipated ways—witness the rapid rise of Facebook and Twitter.

Consider the issue of 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 not just because of different relative prices within each plan but also 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 or indeed even conceptualising this uncertainty in a meaningful way. While consumers on 'cap' plans may vividly remember bills that were way over their plan's minimum monthly charges, 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. It is the latter that the researcher needs to know in order to understand whether, assuming their expectations are correct, they are making erroneous choices. If such information is not gathered, there is a risk of drawing incorrect inferences: some consumer may anticipate changes in their circumstances over the planning period and factor this into their choices of service plan. Where consumers fail to form expectations about how their lifestyles may change over the next couple of years, working out what their optimal choices would be requires modelling

what usage variance they *ought* to have been expecting at the time of the survey given their particular kinds of demographic and lifestyle characteristics. However, to derive these 'rational expectations', it would still be necessary to obtain sample-wide information about recent variance in usage and then presume that this pattern would hold for the population in the near future. Such an inductive strategy might not be wise (particularly for a survey conducted in late 2010) given the potential for major changes in how people use their mobile phones due to the spread of social media such as Facebook and Twitter.

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. We also doubted the reliability of more detailed questions aimed at extracting a probability distribution of past or future usage. 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 took the answers about 'typical monthly usage' of various services from those who used 'cap'-based plans into the parameters of their chosen plan and estimated what percentage of their plan's 'included value' they might typically use. Better still, we simulated 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

respondents succumbing to heuristics and biases if asked to report on or estimate their usage variability.⁹

Next, consider the sensitivity of consumers to differences in relative prices. 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 therefore needed to be able to infer each subject's demand system for the differently priced mobile phone services, also taking account of their willingness to pay for different performance levels on non-price characteristics.

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 consequently 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. Our results would thus be 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. 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.

⁹ Risk preferences clearly also play a role in these decisions. The spreadsheet assumes the consumer minimizes the expected cost and is hence risk neutral. A measure of risk preference is included in the demographic characteristics also collected in the survey, therefore we can attempt to control for this.

Thirdly, consider the issue of product 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 (post-paid) mobile phone service with another kind of service that their provider offered. However, we did not ask how much they saved via bundling as we expected to be able to infer this from the providers' websites and we doubted recall ability about this. In many cases, such inferences were indeed possible, as bundling discounts were of fixed amounts, but some companies offered bundling discounts as a percentage of the total bill for the bundled services. In such cases, we assumed 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 inferred the discount via the answer given for the typical monthly outlay on mobile phone services.

Bundling of telecommunications phone services is only one aspect of complementarity between mobile phone service plans and other products. Consumers with Bluetooth connectivity in their cars, for example, are less likely to use message bank services as they can attend to calls whilst driving. With this capability becoming more common, we should have asked our respondents what was the probability of them buying a car with this capability in the near future. There was no room to do this so we simply had to assume that respondents had been mindful of this issue when providing their answers regarding their typical message bank usage.

Finally, consider the implications of flux in the mobile phone service environment for the set of questions we ideally needed to ask in order to discover how efficiently consumers were choosing. 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. We did not ask our respondents what their conjectures were regarding changes in terms or 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 both for 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.¹⁰

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 services. The trouble was that limited length of the questionnaire precluded attempts to uncover such instances of ‘method in the madness’ of some respondents’ seemingly expensive choices; one also doubts the ability of some respondents to articulate answer such questions. Moreover, if we had been able to include additional questions to discover how rational consumers’ expectations were about upcoming plans and handsets, 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.

From a psychological perspective, a further ‘method in apparent madness’ issue that we would dearly like to have explored was the role of self-control strategies in the selection of pre-paid plans. Pre-paid phone plans that seemed to be more expensive than post-paid plans would have been for their usage levels were possibly being chosen, and opportunities to have automatic recharges via credit card not being chosen, by some consumers as means of limiting their monthly use of their phones, and hence their overall outlay.

The limits to the number of questions that we could ask thus left us with the ‘subjective opportunity cost’ problem raised by Buchanan (1969) and contributors to

¹⁰ Flux in the prices of handsets was even more dramatic than in the prices of connection services during the period in which we were collecting our data, as 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 late 2010 was commonly being supplied (unlocked) for AU\$249, and sometimes for as little as AU\$119 in locked form, though its locked price was normally AU\$179–199.

Buchanan and Thirlby (eds) (1973): we cannot make welfare judgements if we cannot fully uncover opportunity costs.

6. Constructing the calculating engine

Even if consumers know what they want, and the optimal plan is in the list of products they consider, they may still make sub-optimal choices due to the information processing challenges with which they have to deal. Consumers may make computational errors or use simplifying decision rules (for example, using the cost of a two-minute call as a proxy for the overall value for money offered by any mobile phone service plan), even if they do not also succumb to the kinds of heuristics and biases emphasized in modern behavioural economics. The accuracy of such rules may fall well short of what Gigerenzer and Goldstein (1996) have in mind when they discuss the possibility of consumers using decision rules that are both ‘fast and frugal’. In principle, a team of well-trained researchers armed with computational tools ought to be more able than consumers to rank products accurately, by computing the cost of each option. In practice, matters are not so straightforward: bounded rationality impinges both on the gathering of information about preferences and on the construction of a calculating engine to rank products.

As discussed in the previous sections, we were not able to measure all the relevant aspects of consumer preferences, nor indeed always able to compile (or confidently interpret) the necessary information for each available option. The data-gathering problems that we experienced and the complexity of the phone companies’ products forced us to make a number of simplifying assumptions when constructing the spreadsheet for ranking products by their cost for individuals’ usage profiles. For example, to deal with cases of missing price information (as discussed in Section 4) we

recorded a ridiculously high price (\$100,000) for the service. This ensured that the plan was never the preferred option for a consumer who used that particular service (and indeed was at the bottom of the ranking).¹¹

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 the detailed 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, but also regarding more fine-grained details of mobile phone usage. For example, Go Talk customers received a 10 per cent bonus on their pre-paid recharges if they recharged via the Internet but we had not thought to ask about recharging method in our survey and therefore we had to leave this out. One of the small players, People Telecom, offered free calls between People Telecom phones due off-peak hours but because very few providers distinguished between peak and off-peak charges for calls, we did not ask respondents to make such distinctions in specifying their typical patterns of usage. Instead, we assumed that half of the on-net calls were made during this time. The fact that we had not asked our respondents how many days per month they typically used their phones gave rise to a problem with the Optus ‘Dollar Days’ plans, where individual day-long credits only get used up on days where the customer uses the service.

To find the best plan required an assumption regarding the appropriate planning horizon to employ, which was particularly important with post-paid contracts, but also relevant for some prepaid options with a long (up to 365 days) credit expiry. We decided to compute the plan costs over a 12-month horizon. In the case of post-paid options, two additional complications arose: the potential inclusion of a handset, and

¹¹ In cases where providers charged differently for different international destinations, and refused to provide details unless we specified the recipient country, we might have got a better approximation by specifying a representative handful of countries and then averaging the charges.

exit fees from any existing contract. We asked survey respondents whether or not they were on a contract, and if so, the time remaining, along with the type of handset included (if any). Given the number of months remaining on their existing contract, we were able to compute the appropriate exit fee and combine this with the monthly cost savings to compute the payback period (in months) of shifting to the optimal plan. As noted in Section 3, we did not include in the set of available options all possible permutations involving handsets because of the proliferation of these alternatives. Nevertheless, we attempted to account for this within our calculating engine by generating some simple rules of thumb to ensure we were comparing options on a 'like with like' basis. For example, we needed to add to cheaper plans the cost of upgrading to a more sophisticated phone than was included, if that is what the consumer currently had.¹²

These issues aside, the programming of the spreadsheet was an area in which, by applying time and expertise, we could do calculations that would have overloaded ordinary consumers. However, there was one aspect where we had to worry about our own bounded rationality, namely, the possibility of programming mistakes. 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. Initially implausibly large values were relatively easy to find and the errors corrected. However, less dramatic errors proved harder to uncover, and it became increasingly apparent that we might overlook other errors unless we closely revisiting all the programming

¹² In the absence of archived webpages, we developed our rules of thumb with the aid of superseded copied of handset retailers' hard-copy catalogues and online reviews of handsets. Details are available from the authors.

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 by halting the testing process and treating the spreadsheet as if it were now a sufficiently reliable black box.

7. Alternative rationality perspectives

With hindsight, we would not advocate trying to discover optimal choices in complex and fast-changing decision environments. We had presumed there existed choices that would have been optimal for consumers given their goals and we were trying to identify these choices, at least in some ‘best-practice’ sense. Any departure of actual choices from those described as ‘best-practice’ would be characterized as an error (subject of course to caveats about the completeness and assumptions underlying our spreadsheet) according to the standard economic model. It was an exercise in what Smith (2008) calls ‘constructivist rationality’ and what Simon (1976) labelled ‘substantive rationality’. The trouble is, optima are elusive in this kind of context and there is even the risk of labelling consumers as wasting money when they are using products that they rightly believe they should be using given their conjectures about their future needs and products that are likely to become available.

At best, the combination of our survey data and our calculating engine can only be regarded as capable of giving broad indications of the extent to which consumers are wasting their money on their mobile phone service plans. It may serve reasonably well as a means of indicating gross errors, such as the incidence of low-usage consumers who are buying ‘cap’-based plans with far more ‘included value’ than they are likely normally to need rather than simply using pre-paid plans, or heavy users who could

save considerable sums by sacrificing the seeming predictability of pre-paid services and signing up for post-paid plans with lower marginal usage costs. However, it would be most unwise to make precise statistical claims about the extent of errors.

The good news is that, for policy purposes, there is no need for reference points that are constructively or substantively rational. Rather, the issue is whether it is possible to identify means through which consumers might readily be able to increase their chances of taking better decisions even if neither they nor the policy designers are ever going to be able to know what the best decision would have been. From this standpoint, the focus needs to be not on *what* people choose relative to some optimal reference point but on *how* choices in the market in question are made. The reference point thus becomes Simon's (1976) notion of 'procedural rationality', and Smith's (2008) 'ecological rationality'. A decision displays procedural rationality if it is 'the outcome of appropriate deliberation' (Simon, 1976, p. 131) and can be considered ecologically rational if it follows norms and institutions that have emerged via evolutionary selection processes as devices that facilitate spontaneous order.

For behavioural economists, procedural rationality should have an obvious appeal as a point of reference in contexts of the kind addressed in this paper. Departures from procedural rationality can arise for 'heuristics and biases' reasons in the sense that consumers may fail to use appropriate procedures, such as not applying Bayes's algorithm when using new information to revise probabilities (as emphasized in Kahneman, 2011; see also Simon 1976, p. 134), but consumers may also fail to use 'fast and frugal' decision rules that, though not guaranteed to be fully reliable, have been identified as offering acceptable rates of success. However, modern behavioural economists mostly seem oblivious of Simon's work and have tended to act as if conflating substantive and procedural views of rationality: they presume optimal

choices can be identified (which invariably is possible in the kinds of simple betting choices that dominate their literature) and then berate consumers for going about choosing in the wrong way.

Simon's definition of procedural rationality seems to beg the question of how a decision-making process can be judged as involving appropriate deliberation. From the 'substantive'/'constructivist' standpoint, it may seem natural to try to frame 'appropriate' from an 'information economics' perspective, that is, by giving due consideration to probable marginal costs and benefits of search and additional computation, given the risk of not discovering anything worthwhile (Stigler, 1961) or making processing errors due to having more information to process (Heiner, 1986). However, if the probabilities are not known at the outset, it is not possible to specify how far to go with search on the basis of expected marginal costs and benefits. To deal with this underlying infinite regress problem, it seems logical that some form of satisficing is appropriate when deliberating (Winter, 1964) — in other words, that the appropriate reference point is procedural rationality, with behavioural studies or simulations being used to determine what stopping rule is appropriate for the context at hand.

As far as ecological rationality is concerned, the key question is whether departing from conventional practices and ignoring market institutions will result in decision-makers becoming needlessly disadvantaged in processes of social competition and unduly hampered in their ability to make useful cooperative contributions to their social groups. Consumers clearly would have been neither procedurally nor ecologically rational if they tried to find their optimal mobile phone service plan by researching the market as thoroughly as we did and doing the kinds of calculations that we programmed our spreadsheet to do: the choice process would be interminable and all

the while they would be socially compromised because of their failure to commit to a mobile phone service.

From the ecological/procedural rationality perspective, it seems likely that individuals will make needlessly poor choices if they try to 'go it alone' in challenging decision environments instead of trying to call upon a wider pool of cognitive capacity via what Earl and Potts (2004) call the 'market for preferences'. In markets where it is hard to work out the best choice, there may be profit opportunities awaiting entrepreneurs who are prepared to incur the costs of investing in supplying specialist services that enables consumers to outsource their choices and thereby reduce the risk of major mistakes . With the advent of the Internet, such services can easily be automated and run at zero marginal cost, while still being tailored to individual consumers. Evidence of how much brain power it may be profitable to assemble in the case of mobile phone services can be seen at www.billmonitor.com/the-team.html, 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'.

In our Australian study, we asked our survey respondents whether they had used services such as that provided by Billlmonitor's local equivalent www.phonechoice.com.au, but we did not establish whether they actually followed this service's recommendation. At the time we began work on the project, Phonechoice did not offer individually-tailored recommendations; rather, consumers had to make do with a choice of four stereotypical usage profiles (low use, medium use, high use, and student). More recently, however, Phonechoice has begun allowing consumers to input their own usage patterns for domestic services. The service does not model usage variance but does provide a graphical indication of the fraction of purchased service used in a typical month.

To judge how appropriate it is for consumers to outsource their choices to such services, the question that needs to be answered is whether consumers who use such services make savings compared with those who have similar usage profiles but make their choices without availing themselves of these services. It is not necessary to establish how close the service comes to 'best-practice'. Nor was it possible to do so in our study: our own calculating engine was frozen in time around the end of 2010, whereas the Phonechoice service was continually being updated and improved, with no incentive for the service to offer any legacy versions. To get the best approximation for the accuracy of the Phonechoice service versus our calculating engine, we should have entered the usage profiles of our respondents into the Phonechoice calculating engine the moment that we received their data from the company that administered the survey. We did not do this, as it required manually entering usage data for around 1000 respondents and we were still trying to construct our own spreadsheet. We simply did not have the resources to do this. Ultimately, it was impossible to observe how well Phonechoice was actually keeping its service up to date or be sure of how complete and accurate it was.

8. Conclusion

Where market environments are complex and changing rapidly, optimal choices may be impossible to discover. Researchers may throw considerable resources at finding what it would have been optimal for consumers to do but end up unsure of the extent of errors or how efficient the market for preferences is in the context in question. Consumers could well be wasting some of their money, but attempts to find out what they ought to have been doing might be a waste of money, too.

The problem of elusive optima in consumer research has an important parallel, in the context of the theory of the firm, 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 (see also the discussion of Winter's work in Elster, 1984). 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 more 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 be left behind in processes of social competition.

The key lesson from our study is that in taking a behavioural approach to welfare economics in complex, fast changing markets, researchers should not devote resources to uncovering elusive optima. Instead, their focus should be on discovering how consumers may easily improve upon the choices they made, why they were failing to do so, and what policies might best help them into using better decision-making strategies. Economists might assess the efficiency of consumer choices in terms of reasonable rules of thumb rather than with reference to an optimal choice. For example, if the average post-tax wage is \$1000 per week, and spending 15 minutes on the Internet and following a simple search routine could save an average person \$200 a year on their mobile phone plan, then we might say that we have a case for considering policies to enhance the quality of choices in this context.

Alternative approaches to welfare economics would involve trying to discover what works well as 'fast and frugal' decision rules in the context in question, and which commonly used decision rules consumers need to be discouraged from using. To some extent this could involve researchers in devising rules from first principles and then testing them (as in Spearritt, 2011), but it could also entail discovering the rules used by different consumers and studying the outcomes they generate. Large-sample surveys might be able to use short questionnaires that focus on choice and usage and simply ask, 'Please tell us in no more than a few sentences how you made your choice'. However, if there is to be no attempt to find optimal choices, then protocol analysis and experimental economics approaches might be more obvious starting points, with experimental economics having the advantage of offering potential to test policies for improving choices.

Unfortunately, in the light of Waterson (2003), it seems necessary to recognize that even this more modest approach to behavioural welfare economics may be

compromised by the failure of markets to stand still. Waterson points out that regulatory policies aimed to protect consumers against one kind of practice may be undermined by firms changing their strategies to exert leverage on consumer choice in other areas. If policies involve promoting the use of particular decision rules, then we may expect firms to redesign their strategies to take advantage of the limitations of the rules being advocated. Thus conducting welfare analysis and suggesting policy interventions in complex dynamic markets, which look only set to become more common, will continue to pose challenges for economists, both methodologically and practically.

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