

Consumer benefits resulting from Australia's telecommunications sector

Methodology

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Aim of report

Section 105 (1) of the *Telecommunications Act 1997* (the Act) requires the Australian Communications and Media Authority (ACMA) to report each financial year on the performance of carriers and carriage service providers with particular reference to:

- > consumer satisfaction
- > consumer benefits
- > quality of service.

The aim of this report is to outline the methodology used to measure the consumer benefits derived from changes in the telecommunications sector between 2007–08 and 2008–09. Changes in price and the quantity used for a range of telecommunications services for the period are reported, with data available for the following services:

- > mobile calls
- > Short Message Services (SMS) and Multimedia Messaging Services (MMS)
- > fixed-line access
- > fixed-line local call
- > fixed-line national calls
- > fixed-line international calls
- > fixed-to-mobile calls
- > internet data.

Using this data, the change in consumer benefits for the year 2008–09 for each service as well as for the total bundle of telecommunications services is estimated. These estimates are Australia-wide.

The methodology used in this report equates consumer benefits (the language used in the *Telecommunications Act 1997 (the Act)*) with the standard economic concept of consumer surplus. A positive estimate for the change in consumer surplus implies increasing consumer benefits and a negative estimate for the change in consumer surplus implies decreasing consumer benefits. The Department of Communications, Information Technology and the Arts employed a similar methodology in the report titled *Benefits to Consumers of Telecommunications Services in Australia 1995–96 to 1999–2000*.¹ Additionally, Ofcom (via a consultancy) has employed a methodology that estimated the consumer surplus associated with ‘the economic impact of the use of radio spectrum in the UK’.²

What is consumer surplus?

Consumer surplus for a customer in a market is the difference in the amount that a customer would be willing to pay for a good or service and the price that they actually pay.

The amount that a customer is willing to pay is that customer’s ‘walk-away’ valuation of the good or service, that is, the price beyond which they will no longer be willing even to negotiate. Another term for ‘willingness to pay’ is reservation price. This value or ‘price’ is information privately held by the customer and not revealed to a seller. The price actually paid by a customer is invariably lower than a customer’s reservation price and the larger

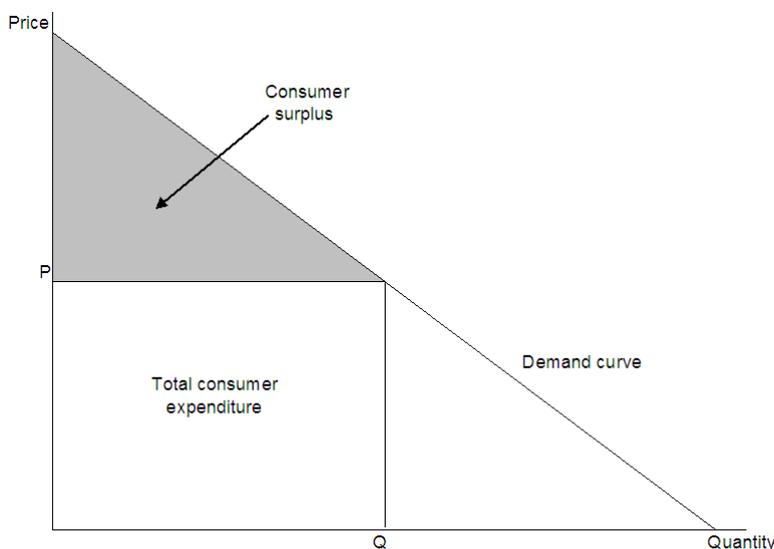
¹ Collins, P., M. McCutcheon and E. Osiowy (2000) *Benefits to Consumers of Telecommunications Services in Australia 1995–96 to 1999–2000*. Report prepared by the Department of Communications, Information Technology and the Arts for the Australian Communications Authority.

² Europe Economics (2006) *Economic Impact of the Use of Radio Spectrum in the UK*. Report prepared for Ofcom. Available at:
www.ofcom.org.uk/research/radiocomms/reports/economic_spectrum_use/economic_impact.pdf

the gap between the two, the greater the feeling the customer has of having received a 'bargain'. Bargaining is the process by which a customer attempts to increase this gap. The size of the gap (the consumer surplus) is consequently a measure of a customer's relative 'happiness' or 'benefit' arising out of the transaction.

The consumer surplus for a whole market is derived by adding the consumer surpluses of all customers in the market. Figure 1 shows a demand curve in a particular (generic) market.³ As with any market-pricing diagram, price is depicted along the vertical axis and quantity demanded is depicted along the horizontal axis. A demand curve is a plot of all reservation prices of all customers in that market. If the actual price paid by each customer is the same (represented by the horizontal line at P in Figure 1) then the shaded triangle is the consumer surplus for that market—it is the sum of the individual consumer surpluses of all those customers in the market who actually bought the good or service at the going price P.

Figure 1 Consumer surplus in a generic market diagram



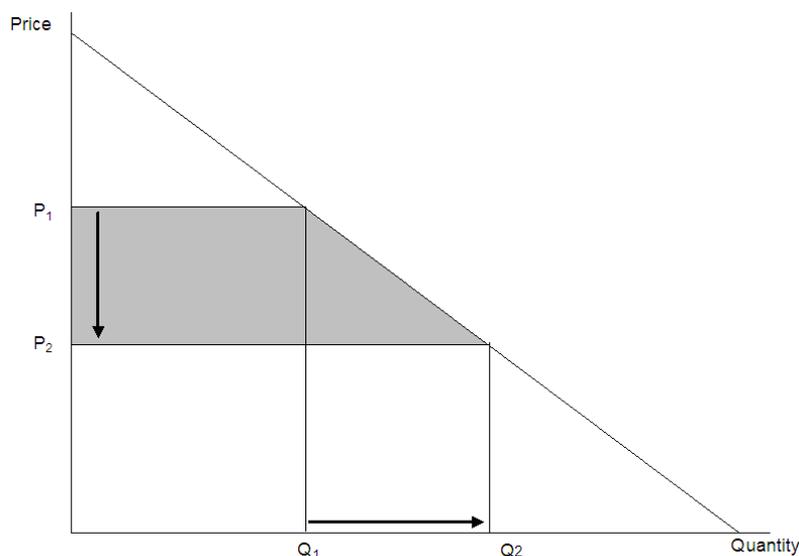
What changes consumer surplus?

Consumer surplus will alter with a change in price or with a change in a non-price characteristic (such as quality or delivery time) of a good or service.

A change in price is expected to result in a change in the total quantity consumed. As exhibited in Figure 2, a reduction in price from P1 to P2 results in a higher quantity of the good or service being consumed (from Q1 to Q2). Since consumers' valuations of a good or service do not change with a change in price, the fall in price increases consumer surplus in the market. The increase in consumer surplus due to a price decrease is represented by the shaded area in Figure 2.

³ The ACMA is employing Marshallian demand curves, in which income and the prices of other goods are assumed to remain constant: Marshall, A. (1930) *Principles of Economics*. 8th edn. MacMillan and Co., London. In empirical work this assumption is largely without consequence: Willig, R (1976) 'Consumer's Surplus Without Apology', *American Economic Review*, 66(4), p. 589-597.

Figure 2 Increase in consumer surplus due to a decrease in price



While the reservation prices of customers do not alter with a change in price, there are other (non-price) factors that may change customers' reservation prices. Consequently, a change in one or more of these non-price characteristics of a good or service affects consumer surplus. It does so by shifting the demand curve.

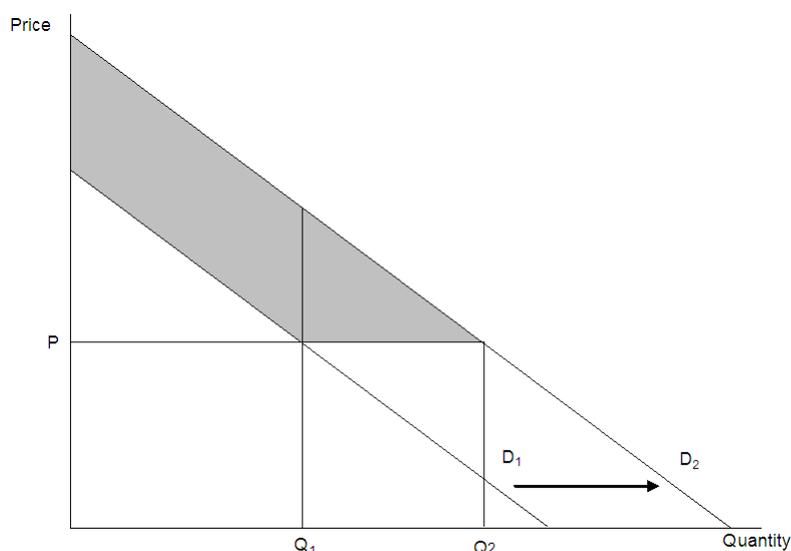
Non-price factors that have the potential—were they to change—to influence consumer surplus in a market are many, and may include:

- > the price and quality of substitute products
- > the price and quality of complement products
- > quality of service
- > the income of customers
- > the tastes and preferences of customers.

Depending on the direction of change in these (and other) non-price factors, the demand curve might shift up or down, thus leading to an increase or decrease in consumer surplus in the market even if the market price for the good or service within the market remains constant.

In the telecommunications context, this occurs when, say, the consumption of mobile calls increases as a result of an increase in the price of fixed-line local calls. As shown in Figure 3, an increase in the price of the substitute service (local calls) pushes the demand for mobile telephone services out and to the right (from D1 to D2). In other words, all customers in the mobile telephone services market now value those services more. This means that a consumer would be willing to consume more at any given price (so at price P, the quantity demanded of mobile telephone services increases from Q1 to Q2). As a result, consumer surplus in the market for mobile telephone services increases as represented by the shaded area in Figure 3.

Figure 3 Increase in consumer surplus due to an increase in the price of a substitute good or service (a non-price factor)



How to measure changes in consumer surplus over a year

Changes in both price and non-price factors impact consumer surplus. Diagrammatically, changes in price factors are represented by a movement along the demand curve, while changes in non-price factors are represented by a movement of the demand curve.

There are three steps involved in teasing apart the twin impacts of both price and non-price factors. The first step involves distinguishing between movements along and movements of the demand curve, the second step involves measuring the changes in consumer surplus resulting from changes in price, and the third step involves measuring the changes in consumer surplus resulting from changes in non-price factors.

Step 1: Distinguishing between movements along and movements of the demand curve for other services

Our starting point is to assume that changes in price and quantity result from shifts of the supply curve. Given available data it is difficult to distinguish between shifts in the demand curve and movements along the demand curve for many services.

For those services where the data showed changes in price and quantity which would be consistent with movements along a fixed, downward sloping demand curve, we adopted the assumption that the demand curve had not shifted.⁴

Step 2: Measuring the change in consumer surplus resulting from changes in price

We are able to estimate the change in consumer surplus using data on the change in the average price and average quantity of a service used for the year.

For each service we assess the change in aggregate consumer surplus by considering first the change in the price and quantity consumed by an individual (representative) consumer, and then multiplying this by the number of consumers.

⁴ Such consistent changes would be decreases (increases) in price being associated with increases (decreases) in the quantity used.

For some services, consumer surplus is likely to increase. For others, consumer surplus may fall. For example, the number of fixed-line access subscribers fell between 2005–06 and 2006–07 and the price (basic access charges per subscriber) increased. As a result, consumer surplus derived from that service fell during that year.

The equation used to measure the change in consumer surplus resulting from changes in price is represented graphically on Figure 4 below. The grey shaded area is the change in consumer surplus. Available data includes the points P1 (Average Revenue per User (ARPU) in 2007–08), P2 (ARPU in 2008–09), Q1 (quantity in 2007–08) and Q2 (quantity in 2008–09).⁵

The relevant equation:

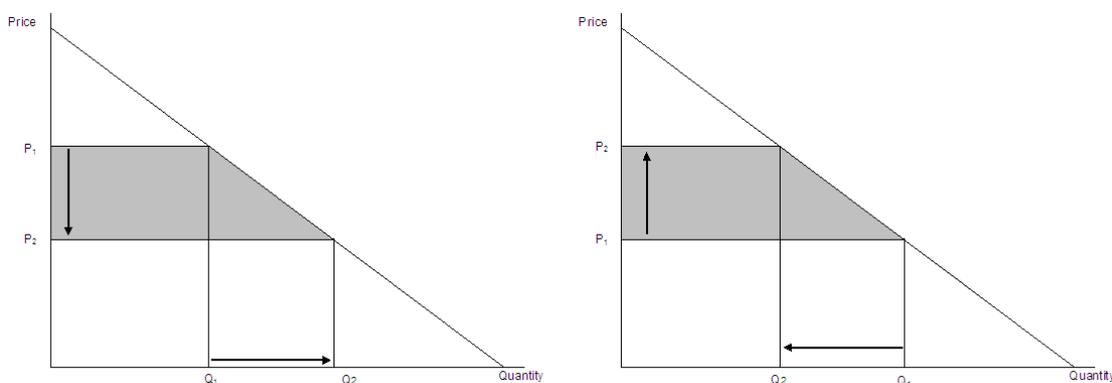
- > for services where price falls and quantity increases (the left-hand chart of Figure 4), is:⁶

$$\Delta CS = ((P_1 - P_2) * Q_1) + (1/2 * (P_1 - P_2) * (Q_2 - Q_1))$$

- > for services where price increases and quantity falls (the right-hand chart of Figure 4), is:

$$\Delta CS = ((P_2 - P_1) * Q_2) + (1/2 * (P_2 - P_1) * (Q_1 - Q_2))$$

Figure 4 Change in consumer surplus due to a change in price



Step 3: Measuring the change in consumer surplus resulting from changes in non-price factors

For some services, the price and quantity data may clearly indicate that both the supply and demand curves are shifting. A price decrease accompanied by a decrease in quantity demanded (or a price increase accompanied by an increase in quantity demanded) cannot be solely explained by a shift of the supply curve. When this is the case, our estimate of consumer surplus takes this into account.

For services such as these we will require estimates of the price elasticity of demand in order to calculate the change in consumer surplus (see below for more on this). Price elasticity of demand is a measure of the movement along the demand curve for a given

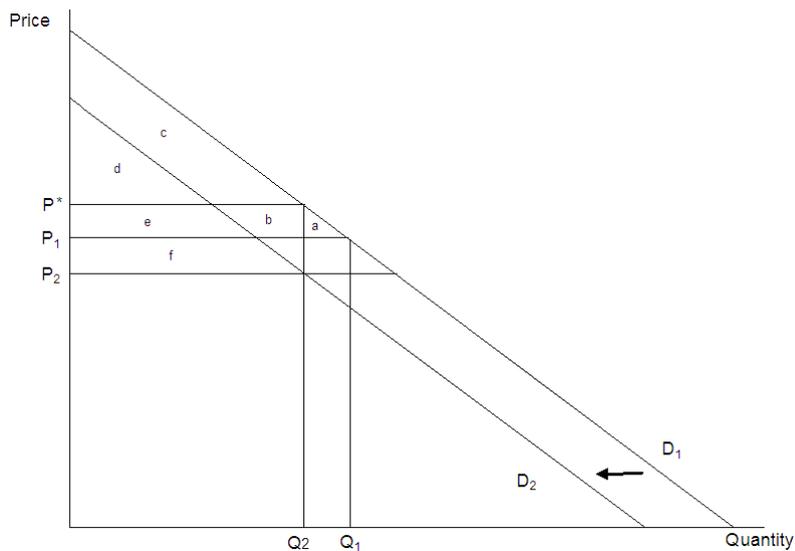
⁵ ARPU is average revenue per user (or unit).

⁶ CS is consumer surplus.

change in price.⁷ Estimates are often obtained using historic data from actual consumer behaviour.⁸

In Figure 5 below, price falls from P_1 to P_2 , but rather than increasing to a new point on demand curve D_1 , quantity decreases, which suggests that the shift in the demand curve is greater than the shift in supply.

Figure 5 Measuring the change in consumer surplus resulting from changes in non-price factors



Assuming a parallel downwards shift of the demand curve by amount $P^* - P_2$ consumer surplus has unambiguously decreased. Consumer surplus changes from:

$$a + b + c + d + e$$

to

$$d + e + f$$

By geometry, the area $c + d$ is equal to the area $d + e + f$ so the resulting loss of consumer surplus is $a + b + e$. This can be estimated as the difference in price $P^* - P_1$ over quantities up to Q_2 plus the difference between price and willingness to pay for quantities from Q_2 to Q_1

$$((P^* - P_1) \times Q_2) + (1/2 (P^* - P_1) \times (Q_1 - Q_2))$$

When estimating the increase in consumer surplus associated with a rise in prices and a rise in demand, an analogous process can be followed.

In Figure 5 above, in order to find the area $a + b + e$ it was necessary to estimate P^* .

The steeper the demand curve, the greater is the difference between P_2 and P^* .

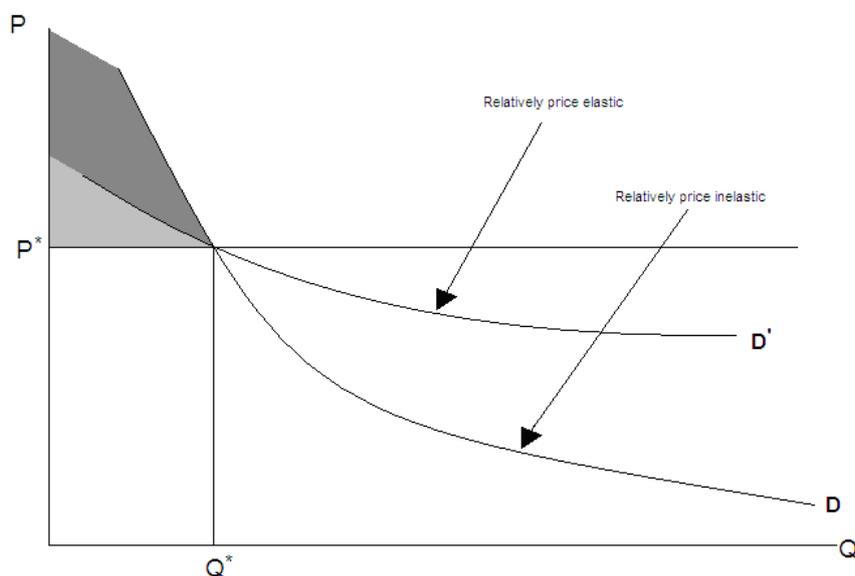
For an increase in price accompanied by an increase in quantity, the change in consumer surplus is greater with a relatively inelastic demand curve. While elasticity is not

⁷ More precisely, it is the ratio of the percentage change in quantity for a percentage change in price.

⁸ See below for the source of elasticities estimates used in ACMA's modelling.

synonymous with slope, at any given point, the more inelastic the curve, the greater the slope (see Figure 6).

Figure 6 Role of elasticity on consumer surplus



In order to measure the change in consumer surplus resulting from changes in non-price factors, we need estimates of the price elasticity of demand for the telecommunication service. From the price and quantity data, it is clear that the demand curves are shifting for three of the eight telecommunications services covered in this report, and thus these require the use of price elasticity of demand in order to calculate the change in consumer surplus, as outlined above. Those services are local, national and international fixed-line telephone services.

The estimates used in this report are sourced from a 2003 study by Vodafone New Zealand, *Review of Price Elasticities of Demand of Fixed-Line and Mobile Telecommunications Services*,⁹ which usefully surveys prior studies of international demand elasticities.

Summary of main assumptions

This section has described the general theory of consumer surplus and the ACMA's methodology used for estimating changes in consumer surplus. These modelling assumptions are:

- 1/ demand is linear in functional form
- 2/ changes in demand are represented only as parallel shifts
- 3/ both demand and supply are calculated over a two-year period
- 4/ demand elasticities (which are required for four services only) are sourced from an international review by Vodafone
- 5/ a strict partial equilibrium approach is used.

⁹ Vodafone New Zealand (2003) *Review of Price Elasticities of Demand of Fixed-Line and Mobile Telecommunications Services*. Available at:

www.comcom.govt.nz/IndustryRegulation/Telecommunications/TelecommunicationsServiceObligations/ContentFiles/Documents/Vodafone%20paper%20on%20price%20elasticities%20for%20weighted%20revenues%20approach1.PDF

Data source

Table 1 below shows, for each telecommunication service examined in this report, the price and quantity variable chosen for the purpose of the modelling used to estimate consumer surplus.

Table 1 Price and quantity variables used in the modelling of changes in consumer surplus

	Price variable	Quantity variable
Mobile calls	Average revenue per call minute	Call minutes per subscriber
SMS and MMS	Average revenue per SMS/MMS	Number of SMS/MMS sent per subscriber
Fixed-line access	Average revenue per subscriber	Number of subscribers
Fixed-line local call	Average revenue per call minute	Call minutes per subscriber
Fixed-line national calls	Average revenue per call minute	Call minutes per subscriber
Fixed-line international calls	Average revenue per call minute	Call minutes per subscriber
Fixed-to-mobile calls	Average revenue per call minute	Call minutes per subscriber
Internet data	Average revenue per GB downloaded	GB downloaded per subscriber

The telecommunications carriers provided the key data used in this report (at the ACMA's request). The data they provided was at the retail level.¹⁰ For internet and SMS/MMS services, the ACMA's data request (as in previous years) was for the period April 2008 to March 2009. For fixed-line and mobile phone services (excluding SMS/MMS), the ACMA's data request was for the period July 2008 to June 2009.

¹⁰ The data reported in this report may vary from data reported by other agencies (such as the Australian Bureau of Statistics). The difference is due to the fact that this is a distinct data request used specifically for the Consumer Benefits report.