The CIE

Australia's telecommunications market structure

The price premium paid by consumers

Contents

Executive summary

Australian telecommunications consumers pay a substantial price premium because of the unique structural characteristics of the Australian telecommunications market.

- Australian households pay a substantial price premium for the incumbent, Telstra, over other operators in both fixed line and mobile services.
- **The premium for using Telstra over other operators is $20 per month for fixed line services and $9 per month for mobile services.**
- The level of price premium for the incumbent in the Australian market does not appear in overseas markets considered. This suggests that structural issues are limiting the ability for competition to drive down market rents.
- **The additional cost to households of telecommunications services from this premium amounts to $3.1 billion per year.**

To put the premium paid by Telstra consumers into perspective:

- The introduction of the carbon tax led to consumers paying in the order of $1.3 billion more for electricity per year.
- The premium paid is equivalent to a 15 cent per litre increase in fuel prices.
- The premium paid is equivalent to each Australian person receiving an additional 3GB of mobile data each month.

Relative to important Government priorities in the 2015/16 Budget:

- A total of $3.5 billion is allocated to the Child Care Package over four years, compared to a premium paid by Telstra consumers of $12.4 billion over the same period.
- A total of $5.5 billion is allocated to the Jobs and Small Business Package over four years, again compared to a premium paid by Telstra customers of $12.4 billion over the same period.

The premium for Telstra reflects both limited competition and differences in service quality, both of which have emerged from structural issues within the Australian telecommunications market. There are many areas where Telstra is the only provider of services, particularly in regional areas. This means regional consumers are heavily affected by Australia's telecommunications market structure.

Up to 3.5 million regional consumers could benefit from better access to competitive mobile telecommunication services. Additionally, Telstra is the only available provider for 46 per cent of fixed line services in regional areas. For a customer receiving only Telstra services, such as some regional customers, the price premium could be between $450 and $650 per household, depending on how many services they use. Therefore, improvements to competition will benefit regional consumers in particular.

1   Putting the consumer price premium into perspective

Households pay $3.1 billion more each year

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The premium paid by households to Telstra is equivalent to

DATA

Receiving an additional 3GB of mobile data per person per month

TAX

More than twice the electricity price impact for households of the carbon tax

15 cents per litre increase in petrol prices

Data source: CIE.

We have identified five important impediments to reduced prices for consumers in Australia's telecommunications market.

1   Historical and continued subsidisation of Telstra, through the Universal Service Obligation (USO), which entrenches the incumbent's market dominance.

2   The current regulatory approach to transmission leads to prices being set substantially above the cost of supply in some areas, which negatively affects competition in regional areas.

3   There is a disparity in spectrum holdings between operators and lower availability of spectrum in regional areas. This acts as a barrier to competition.

4   There are insufficient incentives for co-location of mobile facilities, particularly in regional areas where there are greater retail competition benefits from sharing of some facilities.

5   Consumers are reluctant to move to better value services, reflecting information barriers and the costs of changing provider.

Removing these impediments is not only good for Australian consumers; it will also help drive Australia's productivity growth. These reforms would deliver lower prices and improved services at no cost to taxpayers.

Consumers are paying substantial price premiums to the incumbent in Australian telecommunications markets

Australian telecommunications consumers pay a substantial price premium because of the unique structural characteristics of the Australian telecommunications market.

- Australian households pay a substantial price premium for the incumbent, Telstra, over other operators in both fixed line and mobile services. **The premium for using Telstra over other operators is $20 per month for fixed line services and $9 per month for mobile services.**

- The level of price premium for the incumbent in the Australian market does not appear in overseas markets considered. This suggests that structural issues are limiting the ability for competition to drive down market rents.

- The additional cost of telecommunications services to Australian households from this premium amounts to **$3.1 billion per year**

How do we measure the price premium paid by consumers?

The additional price that consumers pay for purchasing telecommunications services from Telstra is measured by comparing the prices for otherwise similar services – for example, the price difference for a fixed line bundle that offers the same inclusions for free calls and same data levels. The most systematic way to undertake this comparison is 'hedonic pricing'. Details of this approach are set out in the Technical Appendix.

The hedonic pricing method assumes that the value of a product is based on the value consumers place on the characteristics of the product. For example in the context of mobile phones, the value of a phone plan is dependent on characteristics such as the:

- number of included call minutes;
- amount of included data usage;
- type of phone included (if relevant); and
- mobile network providing the service.

By using information on many different phone plans, the aim is to determine the extra amount consumers pay for each characteristic. For example, it estimates the price that consumers are willing to pay for an extra megabyte of included data usage.

Such a model predicts the price of mobile phone plans based on the features included after adjusting for differences in the average price of plans from each carrier.

Dataset on communication service prices and services

There are three main categories of telecommunications products:

- landline phone service;
- broadband internet service; and
- mobile phone and data services.

We have collected data on the prices and characteristics of various products available from retailers in Australia, New Zealand and the United Kingdom.

We have considered broadband internet services and landline phone services together, as the category of fixed line services, given that these services are often sold as a bundle. This is a conservative approach. If fixed line services were examined on an unbundled basis, we expect that the Telstra price premium would be substantially higher.

Size of the price premium for Telstra services

We have constructed hedonic pricing models for fixed line and mobile services separately, to estimate the Telstra price premium for each category of telecommunications service (see Technical Appendix A for details).[1] The results are reported below.

Fixed line services

If all other measurable aspects of the service are held constant, consumers pay $23.70 more for a plan with Telstra than a plan with iiNet, TPG, or any other provider except for Optus. Consumers pay $8 more for a plan with Telstra than a plan with Optus ($23.70 minus $15.80).

Mobile phone services

If all other measurable aspects of the service are held constant, consumers pay:

- 50 per cent more for data on a Telstra service than with another carrier. This equates to an increase in the implied price of data from $3.6 per GB of data cap per month for other carriers to $5.5 per GB for Telstra; and
- a $13.3 additional monthly premium for obtaining a phone package with Telstra relative to other carriers

Using a standard amount of data usage and share of customers on a phone package, the overall premium paid for Telstra's mobile services averages $9 per month.

The total consumer price premium for Telstra services

For both fixed line and mobile markets there are substantial price premiums paid by Australian consumers for Telstra services.

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[1]   We use linear models, which implies that there is an additive effect of extra features on price. (Diewert, W.E., (2003), 'Hedonic Regressions. A Consumer Theory Approach', *Scanner Data and Price Indexes* p.326, http://www.nber.org/chapters/c9740.pdf).

- Using the weighted average price excluding Telstra, the premium for a Telstra fixed line plan is $20 per month.
- Using the weighted average price excluding Telstra, the premium for a Telstra mobile plan is $9 per month.

If we apply these premiums across Telstra's customer base, households are paying in the order of $3.1 billion more due to the Telstra pricing premium per year (table 2). This is equivalent to a cost of $380 per annum per Australian household.[2]

There is a level of uncertainty about this range, with a minimum level of $210 per household per year and a maximum of $560 per household per year.[3]

For a customer receiving only Telstra services, such as many regional customers, the price premium could be between $450 and $650 per household, depending on their use of fixed line services and number of mobile plans purchased. Therefore, improvements to competition will benefit regional consumers in particular.

To put the premium paid by Telstra consumers into perspective:

- The introduction of the carbon tax led to consumers paying in the order of $1.3 billion more for electricity per year.
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Relative to important Government priorities in the 2015/16 Budget:

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2   Impost on consumers from Telstra price premium

Service	Customers	Premium	Total additional revenue
	Millions	$/month	$billions/year
Estimated premium			
Fixed line services	6.2	20.0	1.5
Mobile	16.0	8.6	1.6

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[2] Household numbers are based on private occupied dwellings to be consistent with provision of fixed line telecommunications services. There were 7.76 million occupied private dwellings in 2011 according to the Australian Census, which, when increased using the percentage change in population over that period (6.66 per cent), equates to 8.28 million occupied private dwellings in 2014. Sources: ABS *Australian Demographic Statistics, Mar 2014*, Cat 3101.0., Australian Census 2011.

[3] This range reflects the application of statistical confidence intervals to the estimated price premium.

Service	Customers	Premium	Total additional revenue
Total			**3.1**
Lower bound estimate			
Fixed line bundles	6.2	14.4	1.1
Mobile	16.0	3.6	0.7
Total			**1.8**
Service	**Customers**	**Premium**	**Total additional revenue**
	Millions	$/month	$billions/year
Upper bound estimate			
Fixed line bundles	6.2	27.8	2.1
Mobile	16.0	13.6	2.6
Total			**4.7**

Note: The number of fixed line customers (6.2 million) from the Telstra 2014 Annual Report is the fixed voice domestic retail customers, which assumes all fixed data customers for Telstra also receive voice services. Mobile customer numbers are for domestic retail services from Telstra's 2014 Annual Report.

Source: Telstra Annual Report 2014, CIE.

3   Putting the communications premium into perspective

Households pay $3.1 billion more each year

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15 cents per litre increase in petrol prices

Data source: CIE.

In international markets, price differences for incumbents are small

The presence of a large price premium for the incumbent is unusual compared to international markets.

- In the UK mobile market, which is less concentrated than the Australian market, there are no significant premiums between the different operators.
- In the New Zealand mobile market, the smallest of the three major operators has a lower price level than the other providers, however the weighted average premium to the largest operator is only one-fifth that of Telstra in the Australian market.
- In the UK fixed line market, which is less concentrated than the Australian market, Virgin and TalkTalk have significantly lower prices than BT and Sky. The price premium for BT is about half that of Telstra in the fixed line market.
- In the New Zealand fixed line market, the incumbent Spark has a price premium that is less than one third of Telstra's.

We have constructed hedonic pricing models for fixed line and mobile services in the New Zealand and UK markets (see Technical Appendix A for details).[4] The results are reported below.

Fixed line services internationally

Fixed line broadband services are similarly distributed among providers in Australia and New Zealand. Telstra and Spark (formerly known as Telecom) have 40-50 per cent market share. In New Zealand, Vodafone also has a substantial amount of market share (32 per cent), with other providers making up smaller shares of the market than in Australia.

In the UK the fixed line market is fairly competitive. BT is the largest single provider, however, unlike Telstra and Spark, it does not have a significant market share in the mobile services industry.

4   Fixed line broadband market shares

Australia		New Zealand		UK	
Provider	Market share	Provider	Market share	Provider	Market share
	Per cent		Per cent		Per cent
Telstra	41	Spark	49	BT	31

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4   We use linear models, which implies that there is an additive effect of extra features on price. (Diewert, W.E., (2003), 'Hedonic Regressions. A Consumer Theory Approach', *Scanner Data and Price Indexes* p.326, http://www.nber.org/chapters/c9740.pdf).

Australia		New Zealand		UK	
Provider	Market share	Provider	Market share	Provider	Market share
Optus	14	Vodafone	32	Virgin Media	20
iiNet	15	Callplus	8	Sky	20
TPG	12	Orcon	5	TalkTalk	15
Other	18	Other	6	Other	13

Source: ACCC Telecommunications Competitive Safeguards for 2013-14 p26, Commerce Commission New Zealand 2013 Annual Telecommunications Monitoring Report p19.

For fixed line services in New Zealand, the differences between the prices of the operators is less than in the Australian market. Three of the four largest providers (representing almost 90 per cent of the market share) have prices within $4 per month of each other.

For fixed line services in the UK, Virgin and TalkTalk have prices that are $10 to $8 lower than the market leader BT.

See Appendix B for technical details.

Mobile phone services internationally

Table 5 shows the market shares for mobile services in Australia and compares it with the marketshares for New Zealand and the UK. The UK mobile market is less concentrated than the Australian market. New Zealand has a similar distribution of market share to Australia, although there are only three retailers of mobile services with a significant number of customers.[5]

For mobile phone services in the UK, **there is no premium for any carrier over the other**.

For mobile phone services in New Zealand, mobile plans from 2Degrees are estimated to be $7.60 lower than plans from other providers.

See Appendix B for technical details.

5   Mobile services market shares

Australia		New Zealand		UK	
Provider	Market share	Provider	Market share	Provider	Market share
	Per cent		Per cent		Per cent
Telstra	45	Vodafone	42	EE [a]	32
Optus	27	Spark	33	o2	24
Vodafone	18	2Degrees	25	Vodafone	17
Other	10			Virgin	8
				Other	18

5   Commerce Commission New Zealand 2013 Annual Telecommunications Monitoring Report p23.

Comparison of premiums in Australia and internationally

The price premiums obtained in the Australian market for the incumbent, Telstra, are not replicated in other markets (chart 6).

Using the same approach as for Australia of estimating the weighted average premium for the highest market share business to the rest of the market, premiums in New Zealand are $3 per month in the mobile market and $5 per month for the fixed line market. In the UK, the premium in the mobile market is zero and the premium in the fixed line market for BT is $9 per month.

6   Price premiums for the dominant provider
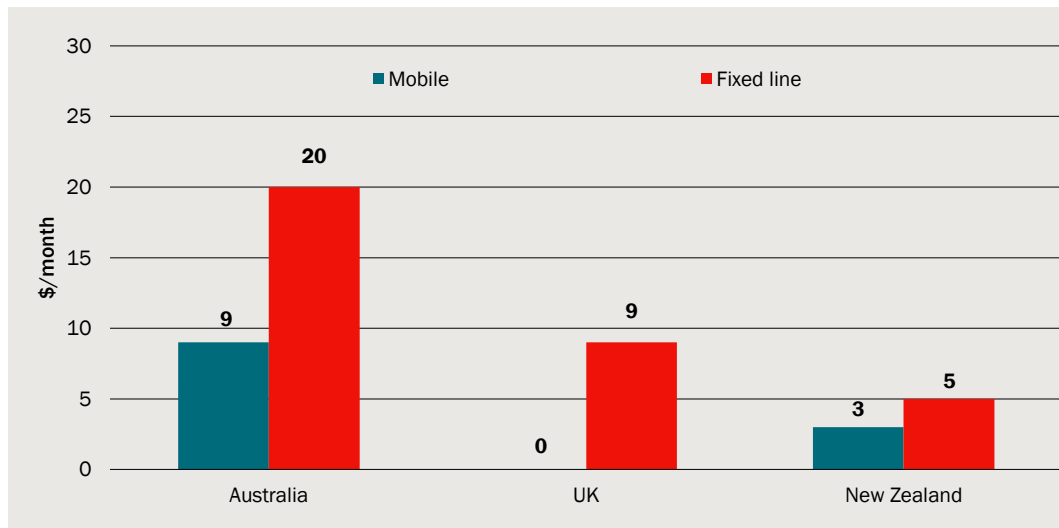
Data source: CIE.

How might we get more competitive telecommunications markets and better outcomes for consumers?

A more competitive telecommunications market is an outcome of:

- removing impediments to competition where possible — for example, ensuring regulated transmission prices are set at cost, subsidies do not advantage one operator, spectrum is available in regional areas for mobile carriers and fixed line access regulations are consistently applied;

- where competition is unlikely to emerge, considering arrangements for access to drive competition as deeply into a market as is feasible — for example, co-location of mobile facilities such as base stations provides consumers with coverage and choice for mobile services, particularly in regional areas; and

- creating conditions that reward competition — such as providing information that allows consumers to understand the quality and price differences of products available to them.

We have identified five main impediments to the functioning of telecommunications markets that have led to the market price premiums observed.

1 Telstra has historically received, and continues to receive, subsidies such as the Universal Service Obligation and NBN Co. agreement
   - Telstra has not used these subsidies to provide lower prices for Australian consumers
   - Instead, these subsidies have allowed Telstra to entrench its market dominance

2 Regulated transmission prices
   - The regulatory approach could lead to transmission prices exceeding the cost of supply
   - Telstra faces lower costs to providing downstream services than firms that are not vertically integrated, creating barriers to competition

3 Disparity in spectrum holdings in regional areas
   - The disparity in spectrum holdings between operators and the lower availability of spectrum in regional areas act as a barrier to competition
   - The release of more spectrum in regional areas will improve network quality for mobile communications if the licence holder utilises that spectrum
   - The high cost of spectrum creates a barrier to entry to the mobile market

4 Ownership and access to facilities (such as mobile base stations)
   - Co-location avoids unnecessary duplication of infrastructure and promotes competition
   - The current facilities access regime does not set prices, and therefore facilities access is effectively not mandatory

- Co-location of mobile facilities is not common in regional areas, where Telstra owns the vast majority of mobile base stations

5 Consumer decisions over telecommunications services show that consumers are slow to change
- Shifts in market share away from Telstra as markets become more competitive shows that consumers take time to change to better value providers
- Slow consumer response to better deals is evident in fixed line markets in particular
- Changes to competition and reductions in Telstra's price premium over other networks will take time to be reflected in market share as consumers will only change providers gradually
- Impediments to better consumer decisions include a lack of systematic information about coverage and quality of mobile and fixed line services

A more competitive telecommunications market would directly lead to lower prices for consumers. It would also lead to productivity gains. Initially these would arise if obligations such as the USO could be restructured to be achieved at lower cost. Over time, a greater level of competition would encourage constant productivity improvements in the sector. A more productive and lower cost telecommunications sector would flow through to productivity gains for the Australian economy.

A   Technical appendices

The hedonic pricing approach

The hedonic pricing method of valuation is a method of determining the value of different characteristics of a product. It does so using statistical models to decompose the price paid for products into the value of each characteristic. It has been used to determine the value placed on various characteristics of real estate, automobiles and other products such as personal computers[6]. This method has also been used for the valuation of characteristics of mobile phone handsets and mobile plans.[7]

A simple hedonic pricing regression model for phone and broadband plans would have the following form:

$$Price = \beta_0 + \beta_1 \times carrier + \beta_2 \times network + \beta_3 \times data\ allowance + \beta_4 \times included\ call\ minutes$$

In determining models, some variables were collected that we have combined into new variables. For example, the *peak data allowance* variable is a combination of the *data allowance* and *off-peak data proportion* variables. Such combinations are done for any of the following reasons:

■ Multicollinearity is where explanatory variables such as the amount of data allowance and the total included call value are correlated. If explanatory variables are highly correlated, the estimates of coefficients may be biased.[8] To avoid multicollinearity, we try to reduce the number of variables used, and combining two variables that are highly correlated allows for an unbiased coefficient estimate of a single variable.

■ Some variables have effects in interacting with other variables – for example, the proportion of the data allowance that is off-peak affects the price of the contract depending on the amount of the data allowance, because if the data allowance is already insignificant, it may not have an effect on consumer value

■ There may be no theoretical explanation for certain categorical variables being significantly related to prices. For example, the term variable is not expected to significantly affect prices, except between those contracts that are month-to-month (and therefore with a minimum duration of 1 month) and those that are fixed length (e.g. 12 months or 24 months). Therefore, we have created the *month-to-month* variable, which combines the different categories of the term variable into one

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6   Triplett, J. (2004), *Handbook on Hedonic Indexes and Quality Adjustments in Price Indexes – Special Application to Information Technology Products*, Organisation for Economic Cooperation and Development, Paris. http://browse.oecdbookshop.org/oecd/pdfs/free/9306081e.pdf

7   Karamti, C. & Grzybowski, L. (2010), 'Hedonic study on mobile telephony market in France: pricing-quality strategies', *Netnomics* 11, 255-289.

8   Karamti, C. & Grzybowski, L. (2010), 'Hedonic study on mobile telephony market in France: pricing-quality strategies', *Netnomics* 11, 255-289.

indicator variable. *Month-to-month* takes a value of 0 if the contract is for a fixed term and a value of 1 if the contract is month-to-month (i.e. not minimum fixed term).

We have excluded from this model characteristics that we found did not provide sufficient explanatory power to justify their inclusion. That is, we excluded characteristics of plans that do not contribute to predicting the price of a plan.

Australian mobile phone services model and results

Table A.1 shows the characteristics of mobile plans for which we collected data.

A.1   Mobile phone plan characteristics

Variable	Units	Description
Raw price	AUD/NZD/GBP	Monthly price of the contract
AUD Price	AUD	Monthly price of the contract converted into AUD using the exchange rate at the time of data collection
Included call value/minutes	Number of calls	Advertised number of minutes of calls or value of calls that is free/included under the contract. We convert included value ($) into included calls by assuming that the standard call lasts for 2 minutes and using the advertised price per minute and flagfall charges from the carrier. We convert included minutes into included calls by assuming a standard call lasts for two minutes. If the number of calls is unlimited, we set the included number of calls to 1000, which is the maximum of the sample.[9]
Included data allowance	GB	The amount of data the customer can use on the network before additional charges are incurred. If the data allowance is unlimited, we have set the allowance to 9GB.
Extra data price	$/MB	The cost per additional megabyte of usage beyond the included data allowance
Number of included SMS	Number	The number of SMSs included in the plan for plans without unlimited SMS. If the plan includes unlimited SMS then this variable is equal to 0.
SMS unlimited?	Yes/no	Indicates whether SMSs are unlimited
MMS unlimited?	Yes/no	Indicates whether MMSs are unlimited
Price of SMS	$	Indicates the price of SMS if messages are not unlimited
Price of MMS	$	Indicates the price of MMS if messages are not unlimited.
Term of contract	Months	Number of months that the customer must pay the monthly fee
Flagfall	$/call	The price of flagfall (fixed price to begin a call).
Rate per minute	$/minute	The price per minute charged for calls
Network		The wholesale network which the plan provides a service on, e.g. Telstra, Optus or Vodafone

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9   Our results are not very sensitive to the choice of this amount. The estimated premium (per month) for Telstra is lower (higher) by approximately $1 ($0.3) if we make 800 (1200) calls equivalent to unlimited calls instead of 1000 calls.

| Variable	Units	Description
Carrier		The retailer of the service, e.g. Telstra, Virgin, Optus

a Certain contracts have month-to-month payments where the carrier states there is no minimum length, however this is implicitly a minimum length of one month as this is the shortest billing cycle available.
Source: CIE.

Chart A.2 shows the distribution of Australia mobile plans by the amount of the data allowance. It illustrates the strong correlation between the amount of data allowance under a mobile service contract and the monthly price of the service. It is also evident that the price of Telstra mobile services is higher for a given amount of data allowance than most of the other contracts. This is especially true at higher levels of data allowance (2.5 to 4GB) as shown by the outlying teal series in chart A.2.

Modelling these prices using a hedonic regression method shows whether this higher price level is due to other characteristics of the plan (such as more included call value) or not.

A.2   Mobile plans (Australia) – price compared to data allowance
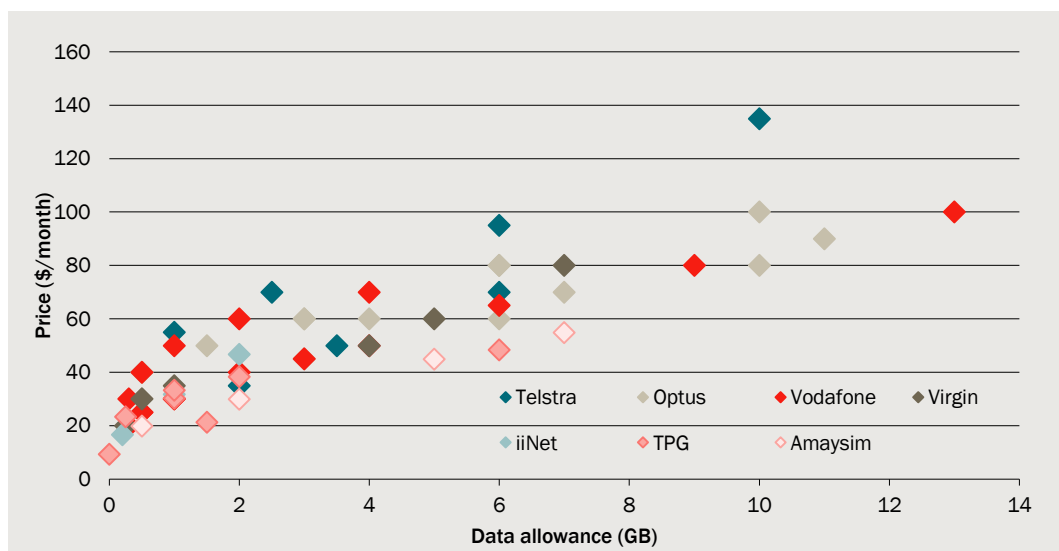
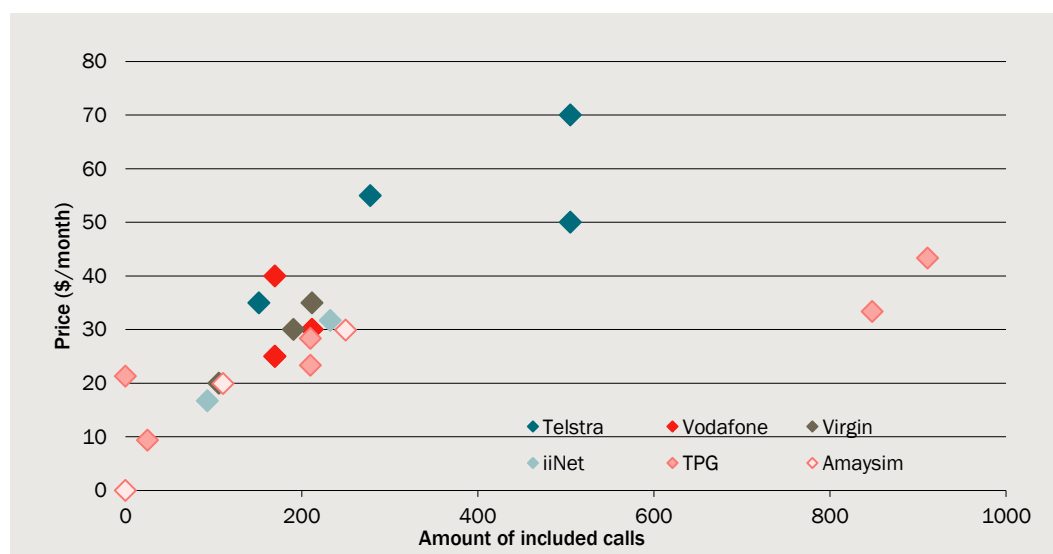*Data source:* CIE.

We can also observe that there is a strong correlation between the value of included calls and the price of the mobile plan.[10] This relationship is shown in chart A.3.

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10   The value of included calls is either explicitly stated by the carrier on their website or has been calculated based on the amount of included minutes and the cost per minute/call.

A.3 Mobile plans (Australia) – price compared to value of included calls

Note: This chart excludes plans with an unlimited call allowance. Some plans include a handset. All Optus plans have an unlimited call allowance.
Data source: CIE.

Table A.4 provides examples of the features in mobile phone plans offered by a selection of the major carriers. Our database also includes plans from Virgin, TPG, iiNet and Amaysim.

A.4 Examples of mobile phone plans

Carrier	Plan name	Phone	Price	Contract term	Included value/calls	Data allowance
			$/month	Months	$ or calls	GB
Telstra	M	IPhone 6	96	24	$1000	2.5
Optus	60 Plan	IPhone 6	82	24	Unlimited	3.0
VHA	60 Plan	IPhone 6	80	24	Unlimited	3.0
Telstra	L	Samsung Galaxy S6	95	24	Unlimited	6.0
Optus	80 Plan	Samsung Galaxy S6	80	24	Unlimited	6.0
VHA	80 Red	Samsung Galaxy S6	83	24	Unlimited	9.0

Note: We have named some plans descriptively where there is no specific name for the plan on the carrier's website.
Source: Carriers' websites, CIE database.

Table A.5 shows the estimated model for mobile services. This model includes an additional cost for data on Telstra services and an additional cost for obtaining a Telstra package that includes a phone. Telstra has recently reduced its bring your own packages so that these are closer to the prices of other telecommunications service providers, although these are more limited in terms of their offering than Telstra packages that include a phone.

- Each additional GB of data costs $3.6 across the market, except for Telstra which costs more than 50 per cent more at $5.5 per GB ($3.6+$1.9)
- Including a phone in a mobile package adds $15.3 per month across the market, except for Telstra where this addition adds $28.8 per month ($15.3+$13.3)

A.5   Estimated prices for mobile phone services - Australia

Variable	Type of variable?	Coefficient	Statistically significant
Constant		$22.6 per month	Yes
Call value included	Continuous	$0.01 cents per call minute	Yes
Data included	Continuous	$3.6 per GB	Yes
Basic mobile phone included	Indicator	$15.3 per month	Yes
IPhone6 included	Indicator	$18.1 per month	Yes
Samsung Galaxy S6 included	Indicator	$12.7 per month	Yes
Additional Telstra impacts			
Additional cost of data with Telstra	Continuous	$1.9 per GB	Yes
Additional cost of phone with Telstra	Indicator	$13.3 per month	Yes

Note: We test whether the premium is significantly different from 0 at the 5 per cent level of significance. We have used heteroskedasticity-consistent standard errors (Huber-White standard errors) given the results of Breusch-Pagan tests for heteroskedasticity. The adjusted R2 is 92% and there are 89 observations.
Source: CIE.

To estimate a price premium per mobile customer per month, we apply the premiums to average mobile data use and then to all Telstra mobile customers. We assume that on average customers are on plans with a 1.5GB/month limit and 43 per cent of customers are on a phone package.[11] This gives an average premium of $9 per month per mobile customer. This is then applied to Telstra's 16 million domestic mobile users.[12]

Note that we have tested alternative specifications that use a percentage premium for Telstra plans. When applied to Telstra's reported average revenue per user this gives a similar overall premium for Telstra mobile.

Australian fixed line services model and results

Broadband internet services and home phone services are considered jointly as fixed line services. This is mainly because these services share some of the same infrastructure and are often sold as a bundle by retailers.

Table A.6 shows the characteristics for which we have collected data on fixed line services.

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11 The assumption of usage is a CIE assumption. The average mobile usage per handset in December 2014 was 0.9GB/month, based on ABS data. The average cap would be substantially higher, so we adopt an assumption of 1.5GB/month. The share of customers including phones is based on Telsyte's Australian Smartphone Market Study.

12 Telstra Annual Report 2014, p. 17.

A.6 Broadband and home phone plan characteristics

Variable	Units	Description
Raw price	AUD/NZD/ GBP	Monthly price of the contract
AUD price	AUD	Monthly price of the contract converted into AUD using the exchange rate at the time of data collection
Total price	AUD	Includes any initial fees (such as for setup) which are divided by 12 (as an approximation of the average length of a contract) to give a monthly total
Term of contract	Months	Number of months that the customer must pay the monthly fee
Included data	GB	The amount of data that can be used before speed is reduced ('shaping') or extra charges are applied. If the plan includes unlimited data, then the data allowance has been set to 3000GB, the highest value in the Australian sample.[13]
Proportion of data allowance that is off-peak	Per cent	The proportion of the data allowance that must be used during a designated 'off-peak' period (such as 3:30-8:30am for TPG)
Technology		ADLS2+, NBN, 'Ultra fibre', phone only
NBN speed tier		The NBN has 4 speed tiers, however we have limited our analysis to the two lower speed levels[14], which are 1 25mbps upload / 5mbps download, and 2 12mbps upload / 1mbps download.
Local calls included?	Yes/no	Indicates whether local calls are unlimited
National calls included?	Yes/no	Indicates whether national calls are unlimited
Mobile calls included?	Yes/no	Indicates whether mobile calls are unlimited
International calls included?	Yes/no	Indicates whether international calls are unlimited
1300 number calls included?	Yes/no	Indicates whether calls to 1300 numbers are unlimited
Calls within network/selected phones included? [a]	Yes/no	Indicates whether additional calls to phones within the network or phones selected by the customer are unlimited/subsidised
Weekend calls included?	Yes/no	Indicates whether calls during the weekend are included
Evening calls included?	Yes/no	Indicates whether calls during the evening are included
Provider		The provider of the plan, e.g. Telstra, Optus

[a] This covers allowances for calls to nominated phones or allowances for additional calls to other phones under contract with the same provider. E.g. Telstra offers the "family calls benefit", which allows for unlimited calls from the home phone to up to four nominated mobile phones under the same account as the home phone. Similarly, other providers may include calls to mobiles supplied by the same provider, etc.

Source: CIE.

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13 Our results are not very sensitive to the choice of this amount. The estimated premium (per month) for Telstra is lower (higher) by approximately $0.3 ($0.05) if we make 2400 (3600) GB of data equivalent to unlimited data instead of 3000GB.

14 We do not consider additional speed tiers of the NBN because this would add to the amount of variables included in the model, which introduces a greater likelihood of multicollinearity. Identifying the valuation of different speed tiers is not a goal of the estimation of this model.

Chart A.7 compares the price of fixed line services for each network to the amount of data allowance during peak times (as defined by each provider). The peak data allowance variable is used in our hedonic price model rather than the sum of peak and off-peak data allowances. Often, providers do not have separate allowances for peak and off-peak periods, and when this is the case, the allowance for peak is generally equal to the allowance for off-peak.

We have created one variable to indicate the peak data allowance because two variables indicating peak and off-peak data respectively would be highly correlated, leading to biased coefficient estimates.

A.7   Fixed line services (Australia) – price compared to peak data allowance
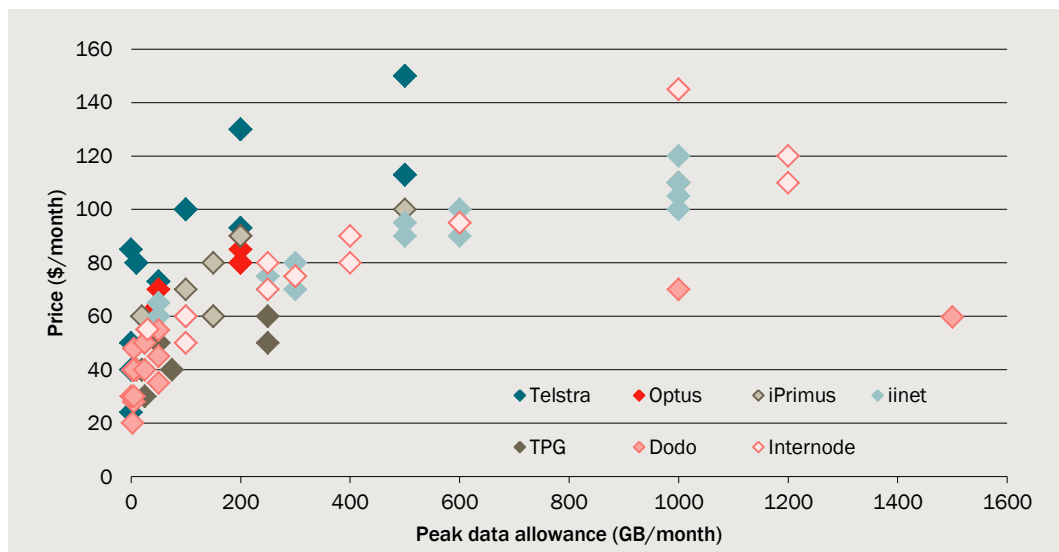
Note: This chart excludes plans with an unlimited data allowance.
Data source: CIE.

Table A.8 provides examples of the features in broadband bundle plans offered by a selection of the major carriers. The plans shown are all available on NBN technology, although they are often also the same plans for ADSL2+. We also use data from ADSL2+ plans. Our database also includes plans from iPrimus and Dodo.

A.8   Examples of NBN broadband bundle plans

Carrier	Plan name	Price	Contract term	Number of call types included	Peak data allowance
		$/month	Months	Number of types	GB
Telstra	L 200 broadband	130	24	4	200
Optus	Bundle 90	90	24	3	200
TPG	Extra bundle	70	24	2	Unlimited
iiNet	NBN 500 25 bundle	105	24	3	500
Internode	NBN silver	75	24	0	300

Note: We have named some plans descriptively where there is no specific name for the plan on the carrier's website.
Source: Carriers' websites, CIE database.

Table A.9 shows the estimated model for fixed line services. This uses the price level (per month) as the dependent variable. The levels model fit the data better than using the natural log model, as used for mobiles. If we use a natural log model then the Telstra

price premium is 30 per cent and Optus is 25 per cent, measured relative to all other carriers.

A.9   Estimated prices for fixed line services - Australia

Variable	Type of variable?	Coefficient	Statistically significant
		$	
Telstra	Indicator	$23.70/month	Yes
Optus	Indicator	$15.80/month	Yes
Bundle	Indicator	$26.40/month	Yes
Naked	Indicator	$23.20/month	Yes
Peak data allowance	Continuous	0.1/GB	Yes
(Peak data allowance)^2	Continuous	-0.00003/GB^2	Yes
Types of calls included [a]	Indicator	7.6	Yes

[a] This variable takes on values between 0 and 5 depending on how many of the following types of calls are unlimited under the plan: local, national, 1300 number, international, and mobile calls.

Note: We test whether the premium is significantly different from 0 at the 5 per cent level of significance. We have used heteroskedasticity-consistent standard errors (Huber-White standard errors) given the results of Breusch-Pagan tests for heteroskedasticity. The R2 is 80% and there are 123 observations.

Source: CIE.

B Estimated models for international markets

B.1 Estimated prices for fixed line services – New Zealand

Variable	Type of variable?	Coefficient	Coefficient significantly different from 0?
		$	
Spark	Indicator	13.0	Yes
Vodafone	Indicator	10.0	Yes
Orcon	Indicator	11.0	Yes
Fibre	Indicator	4.0	Yes
Phone line only	Indicator	-7.6	No [a]
Peak data allowance	Continuous	1.7/1	Yes
(Peak data allowance)^2	Continuous	-0.00005/GB	Yes
Types of calls included	Continuous	9.0	Yes

[a] While this coefficient is not significantly different from 0, it should clearly by related to price and thus it is likely that the premiums for each carrier would be estimated less accurately if it were removed from the model.

Note: We test whether the premium is significantly different from 0 at the 5 per cent level of significance. We not used heteroskedasticity-consistent standard errors (Huber-White standard errors) given the results of Breusch-Pagan tests for heteroskedasticity. All coefficient estimates are in AUD.

Source: CIE.

B.2 Estimated prices for fixed line services – UK

Variable	Type of variable?	Coefficient	Coefficient significantly different from 0?
		$	
Virgin	Indicator	-10.8	Yes
TalkTalk	Indicator	-17.5	Yes
Speed	Continuous	0.3/Mbit	Yes
Included calls	Continuous	6.4	Yes
Phone only?	Indicator	-14.4	Yes

Note: We test whether the premium is significantly different from 0 at the 5 per cent level of significance. We not used heteroskedasticity-consistent standard errors (Huber-White standard errors) given the results of Breusch-Pagan tests for heteroskedasticity. All coefficient estimates are in AUD. The number of types of included calls is different in the UK, with included call types being weekend calls, evening calls and mobile calls.

Source: CIE.

B.3 Estimated prices for mobile phone services in New Zealand

Variable	Type of variable?	Coefficient	Coefficient significantly different from 0?
		$AUD	
Month-to-month	Indicator	-$6.4	No [a]
Included call value	Continuous	0.01/call [a]	Yes
(Included call value)^2	Continuous	-0.0001	Yes
Included data	Continuous	8.3/GB	Yes
2Degrees	Indicator	-7.6	Yes

[a] This coefficient is not significantly different from 0 at the 5 per cent level of significance, but is at the 10 per cent level.

Note: We test whether the premium is significantly different from 0 at the 5 per cent level of significance. We have used heteroskedasticity-consistent standard errors (Huber-White standard errors) given the results of Breusch-Pagan tests for heteroskedasticity.

Source: CIE.

B.4 Estimated prices for mobile phone services in the UK

Variable	Type of variable?	Coefficient	Coefficient significantly different from 0?
		$AUD	
Total included call value	Continuous	0.01/call [a]	Yes
Included data	Continuous	2.4/GB	Yes

Note: We test whether the premium is significantly different from 0 at the 5 per cent level of significance. We have used heteroskedasticity-consistent standard errors (Huber-White standard errors) given the results of Breusch-Pagan tests for heteroskedasticity.

Source: CIE.