Economic Contribution of Mobile Telecommunications in Australia

June 2010

Report by Access Economics Pty Limited for

Australian Mobile Telecommunications Association

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2G	Second Generation
3G	Third Generation
4G	Fourth Generation
ACCC	Australian Competition and Consumer Commission
AE-RGEM	Access Economics Regional General Equilibrium Model
ACMA	Australian Communications and Media Authority
AMTA	Australian Mobile Telecommunications Association
CDMA	Code Division Multiple Access
ENG	Electronic news gathering
FTE	Full-time Equivalent
GDP	Gross Domestic Product
GHz	Gigahertz
GPRS	General Packet Radio Service
GSM	Global System for Mobiles
HSDPA	High Speed Downlink Packet Access
LTE	Long-Term Evolution
M2M	Machine to machine
Mbps	Megabits per second
MHz	Megahertz
MVNO	Mobile Virtual Network Operator
NBN	National Broadband Network
PDA	Personal Digital Assistant
PSTN	Public Switched Telephone Network
TIO	Telecommunications Industry Ombudsman
VHA	Vodafone Hutchison Australia
WAP	Wireless Application Protocol
W-CDMA	Wideband Code Division Multiple Access
WiMax	Worldwide Interoperability for Microwave Access

Executive Summary

The mobile telecommunications industry contributed $17.4 billion to the Australian economy in 2008-09. This includes $6.7 billion in direct contribution and $10.7 billion in indirect contribution. The indirect contribution has grown by over $3 billion in two years.

Mobile data is increasingly important. Access Economics forecasts suggest that, across the industry, mobile broadband subscribers will grow significantly over the coming years, with the total number of mobile data subscriptions passing 50% of the population size in 2012.

The mobile telecommunications industry makes a substantial contribution to the Australian economy. The importance of the mobile telephone has grown over the past two decades as the use and useability of the technology has improved. In addition, the cost of mobile telecommunications services has decreased in real terms, driven down by competition and technological innovation, improving affordability.

Recent technological advancements include the development of mobile data and internet services. A wide range of data content services and applications have become available, including email, mobile video, and social networking. Use of mobile data comes in three main forms:

- 3G-enabled mobile phones and handheld devices;
- Laptop computers, through use of built-in mobile broadband cards, or wireless attachments (for example, USB dongles); and
- Other uses – some applications include back-to-base alarms, integrated transport systems such as those used by some taxi services, and coverage of broadband black spots (3G routers designed to be used in a fixed location).

Mobile telecommunications have become a complement to fixed telephone and internet for most Australians, while some have replaced fixed line telephones altogether in favour of mobile telecommunications. The Australian Communications and Media Authority (ACMA) (2010) estimated that in 2008-09 approximately 10% of Australians aged 14 and over did not have a fixed phone line in their home and used only mobile phone services, with this share slowly rising.

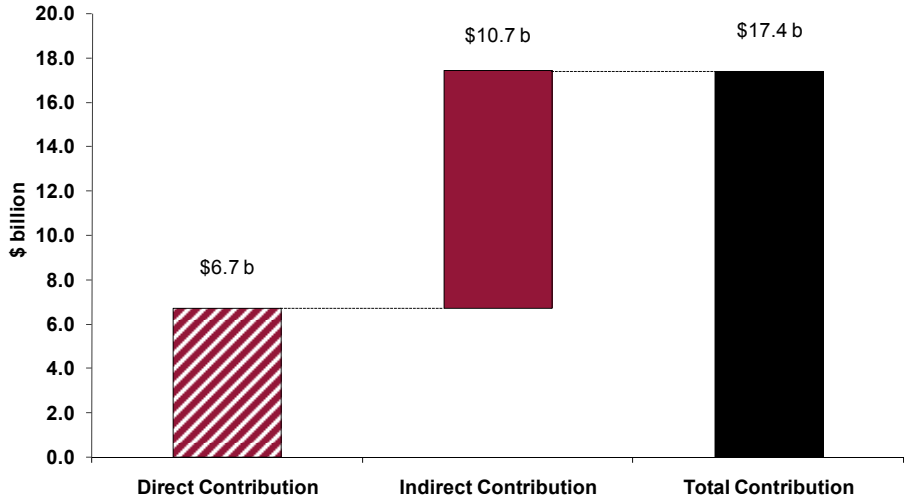
Total mobile subscriptions in Australia at 30 June 2009 totalled 24.22 million (ACMA 2010). In 2008-09 3G subscriptions overtook 2G services for the first time, accounting for 51% of all mobile services. It is estimated that 55% of all mobile phone users now have a phone that is mobile data enabled (ACMA 2010). Increased 3G uptake has also seen a rise in mobile data usage, with 23% of all internet connections now wireless (ACMA 2010).

Total contribution

The total economic contribution of the mobile telecommunications industry is shown in Chart i. Combining the direct and indirect contributions, Access Economics estimates the mobile telecommunications industry contributed $17.4 billion to the Australian economy. Based upon

the estimated Australian population at 30 June 2009 (ABS 2009b), GDP per capita in Australia is $760 higher than would otherwise have been the case.

Chart i: Total economic contribution of mobile telecommunications, 2008-09



Source: Access Economics

The $17.4 billion total contribution has been estimated as a direct contribution (the value of mobile telecommunications firms) and an indirect contribution (the flow-on value of services provided by mobile telecommunications services to other sectors in the economy). The relative importance of these contributions is detailed below.

Direct contribution

The sector's direct contribution to the economy in 2008-09 is estimated to be $6.7 billion (see Table ii). This represents a slight reduction from 2007-08, reflecting competitive forces in the sector putting pressure on margins.

Table ii: Industry revenue and value added, 2004-05 to 2008-09, 2008-09 $m

	2004-05	2005-06	2006-07	2007-08	2008-09
Industry revenue	14,322.0	14,654.5	15,518.7	16,391.9	17,788.3
Industry value added	6,503.7	5,986.8	6,476.0	6,753.6	6,702.5
Gross operating surplus	*4,785.5*	*4,351.6*	*4,944.1*	*5,284.3*	*5,257.7*
Earnings to employees	*1,718.2*	*1,635.2*	*1,531.9*	*1,469.3*	*1,437.0*
Employment	23,893	22,117	21,964	21,170	20,790

Source: IBISWorld J7122 and J7123 and Access Economics estimates

The industry is capital-intensive, with more than three quarters of value added flowing as earnings to capital rather than earnings to employees. Labour productivity within the sector is also increasing (reflected in an increase in revenue per employee). Both carriers and resellers have reduced staff for several years now through both improvements in productivity and structural changes through mergers and acquisitions.

Indirect contribution

The economic impact of the mobile telecommunications industry extends beyond direct benefits, with flow-on or indirect effects generating an additional $10.7 billion in economic contribution of the mobile telecommunications industry. Falling mobile phone service prices have increased consumer benefits from telecommunications. Furthermore, the potential for productivity gains from use of mobile telecommunications and associated increased connectivity of employees has seen significant changes in business practices in almost every industry and sector of the Australian economy.

Methodology

The indirect contribution of the mobile telecommunications incorporates two key factors:

- Price declines – according to the ACMA, in 2008-09 average voice call costs for mobiles fell 4.8%. Falls in the price of mobile telecommunications services create economic benefits for consumers through reducing the price of mobile services, as well as fixed-line services through price and functionality pressures that increase competition.
- Productivity gains – these flow from two avenues:
  - the enhanced connectivity and mobility of workers, utilising voice services and more advanced applications that utilise mobile data on a smart phone handset. This means that time away from the office and 'on the move' that had previously been unproductive can instead be used to catch up on emails or for conducting other work functions.
  - mobile broadband services on laptop computers and in machine to machine (M2M) applications, which are providing a valuable augmentation to existing broadband services available in Australia. These services provide transformational effects that high speed data services have on businesses, and the productivity impacts to business extend well beyond the mere connectivity of workers while away from the office.

Limitations in the modelling mean that only the enhanced connectivity and mobility of workers on handsets have been captured in the modelling, with laptop and M2M applications that are excluded providing additional benefits to the $10.7 billion result here. The value of these laptop and M2M mobile data services is likely to be large. Consequently, this is a conservative estimate of the indirect contribution of the mobile telecommunications industry.

Growth in mobile data

Data has grown rapidly both in total and as a share of revenue for mobile carriers internationally, with the GSM Association (2010) noting large growth across a range of countries. In Europe, Vodafone's data traffic rose 300% over the period 2007-2009, and now represents 11% of all European services revenues. In Latin America, the experience was similar, with Telefonica reporting total growth of nearly 37% in mobile revenue for first half of 2009 year-on-year. This trend was also seen in North America, with Bell Canada reporting a 33% growth in wireless data revenue and 124% growth in subscriptions from Q3 2008 to Q3 2009.

Overseas expectations indicate an ongoing rapid expansion in the adoption and usage of mobile data. Cisco Systems have forecast a 39-fold increase in mobile data traffic from 2009 to

2014, equating to a compound rate of 108% per annum[1]. Similarly, AT&T projects that mobile data by volume will grow at a compound average growth rate of 65%-80% over 2007 to 2018 (Rysavy 2008).

At the subscriber level, the GSM Association expects mobile data customer numbers to increase 71% in 2010 alone[2]. CCS Insight anticipates a slightly slower growth rate than this in Europe, forecasting instead a gain in subscriber numbers over two years (2009-2011) of 95%[3].

Indirect contribution

Using Access Economics in-house General Equilibrium model, Australia's economic output, measured by real GDP, is estimated to be $10.7 billion dollars higher as a result of lower mobile telecommunications prices and enhanced 'on the go' productivity. In addition, investment and employment were projected to be stronger as a result of mobile telecommunications. Mobile telecommunications were projected to increase employment by 27,000 FTEs in 2008-09. A summary of the results is presented in Table iii.

Table iii: Economic impacts in 2008-09

Variable	Change from reference values ($m)	Variable	% deviation from reference case
Real GDP	10,650	Real GDP	0.85
Real GNP	8,972	Real GNP	0.75
Real Consumption	5,271	Real Consumption	0.82
Real Investment	7,536	Real Investment	2.07
Real Exports	(168)	Real Exports	-0.06
Real Imports	2,651	Real Imports	0.95
Employment (000)	27	Employment	0.29

Source: Access Economics

The indirect contribution to GDP has grown significantly in recent years, with a $3 billion increase since the 2006-07. While some of this is due to price declines for mobile services and productivity gains from voice services, the main productivity driver has been increased use of 'first wave' mobile data, i.e. 'on the go' savings from data on handsets. Mobile data is in a period of rapidly increasing use, with an associated rapid growth in productivity gains to the economy in 2007-08 and 2008-09.

Forecast mobile broadband subscriptions for Australia

Access Economics forecasts that the uptake of mobile broadband will substantially increase in Australia over the next five years. The forecasts are summarised in Chart ii, showing both 3G subscriptions and, of these subscribers, what share are users of mobile broadband.

[1] Reardom M, *Cisco predicts wireless-data explosion*.

[2] Fierce Wireless 2010 *GSMA predicts 15% spike in mobile broadband investment*, February 10.

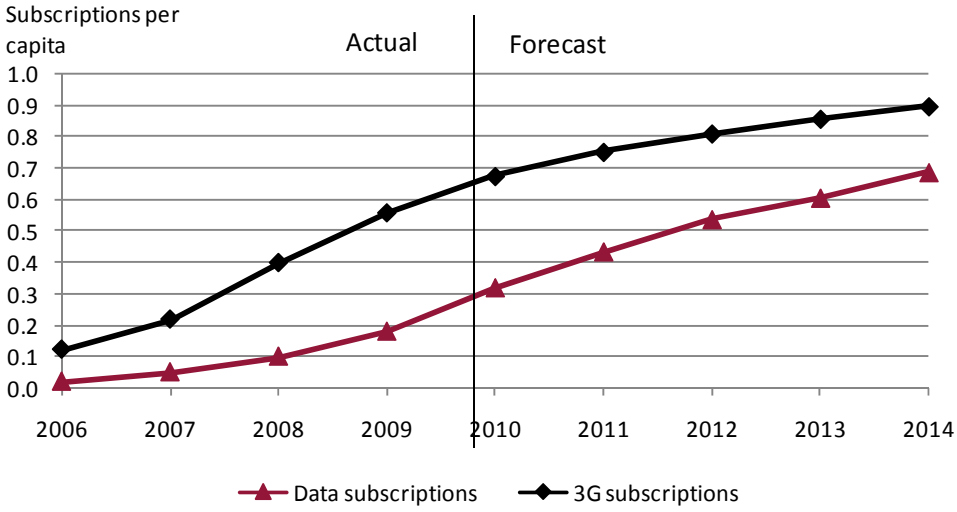
[3] GSA 2010, *Mobile broadband growth results*, January.

The forecasts are based on a combination of ACMA (2010) estimates of actual mobile data uptake to 2008-09 and confidential forecasts from some AMTA members. The forecasts suggest that, across the industry, mobile broadband subscribers will grow significantly over the coming years, passing 50% in 2012, with overall growth in subscriptions of 282% over five years.

Over the period 2010-2014, data subscriptions are forecast to grow at a faster rate than 3G subscriptions, as some of those who have data-enabled devices but are not yet using data services take them up. However a gap of around 20 percentage points is expected to remain in 2014, indicating that there will be some 4 million 3G subscribers with data-enabled devices but not using data.

These forecasts make no assessment about the devices associated with subscriptions, however it is likely that subscriptions associated with 'second wave' connections, in particular using laptops with USB dongles, will be a significant share of this total. These devices, the contribution of which is not captured in this analysis, are likely to be an important source of productivity growth in 2009 and beyond.

Chart ii: Forecast data subscriptions per head of population



Source: Access Economics based on data from AMTA members

Radiofrequency spectrum

As this report illustrates, Access Economics' estimation of the contribution that the mobile telecommunications industry makes to the Australian economy is substantial and is predicted to grow rapidly.

Radiofrequency spectrum is the critical enabling asset for the deployment of mobile telecommunications services including mobile broadband. In order to meet predicted demand, AMTA believes that the industry requires new spectrum allocations, arguing that gaining access to the 2.5GHz and 700MHz frequency bands for mobile data applications is critical if forecast future demand for mobile broadband services is to be met, and if continued technological advancement is to occur.

While the regulator, the ACMA, has identified scope for a change in the allocation of certain spectrum frequencies, spectrum is a finite resource and, therefore, care must be given when determining how it should be allocated, with view to ensuring that the total economic welfare gained from spectrum allocations is maximised.

Concluding remarks

This report demonstrates that the mobile telecommunications industry is of large value to the Australian economy, with this importance on the rise. Mobile data applications are growing in importance for the industry and for business as a whole. In order to harness the full potential benefits of mobile telecommunications, including mobile data, going forward it is necessary to ensure that the industry is able to access adequate additional radiofrequency spectrum, facilitating network upgrades and improved service provision.

Access Economics
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1 Introduction

The importance of the mobile telephone has grown over the past two decades as the use and useability of the technology has improved. In addition, the cost of mobile telecommunications services has decreased in real terms, driven down by competition and technological innovation, improving affordability. The use of mobile telecommunications has significantly impacted upon businesses and the way people live.

Advancements in the capabilities of mobile telecommunications have seen the development and adoption of mobile data and internet services. A wide range of content services and applications have become available, and there are increasing synergies gained from smart phone handset technologies that also function as, for example, music players or cameras.

Although at first glance the Australian market may appear to have reached a saturation point – with more mobile telephones in Australian than people – the rapidly changing nature of the technology ensures an ongoing demand for handset upgrades and, for some, multiple devices, for example a personal digital assistance (PDA) plus a laptop. The increasing uses of mobile technology, including data and internet services, have also ensured that mobile telecommunications remains a growth industry.

It is against this background that Access Economics was commissioned by the Australian Mobile Telecommunications Association (AMTA) to report on the economic significance and contribution of the Australian mobile telecommunications industry. This follows three preceding reports published annually between 2003 and 2005, and is an update of the reports prepared by Access Economics in 2007 and 2008.

1.1 Study objectives

This report utilises a modelling approach consistent with the earlier versions of this report, allowing for reliable cross-year comparisons. The key objective of this report is to update the 2008 report, considering the impacts of developments in the telecommunications industry on the broader Australian economy.

The current report extends the 2008 report, with increased consideration of the role of mobile data. This includes an analysis of the future use of mobile data and modelling of the impact of this usage under a number of scenarios.

It is hoped that this report will be a valuable tool for the industry to promote increased public awareness of the importance of Australia's mobile telecommunications industry and the factors likely to shape its future.

1.2 Approach

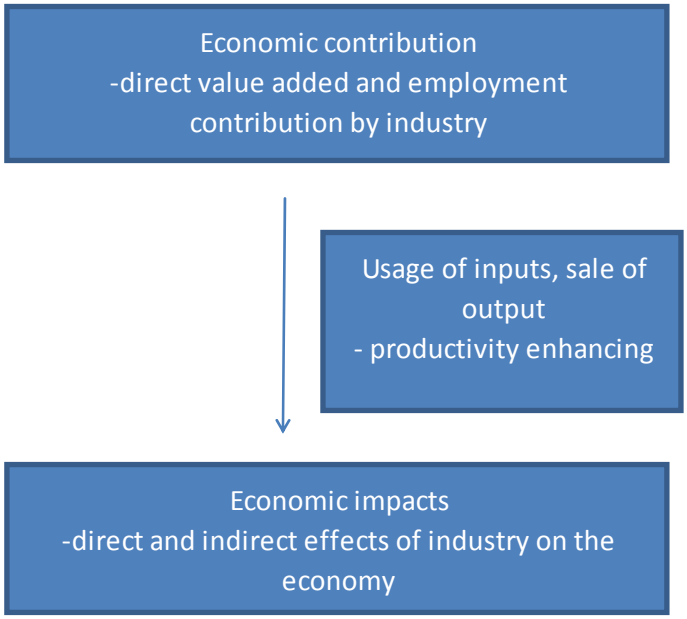
This report is an economic contribution study, determining the value of mobile telecommunications services to the Australian economy.

The economic contribution of the Australian mobile telecommunications industry ('the industry') can be estimated by 'economic contribution' and 'economic impact' studies. The

direct contribution of the industry to the Australian economy can be estimated by calculating the direct value added. However, this is only a partial measure, with benefits accruing across all industries from the productivity gains made by workers utilising mobile telecommunications.

To consider these productivity impacts on the economy more broadly, general equilibrium modelling has also been undertaken. As shown in Figure 1.1, the information compiled in the economic contribution study feeds into the economic impacts analysis.

Figure 1.1: Framework for the analysis



1.3 Report structure

This report is organised as follows:

- Chapter 2 provides a snapshot of the Australian mobile telecommunications industry.
- Chapter 3 discusses recent innovation and investment in the mobile telecommunications industry and discusses the productivity gains these have enabled.
- Chapter 4 describes the direct and indirect economic contributions of the industry.
- Chapter 5 provides some conclusions based upon the findings of the report.

2 The Australian mobile telecommunications industry: an overview

This chapter provides an overview of the mobile telecommunications industry. Topics covered include a brief history of mobile telecommunications technology, the current industry structure, and trends in the mobile telecommunications industry.

2.1 History of mobile telecommunications in Australia

The first Australian cellular networks was constructed in 1981, with the first small cell analogue cellular network launched in 1987. The government mandated the closure of the analogue network upon which these were based in the year 2000 due to its inefficient use of spectrum.

The second generation of mobile technology (2G) commenced operation in Australia in 1993, and continues to play a role in the Australian mobile market. Offering voice and basic data functionality, 2G services operate using the Global System for Mobiles (GSM) network. GSM is a Time Division Multiple Access-based technology that supports voice, data and text messaging and allows roaming between different networks. Telstra, Optus and Vodafone presently operate 2G GSM networks using 900 Megahertz (MHz) and 1800 MHz spectrum. Code Division Multiple Access (CDMA) 2G services were also available in Australia for a number of years, with the closure of the last CDMA network occurring on 28 April 2008.

Carriers in Australia have incorporated the General Packet Radio Service (GPRS) data standard into their GSM networks to increase the functionality of 2G services. This so-called '2.5G' technology is regarded as a stepping stone from 2G to third generation (3G) technologies in that it offers enhanced data services such as Wireless Application Protocol (WAP). WAP offers mobile internet connectivity at relatively low speeds. Constraints on bandwidth and limited web content for handheld display, particularly in light of the arrival of 3G technology, has meant the implementation and take-up of WAP in Australia and overseas remained low.

EDGE technologies have been introduced by Vodafone and Telstra to enhance the data functionality of 3G capable phones in areas where 3G coverage is unavailable. EDGE is a bolt-on to GSM and GPRS networks that increases data speeds. As the popularity of data-enabled phones has increased there has been a greater demand for data access in 2G-only areas, leading to moves to increase functionality of the 2G and 2.5G networks.

2G services are considered to be in decline in Australia, with consumers increasingly migrating to more sophisticated 3G technologies. While 2G usage continues to decline in favour of 3G mobile network operators have yet to indicate any timetable for 2G network closure.

3G and Beyond

3G technology was first offered in Australia by Hutchison's 3 in April 2003. 3G technology offers services such as music and video downloads, mobile broadband, improved internet connectivity and a host of other data-rich services.

3G networks are now being offered by all mobile network carriers in Australia. Initial 3G network implementations used the 2100 MHz spectrum band. Hutchison's '3' and Telstra

jointly operate a 3G network in the 2100 MHz band, while Vodafone and Optus jointly built and operate a 3G network in the same frequency band.

Telstra has also developed an independent 3G network with wider coverage, introducing its Next G™ network in October 2006 using the 850 MHz spectrum. The network claims to cover 99% of the population.

Optus' 3G network was launched in 2005, and uses a combination of the 900MHz and 2100MHz bands. As at March 2010 the mobile network footprint exceeded 97% voice coverage[4]. Vodafone also expanded its 3G network coverage using the 900MHz spectrum range in 2009.

Innovations such as the development of Bluetooth, which allows rapid data transfer from mobile devices to Local Area Networks and personal computers over short distances, have enhanced the functionality of 3G devices. Mobile users are able to conveniently upload and download large amounts of data automatically, without having to incur the cost of using the mobile network to do so, and can take advantage of increased interoperability between devices.

So-called '3.5G' services are enhanced 3G services, typically to High Speed Downlink Packet Access (HSDPA), an advancement that supports 'bursty traffic' and offers theoretical downlink speeds of up to 42 Megabits per second (Mbps). All carriers in Australia have upgraded their 3G mobile services to HSDPA protocol, with networks offering these speeds or higher.

Moves towards deployment of long-term evolution (LTE) technology are underway, with Optus and other members of the SingTel group participating in an Australasian trial during 2010[5]. LTE is a 3G technology from the 3GPP standards group. It will be developed into LTE Advanced which will be a fourth generation (4G) recognised technology. LTE technologies are expected to enhance more demanding data applications such as interactive TV and mobile video blogging[6]. There are plans in Australia for the 2.5GHz frequency band to be made available for LTE use (see Section 2.4).

2.2 The current state of the market

2.2.1 Industry structure

Mobile telecommunications require several entities to work together (see Figure 2.1). Some firms operate across multiple sectors of the industry.

- The **manufacturing or hardware sector** is responsible for building and maintaining the extensive telecommunications network (including base stations, switching equipment, antennas and towers) as well as supplying handsets and associated equipment to end-users. Ericsson Australia, Alcatel-Lucent, Huawei and Nokia Siemens provide

[4] Singapore Telecommunications Limited and Subsidiary, Companies, Management Discussion and Analysis of Financial Condition, Results of Operations and Cash flows for the Fourth quarter and Year Ended 31 March 2010, p 46

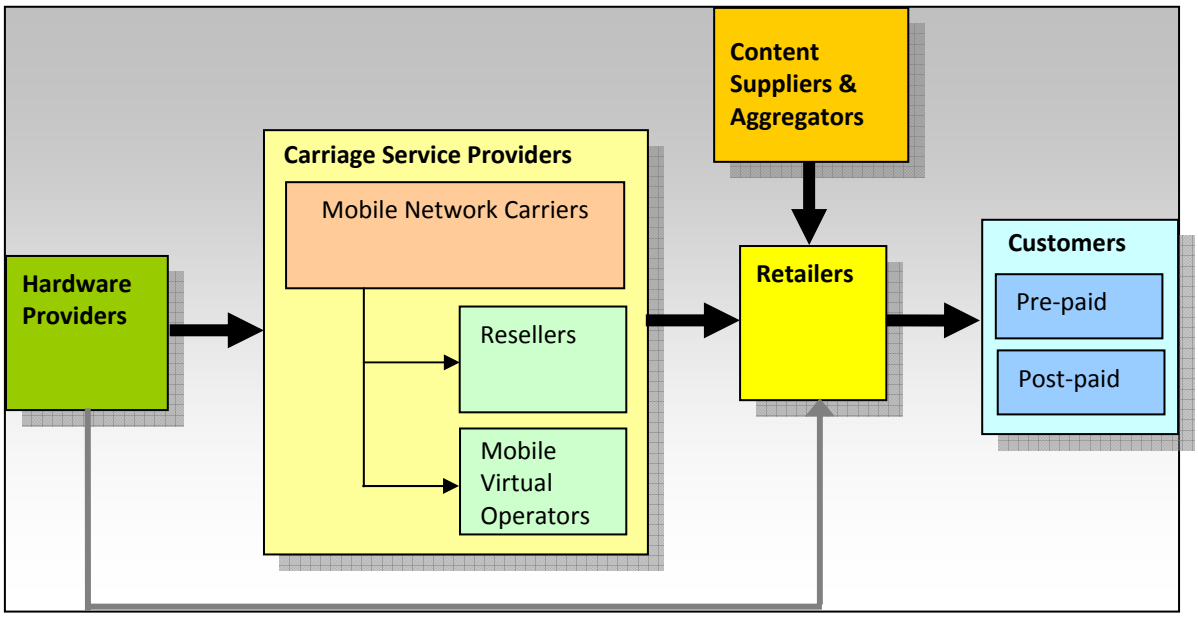
[5] 18 November 2009, SingTel Group to conduct LTE trials in Asia and Australia, http://www.optus.com.au/aboutoptus/About+Optus/Media+Centre/Media+Releases/2009/SingTel+Group+to+conduct+LTE+trials+in+Asia+and+Australia

[6] Global mobile Suppliers Association 2009, *GSM/3G Market/Technology Update*, December 10.

infrastructure hardware to the Australian mobile telecommunications market, while the AMTA members who supply handsets include: Nokia, Motorola, Samsung, LG, Sony Ericsson, i-Mate, HTC, ZTE and RIM. A large proportion of the activity of these firms is undertaken overseas, with most handsets shipped to Australia ready to sell.

- **Carriage service providers** provide telecommunications services to households and businesses using carrier network infrastructure. There are several levels of these.
  - **Mobile telecommunications carriers** are primarily engaged in operating and maintaining switching and transmission facilities that provide direct communication via airwaves. For most of the 2008-09 financial year there were four carriers in Australia: Telstra, Optus, Vodafone and Hutchison's '3', however it is noted that Vodafone and Hutchison merged late in the 2008-09 financial year, reducing the number of carriers in Australia to three.
  - **Resellers** provide telecommunications services by use of a network owned by a third party but bill customers in their own names. Some own switching equipment while others simply buy and resell telecommunications services.
  - **Mobile virtual network operators (MVNOs)** are value adding entities that use an existing network to sell a service, usually one linked to other branded services. Unlike resellers, MVNOs purchase *wholesale* mobile capacity from network carriers. For example, AAPT purchases wholesale mobile capacity from Vodafone. MVNOs in Australia include B Digital, Revolution, Boost Mobile, Primus Telecom, People Telecom and Macquarie Telecom.
- There are several types of firms involved in the provision of mobile **content**.
  - **Content service providers** deliver information and entertainment services, which are sourced and purchased from a variety of channels before being structured and bundled for distribution over mobile networks. The advent of 3G mobile services has increased the importance of the role played by content service providers.
  - **Content aggregators** manage multiple content providers and provide services through content linked to these providers' products such as sourcing, reporting, formatting for multiple streams, quality control and cross-referencing. Examples of Australian content aggregators are Legion Interactive, Infospace and iTouch.
  - **Program developers** use industry development tools to create new and innovative applications for mobile phone users.
- **Retailers** offer mobile services to end users on behalf of carriage service providers.
  - Most carriage service providers have their own retail shops where customers can purchase hardware, particularly handsets and USB dongles, and enter into contracts with the provider to access services.
  - Other retailers include 'non-branded' but still speciality telecommunications, and other retail outlets that offer hardware and services, such as supermarkets and Australia Post; as well as online stores.

Figure 2.1: The Mobile Telecommunications Industry



Source: Access Economics

2.2.2 Population coverage

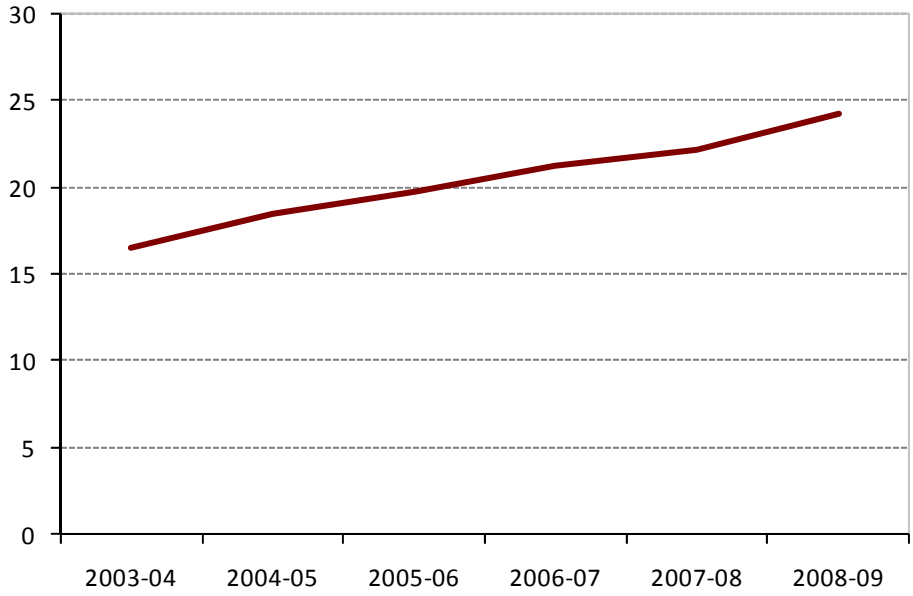
Carriers

There are now more mobile phone services in Australia than people, with a total of 24.22 million services in Australia at 30 June 2009 (ACMA 2010). Forecasts of subscriber numbers from carriers suggest that this figure will continue to grow, albeit at a slower rate than in recent years.

3G services have rapidly increased in use, with a growth in subscribers of 44% over 2008-09, to 12.28 million services. The 2008-09 financial year saw the market share of 3G services overtake that of 2G, with 3G services accounting for 51% of total mobile services at 30 June 2009. This change has been pushed somewhat by reductions in 2G services through closure of CDMA networks, forcing an accelerated adoption of 3G services in some regional areas.

Growth in mobile subscriptions has been relatively consistent in recent years, although the growth rate slowed slightly in the last year. With more subscriptions than people in Australia, there is less demand for additional services. The future growth in mobile services is likely to be constrained by potential applications of the technology and the rate of population growth.

Chart 2.1: Mobile services, at 30 June



Source: ACMA 2010

There are currently six networks in operation in Australia (see Table 2.1, Vodafone and Optus share a W-CDMA network). Over 2008-09 these were operated by four carriers, however late in the financial year Vodafone and Hutchison merged into Vodafone Hutchison Australia (VHA), reducing total carrier numbers to three. All of the 3G networks in Australia today have been upgraded to HSDPA networks. Most carriers have announced plans to upgrade their networks and provide improved service speed over 2009 and 2010.

Table 2.1: Network coverage, by carrier, end 2008-09 financial year

Carrier	Network	No. of mobile services (millions)	Subscriber share (%)	Population coverage (%)
Telstra	W-CDMA	6.3	25.9	99
	GSM	3.9	16.0	93
Optus	GSM	5.2	21.4	96
	W-CDMA	2.6	10.7	96
Vodafone	GSM	3.1	12.8	95
	W-CDMA	1.2	4.9	94
Hutchison	W-CDMA	2.0	8.2	56

Source: Carrier websites and annual reports

Notes: Optus and Vodafone W-CDMA coverage is for Dual Band (2100/900MHz) coverage. Customers with a 2100MHz-only compatible phone receive 80% population coverage. Hutchison figure is for its co-operated 2100MHz network only, customers can attain up to 96% population coverage through roaming to Telstra network. Subscription figures are at 30 June 2009, excepting Optus which is 31 March 2009.

Handsets

Handset shipments (and by association, sales) continue to be strong. A total of 8.8 million handsets were shipped to Australia in 2008. Most of these are sold through mobile carriers and resellers in contract packages. These packages encourage additional sales at a higher rate than subscription growth, through offers of heavily subsidised handsets in exchange for taking out or renewing a fixed period contract.

Table 2.2: Handset shipments, 2008

Month	Handset Sales
January	551,159
February	597,326
March	682,630
April	929,622
May	797,430
June	666,484
July	544,743
August	455,833
September	798,383
October	1,218,642
November	988,132
December	602,371
Total	8,832,755

Source: AMTA website

2.2.3 Competition and regulation

Competition

Competition in the Australian mobile telecommunications industry is high among established firms, both in terms of price and service. All carriers directly provide service to over 95% of the population, with the '3' network accessing this share through a roaming agreement which provides service on Telstra's network in areas where they have no coverage. '3' customers have been able to roam onto the Vodafone 2G network since December 2009 as a result of the VHA merger.

Resellers are limited in their ability to compete on price by the price at which they are able to procure network services from the four carriers. There is also some scope for those firms which offer other telecommunications services to provide price advantages through bundling, benefitting the carriers, as well as some larger resellers. On the whole there are a large number of firms with similar product offerings, and firms that cannot offer price competitive services will lose customers.

As well as strong internal competition, the mobile telecommunications industry is driving competition in other areas of the communications sector. Although most Australians use both mobile and fixed services, there remains competition for which service is used for calls when

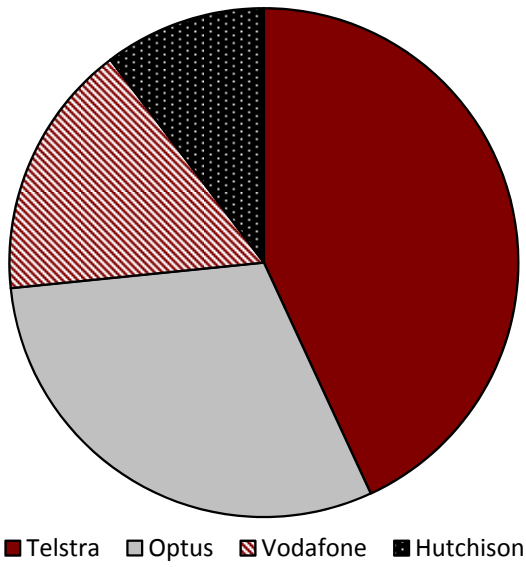
not on the move. If fixed call rates are more expensive than those for mobiles the volume of calls made on mobile handsets will be higher. Similarly, as the functionality of mobile data services increases and mobile internet continues to improve and the price of these falls, the mobile telecommunications industry moves further into direct competition with fixed internet services, however at this stage mobile broadband services primarily remain a complement rather than substitute for fixed line broadband services.

Strategies to attract customers and increase revenue per user have become simpler than in recent years, focused around value for money. This includes an increase in the role of cap mobile plans, and the use of data bundles to encourage the adoption and usage of internet-based services.

Although competition is high among existing market players, there remain substantial barriers to entry to the Australian market for mobile carriers. The capital costs of establishing a nationwide network are prohibitively high for most potential entrants, and even if these expenses can be met, the existing firms all have large market shares from which they generate economies of scale and, where they offer other telecommunications services, economies of scope. The VHA merger likely to increase the magnitude of the economies of scale as duplication of core services is reduced. Finally, the prevailing high rate of technological change in telecommunications presents a barrier, as a new entrant's technology may be out of date even as they launch it. The result is that barriers to entry for new competitors in the mobile sector are high.

Chart 2.2 shows the market share of mobile network carriers by revenue in 2009. Market shares had stabilised in a narrow range around a 40/30/20/10 pattern, with Telstra as the largest carrier holding around 40% market share, followed by Optus, Vodafone and Hutchison respectively.

Chart 2.2: Market share of mobile network carriers by revenue, 2009



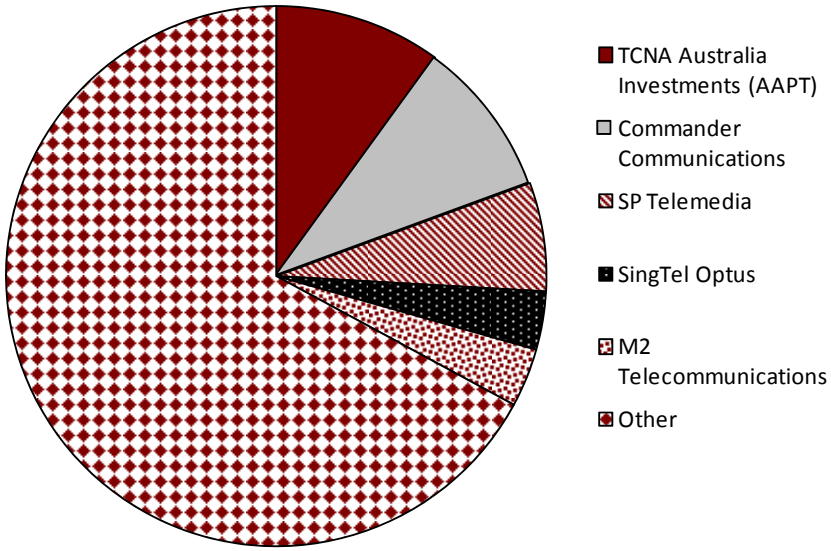
Source: IBISWorld J7122, September 2009

However the shape of the carrier market is set to alter, with approval given by the Australian Competition and Consumer Commission (ACCC) for a merger between Vodafone and

Hutchison in June 2009. The merged company, VHA, will have a market share of 30% across its two brands – Vodafone and 3 – in the Australian market. There are no immediate plans to merge service provision of the two carrier arms, with all existing customer contracts to continue as is through the existing provider.

Chart 2.3 shows the market share for resellers of all telecommunications services in the same year. The barriers to entry are lower for resellers than carriers, as the required infrastructure investments are much lower. As a result there are more and smaller resellers, with none holding a large market share. However the market as a whole is much smaller than that of carriers.

Chart 2.3: Market share of resellers by revenue, 2009



Source: IBISWorld J7123, August 2009

Note: This pie chart includes activity by all resellers, of which mobile telecommunications was estimated by IBISWorld to have accounted for 35% in 2008-09

Regulation

The main regulatory body is the Australian Communications and Media Authority (the ACMA). The specific responsibilities of the ACMA include regulating compliance with legislation, licence conditions and the like; reporting on matters relating to the communications industry, including its performance; and issuing telecommunications licences and radiofrequency spectrum.

Under the *Telecommunications Act 1997 (Cth)*, the telecommunications industry has broad scope for self-regulation. The industry has developed a range of industry codes, primarily via the Communications Alliance industry group. As at 30 June 2009, the ACMA had registered 22 telecommunications codes. The ACMA may act in response to a complaint of a breach of one of these codes as well as more formal regulation.

The Telecommunications Industry Ombudsman (TIO), which carriers are obliged to join, may also be responsible for responding to breaches of these codes. The TIO is funded by members,

and is a dispute resolution body for residential and small business customers and their service providers. Failure to join the TIO scheme may result in pecuniary penalties to a carrier.

The increasingly blurred line between services offered by mobile telecommunications and television and the internet was highlighted by the *Commonwealth Legislation Amendment (Content Services) Act 2007*. This legislation amended the *Broadcasting Services Act* so that viewing safeguard laws which apply to content delivered over the internet and television are now applied to live content and internet accessed via mobile devices.

The ACCC made the 2G GSM network a declared service in 1997, increasing competition and effectively restricting the price carriers may charge for terminating access services.

The regulatory framework under which mobile telecommunications operates may soon shift considerably, with the government announcing plans to enter discussions with Telstra regarding a change in its corporate structure in September 2009[7]. While it remains to be seen whether this will directly affect ownership of any mobile telecommunications infrastructure, any change in fixed services and consumer regulation may have implications for competition and market structure across all telecommunications sectors.

The arrival of the National Broadband Network (NBN) is expected to have a significant impact on the regulatory landscape of the industry. Because of the substantial volume of regulation and regulatory reform required to implement the NBN, the industry as a whole may move from one of mostly self-regulation to one of co-regulation, where the government and industry share the task more equally.

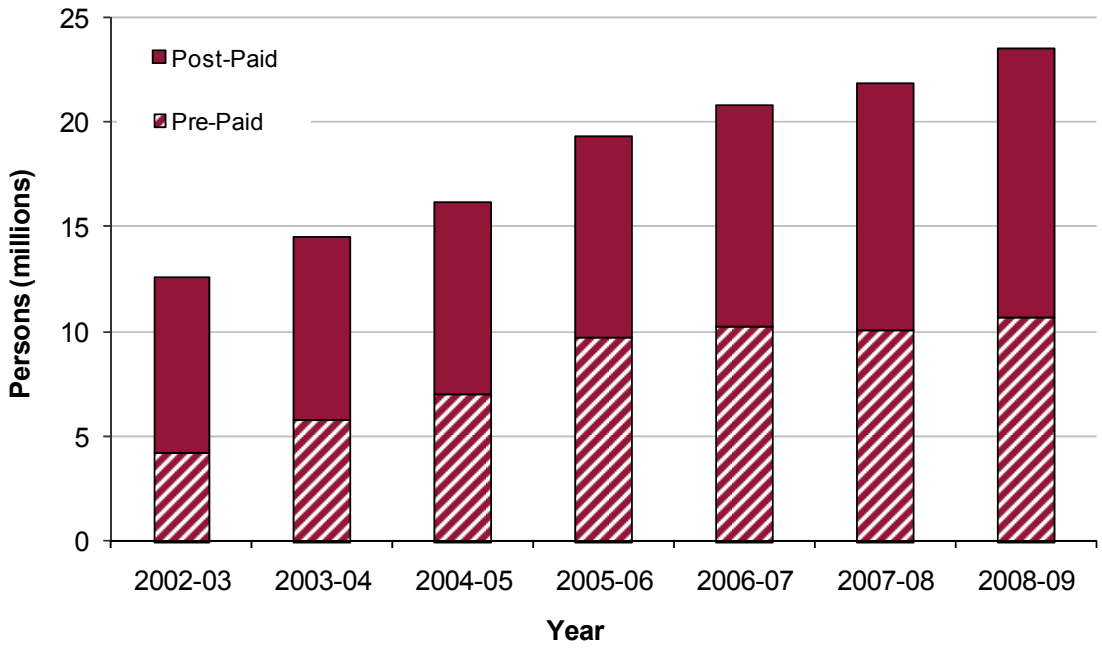
2.2.4 Trends

Pre-paid/Post-paid

There has been a move towards post-paid mobile phone contracts in the past two years, with number of pre-paid services in Australia levelling off. From 2001-02 to 2005-06 pre-paid services were increasing market share, however firms have introduced strategies to arrest and reverse this trend. The ACMA (2009) suggests that incentives offered by service providers to consumers under post-paid contracts – including free or subsidised handsets, periodic repayments for handsets, bundles with data allowances, and cheaper call rates – encourage uptake of these services in preference to pre-paid, where the customer may have better control over their total spend.

[7] Conroy 2009, "Historic reforms to telecommunications regulation", media release, 15 September

Chart 2.4: Pre- and post-paid services



Source: ACMA 2010

Fixed/mobile usage

For most Australians, fixed line and mobile telephone services operate in a complementary fashion. Mobile is used while away from home, and services that are available on mobiles but less so on fixed (for example Short Message Service and video calls) while fixed services are used for making calls while at home.

However for some people mobile phones are a substitute for fixed line phone services. In 2008-09 the ACMA (2010) estimated that approximately 10% of Australians aged 14 years and over did not have a fixed line phone service.

This is part of an overall trend of:

- an increasing proportion of voice calls being carried over mobile networks compared with the proportion of voice calls carried over the fixed-line networks; and
- a decrease in the number of fixed-line connections and an increase in the number of mobile connections.

As mobile subscribers continue to increase in Australia, the number of fixed line subscribers has fallen, with a loss of 0.33 million fixed line services in 2008-09 (ACMA 2010). The absolute numbers of calls from fixed lines fell in most categories, with increases only in calls from fixed to mobile numbers.

The greater convenience of using a mobile phone as a default home contact, rather than a fixed line, is relevant in the drop-off of fixed line usage. Additionally, the falling costs for mobile phone usage mean that calls from a fixed line are no longer strictly cheaper than calls from a mobile.

Mobile phone call costs per minute declined by 4.8% in 2008-09, from 28.7 cents to 27.4 cents (ACMA 2010). The ACMA (2009) suggests the fact that plans that do not charge in a strict per-minute fashion, including "caps" where a fixed price is charged for up to a much larger value of calls, are factors contributing to the ongoing fall in call costs. Average revenue per call minute is higher for 2G mobiles than 3G, with costs of 30 cents per call minute for 2G compared to 26 cents for 3G (ACMA 2010). The difference in pricing between 2G and 3G is driven by differences in intensity of use.

The level of competition posed by mobile services has seen call rates fall for fixed line services, with a decline of 2.3% on average across all Public Switch Telephone Network (PSTN) call types seen in 2008-09. The trend towards mobile services is further highlighted by the increasing share of fixed-to-mobile calls in PSTN call revenues, accounting for 18.6% of total fixed phone services revenue in 2008-09 (IBISWorld J7123).

2.3 The role of mobile data

Mobile data is an increasingly important telecommunications service. Data services consist primarily of information and entertainment services, such as corporate and private email, video streamed off the internet, and social networking. Use of mobile data comes in three main forms:

- 3G-enabled mobile phones, including PDAs and smart phones;
- Laptop computers, through use of built-in wireless broadband cards, or wireless attachments (e.g. USB dongles); and
- Other uses – some applications include back-to-base alarms, integrated transport systems such as those used by some taxi services, and coverage of broadband black spots (3G routers designed to be used in a fixed location).

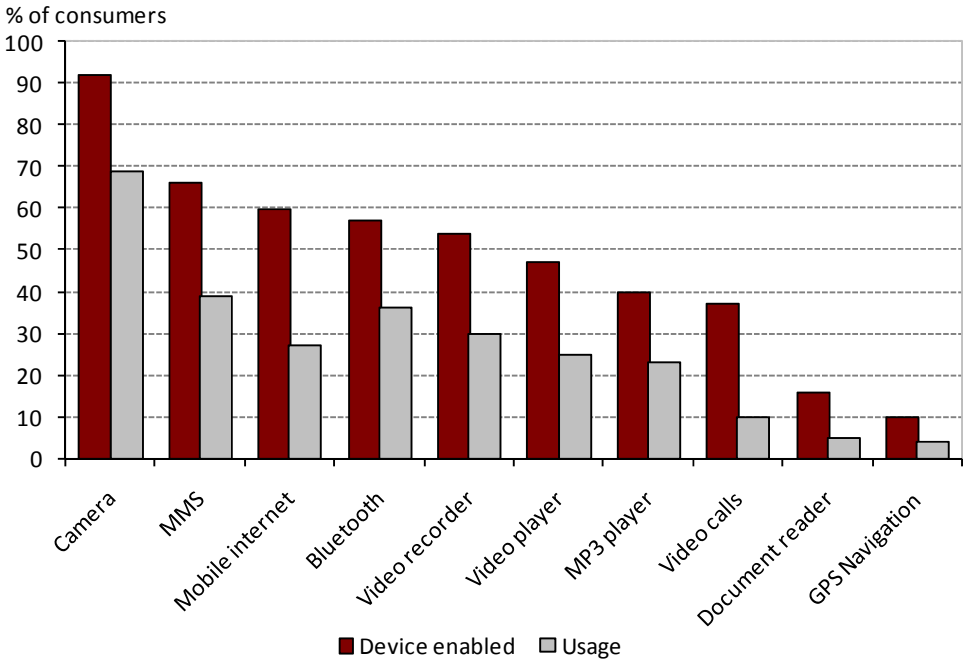
2.3.1 Handheld devices

The 2008 report noted that, although an increasing share of mobile phone subscribers owned 3G-enabled phones, a large proportion of these owners were not making use of these services.

However the role of not just data-capable but data-friendly phones has increased in the past year. The first quarter of 2009 represented the first time that shipments of data-centric smart phones exceeded those of voice-centric phones (IDC, October 2009). The highly popular Apple iPhone, which accounted for 21% of Australian smart phone sales[8], can be partially credited with this rise.

[8] Computerworld, 12 October 2008, "iPhone sends Aussie smartphone market soaring", accessed 28 October 2009

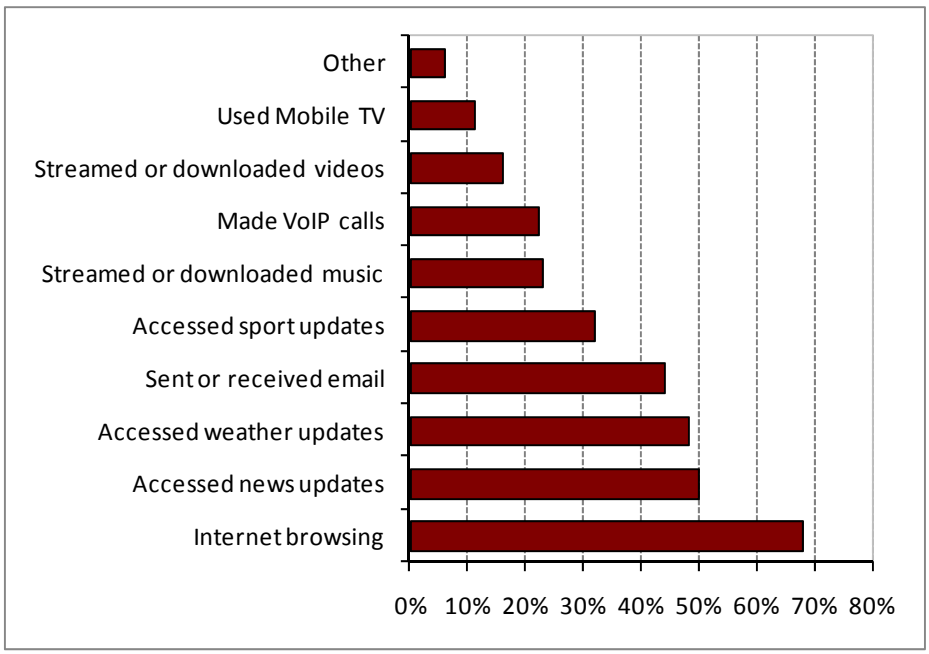
Chart 2.5: Capability and usage of non-voice services, 2008



Source: ACMA 2009

It is estimated that some 55% of all mobile phone users now have a phone that is mobile data enabled (ACMA 2010). However only around one-third of these users, or 18% of all mobile users, used their phone in 2008-09 to utilise non-voice content and services online (ACMA 2010). This represents a substantial increase on evidence in the 2008 report, which suggested that only around 5% of users accessed the internet on their phones.

Chart 2.6: Mobile internet activities undertaken on handheld mobile devices



Source: ACMA 2010

The most popular uses of mobile internet activities are general internet browsing, mobile email, and news and weather services. Use of more advanced services, such as mobile television, remains low.

Social networking is a popular use of mobile data, with the ability to access websites such as Facebook and Twitter via a mobile device viewed as driving the adoption of mobile internet services overseas[9]. Dedicated mobile applications that allow use of these social networking sites without an internet browser have been developed for a wide range of 3G handsets, encouraging the use of handset data.

Mobile carriers and resellers have promoted the adoption and usage of mobile data on handheld devices through the use of bundle plans, where a mobile phone plan is combined with a fixed monthly fee for a given volume of data use.

These handheld devices provide easy-to-access internet services while on the move, however are not generally designed to be used as an individual's sole internet connection. They are more likely to be a supplementary device (at least for data) that is utilised when fixed devices are unavailable.

2.3.2 Laptops

Mobile internet services on laptops have increased in popularity as the major carriers continue to make investments in improving speeds. Some new laptops now contain a 3G card ready for use on wireless networks, while the major mobile carriers, as well as some non-phone internet services providers, offer wireless plans that run with the use of a USB 'dongle' as a modem.

The speeds attainable by mobile internet have increased enough in recent years to be classified as 'broadband' speeds (typically defined as speeds greater than 256Kbps). Depending upon the network used, the average speeds attainable range from 300Kbps to 3Mbps, although there may be some 'bursts' where speeds could reach 8Mbps or higher[10].

Mobile broadband is now in use as an alternative product offering to fixed line broadband where these services are unavailable. This is mostly in more remote locations where it is impractical to roll out cable or fibre.

These services have the full functionality of fixed broadband devices (albeit with lower speeds) and the benefit of portability. This has brought mobile telecommunications into more direct competition with fixed internet services, with scope for some consumers to exclusively use mobile services in areas where mobile broadband is available. However while the scope to exclusively use mobile broadband services exists, it overwhelmingly remains a complement to existing fixed line services.

Mobile wireless internet services are increasing as a share of total internet subscriptions, accounting for 23% of the total in 2009 (ACMA 2010). This includes mobile handsets as well as laptops and other uses, and is indicative of a wider preference for mobile communications, as evidenced by the drop-off in fixed telephone lines in recent years.

[9] BBC online 2009, *Facebook driving mobile net usage"*, 14 July.

[10] Source: Websites of carriers and service providers.

2.3.3 Mobile data expectations

International experience

Data has grown rapidly both in total and as a share of revenue for mobile carriers internationally. In Europe, Vodafone data traffic rose 300% over the period 2007-2009, and now represents 11% of all European services revenues[11]. In Latin America, the experience was similar, with Telefonica reporting total growth of nearly 37% in mobile revenue for first half of 2009 year-on-year[12]. This trend was also seen in North America, with Bell Canada reporting a 33% growth in wireless data revenue and 124% growth in subscriptions from Q3 2008 to Q3 2009[13].

Overseas expectations indicate an ongoing rapid expansion in the adoption and usage of mobile data. Cisco Systems have forecast a 39-fold increase in mobile data traffic from 2009 to 2014[14]. Similarly, AT&T projects that mobile data by volume will grow at a compound average growth rate of 65%-80% over 2007 to 2018 (Rysavy 2008).

At the subscriber level, the GSM Association expects mobile data customer numbers to increase 71% in 2010 alone[15]. CCS Insight anticipates a slightly slower growth rate than this in Europe, forecasting instead a gain in subscriber numbers over two years (2009-2011) of 95%[16].

The increase in useability is also highlighted by ABI Research, who forecast a 55-fold increase in shipments of mobile broadband-enabled consumer products between 2008 and 2014[17].

Forecast for Australia

The use of mobile data is forecast to substantially increase in Australia. Access Economics forecasts that, across the industry, data adoption rates will accelerate over the next five years. This forecast technological adoption rate shows a similar pattern to those seen for recent technologies, such as mobile phones and fixed broadband.

ACMA (2010) indicates that the majority of Australians with a 3G subscription do not use data on their mobile at all, meaning they have a data-enabled phone but have not yet adopted the technology. Consequently adoption rates have been forecast both for 3G subscriptions and for mobile data subscriptions, with the mobile data subscriptions representing those who are actively using the data.

Over the years 2010-2014, data subscriptions are forecast to grow at a faster rate than 3G subscriptions, as some of those who have data-enabled devices but are not yet using data

[11] GSA 2010, *Mobile broadband growth results*, January.

[12] Ibid.

[13] Ibid.

[14] Reardom M, *Cisco predicts wireless-data explosion*.

[15] Fierce Wireless 2010 *GSMA predicts 15% spike in mobile broadband investment*, February 10.

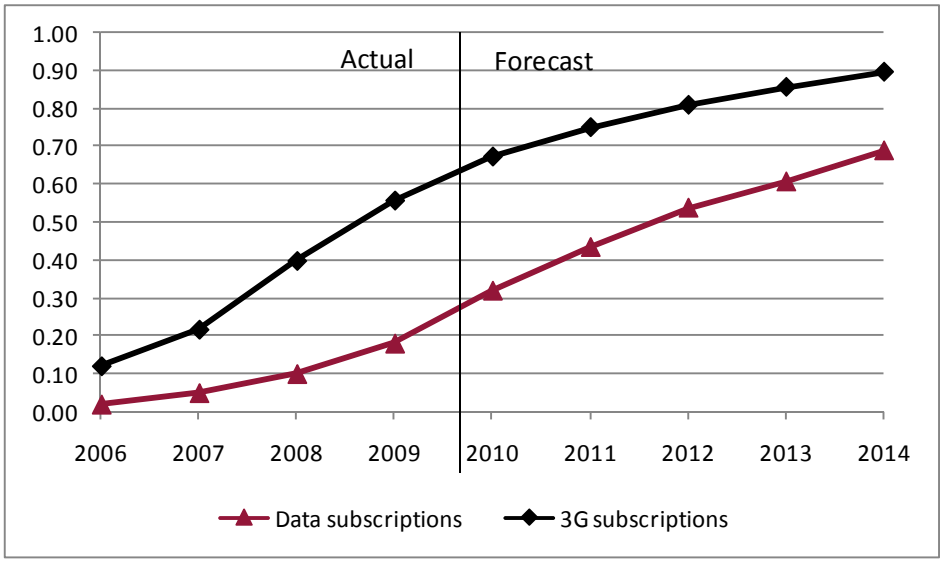
[16] GSA 2010, *Mobile broadband growth results*, January.

[17] Ibid.

services take them up. However a gap of around 20 percentage points is expected to remain in 2014, indicating that there will still be around 4 million 3G subscribers with data-enabled devices but not using data.

The forecasts suggest that data adoption rates will increase by 282% over the next five years (Chart 2.7). This forecast growth would mean that total adoption rates by 2013-14 will be nearing 70%. However because of the many potential mobile data applications, this does not mean that this proportion of the population will have a mobile data service, rather it means that there will be 0.7 services in operation for every Australian.

Chart 2.7: Forecast data subscriptions per head of population



Source: Access Economics

It is likely that a number of these services will reflect duplication, where for example one person has subscriptions for both their mobile and laptop; however the extent of this duplication is unclear. As a result, a given mobile data subscription rate does not necessarily indicate the proportion of the population with a mobile data subscription.

Growth in consumption of mobile data is expected to be even higher than that of mobile data adoption. This represents the fact that existing subscribers are expected to increase their usage. It is unclear how much of this growth will be attributed to handheld devices compared to laptops with mobile broadband.

Comparison with fixed broadband

Fixed broadband connections can serve as both a complement and rival to mobile data applications. In the case of handheld devices they will tend to be complementary, while in the case of a laptop the mobile broadband is more likely to be a substitute stand-alone service.

Access Economics forecasts suggest that fixed broadband adoption rates will slow considerably in the coming years, and the gap between the number of fixed and mobile broadband subscriptions will be close to closed by 2014. Some of the slowdown in fixed broadband adoption rates can be attributed to the rapid uptake of mobile broadband as a new and potentially more useful application.

Mobile broadband subscriptions are growing much more rapidly than fixed broadband, with an 80% growth rate in mobile data subscriptions over 2008-09, compared with less than 18% for fixed broadband. Mobile broadband is also entering its main growth phase of adoption, while broadband in an overall sense is approaching maturity[18]. In the five years to 2014 Access Economics anticipates a growth in mobile data subscriptions of 282%, compared with 31% for fixed broadband.

2.4 Spectrum in mobile telecommunications

2.4.1 Spectrum allocations for mobile telecommunications

Mobile telecommunications rely upon access to radiofrequency spectrum in order to be operational. Planning, allocation and management of spectrum is the responsibility of the ACMA using a range of approaches including spectrum licences to determine conditions of access. Spectrum licences can be obtained for relatively short periods via the apparatus licensing regime and for longer periods, up to 15 years, via the spectrum licensing regime. Australia's first 15-year spectrum licence allocations are due to begin expiring in 2012, requiring the Government to consider its policy approach and a process to manage licence renewal.

The spectrum requirements of carriers have evolved over time. For example, the 1800MHz frequency range was used more intensely in the 1990s and early 2000s when 2G services were the technological leaders as their importance has declined the intensity of spectrum usage in this frequency band has dropped. Going forward, strong demand for advanced mobile data applications and services including mobile broadband will require the retention of existing spectrum and access to new spectrum allocations. As mobile broadband becomes increasingly used as an internet solution, scope for these services to be operated on a range of spectrum frequency bands increases.

Part of the 700MHz range has been identified by AMTA as a key spectrum frequency range for LTE. This is the range in which analogue television is broadcast in Australia, and which is planned to be made available for other purposes following the shutdown of the Australian analogue television networks by the end of 2013. This shutdown will free up a substantial share of spectrum in this range, the so-called 'digital dividend', which may then be reallocated for more productive purposes.

Internationally, the 700MHz band has been identified as a band for LTE rollout, with Verizon in the US indicating that they will deploy LTE in this band (Rysavy 2008) and AT&T indicating that it will deploy LTE in this frequency band in some key markets from 2011[19]. This frequency band is also expected to be used for this purpose in Australia, with Telstra announcing plans to deploy LTE in rural broadband gaps using 700MHz if it is successful at attaining spectrum at auction[20].

[18] This is true of fixed broadband as a whole; however there is ongoing substitution between forms of fixed broadband as existing subscribers upgrade to faster speeds.

[19] GSM Association 2009, *GSM/3G Market/Technology Update*, December 10

[20] Ibid.

A number of European countries have also committed their respective 'digital dividend' spectrum ranges to LTE, including France, Germany, Sweden and Norway[21]. Indeed, trials by operators have commenced in using 'digital dividend' frequencies for High Speed Packet Access or LTE broadband services[22]. AMTA have noted that it is important that the digital dividend process in Australia be progressed in a timely manner in order to ensure pace is kept with international markets[23].

A report prepared by Spectrum Value Partners for AMTA indicated that Australia's economy would be boosted by up to $10 billion if at least 120MHz of useable spectrum from the 'digital dividend' were allocated to mobile broadband uses[24]. Notwithstanding the wide range of views canvassed in the DBCDE's *Digital Dividend Green Paper,* the government has identified 126MHz as a target amount of spectrum seen as optimal for the 'digital dividend' process.

In line with a decision in 2000 by World Radio Conference, the 2.5 Gigahertz (GHz) spectrum band has been identified as a potential space for mobile broadband. This range is already used for mobile broadband services overseas, and this generates compatibility benefits, including the fact that devices designed to operate on the 2.5GHz frequency are already being produced.

In Australia, the 2.5GHz frequency is currently in use for electronic news gathering (ENG) however it has been identified by the ACMA as one that may potentially be reallocated in light of the international identification and allocation of this frequency for mobile broadband purposes. This is the subject of a recently released the ACMA discussion paper *Review of the 2.5 GHz band and long-term arrangements for ENG*, and of an ongoing review. The ACMA discussion paper stated that its preferred outcome is the conversion of the ENG apparatus licences to spectrum licences in part of the 2.5GHz band and the reallocation of the remainder of the band, a 2 x 70MHz allocation, for wireless access services to be primarily used for mobile telephony and mobile broadband services.

AMTA sees gaining access to the 2.5GHz and 700MHz frequency bands for mobile data applications as critical to ensuring the infrastructure is in place if forecast future demand for mobile broadband services is to be met, and if continued technological advancement through the rollout of services such as LTE is to occur[25].

2.4.2 Considerations for the allocation process

While the ACMA has identified scope for a change in the allocation of the 2.5GHz frequency range, spectrum is a finite resource and care must therefore be taken when determining how it should be allocated. In order to maximise total economic welfare from spectrum allocations, consideration should be given to:

- the highest value use for spectrum;
- efficient investment and innovation;

[21] Tony Warren 2009, *Short term action for long term evolution*, presentation to RadComms09

[22] GSA Digital Dividend Update February 2010

[23] ACMA 2009, *Draft Five-year Spectrum Outlook 2009-2014 Submission,* September.

[24] Ibid.

[25] AMTA Spectrum Policy Vision Overview Statement

- competition; and
- consumer convenience.

Highest value use

Governments work on global, regional and local levels to manage, and where necessary coordinate, the allocation of spectrum for specific purposes such as telecommunications, broadcasting, radio astronomy, satellites, defence, meteorology and others. Total economic welfare is maximised where all spectrum is allocated to its highest value use. The highest value use of spectrum is commonly assessed through bidders' willingness-to-pay for the licence. To date in Australia auctions have been used to allocate spectrum, with the highest bidder winning. Provided there are no concerns with issues such as competition and consumer value (see below), the highest bidder will ordinarily have the estimated highest value use for the spectrum.

The highest value use of spectrum is fluid. The value of licence renewal to an incumbent is contingent upon the future expected value of the spectrum to their business. This differs according to the profitability of services provided through that spectrum, as well as the 'life cycle' of the technology in use, in terms of both position on the life cycle curve and its overall length. As a technology, for example 2G mobile services, nears the end of its lifecycle, the amount the incumbent is willing to pay to retain the licence may fall, while a market entrant looking to introduce new technology could have a higher willingness to pay, as they may have many more years across which to generate returns. Equally though most incumbents may plan to reuse existing spectrum for new technology based services. The government needs to carefully consider whether renewal or re-allocation is likely to result in the highest value use approach.

Efficient investment and innovation

Efficient investment and innovation is dependent on the need to provide incumbents and potential licence holders with certainty about their future holdings. If an incumbent is uncertain about whether they are going to retain their licence beyond the end of the current licence period, they may make decisions with an eye to the short term, reducing overall efficiency.

Investment decisions with spectrum holdings can be distorted in several ways. It can involve underinvestment in current projects, such as reductions to maintenance and repair. It can also involve underinvestment in new projects or the deferral of projects until there is greater certainty about the future tenure of licences.

Alternatively incumbent licence holders could choose to roll out technologies which have greater resale value if spectrum licences are lost, rather than technologies which would result in more efficient use of the spectrum. Incumbent licence holders could also choose to invest in projects which have a shorter lifecycle and where the returns occur sooner, but are lower in the long run.

All these investment decisions could result in a reduction in economic welfare if they are made as alternatives to the investment decisions which maximise the value of the use of the spectrum. Licence allocation and renewal processes that reduce uncertainty about future

spectrum availability will aid in ensuring that the efficiency of investment and innovation is maximised.

Competition

This is an important consideration in the distribution of spectrum among market players, both within the same industry and across industries. The ACCC has previously supported the application of competition limits for some auctions in order to encourage competition and the entry of new participants in the telecommunications market (ACCC 2002).

Competition concerns may arise particularly when there is scope for perverse incentives. This includes the scenario where the highest value use may be for a firm to purchase a licence simply to prevent their rivals from gaining access to it. Under such a situation, the licence holder will not be using the spectrum to generate additional economic value, instead merely increasing the value of investments on their other spectrum holdings. However it may be difficult to create an allocation process that completely protects against this outcome.

The *Radiocommunications Act 1992 (Cth)* gives the ACMA scope to utilise a price-based allocation process that limits the number of licences that may be issued to any one person or group of persons, and provides scope for the Minister to direct the ACMA to do the same.

Consumer convenience

Consumer convenience is particularly important in the case of spectrum that has previously been allocated and is due for renewal. If spectrum is being actively used to provide services for consumers, there may be large displacement costs to consumers if that spectrum is then reallocated to a different user.

This is particularly true of mobile telecommunications, where hundreds of thousands of consumers would be impacted if a licence on which one of the mobile carriers provides services were not to be renewed. There is an inconvenience cost to these consumers from losing access to their services, and also in lost utility from investments they have made on the basis of receiving these services, as these often cannot readily be transferred for use elsewhere.

However this social value to consumers is not reflected in a licence bidders' valuation of spectrum. Consequently there is a need to consider the social costs of failing to renew an incumbents' licence in the decision making process.

Other considerations

In some cases, there may be a need to consider additional factors. One such example is the 2.5GHz spectrum frequency and potential benefits from international compatibility. Additionally, this may include spectrum that is allocated to essential services and has a public interest aspect, such as spectrum allocated to defence and emergency services.

3 Productivity, innovation and investment

3.1 Productivity

Productivity gains from information and communications technology are notorious for being difficult to observe in official productivity statistics (indeed the Solow paradox[26] describes this difficulty). Instead the productivity benefits are mostly analysed in a qualitative fashion, using surveys and anecdotes of cases where productivity improvements have occurred.

Handheld devices

Mobile voice

The advancement of mobile devices has led to improved workplace productivity. A survey conducted by Kelly Services found that more than 80% of Australians believe mobile communications technology has boosted their personal productivity[27]. However 36% of those surveyed also indicated that they were working longer hours due to greater contactability.

Anecdotal evidence suggests that mobile telephony has benefited business by allowing for time to be made productive and for people to remain up-to-date with news and developments in the work place whilst out of the office. For example, IDC notes that responding to email is taking up an increasing amount of corporate user's time, so being able to use mobile devices to respond to email when out of the office allows employees to be more time efficient and better at utilising gaps in their work schedule (IDC 2005).

The Centre for Economics and Business Research (CEBR) conducted a study on labour productivity on behalf of the UK telecommunications firm O_2, finding that, overall, mobiles increase UK labour productivity by almost 1%. The gains were largest among 'mobile workers', the group of largely blue-collar workers with no fixed work location, including tradespeople. These numbers imply that, because of mobiles, UK workers can work for around 20 minutes less each week to achieve the same output. In total, the CEBR estimated that the productivity benefits of mobile phones boosted UK GDP by £8.9 billion in 2004.

In the US, a study by Ovum (2008) found that mobile voice services generated productivity gains worth $157 million in 2004. Ovum argues that the widespread adoption of mobile technology has been the catalyst in the turnaround in US labour productivity growth over the past decade.

[26] The Solow Paradox describes a remark by Robert Solow in 1987 that "You can see the computer age everywhere but in the productivity statistics".

[27] Kelly Services 2009, "Mobile technology lifts productivity but lengthens working hours for Australian employees", 7 July, accessed via http://www.kellyservices.com.au/web/au/services/en/pages/about_us_media_release_mobile_technology_lifts_productivity.html on 17 December

Mobile data

As smart phones increase in market importance, the productivity benefits of mobile telephony are increasingly becoming available to office-based workers while they are on the move. A study by Ipsos-Reid found that BlackBerry smart phones enabled users to turn what would otherwise have been 60 minutes of downtime into productive time each workday, adding up to a total of 250 hours per year (Ipsos-Reid 2007). The study further found that cost savings attributable to BlackBerry use equated to US$250 per user per year, and estimated the value of access to time sensitive email and calls while mobile averaged US$5,000 per user per year.

There have been numerous case studies or examples of the impact that mobile telephony has on productivity of a business or firm. For example:

- The Tasmanian breast cancer screening program uses mobile broadband technology to digitally transmit X-ray images from their mobile screening unit to head office in Hobart, saving up to two weeks in processing time and reducing staff time spent on administration.
- Magazine distributors Gordon and Gotch have increased efficiency, accuracy and turn-around time by providing PDA devices to merchandising team members, allowing them to collect information and submit this information wirelessly to the publisher's server.
- Independent internet broadcaster Viocorp improved efficiency through moving all staff to a single corporate account, reducing costs by 50%, and provided all staff with data-enabled phones to increase worker flexibility when working off-site.

The productivity benefits extend beyond improved outcomes for business. Modelling undertaken for Telstra found that, in the long term, annual real household consumption will be 1.4% greater than it would be in a scenario without mobile broadband services[28].

Technological advances increasingly mean that functions previously requiring multiple devices can all be undertaken on a smart phone or PDA. This means that time that had previously been relatively unproductive, such as time spent travelling to and from work, can instead be used to catch up on emails or for conducting other work functions.

Mobile broadband

Mobile broadband services are a rapidly growing source of productivity gains to the economy. Ovum (2008) estimated that, in 2005, mobile broadband services produced productivity gains of $28 billion to the US economy. The potential of rapid adoption of mobile technologies is highlighted in forecast productivity gains, with a forecast total productivity gain from all mobile telecommunications of $427 billion per year by 2016, an increase of 130% on 2005 levels.

Aside from the Ovum report, research considering the productivity impacts of mobile internet services to date has been largely limited to handheld devices to date. However mobile broadband functions on a laptop or similar device in the same manner as 'traditional' broadband, and so studies considering the impact of this may be used as a proxy for additional evidence in this area.

[28] Concept Economics 2009, *Next G Productivity Impacts Study*, February, Sydney.

Connected Nation Inc. (2008) considered the economic impact of increased broadband access and adoption in Kentucky that arose as a result of the ConnectKentucky initiative, which brought together partners in the public and private sectors to foster both the supply of and demand for broadband. When compared to projections of what broadband uptake in Kentucky was expected to have looked like without the initiative, it was found that broadband adoption was 7 percentage points higher. The estimated economic impacts for Kentucky totalled $1.59 billion annually.

Crandall *et al* (2008) controlled for a number of factors that will influence productivity performance including taxes, education level and wages to measure the impact of broadband directly. Their measure of broadband take-up is the number of broadband lines per capita. Using regression analysis, they find consistently positive effects on both employment and output at the State level as well positive effects for all but one of fourteen 2-digit industry sectors examined.[29] Among the results, they found that, for the period 2003-2005, an increase of 0.01 lines per capita – an increase of around 10% – resulted in an increase of 0.46% in output in the non-farm private sector.

A MICUS (2008) study into the impact of broadband on productivity in the EU considers the problem in two steps. Firstly, the impact of broadband on productivity is analysed at the company level on the basis of experiences such as case studies from Cornwall and Piedmont and previous analyses of statistical datasets in the USA, UK and Europe. Secondly, the macro-economic impact of broadband on productivity is evaluated by multiplying the figure obtained at the company level with the indicator of adoption of online services among European companies. Overall, the use of online services generates an average annual productivity improvement of 0.29% across the EU27, with higher benefits in the services (0.32%) and business services (0.58%) sectors, and lower benefits in the manufacturing (0.14%) sector.

3.2 Innovation

Innovation in telecommunications industry has been occurring at a rapid pace for some time, and this trend is continuing.

Networks

Following the closure of Telstra's now-superseded CDMA network in April 2008, Telstra has put considerable effort into migrating customers across to Next G™ network and further expanding this network to more than 99% population coverage. This network operates on the 850MHz frequency band, a lower frequency band that is well suited to regional areas.

Optus continues to expand its network, which operates on the 900MHz and 2100MHz bands. In December 2008, Optus completed its 3G network rollout to reach 96% population coverage, with plans to expand network coverage to 98% of the population. The VHA (Vodafone) 3G network has also been expanded, taking in a larger number of regional centres.

[29] The one sector where the effects were negative was arts, entertainment and recreation although all of the estimates were not statistically significant.

Innovation in networks and services continues to be made. Internationally, moves indicate the arrival of 4G technologies, with much higher internet speeds than what is available on Australian wireless services (IBISWorld J7122).

Indeed, Optus became the first carrier to announced plans to commence trials of LTE 4G technology in Australia in 2010[30]. This trial is expected to take between six and nine months, with Optus indicating that the technology may be capable of peak speeds of 340Mbps. Telstra has also announced plans for a trial of LTE technology[31].

The line between competing technologies has become increasingly blurred due to innovation. Historically the main rival to mobile telecommunications has been fixed line telephony. However as smart phones are adopted and individuals are able to utilise wireless internet services on mobile handsets, a wider range of alternative communications services become direct competitors to mobile telecommunications, including fixed internet services.

Handsets and services

Innovation in handsets and wireless technologies available to be utilised in handsets has also been prolific.

- The release of the iPhone 3G has seen a notable increase in the adoption and use of 3G technology in Australia. This popular handset allows for full 3G capability, and encourages usage of this through an online application store.
- The Amazon Kindle e-book device operates on a 3G wireless connection. This enables download of books purchased from the online store, as well as availability of subscriptions to newspapers and magazines worldwide, which are automatically downloaded to the subscriber's device once available.
- Voice2Text services were first introduced for business customers by Telstra in 2007, with both Optus and Telstra now offering such services. This subscription add-on enables voicemails to be automatically converted and delivered to a subscriber's phone in text message form.
- Innovation has been seen also in the packages offered by carriers, with cap plans an increasingly popular means of moving customers onto post-paid contracts. Bolt-on subscriptions, particularly for download quotas, have also become more prominent in an effort to increase adoption of mobile internet services.

3.3 Investments

The mobile telecommunications industry is a capital-intensive one due to extensive coverage and capacity requirements, the upgrade to advanced network technologies and the development of large scale customer sales, service and billing systems. Many innovations in technology standards require significant infrastructure investments before returns can be earned.

[30] http://www.itnews.com.au/News/160830,optus-to-launch-lte-wireless-trials.aspx, 18 November 2009

[31] http://www.theaustralian.com.au/australian-it/telstra-to-trial-lte-in-may/story-e6frgakx-1225842397175, 18 March 2010

Recent investments

As 2G technologies approach the end of their lifecycle, there is a negligible level of investment in this level of technology, with a focus instead on 3G and trials of LTE.

Telstra has undertaken investment in its Next G™ network to increase maximum download speeds. These increased maximum speeds from 14.4Mbps to 21Mbps, with a rollout for business customers undertaken first in February-March 2009, followed by rollout for residential customers in April[32]. The Next G™ network was upgraded in early 2010 to support peak download speeds of 42Mbps.

Optus continues to roll out network upgrades, including increases in network coverage. Network coverage reached 96% of the population in December 2008. Optus also has plans to extend its 3G network coverage to 98% of the population with the mobile network footprint exceeding 97% voice coverage as at 31 March 2010.

Vodafone has expanded its 3G network coverage, increasing total population coverage from 80% to 94% with recent upgrades. These upgrades cover a large number of regional centres, with the 3G network coverage now having virtually the same reach as Vodafone's existing 2G network.

Investments in less traditional mobile telecommunications have also taken place. There has been considerable research in WiMAX technologies, looking at the provision of high-speed internet over mobile broadband. Research into this has been undertaken by firms not currently active in mobile applications, potentially increasing mobile broadband competition.

Investment in mobile communications has spread beyond firms in the telecommunications industry. An example of this is WiFi hotspots in restaurants and cafes, where customers are able to use the provided wireless internet, either for free or at a charge. This service can be used by a mobile customer on their mobile device without consuming any paid-for data under their contract, improving useability for mobile internet and potentially encouraging the adoption and usage of mobile internet services as a whole.

Planned investment

Telstra has announced plans to further increase the speed of its Next G™ network, with upgrades to increase the speed to a theoretical maximum of 84Mbps during 2011[33]. This upgrade may not be experienced by all Telstra customers, with some likely to be constrained by the speeds that can be tolerated by handsets. Some customers will need to upgrade their handsets in order to utilise the faster speeds.

There are some concerns that investment going forward may be constrained by uncertainty due to the expiry of existing radiofrequency spectrum licenses and access to new spectrum. Recovery of investment in telecommunications infrastructure requires many years of operation, and as such the current lack of certainty as to whether spectrum will be retained long enough to generate an appropriate return.

[32] AAP 2009, "Telstra to roll out world's fastest wireless network", February 17

[33] http://www.telstra.com.au/abouttelstra/media-centre/announcements/telstra-launches-worlds-first-hspa-dual-carrier-network.xml

Government investment

Formal plans for the construction of the NBN were announced by the Federal Government in April 2009. This network involves rollout of fibre to the premises broadband for 93% of Australians in the most densely populated regions, with the next 4% of the population to receive wireless coverage at 12Mbps and the remainder to receive satellite coverage at 12Mbps[34].

Although a large share of those households covered will already have access to 3G wireless technology via the carriers networks, the 12Mbps service that is to be built may expand the total reach of wireless technology in Australia. The speeds offered through this service are slower than current maximum speeds available through the carriers' networks, however it is unclear whether the areas that are due to receive 12Mbps access under the NBN already have access to these speeds.

The NBN nevertheless represents a significant potential government investment in wireless technology over the coming eight years.

[34] Assuming the Federal Government adopts the recommendations of the KPMG/McKinsey NBN Implementation Study.

4 Economic contribution of the industry

The mobile telecommunications industry makes a substantial contribution to the overall Australian economy[35]. In addition to its direct contribution to aggregate output through value added by the industry, mobile telecommunications also benefit other industries and economic sectors by raising the labour productivity of workers. Access Economics has used its AE-GEM dynamic computable general equilibrium model to quantify the economy-wide impacts of falling mobile telecommunication prices and rising labour productivity resulting from increasing mobile device usage.

4.1 Direct contribution

The direct contributions of the telecommunications industry can be summarised as follows:

> **Value added** – the contribution production in the sector makes to gross domestic product (GDP) – totalled $6.7 billion for the 2008-09 financial year. This is down 0.8% from $6.8 billion in 2007-08.
>
> **Employment** in the sector totalled 20,790 full-time equivalent (FTE) persons for 2007-08; down 1.8% from the previous year.
>
> Earnings to employees declined 2.2% in 2008-09.

Table 4.1 outlines the direct economic contribution of the sector for the last five financial years.

Table 4.1: Industry revenue and value added, 2004-05 to 2008-09, 2008-09 $m

	2004-05	2005-06	2006-07	2007-08	2008-09
Industry revenue	14,322.0	14,654.5	15,518.7	16,391.9	17,788.3
Industry value added	6,503.7	5,986.8	6,476.0	6,753.6	6,702.5
Gross operating surplus	*4,785.5*	*4,351.6*	*4,944.1*	*5,284.3*	*5,257.7*
Earnings to employees	*1,718.2*	*1,635.2*	*1,531.9*	*1,469.3*	*1,437.0*
Employment	23,893	22,117	21,964	21,170	20,790

Source: IBISWorld J7122 and J7123 and Access Economics estimates

Output (revenue)

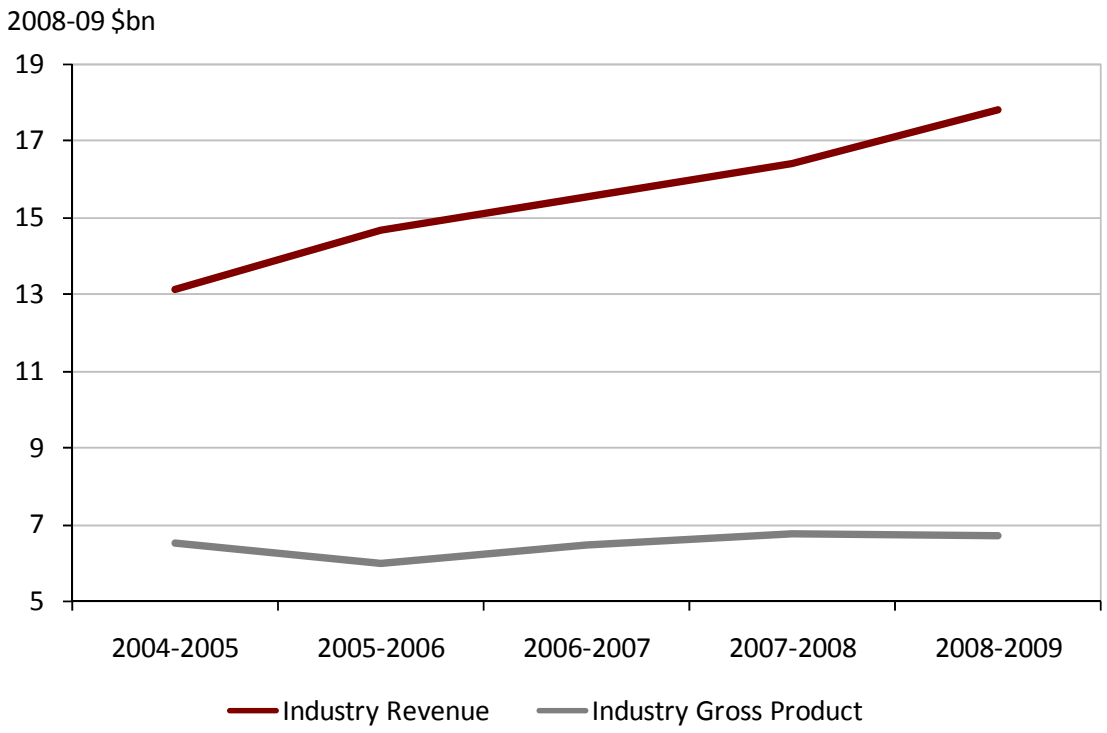
Output in the sector was valued at $17.8 billion for 2008-09, up 8.5% on the 2007-08 total. Chart 4.1 demonstrates the trend of high growth in industry revenue. Industry output has growth strongly in recent years; the 2008-09 result represents a total increase in output of 24.2% over five years.

[35] Note this analysis takes account of mobile carriers and resellers. For example, the mobile handset industry is also an important contributor of value added and employment in Australia. However, data is presently unavailable to quantify the industry wide contribution.

Over the period 2004-05 to 2008-09, increases in revenue have been driven by a substantial increase in mobile telecommunications subscriptions, with the total number of mobile accounts increasing from 18.4 million at the end of 2004-05 to over 24 million in 2008-09. The high growth in subscription numbers has more than offset the downward pressure that falling prices for telephony services has had on revenue figures.

After having eased in recent years, the growth rate in output surged again in 2008-09, even as subscription rates pass 100% of the population. Higher yielding product offerings, including the increased share of data-enabled phones and corresponding increases in data usage, are a large contributing factor to this increase.

Chart 4.1: Industry revenue and value added

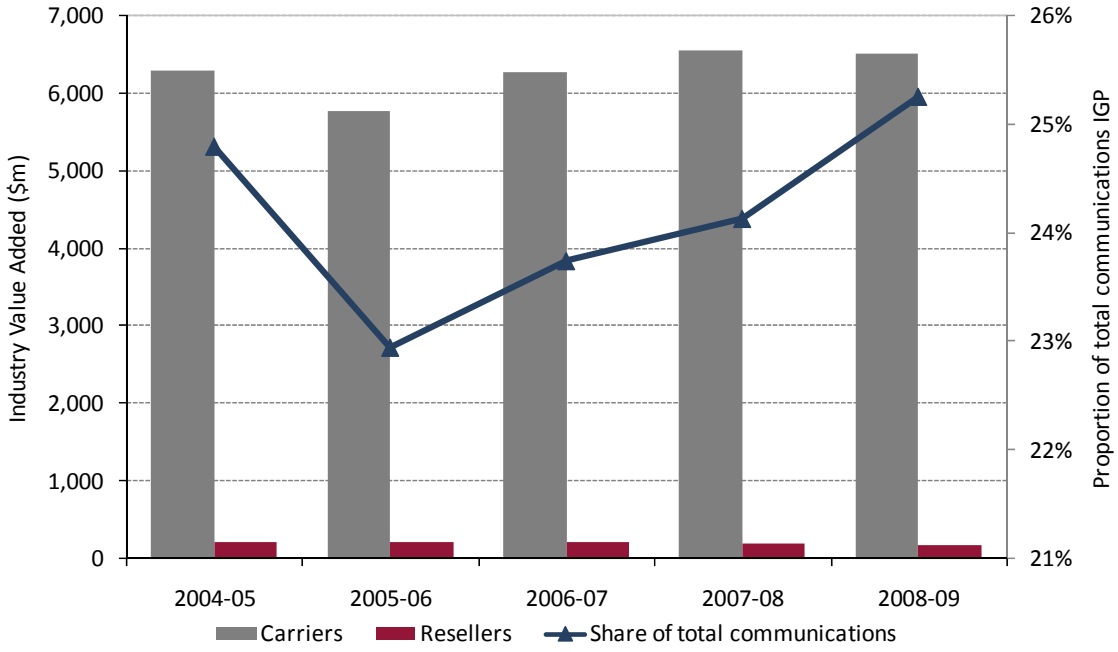


Source: IBISWorld J7122 September 2009 and J7123 August 2009 and Access Economics

Industry value added

The combined industry value added of mobile network carriers and resellers in 2008-09 was $6.7 billion or 0.61% of total GDP for the year. This represents a real decline of 0.8% for the year, with more of the decline attributable to earnings to employees than to capital. The mobile telecommunications industry accounted for 25.3% of the total communications industries' contribution to GDP (Chart 4.2) in 2008-09.

Chart 4.2: Industry value added



Source: IBISWorld J, J7122, J7123, ABS 5204.0 and Access Economics

The total share of resale activity in the telecommunications industry attributable to mobile phones has increased in recent years, from 32% in 2006-07 to 35% in 2008-09. Nevertheless, the reseller component of industry value added remains small compared to the activity of carriers.

Role of labour and capital

Employee earnings are wages paid to those working in the mobile telecommunications industry. In 2008-09, the total wage bill for the mobile telecommunications industry was approximately $1.4 billion. This is a decline of 2.2% on the 2007-08 result. The decline in total wages paid is partially attributable to the difficult business climate in 2008-09, and partially due to the continued decline in employment in the industry.

Table 4.2: Earnings to employees (2008-09 $m)

	2004-05	2005-06	2006-07	2007-08	2008-09
Earnings to Employees	**1,718.2**	**1,635.2**	**1,531.9**	**1,469.3**	**1,437.0**
Carriers	*1,597.9*	*1,535.5*	*1,426.1*	*1,362.6*	*1,327.5*
Resellers	*120.3*	*109.7*	*105.8*	*106.7*	*109.5*

Source: IBISWorld J7122 and J7123 and Access Economics estimates

Earnings in the mobile telecommunications industry attributable to capital were $5.3 billion for 2008-09. In this report, earnings to capital have been derived as the residual of industry gross product once earnings to employees have been accounted for. The total earnings to capital in the industry have been highly stable in real terms over recent years, and also in terms of the share of total industry gross product, accounting for around three-quarters of the total.

Employment

Employment in the sector is estimated to be 20,790 employees FTE in 2008-09. This represents a fall of 1.2% in total number of employees for the year. As is to be expected, the vast majority of persons employed in the mobile telecommunications industry work for network carriers, with less than 10% of total employees working for resellers. Table 4.3 provides a breakdown of the share of total employment by carriers and resellers.

Both carriers and resellers have cut FTE staff for several years now, even as the industry continues to grow. This is largely to do with increased labour productivity. The same telecommunications technology that is increasing total labour productivity economy-wide is having the same effect within the industry itself, while mergers and acquisitions within the industry also play a role.[36]

Table 4.3: Employees, by carriers and resellers

	2004-05	2005-06	2006-07	2007-08	2008-09
Employment	**23,685**	**22,923**	**21,779**	**21,050**	**20,790**
Carriers	*21,468*	*20,850*	*19,800*	*19,065*	*18,745*
Resellers	*2,217*	*2,073*	*1,979*	*1,985*	*2,045*

Source: IBISWorld J7122 and J7123 and Access Economics estimates

Payments to Government

Like all major industries, the mobile telecommunications industry engages with the Australian Government regularly. For example, the industry contributes to government revenues through one off payments for spectrum allocations as well as through annual payments for apparatus licence fees and through other charges such as those relating to the National Relay Service, carrier licences, and numbering charges. Many of these payments are proportional to a carrier's eligible revenue, which is based on the carrier's gross sales revenue less a series of revenue and expense deductions.

Like businesses in other industries, those in the mobile telecommunications industry also pay corporate income taxes to the Australian Government and payroll taxes to State and Territory Governments.

The mobile telecommunications industry is required to make a number of industry-specific payments to government. Access Economics estimates that, in 2008-09, the value of these payments was $176.6 million, although it is noted that the $46.2 million received under the Universal Service Obligation is not retained by the government but rather paid to Telstra to cover the cost of providing universal services in areas where it is not profitable to do so. The portion of this total attributable to each type of payment is detailed in Table 4.4.

In addition, the industry contributes to its effective operation through voluntary and compulsory payments to support various industry associations and self-regulatory schemes, including AMTA and the TIO.

[36] For example, Optus' acquisition of Virgin Mobile and AAPT's acquisition of PowerTel.

Table 4.4: Industry payments to government, 2008-09[37]

Payment type	Basis for calculating payment amount	Estimated 2008-09 payment ($ million)
Radiocommunications licence fee		68.0
Universal Service Obligation	Eligible telecommunications revenue	46.2
National Relay Service	Eligible telecommunications revenue	1.9
Licence fee for fixed service	Number of fixed point-to-point installations	13.4
Numbering charge	Quantity of mobile telephone numbers	40.0
Annual Carrier Licence Charge	Fixed sum plus eligible telecommunications revenue	7.1
Total		**176.6**

Source: Access Economics calculations based on ACMA 2010

Note: Universal Service Obligation payments to Government are passed on to Telstra to cover losses that flow from providing universal services in non-profitable areas.

4.2 Indirect contribution

The economic impact of the mobile telecommunications industry extends beyond direct benefits detailed above. Falling mobile phone service prices have increased consumer benefits from telecommunications. Furthermore, the rise of mobile telecommunications has seen changes in business practices aimed at harnessing productivity gains from their use in almost every industry and sector of the Australian economy. This means that the economic impact of the mobile telecommunications industry encompasses its flow-on impacts on all other industries.

Access Economics has applied its in-house GE model, AE-GEM, to analyse the broader macroeconomic impacts of recent developments in mobile telecommunications. The key indirect effects modelled were falls in the price of mobile service delivery and labour productivity enhancements through the use of mobile voice services in the economy. The estimates are likely to be conservative as they do not incorporate productivity gains from mobile data.

Price declines

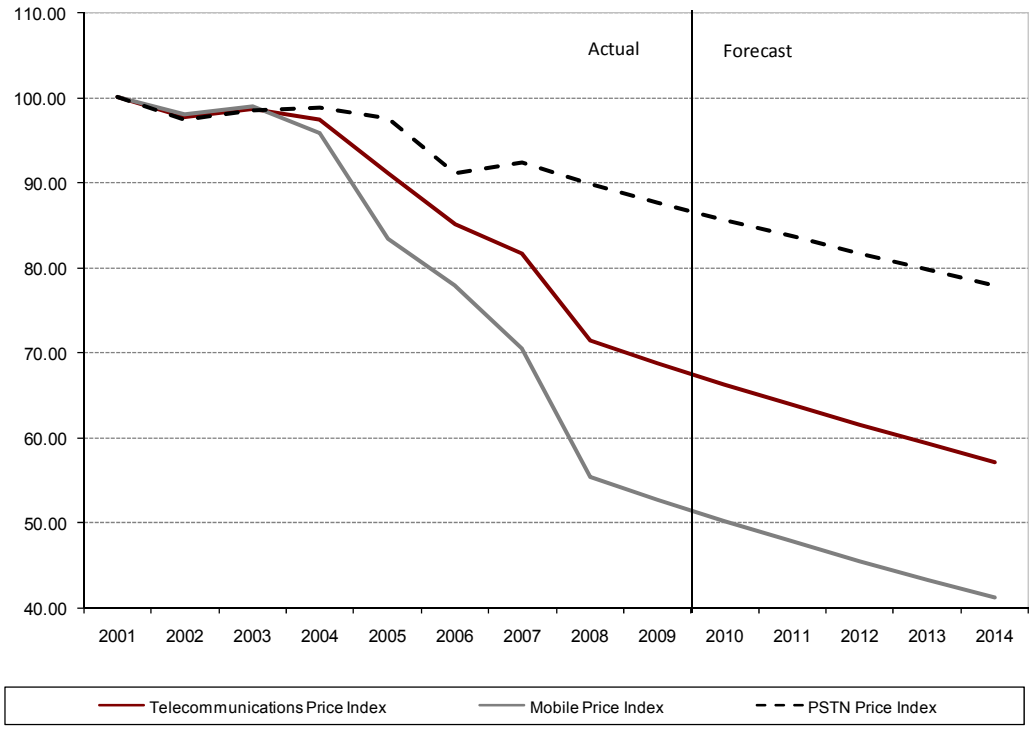
Strong competition in the mobile phone industry has led to cheaper mobile services. According to the ACMA, in 2008-09 average voice call costs for mobiles fell by 4.8% per cent. 2G customers were the beneficiaries of the cost reductions, with a 6.7% reduction in calling

[37] For payments that are contingent on eligible telecommunications revenues, the 2006-07 figures were computed by applying the share of mobile payments in the 2005-06 figures to the total payments made by the telecommunications industry in 2006-07 and adjusting for the rise in the share of mobile telecommunications revenues in total telecommunications revenues between 2005-06 and 2006-07. Licence fees for fixed services were estimated by assuming that the growth rate for such fees were the same in 2006-07 as in 2005-06.

costs in 2008-09, while call costs for 3G customers increased by 1.5% in 2008-09, from 25.6 cents to 26 cents.

The first component of the analysis of indirect effects is the simulation of the historical price reductions achieved by mobile telecommunications service providers over the period 2001-2009 (Chart 4.3).

Chart 4.3: Price indices used in modelling exercise



Source: ACCC, ACMA, Access Economics

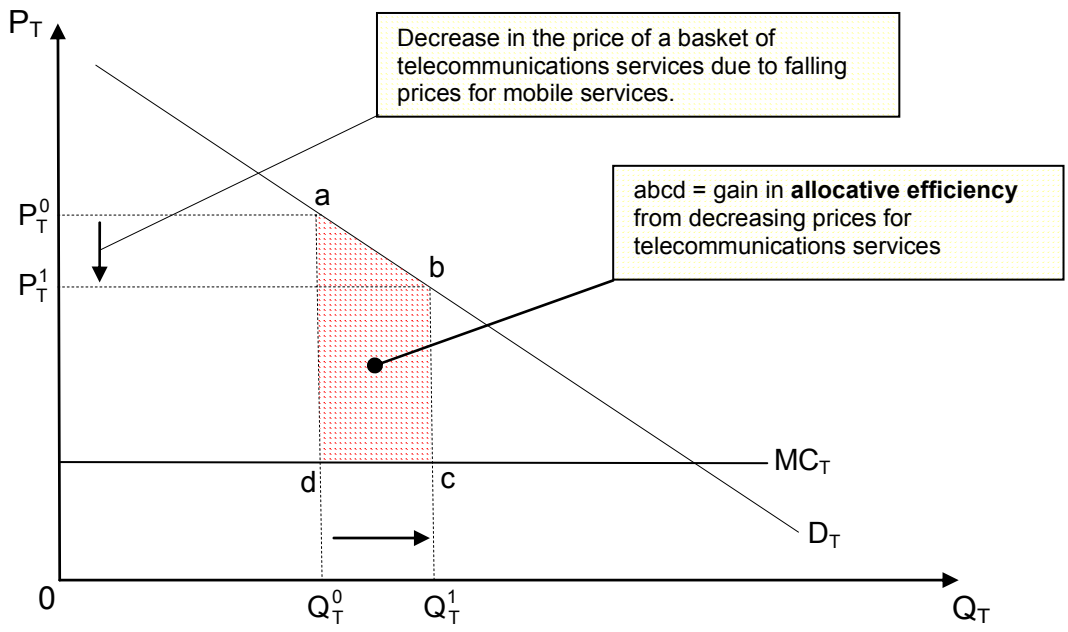
Economic benefits – theory

The fall in price of mobile telecommunications services in Australian creates economic benefits for consumers of telecommunications services, as there will be:

- gains to consumers of mobile services; and
- gains to consumers of telecommunications services more generally through the price pressure that mobile services place on fixed-line services in Australia via competition.

Therefore, the price decrease in mobiles services places downward pressure on the price of a basket of telecommunications services. The price-quantity diagram below captures the economic benefits associated with such an effect.

Figure 4.1: Economic impact of a price decline



The diagram adopts the following notation:

- D_T denotes the demand curve for telecommunications services;
- MC_T denotes the (constant) marginal cost to society associated with supplying telecommunications services;
- P_T is the per-unit price of telecommunications services; and
- Q_T is the quantity of telecommunications services.

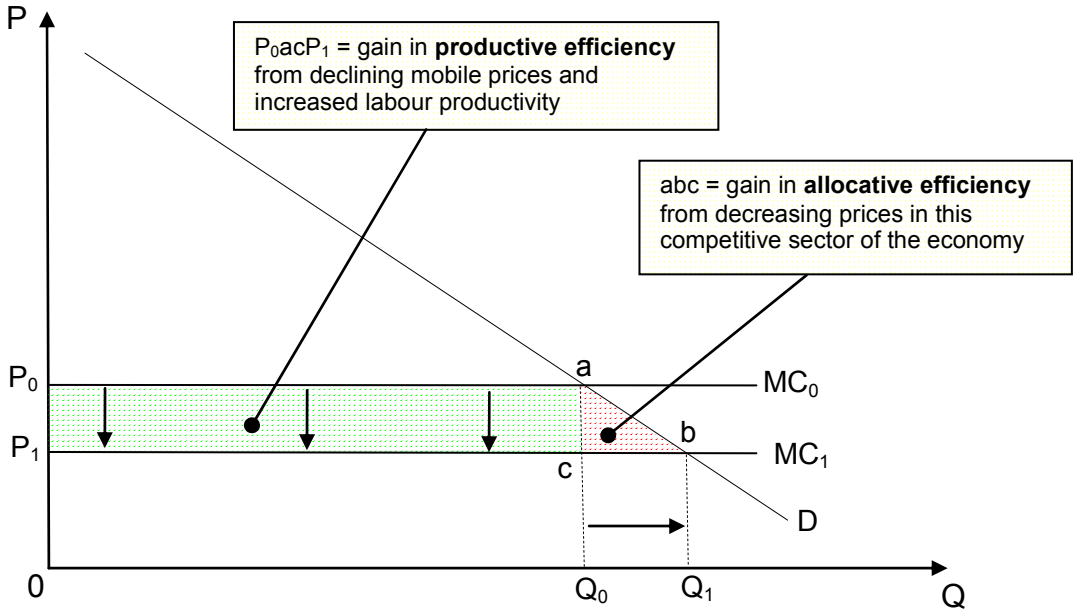
It illustrates that with a fall in the price of a basket of telecommunications services from P_T^0 to P_T^1, there will be an increase in the demand for telecommunications services from Q_T^0 to Q_T^1. As consumers value these additional units supplied from Q_T^0 to Q_T^1 by the amount $abQ_T^1Q_T^0$, and the cost to society of supplying these units is only $dcQ_T^1Q_T^0$, the increase in supply creates an overall increase in welfare equal to the red-shaded area abcd.

Productivity gains

Aside from mobile services being consumed, mobiles are also an input for many businesses across many different sectors of the economy. As detailed in Section 3 above, studies suggest that mobiles have a positive impact on the productivity of workers, and this will lead to gains in productive efficiency across the economy. These gains arise from the improved ability of workers to remain productive while 'on-the-go' through use of voice and data applications, for example through the ability to receive and reply to email.

The figure below captures this effect, by illustrating the increase in efficiency associated with a productivity gain in a particular competitive sector of the economy.

Figure 4.2: Economic impact of productivity improvements



Using similar notation to the previous section, the impact of mobiles on labour productivity in competitive sectors in the economy, is to decrease the marginal cost of production to society from MC_0 to MC_1, decrease the price from P_0 to P_1, and increase quantity from Q_0 to Q_1. The decrease in the cost of supplying Q_0 units, leads to a gain in productive efficiency equal to the green-shaded rectangle area P_0acP_1, while the increase in quantity from Q_0 to Q_1 leads to a gain in total welfare equal to red-shaded triangle area abc. Therefore, across each competitive market, the increase in productivity resulting from mobile telecommunications services generates an overall efficiency gain equal to area P_0abP_1.

Surveys conducted by Telstra indicated that on average, commercial users of the Next G™ network felt that their productivity had been improved on average by 9.3 per cent. The productivity improvements were quantified as estimated cost savings that the businesses using Next G™ have achieved in different areas (such as travel costs, administration costs and monitoring of staff costs)[38]. Earlier work by CEBR, on behalf of mobile phone provider O_2, in the UK had estimated that, on average, each worker in the UK in 2004 saved 20 minutes per week from the use of mobile phones[39].

These estimates of the productivity gain have been incorporated into the model as measures of the productivity gain from mobile phone usage, with the O_2 figures used for the productivity benefits of non-data activity and the Telstra study used as a base for the data analysis. Although mobile broadband is an increasingly widely used technology, the productivity gains measured here do not incorporate its use.

[38] Econtech, 2007. *Productivity gains of Next G™: results on the customer survey*. Report to Telstra.

[39] CEBR, 2006. *An analysis of how mobile phone use contributes to business productivity*. Report to O_2.

The industry is rapidly growing, both in terms of overall subscriptions and the uptake of the 3G network. According to the ACMA the number of 3G services in operation was 12.3 million at 30 June 2009, a 44% annual increase. Revenue from 3G services increased 47% over the year 2008-09[40].

Based on these sources, Access has estimated productivity shocks taking into account the higher proportion of mobile phone users accessing data services in 2008-09, as shown by the continuing increase in 3G subscriptions. The 2008-09 mobile data adoption rate of 18% (ACMA 2010) is used to estimate the impact of data on productivity.

Modelling results

The estimated economic impact of mobile telecommunications on the Australian economy was to raise economic growth as measured by GDP, in real terms, by $10.7 billion in 2009. That is to say, if mobile price levels had not fallen relative to the CPI from 2001, and there were no flow-on effects to PSTN prices or labour productivity, Australia's GDP would have been $10.7 billion lower in 2009. The results of the GE modelling are found in Table 4.5.

Table 4.5: Economic impacts in 2008-09

Variable	Change from reference values ($m)	Variable	% deviation from reference case
Real GDP	10,650	Real GDP	0.85
Real GNP	8,972	Real GNP	0.75
Real Consumption	5,271	Real Consumption	0.82
Real Investment	7,536	Real Investment	2.07
Real Exports	(168)	Real Exports	-0.06
Real Imports	2,651	Real Imports	0.95
Employment (000)	27	Employment	0.29

Source: Access Economics

Australia's economic welfare, measured by gross national product, was projected to be $9.0 billion higher in 2009 than would otherwise have been the case.[41]

In addition, investment and employment were projected to be stronger as a result of mobile telecommunications. For example, mobile telecommunications were projected to increase employment by 27,000 FTEs in 2009. These are not roles in the telecommunications industry, rather they are roles generated by the improved productivity and reduced cost of telecommunications services that have been driven by mobile telecommunications.

The trade impact of mobile telecommunications is overall negative, relating to the relatively high proportion of telecommunications hardware that is produced overseas and imported for domestic consumption. Additionally, the increased economic activity that has resulted from

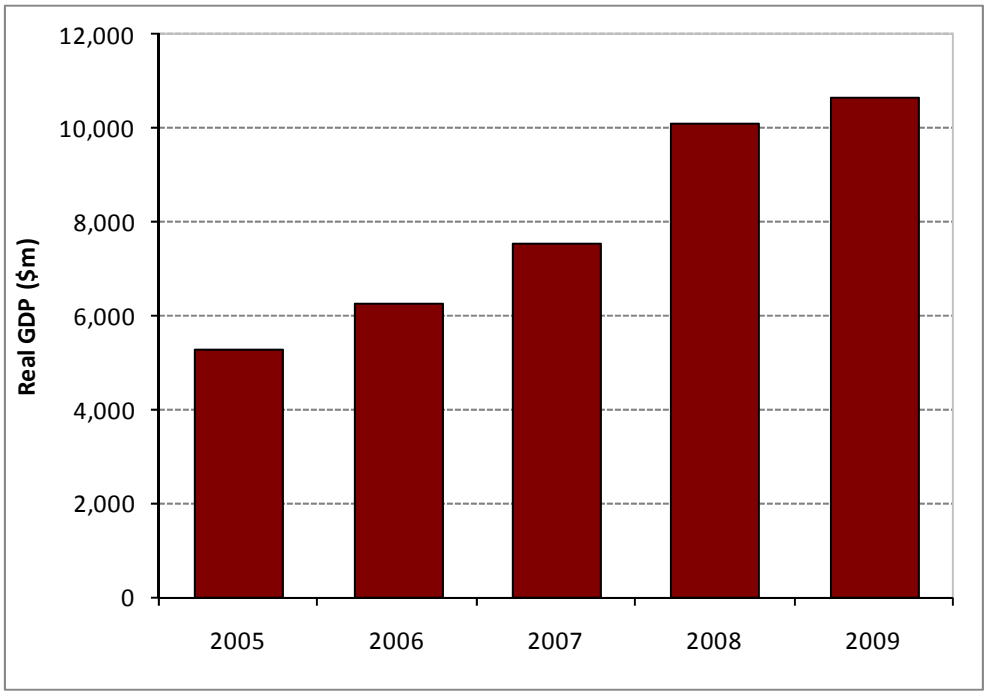
[40] Australian Communications and Media Authority 2010, *Communications Report 2008-09*, ACMA, Melbourne

[41] GDP measures the output produced in Australia and includes income generated by foreigners residing in Australia. GNP measures the output and income generated by Australians, including those living abroad.

mobile telecommunications has increased Australians' ability to purchase goods and services. Real imports are $2.7 billion higher as a result of mobile telecommunications services.

The indirect contribution to GDP has grown significantly in recent years, with a $3 billion increase in the result since the 2006-07 analysis (Chart 4.4). While some of this is due to price declines for mobile services, the main driver has been the productivity gains from increased mobile data adoption by new consumers and higher usage by existing consumers.

Chart 4.4: Economic impact on GDP



Source: Access Economics

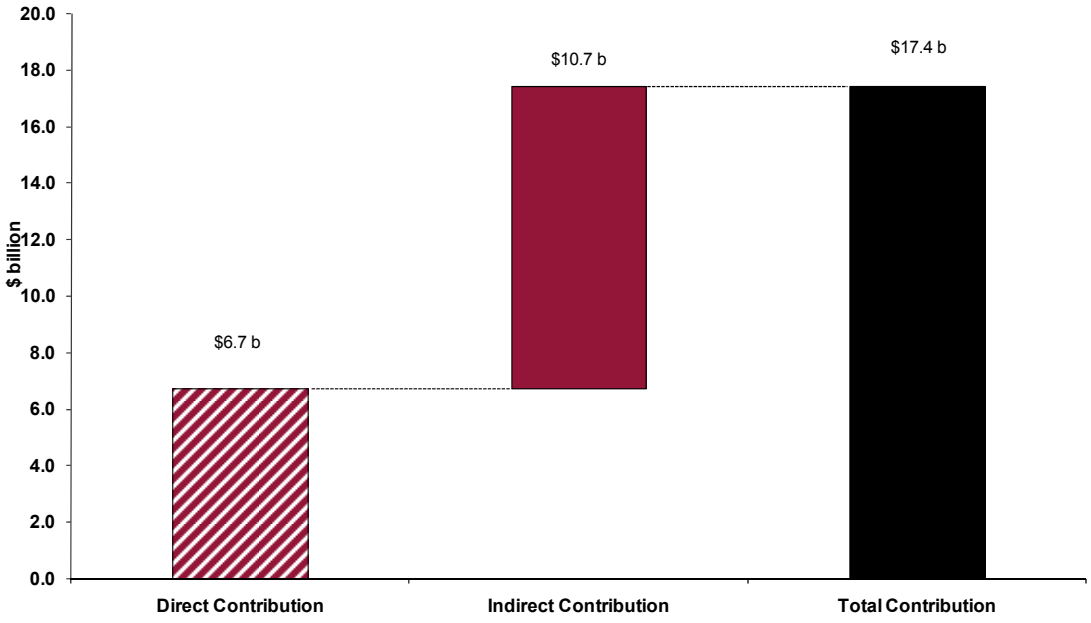
4.3 Total contribution

The total economic contribution of the mobile telecommunications industry is detailed in Chart 4.5. Combining the direct and indirect contributions, Access Economics estimates the mobile telecommunications industry contributed $17.4 billion to the Australian economy, that is, total GDP in Australia would have been $17.4 billion lower if the mobile telecommunications industry did not exist. Based upon the estimated Australian population at 30 June 2009 (ABS 2009), GDP per capita in Australia is $760 higher than would otherwise have been the case.

This total contribution is $3.2 billion higher than was reported for 2006-07. This change is predominantly an increase in indirect contribution, with productivity benefits to workers rather than increased production from the industry itself. In particular, the rapid adoption of mobile data over the past two years (with adoption rates increasing from 5% in 2006-07 to 18% by 2008-09) and increased usage of data by existing subscribers has enhanced the productivity impact of the industry.

Forecasts of rapid growth in mobile data adoption, with expectations of additional increases in usage by existing subscribers, suggest that the productivity impact of the industry is likely to continue to grow significantly over the next five years.

Chart 4.5: Total economic contribution of mobile telecommunications, 2008-09



Source: Access Economics

5 Concluding remarks

The Australian mobile telecommunications industry continues to increase in importance for the Australian economy. In 2008-09 the industry contributed $17.4 billion to the Australian economy. The indirect contribution of the industry represented more than 60% of the total value of the industry, indicating that mobile telecommunications services provide significant flow-on benefits to those businesses that make use of them.

The importance of the mobile telecommunications industry is on the rise in Australia, with growth of $3 billion in the contribution of the industry over two years. Mobile data applications are growing in importance for the industry and for business as a whole. In order to harness the full potential benefits of mobile telecommunications, including mobile data, to the economy going forward it is necessary to ensure that the industry is able to access adequate additional radiofrequency spectrum, facilitating network upgrades and improved service provision.

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Appendix A: Economic contribution studies

'Economic contribution' studies are intended to quantify measures such as value added, exports, imports and employment associated with a given industry or firm, in a historical reference year. The economic contribution is a measure of the value of production by a firm or industry.

Value added (output after deducting the value of inputs) is the most appropriate measure of an industry's/company's economic contribution to gross state product (GSP) at the state level and gross domestic product (GDP) at the national level.

The value added of each industry in the value chain can be added without the risk of double counting across industries. Value added of an industry can be calculated directly by summing the returns to the primary factors of production, labour and capital (the gross operating surplus, 'GOS', or profit), as well as production taxes less subsidies.

Measures such as total revenue or total exports double count — that is, overstate the contribution of an industry/company to economic activity — as they include the value added of other industries. For example the industry's sales revenue includes the value added of external firms supplying inputs to the industry.

While describing the geographic origin of production inputs may be a guide to a firm's linkages with the local economy, it should be recognised that these are the type of normal industry linkages that characterise all economic activities.

Unless there is significant unused capacity in the economy (such as unemployed labour) there is only a weak relationship between a firm's economic contribution as measured by value added (or other static aggregates) and the welfare or living standard. Indeed, the use of labour and capital in production is a cost to the economy. In simple terms, economic resources (land, labour, capital) are not for exclusive use by the industry (or any other business). That is, activity related to the industry comes at an opportunity cost as it may reduce the amount of resources available to spend on other (possibly more worthwhile) activities than producing and exporting minerals.

This is not to say that the economic contribution of the industry, including employment, is not important. As stated by the Productivity Commission (PC) in the context of Australia's gambling industries:[42]

> *Value-added, trade and job creation arguments need to be considered in the context of the economy as a whole…income from trade uses real resources, which could have been employed to generate benefits elsewhere…These arguments do not mean that jobs, trade and activity are unimportant in an economy. To the contrary they are critical to people's well-being. However, any particular industry's contribution to these benefits is much smaller than might at first be thought, because substitute industries could produce similar, though not equal gains.*

[42] Productivity Commission 1999, *Australia's Gambling Industries*, Report No. 10, AusInfo, Canberra, (page 4.19).

In a fundamental sense, economic contribution studies are simply historical accounting exercises. No 'what-if', or counterfactual inferences, should be drawn from them.

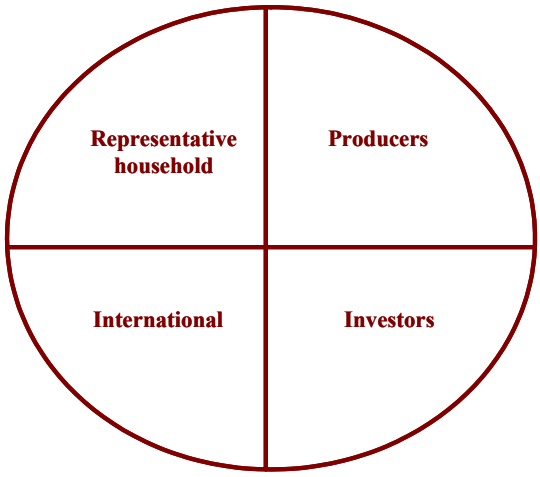
Appendix B: AE-RGEM

AE-GEM is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various *components* of the model, each which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works.

Figure B shows the key components of the model for an individual region. The components include a representative household, producers, investors and international (or linkages with the other regions in the model, including other Australian States and foreign regions). Below is a description of each component of the model and key linkages between components. Some additional, somewhat technical, detail is also provided.

Figure B: Key components of AE-GEM



AE-GEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases,

the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.

- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.
- Producers are cost minimisers, and in doing so choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
  - The model contains a more detailed treatment of the electricity sector that is based on the 'technology bundle' approach for general equilibrium modelling developed by ABARE (1996).[43]
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.
- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But in relative terms imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.
- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that

[43] Australian Bureau of Agricultural and Resource Economics (ABARE), 1996, *MEGABARE: Interim Documentation*, Canberra.

impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

The representative household

Each region in the model has a so-called *representative household* that receives and spends all income. The *representative household* allocates income across three different *expenditure* areas: private household consumption; government consumption; and savings.

Going clockwise around Figure B, the representative household interacts with producers in two ways. First, in allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as *inputs into production* along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The *representative household's* relationship with investors is through the supply of investable funds – savings. The relationship between the *representative household* and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

Some detail

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a Cobb-Douglas utility function.
- Private household consumption on composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. Private household consumption on composite goods from different sources is determined is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.
- All savings generated in each region is used to purchase bonds whose price movements reflect movements in the price of generating capital.

Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by

producers. In other words, investment demand adds to household and government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

Some detail

- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996).
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).
- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply is (assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as AE-GEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

Some detail

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within,

and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions must be met such as global exports and global imports are the same and that global debt repayments equals global debt receipts each year.

Table A outlines the eight regions in the model, including Australia, countries like China and Japan and multi-country regions like East Asia and the Euro Zone.

Table A: Modelling regions

	Region
1	Australia
2	China
3	Japan
4	East Asia
5	India
6	USA
7	Euro Zone 27
8	Rest of the World

Source: Access Economics