The Allen Consulting Group

Quantifying the possible economic gains of getting more Australian households online

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Report to the Department of Broadband, Communications and the Digital Economy

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Chapter 1

About this report

The Department of Broadband, Communications and the Digital Economy (the Department) has commissioned the Allen Consulting Group (ACG) to undertake this study to quantify the economic gains associated with increasing the number of Australian households connected to the Internet.

Access to, and use of the Internet, is already central to the operation of the economy. However, high-speed broadband connections via the National Broadband Network (NBN) will increasingly provide high-speed Internet connectivity and allow for users to upload and download large computer files and video streaming. In the coming decade, the Internet will become increasingly important, with broadband access as fundamental a requirement for social and economic participation as the telephone and electricity.

Notably, access to the Internet at home – and particularly broadband access – is lagging amongst specific sub-groups in the population. Lagging access by the elderly, those in regional and remote areas and those in lower income earning brackets are of particular concern to the Department.

1.1 What this study does

This study provides the following.

- A 'stocktake' of the benefits associated with increased household Internet usage. This includes the benefits that will likely accrue to households, businesses, government and third sector organisations.
- A dollar value estimate of the cumulative benefits households are expected receive from an increase in connectivity by 10 and 20 percentage points.
- An estimate of the implications increased household connectivity has for productivity.
- An estimate of the overall gains in the context of the economy at large and to differing parts of Australia, as calculated using a Computable General Equilibrium (CGE) model.

1.2 Limitations of the study

A number of important caveats should be considered when interpreting the results of this study.

First, as the focus of the study is on household broadband connections, a household that accesses the Internet through an off-site connection (such as at work or university) is not included in this study. The definition of broadband Internet connection is consistent with that of the ABS, which defines a broadband connection as an 'always on' Internet connection with an access speed equal to or greater than 256 Kilobits per second.

Second, it should be noted that no consideration of the potential costs and resources required to achieve this uptake has been provided for in this analysis, as this is outside the study's terms of reference. The costs of any initiative to increase Internet take-up may mean that some of the benefits identified here will not be realised either in part or in full. Moreover, the investment necessary to provide this level of connectivity may have a stimulatory effect in its own right. The economic implications of these impacts have not been assessed.

Third, the focus of the report is on the effect of increasing household broadband Internet take-up at home. No consideration is given to the increased use of business or government Internet use (except as through interactions with households). Non-home based connections (such as at work) are also not considered.

Fourth, the study refers to current broadband technology. The study does not consider next-generation broadband technology (such as that provided by the NBN) when forming any quantitative impacts. How next-generation broadband might impact on the analysis is discussed qualitatively where possible. Generally, because next generation broadband will be able to provide additional services to households, the estimates reported might be considered conservative.

Fifth, the findings presented here are the product of desktop analysis of available resources and data. No new data has been generated to inform the analysis.

And sixth, the analysis has not attempted to account for the dynamics involved with a high-speed broadband rollout. Increasing Internet take-up by the magnitudes considered here may in practice involve some delays. The dynamics of increasing household connectivity may be influenced by:

- the time required to provide appropriate infrastructure;
- delays in households acquiring an Internet connection; and
- the time it takes for disconnected households to acquire the skills necessary to navigate the Internet and realise the full extent of its benefits.

In light of these limitations, the results reported here should be considered illustrative of the potential benefits that might be amassed in time.

1.3 Report structure

The remainder of the report is structured as follows. Chapter 2 provides an overview of Internet connectivity in Australia; Chapter 3 presents a stocktake of the potential benefits that are enjoyed from joining the network; Chapter 4 considers alternative scenarios of heightened broadband connectivity, and quantifies the benefits where possible; Chapter 5 reports the results of the modelling exercise; and Chapter 6 concludes the report, providing a summary of the key findings of the analysis.

Chapter 2

Connected Australians

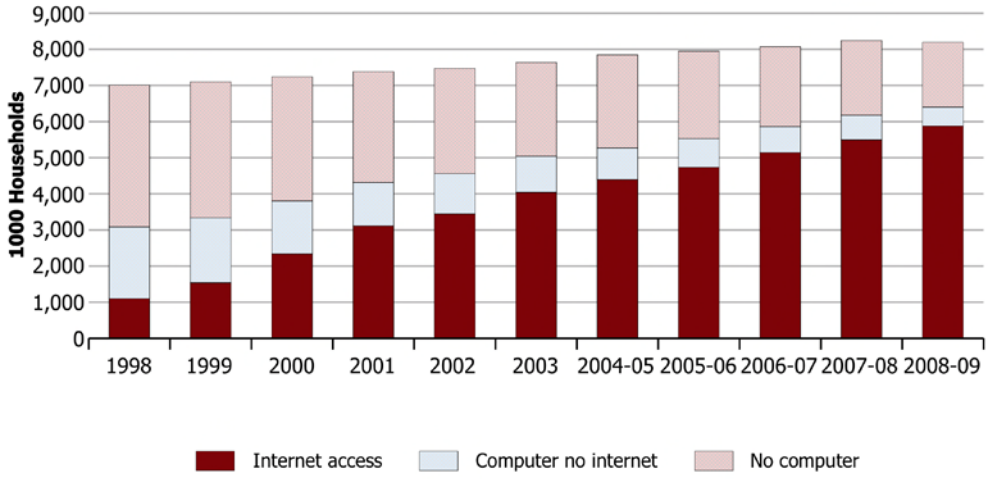
This chapter provides an overview of household Internet connectivity in Australia.

2.4 Who is connected?

Data regarding household Internet use is collected annually by the ABS. Approximately 72 per cent of Australian households (some 5.9 million) had a home Internet connection in 2008/09. This has grown rapidly over the past decade — in 1998 just 22 per cent of households had a connection. The figure below plots the growth of household Internet connections in Australia over the past 10 years.

Figure 2.1

HOUSEHOLD COMPUTER AND INTERNET CONNECTIONS, 1999-2008/09



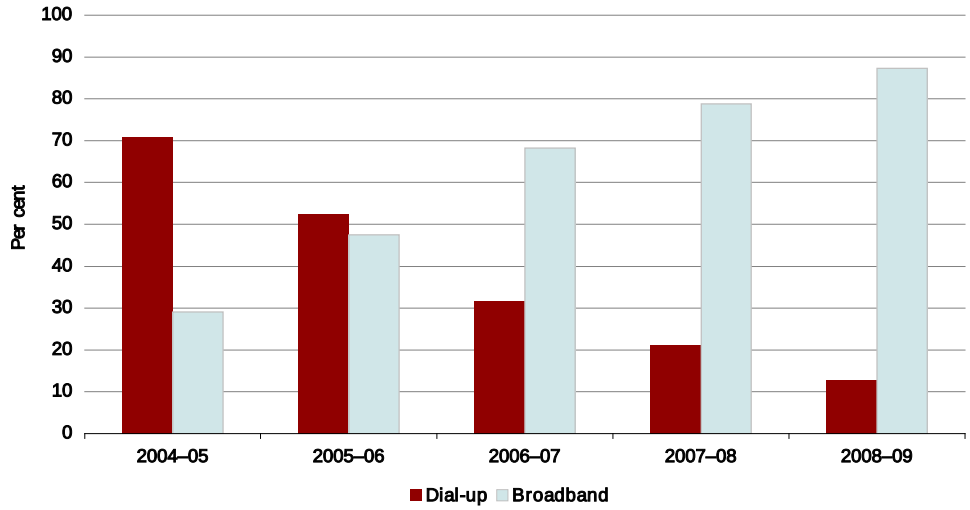
Source: ABS 8146.0

Growth in the number of Internet connections has accompanied a rise in the number of households with computers. The proportion of households with computers grew from 47 per cent in 1999 to 78 per cent in 2008/09. But the proportion of computer owners with Internet connections has grown at a faster rate. In 1999, less than half (46 per cent) of computer owners had an account; whereas today this proportion exceeds 90 per cent.

Broadband connections have become the dominant connection type households use to connect to the Internet. In the past six years, the proportion of households using a broadband connection to connect to the Internet has risen from under 30 per cent, to nearly 90 per cent. Over this brief period, broadband has replaced dial-up as the preferred connection type. Figure 2.2 reports the proportion of households with Internet access by connection type.

Figure 2.2

INTERNET CONNECTIONS BY HOUSEHOLDS WITH INTERNET, BY CONNECTION TYPE

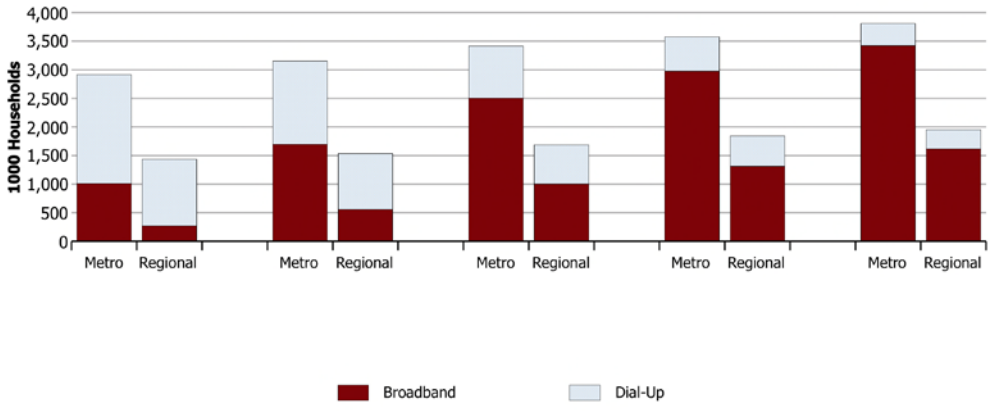


Source: ABS 8146.0

The proportion of households in regional areas with Internet connections has been around ten percentage points less than households in metropolitan areas. In 2008/09, 76 per cent of metropolitan households enjoyed an Internet connection, while connections existed in only 65 per cent of regional households. Moreover, metropolitan households also enjoyed faster connections as well. Although dial-up connections are phasing out of the market, regional households are still nearly 70 per cent more likely to connect to the Internet through a dial-up connection than are households in metropolitan areas. Internet connections in regional and metropolitan areas over the past 5 years are shown in Figure 2.3.

Figure 2.3

INTERNET CONNECTIONS BY LOCATION, 1999-2008/09

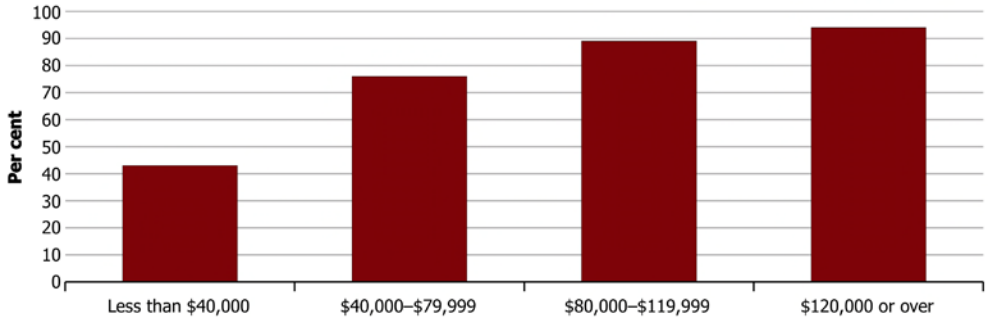


Source: ABS 8146.0

Internet connections also differ by household income. Nearly all households with an income in excess of $120 000 had Internet connections in 2008/09, while less than half of households with incomes under $40 000 had such connections.

Figure 2.4

INTERNET CONNECTIONS BY HOUSEHOLD INCOME, 2008/09



Source: ABS 8146.0

The results of the ABS survey are similar to a study by the Australian Communications and Media Authority (ACMA 2008). The ACMA study focused on 'family households' and found that Internet penetration exceeded 90 per cent (of households with a child aged 8-17 years). The study also found evidence of a 'Digital Divide' among certain social groups. Box 2.1 highlights some of the key findings of the ACMA study.

Box 2.1

CHARACTERISTICS OF FAMILY HOUSEHOLDS WITHOUT THE INTERNET

A study by ACMA on Australian households with children aged 8-17 years found that only 9 per cent did not have an Internet connection.

Notably, some demographic sub-groups were particularly well represented among those households that did not have Internet connections. The proportion of households with 8-17 year olds without Internet connections comprised of:

- 25 per cent of family households with a combined annual income of $35 000 or less;
- 19 per cent of families with a single parent;
- 16 per cent of family households where the respondent parent had not completed secondary school; and
- 13 per cent of families located in country areas.

Notably, those households with the above characteristics, but with the Internet, were also much more likely to have only a dial-up connection.

Source: ACMA 2008.

2.5 Time spent on the Internet

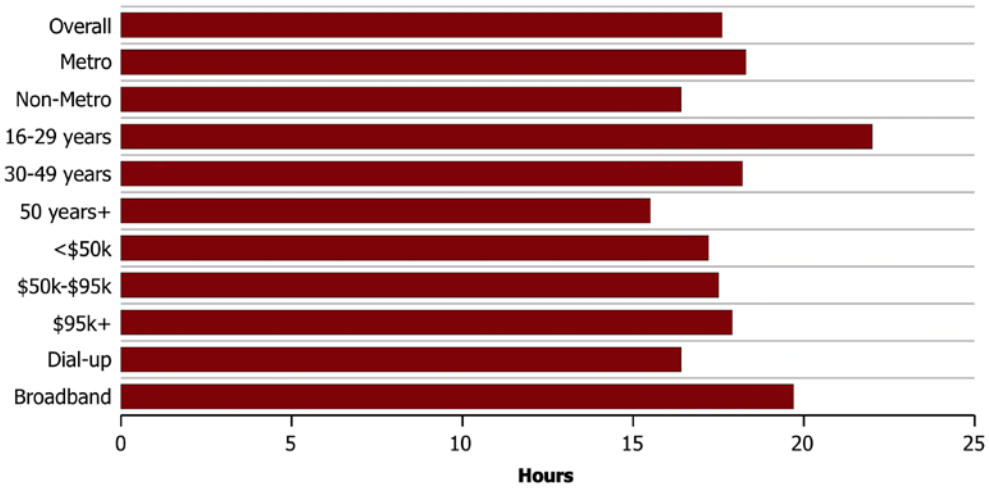
The ACMA (2009) reports that as more Australians become familiar with the Internet and its potential benefits — they begin to use it for more day-to-day activities such as banking, shopping, entertainment and research. As a consequence, their Internet use increases. The study showed that the number of people who use the Internet more than once a day has increased from 36 per cent in 2004, to 52 per cent in 2008.

A Nielson (2010) survey estimates that on average a household spends about 17.6 hours a week on the Internet (from all connections sources including home, work and educational). This is more than the time spent reading (15.9 hours), watching TV (13.4 hours), watching movies (3.5 hours) or exercising (5.2 hours).

Like Internet connections, this varies by location, connection type, income and age. Typically, those in metropolitan areas, younger persons and persons on higher incomes use the Internet for more hours than those households not in those categories. This mirrors Internet connection patterns outlined in the previous sections. Households with access to broadband were also more likely to use the Internet for longer as well. Figure 2.5 reports the results of a study by Nielsen on Internet use.

Figure 2.5

HOURS SPENT ON THE INTERNET



Source: Nielsen 2010.

2.6 Key points

- **Household Internet connections have increased substantially over the past decade and have now reached 72 per cent of households. Almost all households with computers have Internet connections.**
- **Broadband is the dominant connection type among Australian households.**
- **A 'Digital Divide' exists within the whole Australian community, with certain sub-groups less connected. This includes rural populations, older households, lower income groups and other social sub-groups.**
- **A sense of the value that Australians already place upon Internet connections is apparent from the time that they spend online. On average a household spends 17.6 hours on the Internet each week (from all connection points, including home, work and places of study).**

Chapter 3

Taking stock of the expected gains

The rapid uptake and widespread use of the Internet by households over the past decade suggests that the benefits of an Internet connection are significant. An Internet connection provides access to a vast and diverse stock of information and media as well as new online services and markets. Additionally, reflecting network and communications effects, the benefits of household Internet take-up and use extend beyond households — with businesses, government agencies and community groups benefiting as well.

This chapter provides a 'stocktake' of the benefits enjoyed by all stakeholders from increased household Internet connections. It begins with a discussion about how networks generally provide benefits, and then considers the benefits enjoyed by individual sectors from increased Internet connections.

3.7 Network effects

Obtaining access to the Internet is to join a network. Throughout history, networks have been the foundation of the way that people connect with other people. Traditional networks include waterways, roads and railways. When individuals, households, business organisations, government and third sector organisations access and use the Internet they obtain access to a medium which enables them to communicate with each other and most of the rest of the world at very little cost and certainly much lower cost than traditional networks. Equally, each person accessing networks allows the rest of the world to reach out and communicate with them.

Inclusion in a network generates many benefits. These include *direct* benefits and *indirect* benefits. The direct benefits in relation to traditional networks such as transport were often tangible in terms of cost savings or intangible in terms of time-savings. With information networks, benefits include access to information and knowledge resources, competencies as well as cost savings. The indirect benefits from networks encompass the greater access to information flows and the strategic advantages from being positioned in the network (Gottinger 2003).

The indirect benefits of network access have many interesting features. Often these benefits accrue from network effects or network externalities. Network externalities are the additional gains enjoyed by existing members when a new member is added to the network. Shy (2001) characterises these benefits by asking:

> Would I subscribe to a telephone service knowing that nobody else subscribes to a telephone service? The answer should be: Of course not! What use will anyone have from having a telephone for which there is no one to talk to? Would people use e-mail knowing that nobody else does? Would people purchase fax machines knowing that nobody else has such a machine?

With network externalities, the additional benefits for everyone in the network as a whole may be larger than the benefits and costs incurred by the additional user.

In a network economy, much value is created and shared by all members of a network complementing that contributed by individual companies and the economies of scale that stem from the size of the network — not the enterprises in the economy (Kelly 1998). Similarly, because value flows from connectivity, analysts note that an open system that enables growth is preferable to a closed system because the former typically has more network nodes that raises scale. Analysts of network economics also note that networks are blurring the boundaries between a company and its environment (Boyett and Boyett 2001). There are already many examples in current experience where the network at large is adding value. This includes Internet sites such as *YouTube* or *EBay* where the addition of members adds content as well as contributing to the size of the market, adding value to advertisers and consumers on that site.

3.8 Benefits from a household Internet connection

The Internet has provided a significant structural change to how the economy functions. The nature of its impact is the subject of a rich literature that has developed over the past decade. From the literature, it is clear that the Internet poses additional opportunities beyond those of traditional networks.

Much analysis has concentrated upon the direct benefits. Key issues include productivity enhancing aspects for business and public sector applications. Analysis since the late 1990s has shown that business applications such as e-commerce would shorten and rationalise supply chains (ACG 2000). Impacts of Internet access have also been measured on a similar basis to how other infrastructure service investments might be measured. Much of the focus is upon the reduction in the costs of doing business and other benefits associated with the elimination of the costs of time and distance (Thompson and Garbacz 2008).

The *indirect* benefits of increased Internet connections (broadband in particular) may be of even greater significance. Crandall et al (2007) argue that network externalities — or 'spill-over' effects — have provided the community with the greatest benefits. This includes additional benefits that accrue to business, government and community organisations. The knowledge transfer accessed by the broadband network can be expected to produce wholesale increases in total factor productivity that will generate lasting long-term benefits for the economy at large.

Quantitative estimates of the impact of the Internet can be difficult to obtain. Problems arise because of broadband's relatively recent development, its rapidly evolving nature and difficulties in effectively disentangling broadband from ICT more broadly (OECD 2008).

Estimates of the overall contribution of the Internet draw together both direct and indirect effects.[1] They also typically bundle the Internet within a range of other changes. On this basis the OECD had estimated that the Information, Communication and Technology (ICT) sector increased GDP growth by between 0.3 and 1.3 percentage points since the late 1990s (OECD 2003). Notably, estimates for the Australian experience approach the higher end of this range (between 1.1 and 1.3 per cent) (Parham, et al 2001, Gretton et al 2002). More recent studies have linked a quarter of EU GDP growth and around 50 per cent of productivity growth directly to ICT (European Commissioner for Information Society 2007).

[1] A comprehensive discussion of the literature can be found in DCITA (2007).

A MICUS (2008) study has focused directly on online activities in Europe. This study estimated that the use of online services generates an average annual productivity improvement of 0.29 per cent in the EU27.

Locally, a number of regional studies have estimated the impact of further broadband investment. ACG (2003) evaluated in detail the economic impact of a 'true broadband network' throughout the Brisbane and Moreton statistical divisions, as well as for the state of Queensland at large. The study estimated net gains to the region with a present value of $2.6 billion, including the creation of 15 000 jobs (over 15 years).

Similarly, a 2004 Victoria study estimated that Victorian Gross State Product (GSP) would increase as a result of broadband investment by between 0.47 and 0.82 percentage points on average to the year 2015 (ACIL Tasman 2004). And a study on increased broadband adoption on the Yorke Peninsula (SKC 2008) predicted regional benefits of $9.4 million per annum in 2010, with additional flow on benefits to the South Australian economy of $1.8 million per annum.

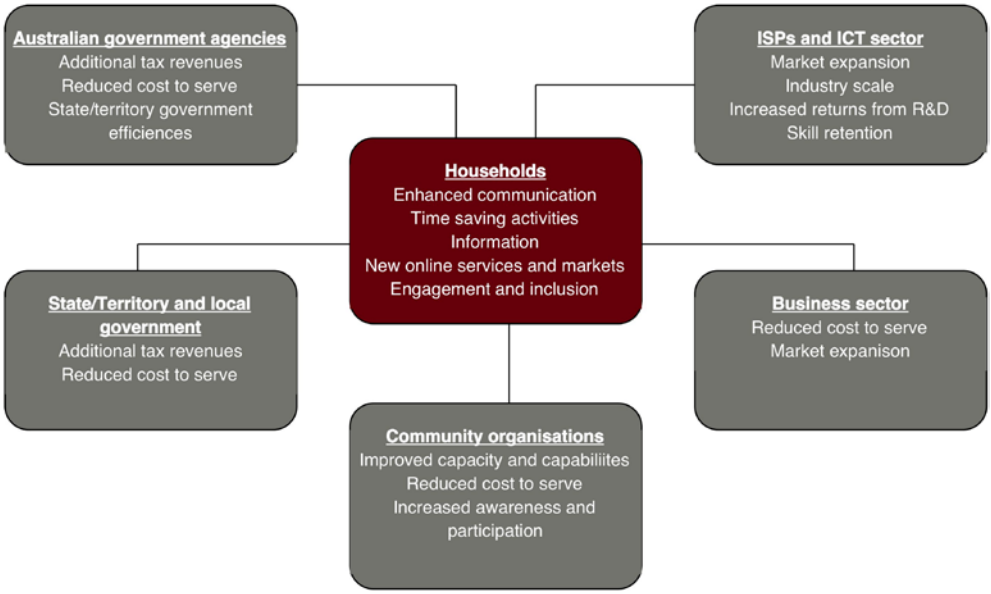
Being a relatively new phenomena, the literature on high-speed broadband is less developed. Access Economics (2009) however has estimated that the net impact of a national high-speed broadband network could add as much as $9.5 billion to Australia GDP (depending on the nature of the network rollout).

The gains from greater household use of the Internet will be a subset and a smaller part of the overall growth experienced to date from greater application throughout the economy. It is important to distinguish impacts that relate to expansion in household use from those that arise from business and government. In effect, it is necessary to assess the implications of greater household demand and use from the greater use of the Internet in supplying goods and services in the economy (including government and third sector services).

Figure 3.1 maps the expected direct and indirect benefits that may accrue to various sectors of the community as a result of increased household connectivity. The discussion that follows below considers these impacts in more detail.

Figure 3.6

MAPPING BENEFITS FROM INCREASED NUMBERS OF HOUSEHOLDS USING THE INTERNET



Source: Allen Consulting Group.

3.8.1 Households

Online services can benefit households in a variety of ways. The Internet can offer households access to vast amounts of information and media as well as to e-commerce and online services. The ability to telecommute has provided opportunities to work, study, shop, communicate and relax from home — and this in turn has resulted in structural changes to the economy.

An ACMA (2010) study found that frequent Internet users were more likely to be experienced online users with greater knowledge of available services. As a consequence, they were more likely to have developed to the necessary level of skills and confidence in using these services over time. For example, the study found that frequent users were at least twice as likely to undertake online transactions compared with infrequent users.

Table 3.1 reports the results of a 2010 Nielson survey on Internet use. The survey found that email, banking and bill payments were the most common uses of the Internet. The survey is broadly consistent with the findings of a 2010 report by Sensis that found that paying bills and undertaking other transactions were also among the most frequent uses of the Internet by households.[2]

[2] Email communication was not included in this study.

Table 3.1

HOUSEHOLDER ENGAGEMENT WITH VARIOUS ONLINE ACTIVITIES, 2009, PER CENT

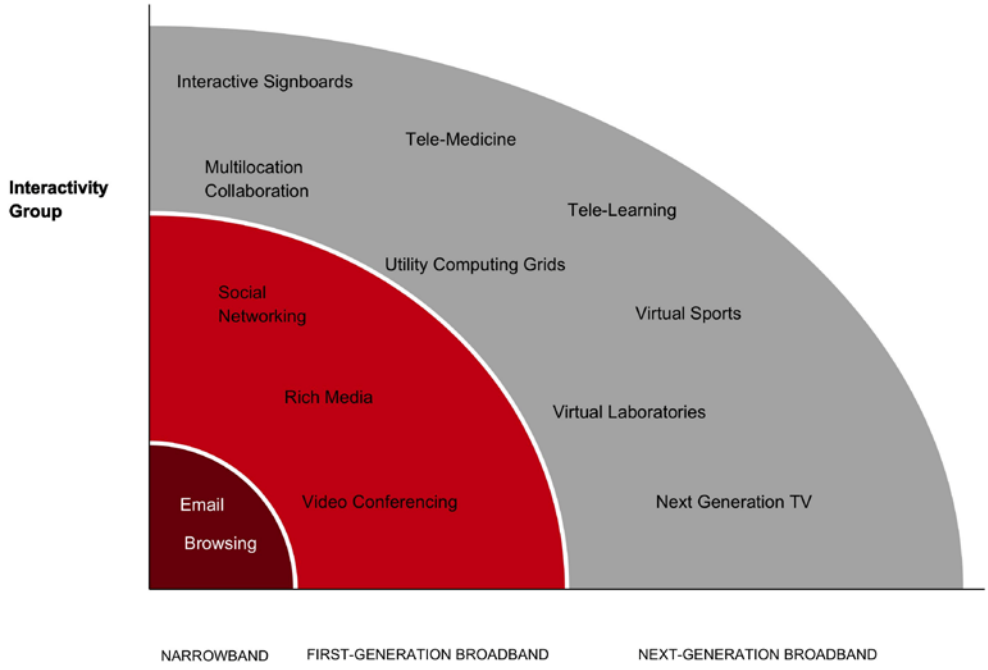
Activity	Used regularly	Used (but not regularly)
Email	97	2
Banking	76	8
Bill payment	71	9
News, sports or weather updates	59	15
Maps/directions	51	22
Online social networking	45	23
Directories	42	28
Airline ticket purchase	39	32
Accommodation bookings	37	33
Auctions	31	29
Subscribe to email newsletters	31	24
Submit forms / info government websites	31	34
Instant messaging	31	36
Local/community information	29	27
Make payments for government services	28	27
Education / study sites	27	26
Health and medicine sites	23	31
Downloading audio	21	18
Online forums	20	38
VoIP – audio call	17	31
Downloading video	17	18
VoIP – video call	16	31
Downloading podcasts	9	20
Gambling	8	22
Online multiplayer (PC) gaming	7	17

Note: Respondents were able to choose more than one Internet activity.
Source: Nielson (2010).

It can be expected that the development of a high-speed broadband network will both enhance the services currently on offer, as well as provide access to a variety of new services as well. Precisely what services will be made available in the future is difficult to predict, however the figure below is indicative of the types of services that might be expected. The figure below is indicative of the types of services that may be made progressively available through different bandwidth Internet access types.

Figure 3.7

THE FUTURE OF ONLINE SERVICES



Source: Booze&Company 2009.

With this in mind, the focus of this report is on services currently available. At a high level, the benefits a household receives from an Internet connection stem from:

- enhanced communication;
- engaging in online activities that are time-saving;
- acquiring useful information;
- an increase in the set of choices available;
- new online services; and
- engagement and inclusion.

Note that these are largely direct benefits to the household. Each is discussed below.

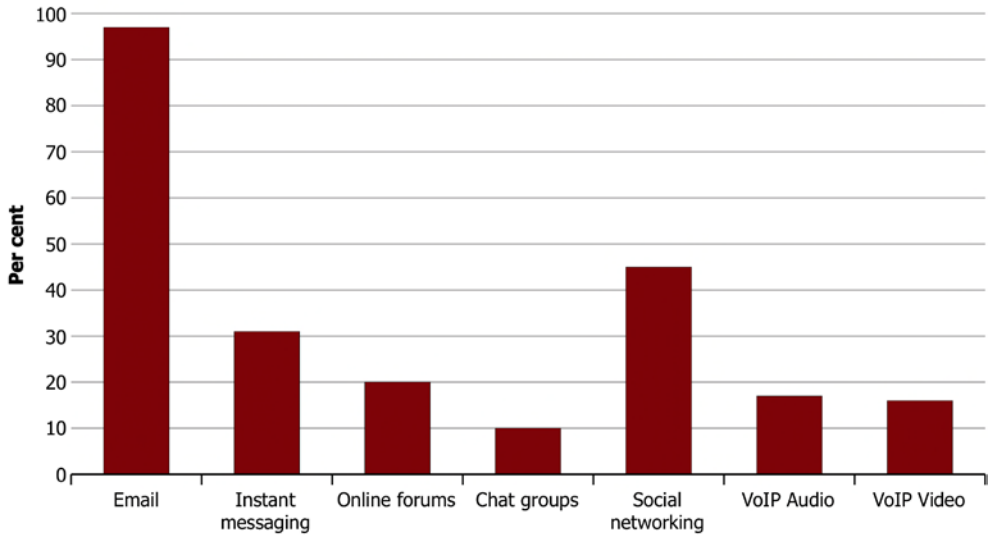
Enhanced communication

The Internet has revolutionised the way society communicates. It has provided a platform through which households can communicate across long distances and at very low cost. Email, VoIP (Voice over Internet Protocol), instant messaging and video conferencing are available on a consistent basis worldwide.

The use of email as a communications tool among Internet users is near universal (97 per cent), with many users employing a variety of communication services. Despite being only a recent phenomena, social networking is already the second most regular form of online communications — nearly half of Internet users in the survey reported using these services. Figure 3.3 reports the results of a Nielson survey on the use of online communication services.

Figure 3.8

REGULAR HOUSEHOLD USE OF ONLINE COMMUNICATION SERVICES, 2009



Source: Nielson 2010.

Time saving activities

When compared to households that are not online, the Internet provides several opportunities that provide a reduction in the 'time cost' of an activity. By reducing the time required to undertake a one activity, an individual has more time to spend on other activities — such as work, study or leisure.

In the absence of the Internet, accessing certain professional and government services can often be an expensive and time-intensive activity. Rural communities can be particularly burdened when services are only available in distant urban areas. The use of digital technology can facilitate decentralised access to services and save time and money for households no longer required to travel.

Many of the online activities identified in the 2010 Nielson survey (see Table 3.1) related to time-saving activities. Banking, bill payment, directions, directories, airline and accommodation bookings were all listed in the top 10 regular activities undertaken. Similarly, a NOIE (2000) study identified the following time saving online activities, which are still relevant today:

- finding information about goods and services;
- finding information relating to studies or work (such as avoiding trips to libraries, job centres, or enabling people to work from home);
- studying online (saving time in travelling to place of study, and fewer restrictions on exact time of study);
- buying goods and services (such as avoiding time spent travelling to shopping centres, or standing in queues); and
- paying bills and banking (again avoiding travel and queuing time - unless the telephone is an option, but where time savings can still be achieved by avoiding potentially long recorded messages).

Information gathering

The instant and inexpensive transfer of digital data through the Internet, has made information cheaper, richer and more accessible than ever before. A study of Australian family households, overwhelmingly reported that learning and educational opportunities were one of the key benefits from having access to the Internet at home (see Box 3.1).

Box 3.2

BENEFITS ASSOCIATED WITH YOUNG PEOPLE'S ONLINE ACTIVITIES

An ACMA study reported that of the 91 per cent of family households with the Internet, a majority of parents felt their child received some or many benefits from using the Internet. This is despite more of these parents also being concerned about their child's use of the Internet compared with other electronic media and communications activities.

53 per cent of parents with Internet access at home believed that their child received 'many' benefits, and a further 44 per cent believed they received 'some'. Only 2 per cent of parents believed their child received hardly any or no benefits. (A further 1 per cent could not say.)

The main benefits identified by parents were:

- learning and educational opportunities — specifically for researching and completing school assignments, and providing access to a wide variety of resources, learning and knowledge;
- skills development;
- helping their child stay in touch with their friends;
- entertainment value; and
- relaxation.

Source: ACMA 2008

In many cases information can result in the time savings discussed above, but the quantum of information available can be a source of additional benefit. For instance, households can use the Internet to:

- gather information to compare products and prices — which in turn can lead to more informed choices and real savings;
- discover new services, products and opportunities; and
- learn and acquire knowledge — which can have an intrinsic value in and of itself.

An increase in household Internet connections will provide households access to this information. And, as the next generation of high-speed broadband is rolled out, new opportunities will present themselves as to how to disseminate and present this information.

Moreover, as a consequence of being a better-informed society, consumers are now better equipped to make informed choices. This allows them to make more rational and efficient decisions (ACIL Tasman 2004).

Increased choice

The Internet serves as an access point to the global market place. This market is highly sophisticated, highly integrated and global. A range of products and services have been made available on an unprecedented scale and households are no longer geographically bound for their consumption.

The competitive pressures market expansion has placed on business to reduce their costs has resulted in additional cost savings to consumer that purchase products online (such as airline tickets, insurance etc), or to consumers that 'bundle' services (such as utilities or communications).

New online services

New products — including online services, gaming and media/entertainment — have accompanied the Internet and provide additional benefits as well.

Consumers can also substitute physical services for digitally delivered services and take advantage of the convenience factor that accompanies them. Lifestyles may also change because of the new information age, away from use of some physical goods towards essentially free information goods. People's locational decisions may also change as a result of broadband, through such possibilities as telecommuting (ACIL Tasman 2004).

The next generation of high-speed broadband will provide additional online services. Telemedicine for example, extends the reach of vital medical services in diagnosing and treating ill and injured patients in rural areas. It also allows doctors to quickly and inexpensively consult with specialists in distant locations. (Access Economics 2009). The service is dependent on a high-speed broadband network to function effectively, and cannot be provided through a low-speed connection.

Engagement and inclusion

The Internet has made possible greater social and economic inclusion. The Internet allows for greater communication between communities, and as a primary platform to exchange information. The rising popularity of social networking sites has only bolstered this function. Online Australians have been participating more frequently in social networking with 45 per cent reporting regular use in 2009, up from 38 per cent in 2008 and 26 per cent in 2007 (Nielson 2010).

Unfortunately, membership of the online community requires Internet access. Those without a connection are excluded from the social interactions that occur online. As the Internet continues to grow as a medium for information exchange, and delivery of services membership will become increasingly important.

Increased connectivity will help bridge the 'Digital Divide' and benefit those households currently excluded from the online community. This is likely to have a particularly beneficial impact on certain social sub-groups disproportionately without Internet access. Some of these groups are discussed in Box 3.2.

Box 3.3

AUSTRALIA'S DIGITAL DIVIDE

A study of Australia's Digital Divide identified some of the starkest inequalities in Internet access related to the following groups.

1. Indigenous Australians were 69 per cent less likely than non-Indigenous Australians to have any Internet connection and were about half as likely to have broadband access.
2. Geography continued to impact on household Internet connectivity. For example, 66 per cent of dwellings in major cities have access to the Internet, compared to 42 per cent for very remote Australia.
3. Educational attainment influenced overall and broadband Internet access. For example, when controlling for other factors, persons with postgraduate qualifications had about 3.9 times the likelihood of having broadband compared with those without these qualifications. People with certificate level qualifications were about 1.2 times more likely to have access to any Internet than those without.
4. Income was considered the single largest determinant of Internet access and broadband, with results showing that higher income increased the likelihood of a person having any Internet connection. When all other variables were held constant, the likelihood of having any Internet access for persons with an equivalent household income of $1,000 to $1,999 per week were about 2.7 times more than those earning less than $599 per week.
5. Disability: only 28 per cent of people requiring assistance with core activities had broadband access, in comparison with 48 per cent for people not needing assistance.
6. Single parent households with dependent children under 15 years had 77 per cent Internet and 52 per cent broadband access compared with 92 per cent and 68 per cent respectively for comparable dual parent households.

Source: Notley and Foth (2008).

3.8.2 Business and industry

The benefits to business and industry from an increase in the number of households online will depend in the nature of the business considered. The benefits to the ISPs and the ICT industry, for example, will be particularly acute. Businesses in other sectors are also likely to benefit, however their gains might be more diffuse.

The benefits accrued by ISPs and the ICT industry are discussed below, as are the potential gains to other businesses.

ISPs and ICT

ISP and the ICT industry more broadly can expect a considerable gain from an increase in the number of connected households as is being proposed. A 10 to 20 percentage point increase in the number of connected households equates is equivalent to an additional 0.8 to 1.6 million additional customers. This provides a substantial increase in turnover and also allows firms to spread capital costs over a greater base and receive a greater return from R&D investments.

The ICT industry may further benefit from the increased scale — which may promote the development of firms within the sector. A larger, and more developed ICT industry is likely to assist with skills retention and promote innovation and dynamism.

Other businesses

E-commerce has provided the business sector with opportunities to reduce costs at all points along the supply chain. Firms can use Internet technologies to streamline and integrate all aspects of their business including production, sales, logistics and administration. Improvements in business-to-business dealings have been particularly beneficial (ACG 2000).

A major international study on the impact of the Internet to business costs and revenues shows this impact to be extensive (Net Impact Study 2002). For example, it is estimated that in the US, adoption of 'Internet business solutions' cumulatively reduced business costs by over $155 billion, and increased revenues by $444 billion. Locally, ACG (2003) using data gained from a survey of businesses on the costs savings derived from using broadband Internet estimated that on average, the cost savings would result in a productivity gain of around 0.32 per cent for business. The survey results also indicated that businesses experienced savings in costs of around 6.3 per cent from broadband Internet.

The benefits a business enjoys from increased household connections are largely realised in two ways. The first is the reduction in a business' cost to serve. This includes the costs associated with sales and service, logistics, packing and shipping, marketing and advertising and customer acquisition and retention. Household Internet connections can help to reduce these costs by:

- reducing the reliance on labour-intensive customer service; and
- lowering the costs of advertising and marketing, as well providing opportunities to connect with wider and more targeted audiences.

Additionally the Internet expands a business' potential market. Just as households are no longer bound geographically, neither is the business sector. Notably, those businesses that are able to take advantage of the e-commerce opportunities are likely to benefit most from increased household connections. This includes not just those firms able to substitute towards online servicing (such as banking and insurance, tourism and many aspects of retail), but also those businesses with a customer base that is connected to the Internet as well.

3.8.3 Government and third sector

Properly designed and implemented, e-government can improve efficiency in the delivery of government services, simplify compliance with government regulations, strengthen citizen participation and trust in government and yield cost savings for citizens, businesses and the government itself. E-government has already transformed much of the way government operates — expanding both the capacity and capability of government agencies.

Internationally, widespread broadband deployment has proven to be a key transformation tool to address that issue and effect change in rural and underprivileged communities especially. High-speed broadband has enabled governments across the world to offer remote diagnostics through e-health, bring quality education to underprivileged communities, widen employment opportunities, and provide more citizens with an opportunity to influence policy (Booz & Company 2010). The ability to provide households with information, brochures and reports has helped to make the public sector more transparent and accessible as well.

How state/territory and federal government agencies and community organisations might expect to benefit from an increase in household connectivity is discussed below.

Australian Government

The Australian Government can expect to benefit in three ways. The first is a consequence of the improved productivity in the private sector. It can be expected that efficiency gains by households and businesses will stimulate additional economic activity — and provide the Commonwealth with additional revenues as a result.

Second, in much the same way as businesses benefit from increased household connections, Australian Government agencies can also expect a reduction in their cost to serve. Savings can be expected among those activities that involve:

- communicating with the community, including:
  - education campaigns about new and existing policies; and
  - the results of government reports and studies;
- informing the community, including:
  - providing advice on compliance requirements;
  - providing information about entitlements and services offered; and
- servicing the community through products such as *Etax* and telehealth.

In addition to accruing the above as direct savings, these impacts also reflect an improvement in the overall speed and efficiency of the government.

Finally, the third source of benefits relates to the savings made by state and territory governments. As state/territory governments realise their own benefits from increased household connectivity, the demand for Commonwealth funds can be expected to decline as a result (for a given level of services).

States/territory and local governments

State/territory and local governments can also expect to benefit from increased household connections. Many of the services provided by governments at these levels are complementary to e-government. These include:

- health services;
- education services;
- housing and property development;
- business regulation;
- transportation — including licenses, registration, public transport ticketing and other related services;
- fines and payments; and
- other government services.

Some examples of how these services have been achieved internationally are considered in Figure 3.4. It is worth noting that many of these services have required a high-speed broadband network in order to be delivered effectively.

Figure 3.9

PUBLIC SERVICES AND SOCIAL INCLUSION THROUGH HIGH-SPEED BROADBAND

	Description	Example Initiatives
Improve Healthcare	Telemedicine offers the opportunity to bridge the gap between healthcare services in rural and urban areas	A tele-pathology system developed in Japan allows pathologists using high-definition video and remote-controllered microscopes to examine tissue samples from patients living in rural areas
Better Education	E-Learning and online video tutorials can be a powerful tool to improve educational services in rural areas	South Korea developed the Education Broadcast Service (EBS) to help childeren in rural areas better prepare for national aptitude test through access to free vidoe tutorials
Employment Opportunities	High-speed boardband enables tele-working in rural areas and creates rural entreprenurs	The U.S. government is active in promoting tele-working for the federal government in order to promote employment in rural areas as well as reduce traffic congestion
Access to Government Services	Broadband allows residents and business in rural areas to have access to e-governemnt services	The Rural eGov project of the European Union aims to study the needs of small- and medium-sized enterprises (SMEs) in rural areas for governemntal and public services and offer policy recommendations to EU government

Source: Booz & Company (2010).

To the extent that information about these services, or the services themselves, can be automated and provided online, this reflects an increase in government efficiency. This, coupled with any gains accruing to government from increased economic activity, will allow for greater budget surpluses.

Third sector organisations

Community organisations, and NGOs generally, are unique in the services they provide. The success of these organisations is highly dependent on maintaining a high profile within the community and an active dialogue with their membership base.

An increase in household Internet connections will assist activities on both these fronts. Increased household Internet connectivity allows for:

- easier, cheaper and a wider dissemination of information that can raise awareness of relevant issues and services offered;
- greater participation by members through forums, message boards, surveys and petitions;
- improved coordination of organisation-run activities — such as fund raising and events; and
- direct delivery of services.

Notably, because many organisations in this sector service populations that are relatively *disconnected* — such as those in regional areas, the elderly and low-income groups — the gains here are likely to be quite significant. An increase in household connections that includes these populations will expand both the capacity and capabilities of third sector organisations in the same way as for many government services.

3.9 Key points

- **The Internet is a network that generates direct and indirect benefits. Business, government and community organisations each receive benefits from increased household Internet connections, particularly to high-speed broadband.**
- **Benefits of high-speed broadband services to households include: enhanced communications; time-savings; information; new online services; access to markets; and social inclusion.**
- **The benefits of high-speed broadband services to business include market expansion and reduced costs to serve. Benefits to ISPs and the ICT sector include industry scale, increased returns from R&D and skill retention.**
- **Benefits to government include increased economic activity and public sector efficiencies.**
- **Benefits to community organisations include increased engagement and participation by members.**

Chapter 4

Increasing household broadband connections

The magnitude of benefits enjoyed from an increase in Internet connections will depend largely on two factors. First, the scale of the increase has obvious implications for the quantum of benefits amassed. A larger increase in use can generally be expected to produce larger gains.

Second, the quantum of benefits will be affected by where those connections occur. Chapter 2 highlighted that significant differences existed across the different social sectors. An Internet connection by a member of a relatively unconnected community may generate more benefits than a connection in a community that is already relatively saturated.

This chapter outlines the nature of the 'scenarios' used to estimate benefits.

4.1 Change scenarios

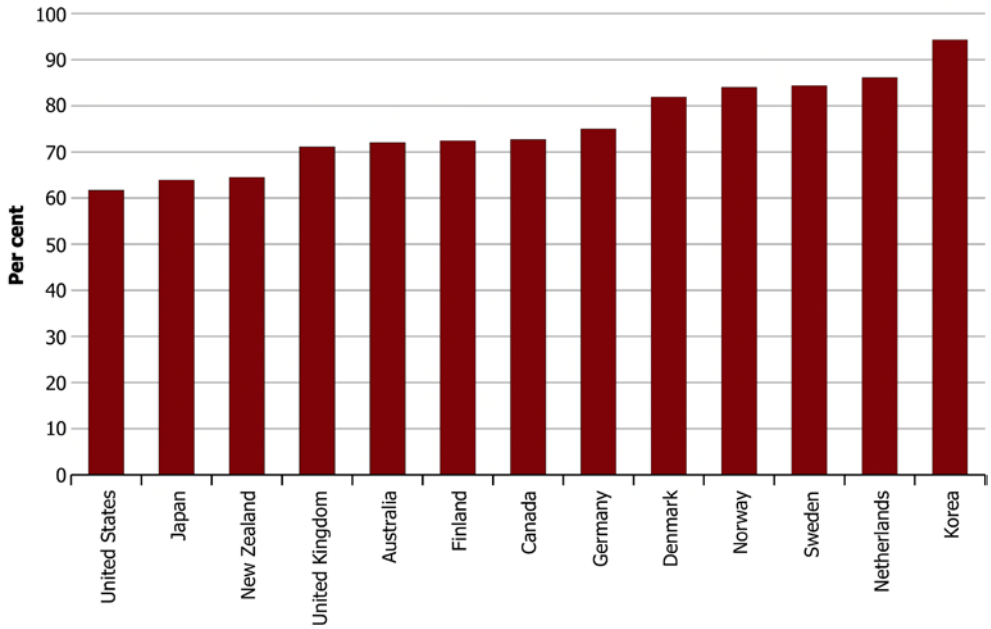
The benefits of increased household connections have been assessed under two scenarios.

- The first scenario, 'moderate expansion', considers the benefits of an increase in connectivity of 10 percentage points.
- The second scenario, 'greater expansion', considers the benefits of increase by 20 percentage points.

An increase in household Internet connections from 72 per cent to 82 per cent is well within the upper and lower bounds of Internet access achieved in different countries. Achieving this change in Australia would put Australia on par with Internet current household take-up in Denmark or Norway. A 20 percentage point increase would be akin to the take-up levels current in Korea (see Figure 4.1).

Figure 4.10

HOUSEHOLD INTERNET ACCESS, INTERNATIONAL COMPARISONS, 2008



Source: ABS 8146.0

Notably, the quantum increases in the change scenarios are not targeted towards any particular regional or social group. Rather they reflect a uniform increase in connectivity that would increase the national take-up rate by 10 and 20 percentage points respectively.

Related to this, the per-household benefit estimated for in the moderate expansion scenario is expected to be the same as in the greater expansion scenario. It is unclear if, given the current distribution of Internet connections and the level of connectivity, the increasing Internet connections would result in diminishing, constant or increasing returns.

- On the one hand, the benefits of an Internet connection may increase at a decreasing rate (diminishing returns) as the community approaches saturation. This is because, as with most technologies, the spillover gains to business, government and other households (the network externalities) become smaller and smaller.
- On the other hand, given the that certain populations and social groups are relatively 'disconnected', a new connection within these groups will provide access to new markets and thereby generate greater benefits. Here, the network externalities generated by new connections can drive increasing benefits as the scale and scope of the network expands.

Without evidence to suggest which of these forces has a greater impact, a linear relationship has been assumed for this exercise. This issue is considered further in Box 4.1

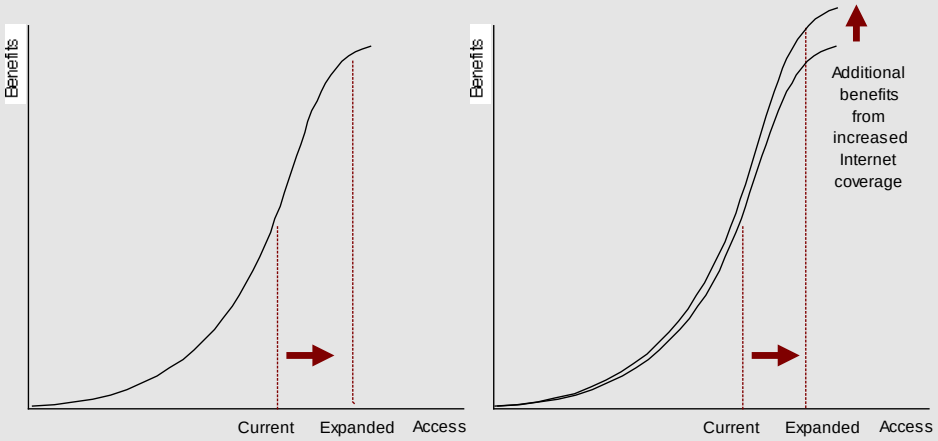
Box 4.4

BRIDGING THE DIGITAL DIVIDE MAY PRODUCE ADDITIONAL BENEFITS

As a network industry, the benefits of greater connectivity will increase in a particular way. For low levels of access, increased access is likely to provide benefits that grow exponentially. The capability and capacity of Internet grows very fast during this early period.

For higher levels of access however, the benefits of increased access can be expected to taper off. A critical mass is achieved, and the gains provided by additional members diminish (but stay positive).

This relationship is quite typical of network industries and technology adoption more broadly. It is depicted in the left hand figure below.



A key difference here however, is that the Digital Divide means that despite high levels of access Australia wide, significant sub sets of the community are essentially not connected to the Internet. Additional household connections in a regional or remote community (where connection rates are is low) expands the Internet's coverage — providing greater benefits than would be achieved if a new connection were made in a highly saturated area. The effect of expanding the Internet's coverage — rather than just its membership — is depicted in the figure on the right hand above.

The scenarios being estimated in this study consider a uniform increase in connections (as depicted in the first figure). To the extent that new connections are likely to be concentrated among the less connected communities, the benefits here may therefore be conservative.

Source: Allen Consulting Group.

4.2 Quantifying benefits

The benefits identified in the previous chapter reflect the direct benefits households receive, and the indirect benefits enjoyed by the other sectors.

A key challenge arises when seeking to measure the overall size of the gains. Many of the impacts mapped in the previous chapter involve transfers between different groups. Some of the benefits to households from increased Internet use would for example also appear as a benefit to ISPs providing that Internet access. There is therefore a danger of double counting some benefits unless a cautious approach is adopted.

In addition, it is not practical to place a monetary value on the increase expected in each of the change scenarios for all of the gains identified in the inventory of gains.

Ideally the basis for measuring the gains should take into account the indirect impacts as well as direct impacts. A danger with doing so is that it becomes harder to be completely transparent about how direct impacts flow through and stimulate additional indirect impacts.

The basis of estimating the impacts and placing a value on them while dealing with these challenges is discussed below.

4.2.4 Quantifying household value

The benefits a household receives from Internet connections can be approximated and valued using a number of techniques. This includes measures of 'willingness to pay', measuring factor input costs and valuing the individual services provided. Notably, while each of these measures is conceptually sound, each also has its limitations.

For this study, household benefits have been estimated using a measure based on the additional time value of Internet use. The value of additional household connections are approximated by valuing the amount of time spent accessing online services. Consistent with the methodologies mentioned above, this approach makes use of the knowledge that people (as generally rational economic 'agents') balance value of resource inputs with economic values. Put another way, the time spent on Internet use is a robust indicator of the value of that time. The problems of this measure relate mostly to valuing the opportunity costs of time — but otherwise it should provide a reasonable metric for the purposes of this exercise. The box below provides a further discussion on this issue.

Box 4.5

TIME-USE VALUE

The benefits to a household from using the Internet might be estimated using either of two approaches.

- The first, sums the values of the individual online services. This is the approach adopted in NOIE (2000), which accounted for the value of time saving activities, price savings and other benefits broadly defined.
- The second, considers the value of the resources used to provide those services. This could mean the summed value of factor inputs (such as labour and capital) used to produce online services, or it could mean the value of resources an individual expends to acquire those resources — principally time.

Conceptually, the two approaches should produce the same estimate. This is true because the economy is generally good at balancing the value of resource inputs with economic values. The economy will generally not produce more of a product if its value is worth less than it costs to produce; and similarly it will increase production while ever its value exceeds production costs.

The same is true for household Internet use. The amount of time a household spends on the Internet has an opportunity cost — the time not spent on other work/leisure activities. A household will only spend time on the Internet while the benefits of doing so (however they amass) exceed the benefits of other uses of their time.

This approach is commonly adopted in studies of other industries and technologies. In particular, a time-value approach is commonly employed to estimate the impacts of investment in transport infrastructure.

Source: Allen Consulting Group.

A gross time-value estimate of the value of online Internet access can be estimated using the following information.

- The average household spends approximately 19.7 hours on the Internet (through a broadband connection), the majority of which, 82 per cent, access from a home connection (Nielsen 2010).
- Average weekly earnings (the best estimate of the opportunity cost of time) for a full time worker in May 2010 were $1256 (ABS 2010). Based on a 37.5 hour working week, this equates to about $33.5 an hour.

Combined, this implies that the gross value of a broadband Internet connection to the average household is approximately $660 per week. However it is necessary to amend this gross estimate in two ways.

First, in order to isolate the time spent accessing the net from just home connections, the number of hours spent online has been adjusted by a factor 0.82 (that is, households spend approximately 16.1 hours per week on the Internet from a home connection). There exists no evidence to indicate whether or not the number of hours spent accessing the Internet from a work/educational connection would be disproportionately high or low. For this reason, it has been necessary to assume that Internet usage patterns are uniform across access points.

Second, some of the online activities undertaken will simply substitute digital services and content for physical media/services and content. This includes the substitution of online editions and blogs for physical newspapers and magazines, a shift towards Internet bill paying facilities, the downloading and streaming of movies/media and the substitution of social networking and email for telephone communications. To an extent the online component of these activities will provide additional gains, but it is unlikely to provide the bulk of the benefits. To account for this substitution, gross benefits have been further reduced by a factor 0.33. Or in other words, only one third of the time spent on the Internet is expected to be value-adding for households. This factor is based a consideration of the data presented in Table 3.1.

On balance then, it is estimated that on average a household with a broadband connection values that connection at $148 per week (approximately $7 699 per year). This is comparable to estimates reported in a recent US study that estimated Americans benefited by around $US 70 per week (Hamilton Consultants 2007) — where estimates of the time American households spent on the Internet were roughly half of that in Australia, and average weekly earnings were lower in the US as well. Accounting for inflation, the 2000 NOIE study also estimated household benefits of between $90 and $150 per week, depending on household size. Benefits estimated in this study did not include many of the services now provided by the Internet (such as social networking, media streaming or VoIP).

It follows then, that a cumulative estimate of the time-value associated with an increase in household connections by 10 percentage points is $6.3 billion per annum; and $12.6 billion per annum, assuming a 20 percentage point increase. These results are summarised in the table below.

Table 4.2

TIME VALUE TO HOUSEHOLDS OF INCREASED INTERNET CONNECTIONS

Scenario	Home use	Time value	Value adding services	Weekly HHold benefit	Annual HHold benefit	New connecs	Annual Total benefits
	Hours	*$2010/ hr*	*Per cent*	*$2010*	*$2010*	*1000 hholds*	*$2010 billion*
10 per cent	13.4	33.5	33	148	7699	819	6.3
20 per cent	13.4	33.5	33	148	7699	1638	12.6

Source: Allen Consulting Group.

It should be noted that these results would differ were the scenarios to reflect targeted increases among populations where connections are particularly low (consider again Box 4.1). Furthermore, these results reflect the current level of available technology. The services that could be potentially delivered through a high-speed broadband network would likely provide households with a greater value than those suggested in the table above.

The results in Table 4.1 should be distinguished from the indicators of economic gains typically reported in studies of this nature.[3] It reports on a gross measure of the additional time applied to Internet use and blends many factors together that could be viewed as costs and benefits. This value is therefore, not directly comparable to indicators that would normally be viewed as clear benefits. Generally reasonable indicators of increases to community welfare include changes in income, output or more reliably: household consumption. Changes in some of these indicators are reported in the next chapter.

4.2.5 Quantifying benefits to business and government

The nature of the indirect benefits to business and government arising from increased Internet use largely relate to improved efficiencies in servicing customers and acquiring new business. This is comparable to an improvement in multi-factor productivity (MFP).[4]

Empirical evidence of the effects of the Internet on MFP has been documented in many recent studies. Estimating the value of this impact however, often requires longitudinal data several years removed. And because of this, recent estimates are not readily available.

Gretton et al (2002), estimates the impact of the Internet on MFP for the years 1995-1998 by industrial sector. These results are reported in Table 4.2 and range from between 0.07 and 0.28 percentage points. The per annum impacts of the Internet of the Internet can be estimated by taking the average over the period, and range from between 0.02 and 0.09 percentage points.

[3] For example, Access Economics (2009), Acil Tasman (2004) or ACG (2003).

[4] MFP is a measure of output per unit of some combined set of inputs. A change in MFP reflects the change in output that cannot be accounted for by the change in combined inputs. As a result, MFP reflects the joint effects of many factors including new technologies, economies of scale, managerial skill, and changes in the organisation of production.

Table 4.3

IMPACT OF THE INTERNET ON MFP, PERCENTAGE POINT INCREASE

Sector	1995-1998	Annualised impact
Manufacturing	0.14	0.05
Construction	0.18	0.06
Wholesale trade	0.07	0.02
Retail trade	0.12	0.04
Accom, cafes and restaurants	0.13	0.04
Transport and storage	0.09	0.03
Cultural and recreational services	0.28	0.09
Property and business services	0.17	0.06
All sectors	0.14	0.05

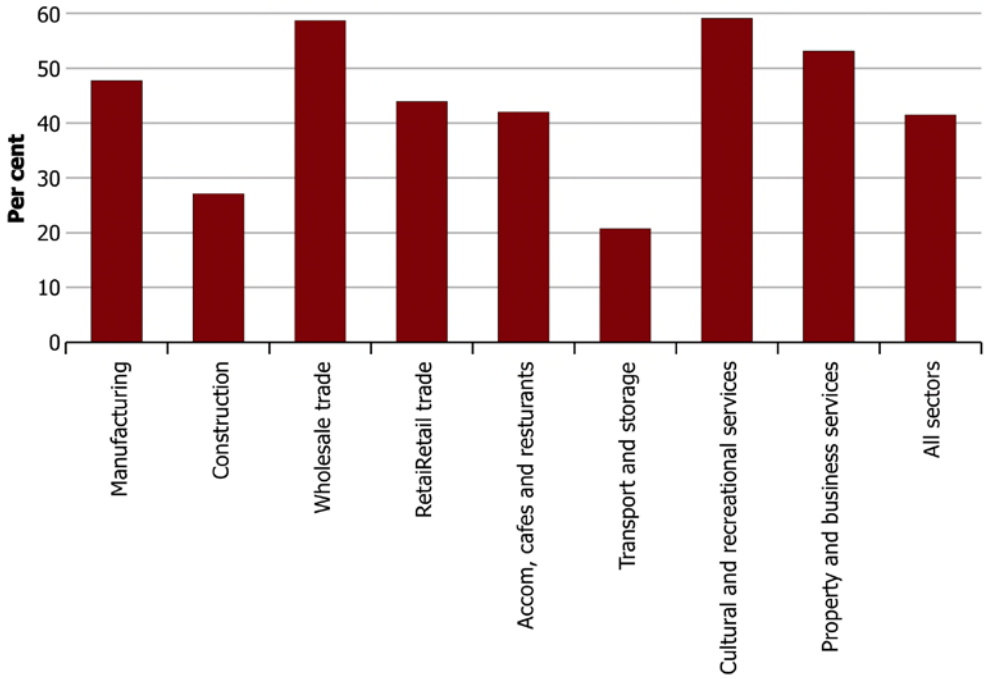
Source: Gretten et al (2002) and Allen Consulting Group.

Notably, not all of the impacts on MFP (indicated in the table above) can be attributed to households Internet use. The availability of online business-to-business services will have made a substantial contribution as well. To account for this, the impacts above are weighted by each sector's web presence. An industry with a high web presence infers greater use of the medium to interact with customers than an industry with a low web presence. And consequently, a greater proportion of the increase in MFP can be attributed to household Internet use.

Data on firms with a web presence is available form the ABS for the year 2008/09 and is reported in Figure 4.2. While it can be expected that firm web presence may have grown significantly between 1998 and 2008/09, the relativities between industry web presences should still provide a close approximation of the weightings required here. The sector with the greatest web presence in 2008/09 was the cultural and recreational services (59.1 per cent), while the lowest was transport and storage (20.7 per cent).

Figure 4.11

FIRMS WITH WEB PRESENCE, PER CENT, 2008/09



Source: ABS 8166.0 and Allen Consulting Group

Finally, household Internet connections over the 1997-1999 period grew by approximately 5.6 percentage points a year, from 4.8 per cent to 16 per cent. The incremental impact of household connectivity on MFP can be estimated by taking the ratio of weighted MFP productivity growth to the growth in household Internet connectivity. For each sector this will provide a metric that estimates the impact on MFP of 1 percentage point increase in household Internet connectivity. For example, it is estimated that a 1 percentage point increase in household Internet access will increase MFP in the Property and Business Services sector by 0.005 percentage points. Estimates for each sector are reported in Table 4.3, as are estimates relating to increases in connectivity of 10 and 20 percentage points.

Table 4.4

ESTIMATING PRODUCTIVITY IMPACT, PERCENTAGE POINT INCREASE TO PRODUCTIVITY GROWTH

Sector	1 percentage point increase in household connectivity	10 percentage point increase in household connectivity	20 percentage point increase in household connectivity
Manufacturing	0.004	0.040	0.080
Construction	0.003	0.029	0.058
Wholesale trade	0.002	0.025	0.049
Retail trade	0.003	0.032	0.063
Accom, cafes and restaurants	0.003	0.033	0.065
Transport and storage	0.001	0.011	0.022
Cultural and recreational services	0.010	0.099	0.198
Property and business services	0.005	0.054	0.108
Government	0.003	0.035	0.070
All sectors	0.003	0.035	0.070

Notes: The Government sector has been added to this table and it is assumed to have the same characteristics as the economy at large.
Source: Allen Consulting Group.

Table 4.3 also includes estimates for the productivity impacts on the Government sector. Unfortunately no data exists relating to either the productivity impacts of the Internet on the provision of government services, nor on government web presence. Because of the multifaceted nature of government services, it has been estimated that government adopt the same characteristics as the economy at large. A 10 per cent increase in household Internet connectivity is estimated to improve the efficiency of government activities by 0.035 percentage points, and 0.07 percentage points for a twenty percent increase.

The size of the values reported in Table 4.3 may be misleading. Many analysts have observed that even seemingly small productivity changes drive major improvements over time.

> Over long periods of time, small differences in rates of productivity growth compound, like interest in a bank account, and can make an enormous difference to a society's prosperity. Nothing contributes more to reduction of poverty, to increases in leisure, and to the country's ability to finance education, public health, environment and the arts.'[5]

[5] Alan Blinder and William Baumol 1993, Economics: Principles and Policy, Harcourt Brace Jovanovich, San Diego, p. 778.

The changes reported in Table 4.3 are relatively large in the context of changes experienced in period of major productivity change. Estimates of the effects railways and steam technology had on productivity growth during the industrial revolution, for example, are in the magnitude of 0.26 and 0.38 per cent respectively. Likewise, labour productivity growth in Australia over the last three decades has averaged about 1.5 per cent per annum (ACG 2010). The changes from increased household use of the Internet which is an incremental change that impacts upon a part of the economy is in fact estimated to account for a relatively large part of economy wide productivity growth.

It is notable that the benefits to ISPs and the ICT sector have not been estimated here. Benefits that flow to this sector are mostly the result of payments by households — and as such have already been accounted for. The gross benefit a household accrues will exceed the costs of acquiring the service (otherwise the household would not choose not to purchase it) and the benefits to ISPs and the ICT sector will therefore already have been accounted for. To include a specific value for these payments as *additional* would be double counting.

4.3 Key points

- **It is estimated that the time-value of a household with an Internet connection is approximately $148 each week ($7699 per year).**
- **Cumulatively, the value of the time households will spend online is considerable. It is estimated to amount to $6.3 billion for a 10 percentage point increase in the number of household connections; and $12.6 billion for a 20 percentage point increase.**
- **The benefits to business and government take the form of a productivity shock. Multi-factor productivity has been estimated to increase by 0.04 percentage points for a 10 percentage point increase in connectivity; and 0.07 percentage points for a 20 percentage point increase.**
- **These impacts can be viewed as an estimate of the direct gains from increased household connections and use of the Internet that are able to be valued in monetary terms. It is necessary however, to consider these impacts in the context of the economy at large in order to obtain indicators of their value that are comparable with the usual measures of gains and economic benefits.**

Chapter 5

Economy wide gains

This chapter reports the possible economic gains from an increase in household broadband connections (as described by the scenarios outlined in the previous chapter) including direct and indirect effects.

The estimates provided here should be interpreted with some caution. Technology is highly dynamic, as are its applications. However the estimates reported here refer to a change in the economy based on *current* circumstances, and *current* perceptions of an Internet connection.[6] Over time, as broadband becomes more pervasive and sophisticated, it is likely that this benefit will further increase. The effects of the structural change that may occur as a result of investing in the NBN have not been captured here.

It is acknowledged that there are many factors that cannot be predicted, their impact will consequently lie outside of these results. Nonetheless, the exercise undertaken here still reflects a reasonably robust understanding of the interplays that exist in the Australian economy. In the long-term, Australia's economic growth is fundamentally a product of productivity, participation and population.[7]

5.4 A framework to measure direct and indirect gains

The value of benefits reported in the previous chapter reflects the direct gains likely to be obtained from increased Internet use. This includes impacts on households as well as suppliers that use the Internet. This does not fully include the indirect and flow-on benefits.

Not all of the indirect and flow-on benefits are able to be measured reliably. The Internet is changing many things at the same time: products, services, consumer tastes and service providers' abilities are all changing together, often in unpredictable ways. While the specifics of some industries and products may be difficult to predict, prediction of overall economic outcomes, even into the longer term with much technological change, have been more reliably predicted. Use of economy wide models that specifically keep track of quite predictable factors such as the amount of labour and capital available as well as accounting for trend technological change and changes in consumer tastes can make reasonably robust estimates of many structural changes, including those that have flow-on effects.

The wider impacts of increased household connectivity have been estimated using a CGE model of the Australian economy — the Monash Multi Regional Forecasting (MMRF) Model. Box 5.1 provides a brief description of the MMRF model. Appendix A provides a detailed write-up on the MMRF model, including the modelling techniques and assumptions about the modelling.

[6] This is consistent with other studies of a similar nature. See for example SKC (2008).

[7] Department of the Treasury (2010).

Box 5.6

THE MMRF MODEL

The MMRF is a multi-sector dynamic CGE model of the Australian economy, covering the six states and two territories. It models each region as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries, and so on. Since MMRF is dynamic, it is able to produce sequences of annual solutions connected by dynamic relationships.

The MMRF contains 58 industrial sectors, which produce 63 commodities. The sectoral details allow the benefits of higher BIM adoption rate to be allocated appropriately across the different sectors.

The MMRF model is a high-level representation of the Australian economy, facilitating measurement of the wider effects of changes in economic activity in key industries and regions. To the extent that economic activity is interlinked, the MMRF model captures any indirect effects that arise from direct measures. In this instance, the direct impacts of increase household connection to the internet would lead to more time available to the household in economic activities and cost savings from the businesses and the public sector in delivering goods and services. This implies an increase in effective labour supply and productivity. The MMRF would capture the flow-on impacts of a larger work force and higher productivity on the Australian economy.

Importantly, the MMRF model is widely known and has been used for a wide range of policy studies. The Productivity Commission used the model to examine the potential benefits of the National Reform Agenda, and the Commonwealth Treasury used a version of the MMRF to produce the 2008 report, *Australia's Low Pollution Future*, which was a companion report to the Climate Change White Paper. The MMRF model has therefore demonstrated its ability to estimate economy-wide impacts of industry or policy changes.

Source: Allen Consulting Group, 2010.

The MMRF model is a high-level representation of the Australian economy, facilitating measurement of the wider effects of changes in economic activity in key industries and regions. To the extent that economic activity is interlinked, the MMRF model captures any second round effects that arise from the impacts estimated in the chapters above (the first round impacts).

For this exercise, first round impacts include:

- the benefits to households; and
- the impact on productivity in industry sectors.

The MMRF itself calculates and captures the flow-on impacts of the higher productivity to the upstream and downstream sectors.

Benefits to households have been analysed in terms of an increase in the *effective labour supply*. Internet access provides increase in the value of a household's consumption bundle (through online services, time saving activities and improved communications), which is synonymous with an increase in income. To isolate the effects this has on the productive sectors of the economy, it has been estimated that half of the value adding Internet hours are related to the productive sectors, and the other half to leisure.

The impact on each sector's productivity is as described in Table 4.3.

In this report, the following scenarios are modelled to estimate the possible economic gains of getting more Australian household online.

- Base case scenario — this refers to the 'business as usual' scenario where there is no change in household adoption rate of the internet.
- 'Moderate expansion' — this considers the benefits of an increase in household internet connectivity by 10 percentage points.
- 'Greater expansion' — this considers the benefits of an increase in household internet connectivity by 20 percentage points.

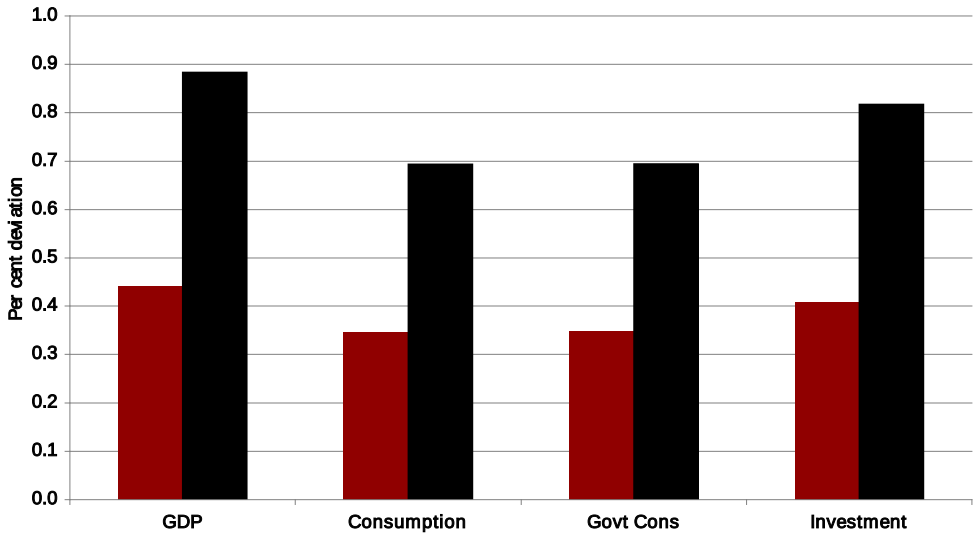
The results in this report detail the economic impacts attributable to an increase in household broadband connections. These impacts are calculated by comparing key economic outcomes under the adoption scenarios against the 'base case' scenario. A convenient way of reporting these impacts is as per cent deviation from base case (where there was no increase in household access). It is important to note that the results from the economic analysis described in the sections below are in 2009/10 dollars in the year 2009/10.

5.5 Community-wide impacts

Figure 5.1 reports the impacts of increased household Internet access on key economy or community wide indicators including GDP, private consumption, government consumption and investment for both scenarios. It is estimated that a 10 percentage point increase in connectivity will raise GDP by 0.44 per cent, and approximately double this for an increase of 20 percentage points.

Figure 5.12

COMMUNITY-WIDE IMPACTS BY SCENARIO



Source: Allen Consulting Group.

Private consumption — generally viewed as a better indicator of household welfare — can be expected to be increase by between 0.35 and 0.69 per cent. To put into perspective, a 10 percentage point increase in household internet take-up rate could boost private consumption by $2.4 billion in 2009-10 economy. A 20 percentage point increase could boost private consumption by $4.8 billion (in the 2009/10 economy). In practice it would probably take several years for this estimate of the full benefit for all households to be realised reflecting lags in access, adoption, utilisation and adjustment throughout the community.

Investment can be expected to be higher by 0.41 and 0.82 percentage points, under the moderate and greater expansions respectively. This is a consequence of the productivity improvements incurred by each sector.

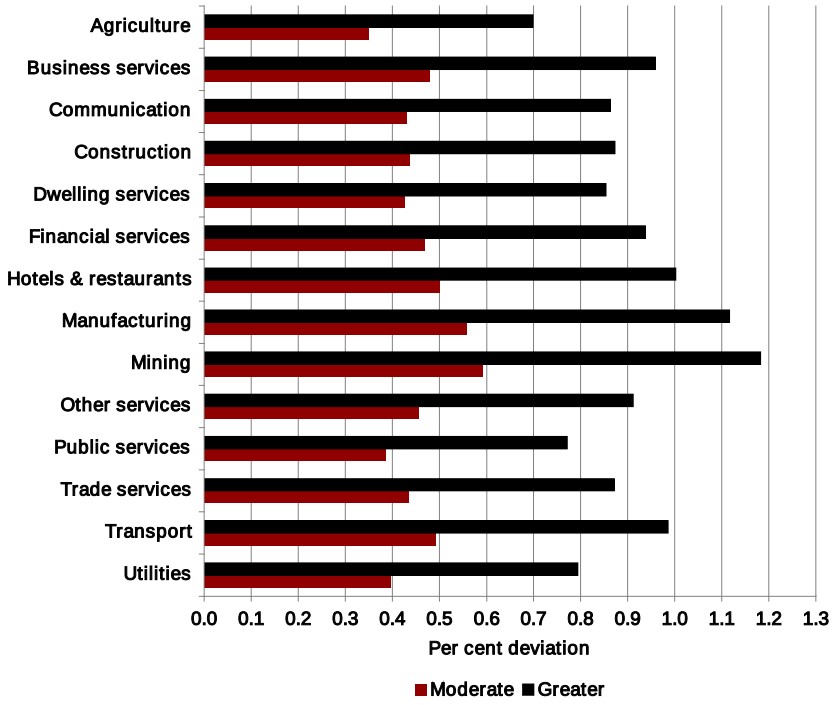
The public sector benefits as a result of both increased efficiencies in the provision of government services, and from increased economic activity. As a result of the greater Internet access, it is estimated that government expenditure could increase by between 0.35 and 0.69 percent, for the two scenarios respectively.[8]

5.6 Industry impacts

The increase in economic activity differs by sector. Figure 5.2 reports the expected growth in output by industry under the two scenarios.

Figure 5.13

INDUSTRY IMPACTS BY SCENARIO



Source: Allen Consulting Group.

[8] It should be noted that the increase in government expenditure is a product of the MMRF's closure assumptions. A neutral assumption has been made to reflect growth in government sector consumption that follows changes in the private sector.

The sectors that benefit the most from the increased broadband access are those that attract high levels of investment. The mining and manufacturing sectors, despite not having a significant web presence, benefit considerably from the increase in access in both scenarios. Output in these sectors is estimated to be higher by 0.59 and 0.56 per cent respectively under the moderate expansion scenario, and by 0.91 and 0.77 per cent respectively under the greater expansion scenario.

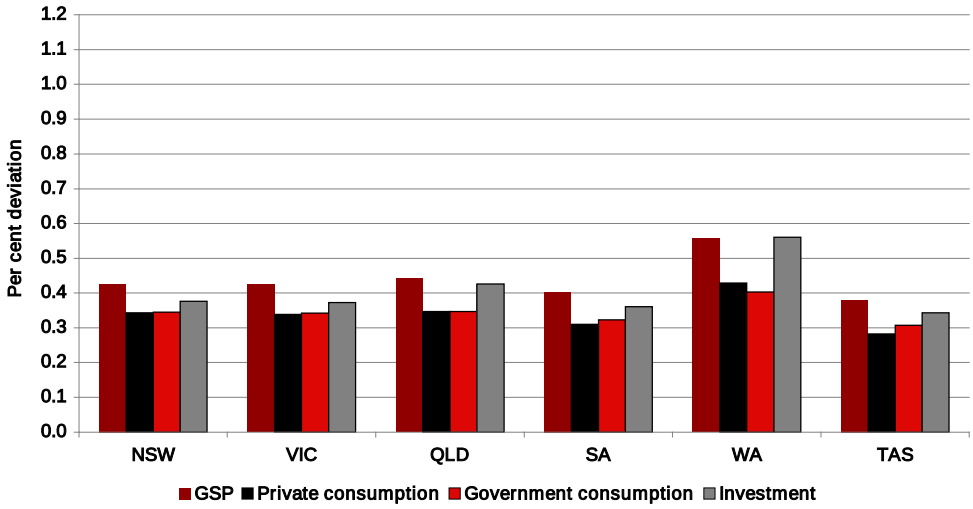
5.7 State impacts

Impacts on individual states reflect their respective industry mix. WA enjoys the most growth in GSP, a result influenced by the positive impacts on the mining sector. WA GSP is estimated to be boosted by 0.56 and 1.12 per cent (for each scenario), while on average, GSP in the remaining states is higher by 0.41 and 0.83 per cent (respectively for each scenario).

Investment, consumer expenditure and government expenditure in each of the states follows a similar trend as the economy wide results, with the WA economy leading all others. The expected effects on these key indicators are reported in Figure 5.3 and Figure 5.4 for the moderate and greater expansion scenarios respectively.

Figure 5.14

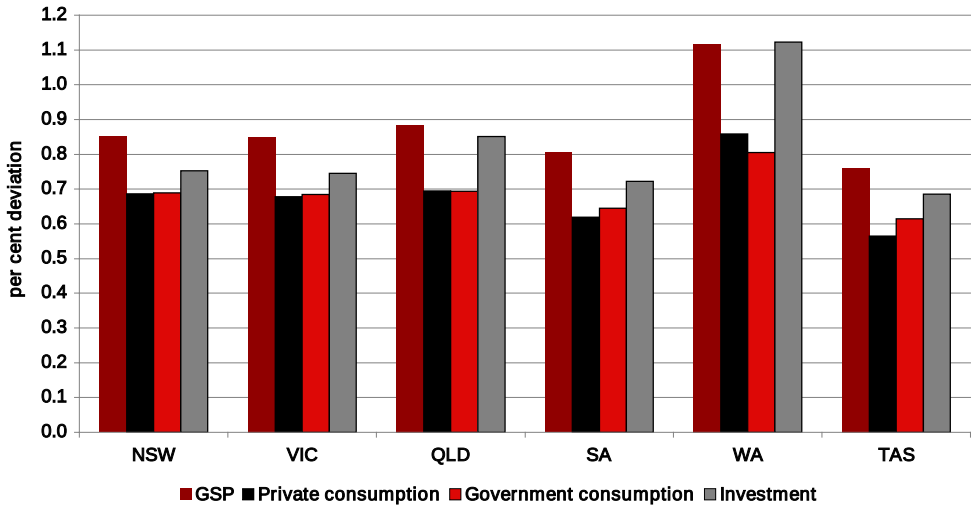
STATE IMPACTS, MODERATE EXPANSION SCENARIO



Source: Allen Consulting Group.

Figure 5.15

STATE IMPACTS, GREATER EXPANSION SCENARIO



Source: Allen Consulting Group.

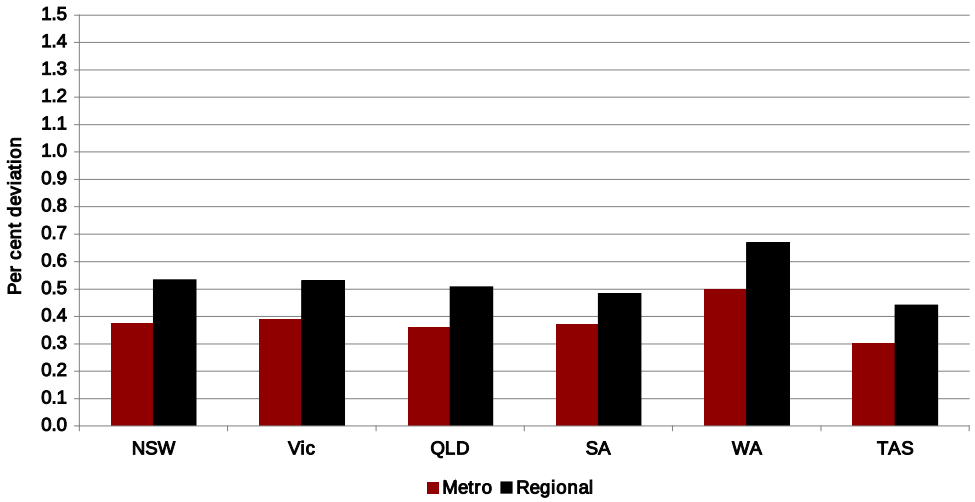
5.8 Regional/metropolitan impacts

A significant difference can be observed between regional and metropolitan areas. In each of the states, growth in the output of regional areas outperformed growth in the output of metropolitan locations. On average, a 10 percentage point increase in connectivity raised regional output by 0.53 per cent, while metropolitan areas experience a smaller boost of 0.38 per cent. Under the greater expansion scenario (20 percentage point increase in connectivity), output is estimated to be higher by average of 1.05 per cent in the regional areas, and 0.77 per cent in metropolitan areas. The biggest difference between regional and metropolitan growth came in WA and NSW.

The expected impacts on production in regional and metropolitan areas are reported in Figure 5.5 and Figure 5.6 for the moderate and greater expansions respectively.

Figure 5.16

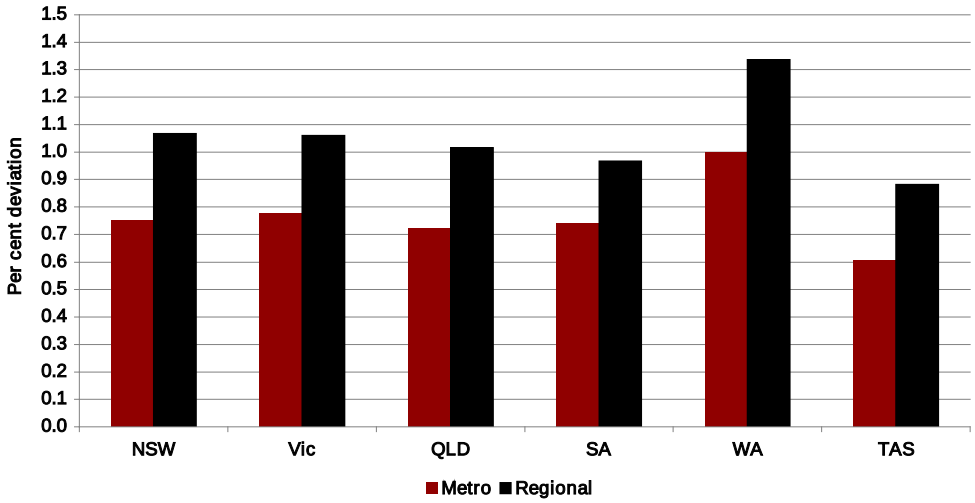
REGIONAL IMPACTS, MODERATE EXPANSION SCENARIO



Source: Allen Consulting Group.

Figure 5.17

REGIONAL IMPACTS, GREATER EXPANSION SCENARIO



Source: Allen Consulting Group.

Note that the difference observed between regional and metropolitan areas is not a result of the gains expected from an attempt to bridge the Digital Divide. The scenarios have assumed a uniform increase in access, and have specifically not sought to weight the expansion towards a particular community. It follows therefore, that the surplus gains enjoyed by regional communities are likely to understate the impacts of how a broadband rollout would occur in practice.

5.9 Key points

- **The wider economic gains from increased household use of the Internet have been assessed using a CGE model of the Australian economy.**
- **A 10 percentage point increase is estimated to increase private consumption of 0.35 per cent.**
- **A 20 percentage point increase is estimated to increase private consumption of 0.69 per cent.**
- **The increase in investment is the main driver of this growth, with the government and consumer sectors also gaining. Mining and manufacturing in particular gain from the increased investment dollars in the economy.**
- **Regions in particular benefit as a result increased connectivity. This is in part a result of the industry concentration in those areas, which enjoy higher gains flowing from increased investment.**

Chapter 6

Key findings

This final chapter interprets the results presented in the previous chapters. The caveats discussed at the beginning of this report should be considered in interpreting these results.

The benefits of an increase in household Internet connections are far reaching, and extend well beyond just households. The Internet provides the ability to communicate and exchange information instantaneously and across vast distances, enabling individuals and businesses to participate in the economy, regardless of their location.

The benefits of increased household Internet connectivity are summarised for households, business, government and community organisations in Table 6.1. The greatest benefits can be expected by the household sector themselves. Households benefit from access to new online services and information and from the connection to the 'social community.'

It has been estimated that the value of the time the average household will spend on the Internet amounts to approximately $148 per week ($7 699 per year). This estimate is broadly consistent with the findings of other studies, both in Australia and overseas. This is a gross measure that includes both benefits and costs incurred by households. It is necessary to view this change within the context of the wider economy to obtain a comparable indicator of the gains for households from this change.

An increase in the number of households with Internet connections by 10 percentage points (819 000 additional households) would provide gains to households of $2.4 billion (as of 2009-10 economy) in terms of the change in the value of consumption that they are expected to sustain. An increase in connections by 20 percentage points (1.6 million additional households) would provide a benefit of $4.8 billion (as of 2009-10 economy).

Other sectors in the economy benefit indirectly. The indirect benefits of increased household connectivity include:

- for businesses — the reduction in the costs of customer acquisition and client servicing;
- for government — improved public sector efficiencies and the returns form greater economic activity; and
- for community organisations — increased engagement/participation with community groups.

Relative to the gains to the household sector, these benefits although considerable, are expected to be somewhat smaller in their magnitude.

For business and government these indirect benefits manifest as improvements in (multi-factor) productivity. Reflecting the extent of firm web presence in each sector, productivity has been estimated to increase by between 0.01 and 0. 1 percentage points (depending on the sector) as the result of a 10 percentage point increase in access; and by between 0.02 and 0.2 percentage points for a 20 percentage point increase. On average MFP has been expected to increase by 0.04 and 0.07 respectively for the two scenarios.

The total effects on the economy have been estimated using a CGE model. Accounting for the economy's interplays and sectoral relationships, it can be expected that a 10 percentage point increase in household Internet connections would increase GDP by 0.44 per cent, including gains to the consumer, investor and government sectors. An increase by 20 percentage points would produce an increase in GDP of roughly double this, approximately 0.88 per cent.

Non-metropolitan regions in particular benefit as a result increased household connectivity. This is in part a result of the mix of industries in those areas, which enjoy higher gains flowing from increased investment. On average, a 10 percentage point increase in connectivity raises output in regional areas by 0.53 per cent, some 0.14 percentage points higher than growth in metropolitan areas. A 20 percentage point increase would raise output in regional areas by 1.05 per cent, 0.029 percentage points higher than growth in metropolitan areas.

Again it should be noted that the above estimates have only taken account of current perceptions of broadband Internet technology. The potential services that may be made available through high-speed broadband have not been accounted for. In light of this, it may be the above analysis may be considered a relatively conservative benchmark for the benefits that could be achieved from next-generation technology.

Table 6.5

SUMMARY OF BENEFITS FROM INCREASED INTERNET ACCESS

Benefit	Likely size of benefits	Moderate expansion (10 percentage points)	Greater expansion (20 percentage points)
Households			
Enhanced communication through email, instant messaging, VoIP and other services.	High	Gains to household consumption of $2.4 billion	Gains to household consumption of $4.8 billion
Time saving activities including telecommuting, online shopping, remote work and study opportunities, information gathering and accessing services	High		
Price/product discovery	High		
Education and knowledge	High		
Access to new online services such as social networking, media/entertainment and professional services	High		
Substitution of physical services to services delivered electronically	High		
Inclusion and engagement in the online community	High		
Business			
Increased revenues to ISP and ICT companies from larger customer base	High	While the benefits to ISPs may be high, these benefits reflect payments received from the household sector, and are already included in the gross measure of benefits to this sector.	
Higher expected return on R&D investments by ICT industry	Low		
Industry scale and skill retention	Low		
Expanded market potential for other businesses	Low – med	MFP growth increases across a variety of sectors, economy wide average 0.035 percentage points	MFP growth increases across a variety of sectors, economy wide average 0.070 percentage points
Reduced cost to serve arising from change in business practices and cheaper marketing solutions	Low – med		
Government			
Increased revenues as a result of greater economic activity	Low	Economy wide analysis estimates 0.35 per cent increase	Economy wide analysis estimates 0.69 per cent increase
Government efficiencies in program and service delivery	Low	Public sector efficiency growth in line with MFP growth	Public sector efficiency growth in line with MFP growth
Reduced costs associated with community communication and engagement	Low		
Community organisations			
Increased capacity and capability	Low	Not quantified	Not quantified
Reduced costs associated with awareness and participation	Low		

Source: Allen Consulting Group.

Appendix A

The MMRF Model

A.1 The MMRF model

The Monash Multi-Regional Forecasting (MMRF) model is a Computable General Equilibrium (CGE) model of Australia's regional economies developed by the Centre of Policy Studies (CoPS) at Monash University (CoPS, 2008). It is a model of the entire Australian economy and it captures the interactions between different regions and sectors. For a detailed description of the theoretical structure of the model see Peter et. al., 1996.

The MMRF model is used for a wide range of policy studies, including the analysis of state tax reforms and the potential benefits of the National Reform Agenda. More recently, the Department of the Treasury and the *Garnaut Climate Change Review* applied the MMRF model to the national climate change modelling to assess the impacts of the proposed CPRS on the Australian economy.

Appendix A provides an overview of the MMRF model, detailing its modelling capabilities, core structure and economic principles.

A.2 Introduction to the MMRF model

The MMRF is a dynamic model of the Australian economy that models the behaviour of economic agents within each of Australia's eight states and territories. Each region is modelled as an economy in its own right, with region-specific commodities, prices and industries. The model contains explicit representations of intra-regional, inter-regional and international trade flows.

Each sector produces capital that is specific to the region in which it is located. In each region, there is a single representative household and a regional government. At the national level, the Commonwealth Government is also represented. Finally, the rest of the world is represented as a single agent, whose behaviour is driven by regional international exports and imports. The regions are linked through inter-regional trade, labour and capital mobility, and the taxing and spending of the federal government.

A.3 The database

There are many versions of the MMRF model. The version of MMRF used for this project provides a representation of the Australian economy as it was in 2005-06.

The model allows for joint production — where one industry can produce a number of different commodities. Specifically, the model contains 58 industrial sectors, which produce 63 commodities. The industries and their related commodities are detailed in Table A.1 and Table A.2 respectively.

Table A.1

MMRF: INDUSTRIES

Industry	
Agriculture, Forestry and fishing	30. Motor vehicles and parts
1. Sheep and beef cattle (high emissions)	31. Other manufacturing
2. Dairy cattle	**Utilities**
3. Other livestock (low emissions)	32. Electricity generation: Coal
4. Broadacre agriculture except for animal	33. Electricity generation: Gas
5. Other agriculture	34. Electricity generation: Oil products
6. Agricultural services and fishing	35. Electricity generation: Nuclear
7. Forestry	36. Electricity generation: Hydro
Mining	37. Electricity generation: Other
8. Coal mining	38. Electricity supply
9. Oil mining	39. Gas supply
10. Gas mining	40. Water supply
11. Iron ore mining	**Services**
12. Non-ferrous ore mining	41. Construction services
13. Other mining	42. Trade services
Manufacturing	51. Financial services
14. Meat and meat products	52. Business services
15. Other food, beverages and tobacco	53. Dwelling services
16. Textiles, clothing and footwear	54. Public services
17. Wood products	50. Communication services
18. Paper products	43. Accommodation, hotels and cafes
19. Printing and publishing	55. Other services
20. Petroleum and coal products	56. Private transport services
21. Chemicals	57. Private electricity equipment services
22. Rubber and plastic products	58. Private heating services
23. Non-metal construction products	**Transport**
24. Cement	44. Road passenger transport
25. Iron and steel	45. Road freight transport
26. Alumina	46. Rail passenger transport
27. Aluminium	47. Rail freight transport
28. Other non-ferrous metals	48. Water, pipeline and transport services
29. Metal products	49. Air transport

Source: CoPS, MMRF database.

Table A.2

MMRF: COMMODITIES

Commodities	
1. Sheep and beef cattle (high emissions)	33. Other non-ferrous metals
2. Dairy cattle	34. Metal products
3. Other livestock (low emissions)	35. Motor vehicles and parts
4. Broadacre agriculture except for animal	36. Other manufacturing
5. Bio fuel	37. Electricity generation: Coal
6. Other agriculture	38. Electricity generation: Gas
7. Agricultural services and fishing	39. Electricity generation: Oil products
8. Forestry	40. Electricity generation: Nuclear
9. Coal mining	41. Electricity generation: Hydro
10. Oil mining	42. Electricity generation: Other
11. Gas mining	43. Electricity supply
12. Iron ore mining	44. Gas supply
13. Non-ferrous ore mining	45. Water supply
14. Other mining	46. Construction services
15. Meat and meat products	47. Trade services
16. Other food, beverages and tobacco	48. Accommodation, hotels and cafes
17. Textiles, clothing and footwear	49. Road passenger transport
18. Wood products	50. Road freight transport
19. Paper products	51. Rail passenger transport
20. Printing and publishing	52. Rail freight transport
21. Petrol	53. Water, pipeline and transport services
22. Diesel	54. Air transport
23. LPG	55. Communication services
24. Aviation fuel	56. Financial services
25. Petroleum and coal products nec	57. Business services
26. Chemicals	58. Dwelling services
27. Rubber and plastic products	59. Public services
28. Non-metal construction products	60. Other services
29. Cement	61. Private transport services
30. Iron and steel	62. Private electricity equipment services
31. Alumina	63. Private heating services
32. Aluminium	—

Source: CoPS, MMRF database.

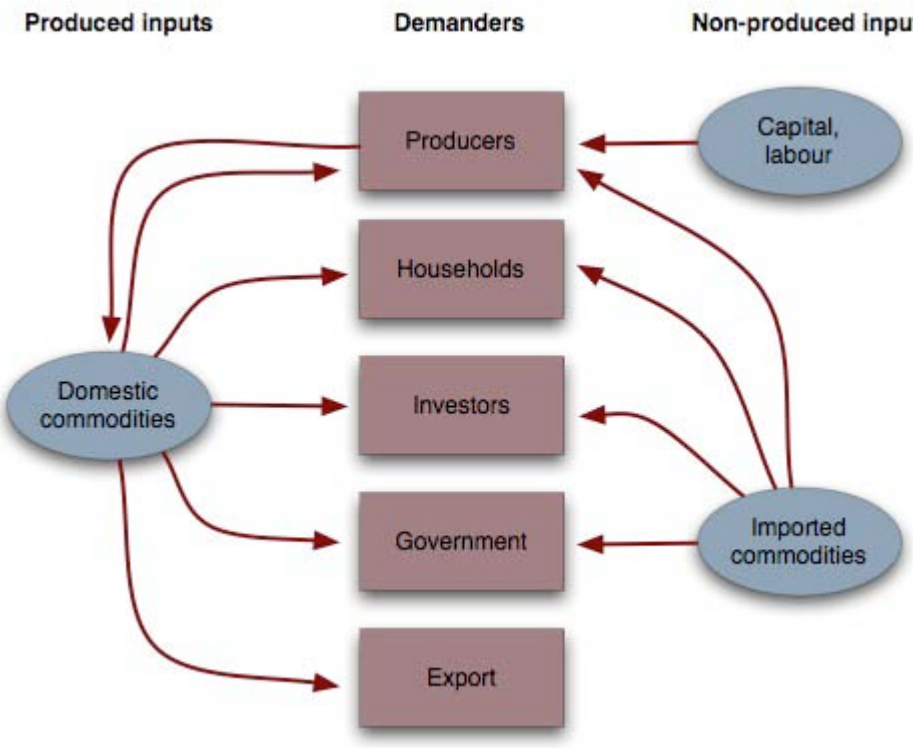
The MMRF database is comprised of detailed input-output tables for each state and territory as well as a set of government fiscal accounts. Each of the eight input-output tables details the core cost structure of each region specific industry and how each industry in each state economy is linked to other industries within that state and other states. Further, they show the flow of goods through the economy and the final demands of the principal economic agents.

A.4 Structure of the model

The core structure of the MMRF model is illustrated in Figure A.1. Producers use primary factors (labour, land and capital), region specific intermediate goods, and imports to produce domestic commodities. Domestic commodities and imported commodities flow to households, investors, and governments. In addition a proportion of domestic commodities flow to foreigners as exports. As well as demand schedules, the MMRF model has a detailed government budget and a set of regional labour markets.

Figure A.1

STRUCTURE OF THE MMRF MODEL



Source: Allen Consulting Group analysis, 2010, adapted from Monash.

The MMRF model is built on the core assumptions of neoclassical economics. Consumers aim to maximise utility within a fixed budget constraint, while firms select the mix of inputs that minimises costs for their level of output. This optimising behaviour determines the regional supplies and demands of commodities and the demand for primary factors within the model. Labour supply at the national level is governed by demographic factors and national capital supply is determined by rates of return. Both labour and capital can cross regional borders such that each region's stock of productive resources reflects relative employment opportunities and relative rates of return.

Assumptions regarding the economic behaviour of agents together with detailed input-output tables for each of the eight regions are linked by mathematical equations. This allows for second round impacts or feedback responses to be accounted for in the modelling framework. For instance, it allows for price response adjustments across all industries and factors. In this way, the results detail the actual effect of a change on the entire economy, not just within the region or industry that is directly affected. This allows a more sophisticated insight into policy analysis than is possible from partial equilibrium analysis or input-output analysis.

The model is driven by the assumption of competitive markets. That is, all markets clear and there exists equality between the producer's price and marginal cost for each sector in each region (all markets clear with the exception of the labour market). The purchasers price and producers price differs by the size of any government taxes and associated margins. All government taxes are levied as ad valorem sales taxes on commodities. Margins are additional costs associated with transport or retail trade required for market transactions.

Aggregate demand

Demand for goods from households, investors, governments and foreigners together comprise aggregate demand as represented in the equation below.

$$Y = C + I + G + (X - M)$$

Where:

- Y is aggregate demand;
- C is household consumption;
- I is investment;
- G is government spending;
- $X$is exports; and
- M is imports.

The components of aggregated demand and how they are represented within the model are discussed below.

Household demand

There exists a utility maximising representative household in each of the eight regions. Households consume bundles of goods from either domestically produced or imported commodities. Domestically consumed goods are a combination of goods from the eight regions. Total household demand is disaggregated into essential goods and luxury goods, as represented in the equation below.

$$X_i = X_i^{Sub} + X_i^{Lux}$$

Where:

- X_i is total household demand;
- X_i^{Sub} is essential consumption; and
- $X_i^{Lux}$is luxury consumption.

In MMRF it is assumed that a household will first purchase all essential goods before purchasing any luxury goods such that disposable income for luxury goods is a function of total income and the summed value of essential consumption.

$$Y^{Lux} = Y - \sum P_i X_i^{Sub}$$

Where:

- Y^{Lux} is income for luxury goods;
- Y is total disposable income
- P_i is price of good i; and
- X_i^{Sub} is quantity of essential good X.

MMRF assumes a non-homothetic utility function (MMRF applies a Klein-Rubin utility function), which allows both income and relative prices to affect consumption.

Capital creation

Investors in each regional sector combine inputs to generate capital. Investors are limited to the technology set that is available for production in that regional sector. Rates of return are used as a signal for capital investment or disinvestment.

Government demands

There are nine governments represented in MMRF — the eight regional governments and a federal government — each demanding commodities. Government demands are either imposed on the model or determined endogenously by setting government expenditure rules. For example, government expenditure could be linked to aggregate consumption.

Foreign demand

Most exports can be categorised as either traditional exports, non-traditional exports or tourism exports. Demand for traditional exports is characterised by a downward slopping demand curve and associated assumptions regarding foreigners' preferences for Australian goods. Each regional sector has an associated export market, which faces a downward sloping foreign demand curve. It is assumed that the foreign demand schedules are specific to the regional sector; as such movement in world prices can differ across different regions.

The demand for non-traditional export goods is driven by the average price of the collective non-traditional export bundle. In the MMRF database, non-traditional exports account for two per cent of total national exports and include: electricity generation, gas and water, construction, trade services, rail transport and dwellings.

Within MMRF, it is assumed that the tourism sectors — hotels and cafes, road transport, air transport and other services — do not face their own individual demand schedules. Rather, foreigners purchase a holiday bundle, the quantity of which is determined by the average price of the tourism goods.

Demands for inputs used in production

Producers in each region utilise primary factors — land, labour and capital — intermediate goods and imported goods to produce domestic commodities. Producers are assumed to choose the mix of inputs that minimises costs for a given level of production. The MMRF model assumes a multi-stage nested structure of production. At the first stage the optimal combination of region specific intermediate goods and the optimal combination of occupational specific labour is selected. At the second stage, producers make decisions regarding the optimal combination of the three primary factors and the combination of imported and domestically sourced goods. Finally, producers combine primary inputs and intermediate goods to produce a level of output at minimum cost.

A.5 Government finances

MMRF contains a set of equations detailing government revenues and government expenditures for each government. Government revenues are comprised of income taxes, sales taxes, excise taxes, taxes on interregional trade and receipts from government assets. Government expenditures include — as detailed above — expenditure on commodities as well as transfer payments to households. In addition, for the Federal government there is a set of equations describing fiscal transfers to the states.

A.6 MMRF dynamics

There are two main types of inter-temporal links incorporated into MMRF: physical capital accumulation and lagged adjustment processes.

Physical capital accumulation

It is assumed that investment undertaken in year t becomes operational at the start of year t+1. Thus, given a starting point value for capital in t=0, and with a mechanism for explaining investment through time, the model can be used to trace out the time paths of industry capital stocks.

Capital stock in industry *i* in state/territory *s* in year t+1 is determined by the equation below.

$$K_{i,s}(t+1) = (1 - DEP_{i,s}) * K_{i,s}(t) + INV_{i,s}(t)$$

Where:

- $K_{i,s}(t)$ is the quantity of capital available in industry *i* located in state/territory *s* at the start of year *t*;
- $INV_{i,s}(t)$ is the quantity of new capital created through investment for industry *i* in state/territory *s* during year *t*; and
- $DEP_{i,s}$ is the rate of capital depreciation in industry *i*, treated as a fixed parameter.

Investment in industry *i* in state/territory *s* in year *t* is explained via a mechanism that relates investment to expected rates of return. The expected rate of return in year *t* can be specified in a variety of ways. In MMRF two possibilities are allowed: static expectations and forward-looking model-consistent expectations. Under static expectations, it is assumed that investors take account only of current rentals and asset prices when forming current expectations about rates of return. Under rational expectations the expected rate of return is set equal to the present value in year *t* of investing $1 in industry *i* in state/territory *s*, taking account of both the rental earnings and depreciated asset value of this investment in year t+1 as calculated in the model.

Lagged adjustment processes

One lagged adjustment process is included in MMRF. This relates to the operation of the labour market in year-to-year simulations.

In comparative static analysis, one of the following two assumptions is made about the national real wage rate and national employment:

- the national real wage rate adjusts so that any policy shock has no effect on aggregate employment; or
- the national real wage rate is unaffected by the shock and employment adjusts.

MMRF's treatment of the labour market allows for a third, intermediate position, in which real wages can be sticky in the short-run but flexible in the long run and employment can be flexible in the short-run but sticky in the long run. For year-to-year simulations, it is assumed that the deviation in the national real wage rate increases through time in proportion to the deviation in aggregate employment from its baseline-forecast level. The coefficient of adjustment is chosen so that the employment effects of a shock are largely eliminated after about ten years. This is consistent with macroeconomic modelling in which the Non Accelerating Inflation Rate of Unemployment (NAIRU) is exogenous.

A.7 Closure assumptions of MMRF

In MMRF, there are more endogenous variables than the number of equations. For the model to generate a solution, the number of endogenous variables must match the number of equations. Hence, some endogenous variables are set to be exogenous to ensure the number of endogenous variables matches the number of equations.

The desired economic environment/assumption for the policy scenario determines the choice of exogenous variables. These choices are also known as the closure assumptions. The most common closure assumptions are the long run, short-run economic closure and fiscal closure.

Short-run closure

In the short-run, the economy is less able to respond to policy changes, as prices and wages are sticky (or fixed). Labour market (in terms of employment) is flexible and unemployment rate can be above or under its natural rate. Capital stock is fixed in the short-run, and investment responds to changes in rates of return.

Long run closure

The key elements of a typical long run economic environment are:

- At the national level, long run employment is determined by demographic factors (birth and death rates, the level of international migration, etc.). Additionally, the unemployment rate reverts to its natural rate or NAIRU in the long run. Therefore, the national employment figure is fixed. However, labour is perfectly mobile across industry and states, thus there can be changes in industry and state employment.
- Labour market adjusts via changes in real wages.
- Capital stock in each industry adjusts to equilibrate its expected and actual rates of return on capital. The baseline expected rates of return are determined by values in the MMRF database. Industries' demands for investment goods are linked by an exogenous investment/capital ratio to changes in their capital stock.
- Nominal household consumption in each region is a constant share of post-tax household disposable income.

Fiscal closure

The role of government also plays a part in determining the impacts of a simulation. A typical fiscal closure will have the following assumptions:

- real government consumption (Commonwealth and States) is fixed; and
- government budget balances (Commonwealth and States) are fixed, via changes in the fiscal item 'Government transfers to households'.

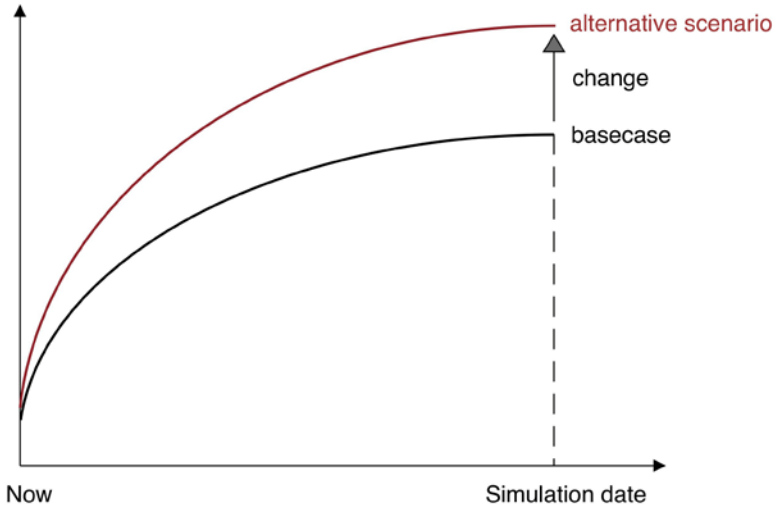
A.8 Interpretation of MMRF simulations

The MMRF can be solved in comparative static or recursive dynamic modes. Comparative static modelling shows the effect of a policy shock only. That is, it answers 'what happens when this happens?' without stating the adjustment process.

A dynamic CGE model would provide answers on the forecast structure of the economy under the baseline and the alternative case. It provides an explicit baseline over time against which the impact of a policy change can be compared. The model could incorporate more up to date data and the timing and policy paths are clear.

Figure A.2

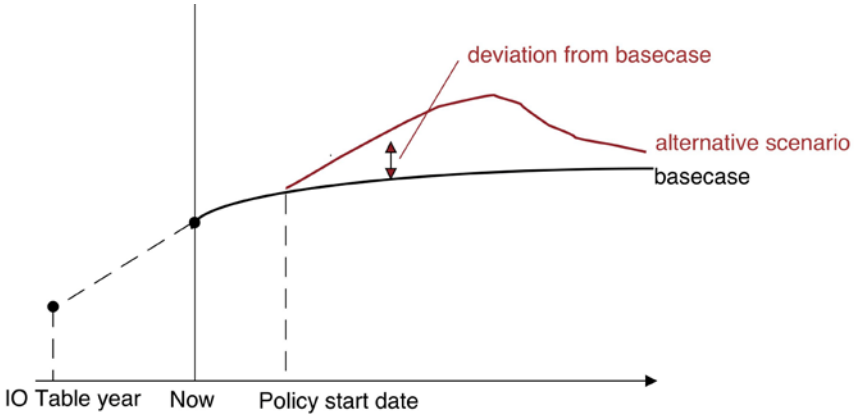
COMPARATIVE STATIC INTERPRETATION OF RESULTS



Source: Allen Consulting Group analysis, 2010.

Figure A.3

DYNAMIC INTERPRETATION OF RESULTS



Source: Allen Consulting Group analysis, 2010.

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