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A Report for the National Office for the Information Economy (NOIE)

Australia's Information Economy

The Big Picture

The Allen Consulting Group Pty Ltd

ACN 007 061 930

Sydney

3rd Floor, Fairfax House, 19 Pitt St

Sydney New South Wales 2000

Telephone: (61-2) 9247 2466

Facsimile: (61-2) 9247 2455

Melbourne

4th Floor, 128 Exhibition St

Melbourne Victoria 3000

Telephone: (61-3) 9654 3800

Facsimile: (61-3) 9654 6363

Canberra

Level 3, 60 Marcus Clarke St

Canberra ACT 2600

Telephone: (61-2) 6230 0185

Facsimile: (61-2) 6230 0149

Online

Email: allcon@allenconsult.com.au

Website: www.allenconsult.com.au

The Centre of Policy Studies

Melbourne

Monash University
Clayton Campus, Wellington Road

Clayton Victoria 3168

Telephone: (61-3) 9905 5464

Facsimile: (61-3) 9905 2426

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Executive Summary

What difference will the Information Economy make to the big picture? What will it do to GDP, employment and trade? What are the risks to the outlook? How significant are they?

Key Findings

The study indicates that increased involvement by Australian businesses in the Information Economy offers substantial economy wide gains. These include:

- Higher underlying growth — increasing GDP by up to 2.6 percent over levels that we would otherwise obtain by 2004-05.
- More jobs — employment would be higher than otherwise by around 1.2 percent, or around 110,000 jobs by 2004-05.

These findings are based on feedback received from a nation wide survey of businesses. Survey findings have been input into the MONASH model — a framework that reflects behaviour of the Australian economy to change that has been tried and tested in many economic studies.

The findings confirm the thrust of earlier work conducted for NOIE that the structural change brought about with the shift to electronic commerce has considerable economic significance. The Information Economy is not just an information technology (IT) issue.

In some ways, these figures represent a best-case potential outcome. In dry economic terminology, this is the expected outcome with fully competitive markets, flexible labour markets and without resistance to change.

The study also identifies factors which business flags as posing barriers to increased participation in the Information Economy. These include:

- a lack of affordable broadband Internet access;
- a continued IT skills shortage; and
- sustained privacy and security concerns.

All of these factors are well known to analysts, industry and government. There are already major policy initiatives in place to address each factor. The study has assessed what the impact of these factors would be if fears and concerns are in fact realised (if policy were not effective) drawing on reasonable assumptions about the nature of the barriers in different scenarios.

Key observations about the forecast impact of each of the barriers based on MONASH model simulations are that:

- constrained utilisation of the Information Economy due to concerns about security of privacy and data appears to undermine the expected gains in output and employment by more than the other identified types of barriers;
- poor access to and utilisation of broadband Internet capacity reduces the expected gains for output and, to a larger extent, upon employment. Industry arrangements that restrict output and raise prices for broadband are seen to reduce the surge in growth that would otherwise be expected; and
- a shortage of IT skills has a more pronounced effect in constraining the expected increase in employment.

If all three barriers were permitted to play out fully, the effect would be to limit gains to GDP from the Information Economy to around a fifth of their potential and result in a contraction in employment. These indicators can be viewed as the expected benefit of effective policy measures to combat the identified barriers. That is, the study quantifies economic losses that we could avoid with an effective strategic policy approach to further development of the information economy.

Section One

Context

There is increasing evidence of a major structural change in the Australian economy. Australia has been able to sustain economic growth despite a downturn in the economies of global leaders such as the US and Japan. It has withstood a collapse in other major markets in the Asia Pacific. The bursting of the dot com bubble appears to have had no material impact, as with the cyclical downturn in the IT sector. There is some evidence that the gains from the structural transformation in the economy towards the Information Economy have underpinned Australia's robust performance. This section looks at the nature of this change and reviews the factors that have been identified as likely to have broader economic significance.

1.1 This Study

The Allen Consulting Group in conjunction with the Centre of Policy Studies are pleased to provide this report to the National Office for the Information Economy (NOIE).

The study utilises the findings of a recent investigation conducted for Cisco, called *Built for Business*, about the size and nature of the Information Economy in Australia. It also draws on data collected by The Allen Consulting Group and others about the Information Economy and its economic impact. In addition, this study follows and builds upon key findings and frameworks from NOIE's *E–commerce Beyond 2000* report.

The main analytical tool used is the MONASH model of the Australian economy. This has been employed to assess the wider, flow on implications of the changes that greater involvement in the Information Economy is expected to bring.

1.2 The Information Economy Is Here and Growing

The *Built for Business* report conducted for Cisco found that the Information Economy[1] accounts for a significant share of economic activity in Australia, with estimated revenues of approximately $28 billion, which equates to 4.3 percent of Australia's gross domestic product (GDP). It also found that the Information Economy was growing at a rapid rate.[2]

1.3 Economic Impacts

This study identifies distinct impacts arising from greater involvement in the Information Economy, including:

- B2B gains — these gains were estimated from the survey of Australian businesses reported in Cisco's *Built For Business* report;
- B2C gains — these gains were flagged in NOIE's *Beyond 2000* report; and
- increases in resources required to support the Information Economy.

These direct impacts were separately identified and applied additively to the MONASH model to obtain a central case simulation of the scenario where greater involvement in the Information Economy is forecast — see Appendix A which outlines in detail the shocks applied to the MONASH model to obtain the central case scenario.

1.3.1 B2B Gains

One of the key insights stemming from greater use of the Information Economy was a reawakening about the role of the supply chain in shaping competitiveness. B2B gains are the efficiency gains expected to be obtained through reductions in the cost of business transacting with their suppliers. That is, in those transactions that are conducted on a business–to–business (or B2B) basis.

A recent OECD study examined the effects of the Internet across businesses, sectors and countries.[3] While the effects appear to differ

depending upon industry characteristics, Internet access and regulatory conditions, benefits within the supply chain include:

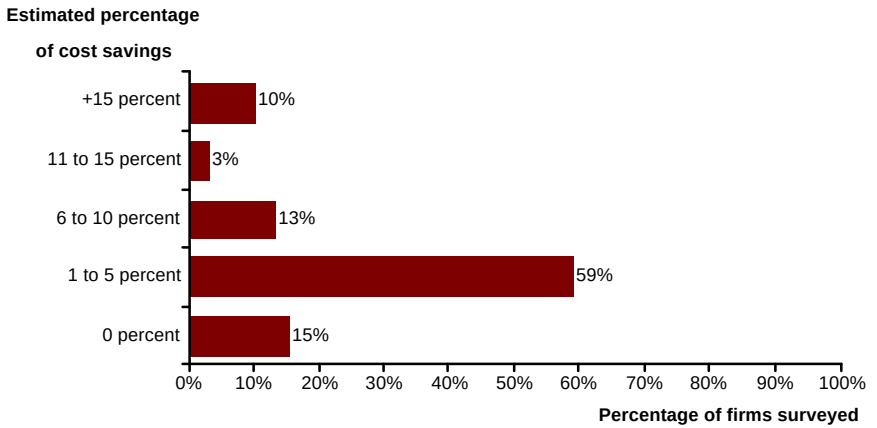
- lower search costs when business look for better or lower costs inputs and improved search effectiveness;
- speeds and improves communication within firms and with outside parties, facilitates networking with suppliers and other business clients (B2B), consumers (B2C), specialists, research institutions, government;
- improves efficiency and/or effectiveness of key business operations (administrative functions, human resource management, product development, manufacture and assembly, marketing, after-sales services);
- facilitates and expands direct sales potential, expands potential markets; and
- provides a venue for new or modified products.

Australian studies, often drawing on case studies, indicate similar types of cost savings experienced by firms undertaking online transactions. NOIE's *Advancing with E-commerce* report noted that on average 55 percent of the firms examined experienced a gross benefit from e-commerce in the form of efficiency savings.[4]

Built For Business added to the discussion about the nature of structural change brought about by the Internet. Unlike earlier studies, which tended to examine B2B gains on a firm–by–firm basis, *Built For Business* involved a nation-wide survey of Australian businesses. This allowed quantitative comparison of businesses involved in the Internet Economy with those that were not.

The evidence from *Built For Business* was that firms in the Information Economy enjoyed a substantial competitive edge over those that were not. 10 percent reported savings of 15 percent of more. More than half of the firms surveyed that were in the Information Economy reported reductions in their cost base of between 1 to 5 percent. See Figure 1.1 below.

Figure 1.1 — Business Cost Savings from Use of the Internet



Source: Cisco Systems, *Built For Business* Report, 2001

This finding was broadly consistent with earlier studies conducted in the United States by the University of Texas which found that Internet Economy employees are very productive in the US.[5]

A further finding from *Built For Business* was that business expects that the Australian Information Economy will continue to grow. Businesses in the Information Economy forecast revenue growth of about 25 percent per annum over the next three years. This implies an additional productivity gain in the pipeline.

The current downturn in the IT supply industry is not inconsistent with sustained progress in businesses making more use of the Internet. There is ample anecdotal evidence that businesses are continuing to apply Internet solutions without major expenditures on hardware. The downturn faced by IT equipment suppliers has created a buyers market for customers with lower prices.

1.3.2 B2C Gains

It is important, however, not to overlook 'Final demand', or in Information Economy lexicon, business–to–consumer (B2C) transactions. These types of transactions have fallen in and out of fashion with Internet analysts and investors. Originally, the capacity to operate a business reaching to consumers anywhere and at anytime was a major driver for investment in many new dot com companies. With more experience, however, it has become apparent that businesses depending entirely on B2C face many challenges. B2C activity is not growing as quickly as B2B. Nevertheless, consumption is the point of economic activity and B2C transactions (whether enabled by the Information Economy or not) account for a large share of the total number of transactions. Comprehensive analysis of the broader economic impacts of the Information Economy requires taking B2C activity into account.

As discussed earlier, many of the studies have discussed and quantified the costs savings from online B2B transactions on a firm–by–firm basis. However, in relation to B2C gains, the story is different. Most of the available analysis about B2C transactions concentrates upon the size of the market and its rate of Internet enabled growth. There is, however, little analysis about what difference Internet enabled B2C activity actually makes to the economy, and the actual online gains, if any, that are passed onto consumers. For example, while airlines have reported that online bookings for bookings and tickets allow companies to cut costs by up to 30 percent, nothing has been reported about the cost savings passed onto consumers.[6]

Although the evidence is limited, there are two key empirical studies which have attempted to report the B2C gains:

- a study conducted by a MIT academic regarding American sales found that the prices of many items purchased over the Internet are up to 16 percent lower than equivalent goods sold through traditional approaches.[7] Items with the largest reductions included books and music CDs.
- an OECD study reported savings on the various distribution costs from e-commerce compared to distribution via the traditional system with estimates ranging from 50 percent for life insurance purchases, 89 percent for banking services and up to 97 percent for software distribution.[8]

These studies imply that consumers are enjoying some of the benefits from the Internet's capacity to remove friction from normal market channels, reflected in lower prices.

This study follows the earlier work published in *E-commerce Beyond 2000* which factors in the available empirical evidence to assess the economic implications of growth in electronic commerce activity in Australia and includes in reductions in 'margins' between final consumers and sellers.[9] The reduction in margins between final consumers and sellers assumed is conservative compared to the estimates reported by the few studies (as discussed above) that have attempted to quantify the B2C gains. More information about this parameter is provided in the Appendix to this report.

1.4 No Free Lunches

Another important aspect of the study is the need to reflect the resource costs required to develop enhanced capability in the Information Economy throughout a growing portion of the economy — see Appendix A for a more detailed discussion of the implications of Australian businesses incurring additional Information Economy expenditures so as to yield greater involvement in the Information Economy. This follows approaches adopted in earlier studies.[10]

Section Two

Economic Impacts

The spread of the Information Economy is expected to change outcomes in the wider economy and change the composition of industrial economy. Real output, employment and other measures of economic well-being are expected to improve from increased participation in the Information Economy.

This study seeks to assess the economy wide implications — in particular, examining implications for economic activity (ie, GDP), employment and prices, among many other economic indicators over the next decade. To forecast these impacts the MONASH model of the Australian economy was used to simulate the expected changes.[11] Details about the model and the way that it was used are provided in the Appendix to this report.

2.1 Economy Wide Forecasts

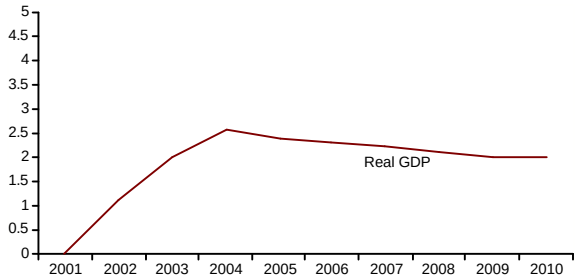
The major results from the simulation reflecting increased participation in the Information Economy — the central case — are that:

- Increased participation in the Information Economy will boost real GDP with the increase peaking at an additional 2.6 percent in 2004-05, with a long-term GDP increase of 2.0 percent.
- Employment will be higher than otherwise in 2004-05 with an increase of up to 1.2 percent. In the longer term, wages rise and employment returns to normal levels. This trims the longer run increase in GDP to around 2.0 percent, which would be sustained thereafter (in the absence of other shocks to the economy).
- Increased participation in the Information Economy will boost incomes, especially in the medium to longer term, and result in an increase in economic wellbeing (in terms of an increase in consumption potential).

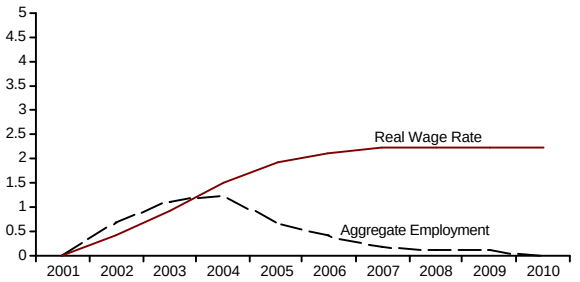
The increase in real consumption peaks at 3.4 percent in 2004-05, with a further increase of 2.4 percent forecast until 2010-11.

Figure 2.1 — Economy Wide Implications (percentage deviations from base case)

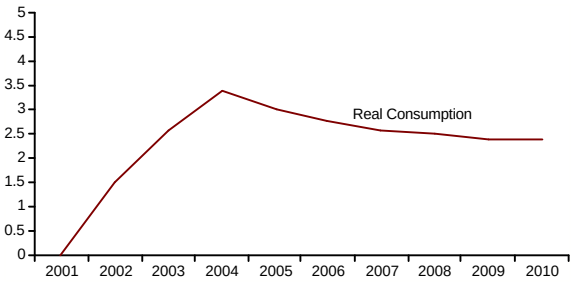
(a) Change in Real GDP



(b) Change in Wages and Employment



(c) Change in Consumption



Source: MONASH model simulations

2.2 Industry Forecasts

The potential expansion appears to be broadly based. All industries are forecast to expand output, although some sectors will do better than others.

Expected changes by industry sector are plotted in Figure 2.2. The specific industries are discussed below.[12]

2.2.1 Agriculture and Mining

This sector does not enjoy a particularly strong initial productivity stimulus. Unlike the other sectors, where output and employment growth peaks in 2004-05 this sector experiences a sustained mild increase in both output and employment of around 2.5 percent respectively. This reflects economy–wide influences.

2.2.2 Manufacturing

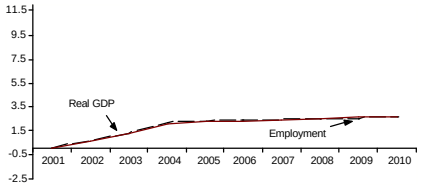
The manufacturing sector is foreshadowed to experience an average increase in the level of output of around 3.5 percent from 2004-05. Employment remains largely unchanged from base case levels. The productivity gains in labour are offset by the increase in wages in the long run, leaving the overall employment level unchanged.

2.2.3 Utilities

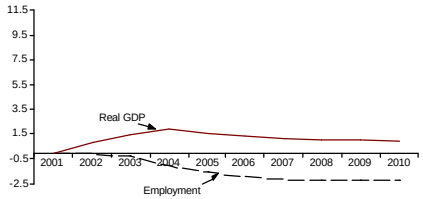
The utilities sector performs similarly to the finance, insurance, property and business services sector in that both output and employment rise and peak at the same time. Output peaks at 3.7 percent in 2004-05 while employment peaks at 2.7 percent in 2004-05. However, the distinguishing feature of the utilities sector is that employment falls away from the peak more rapidly. This is because this sector's output is in less demand in constructing capacity by the rest of the economy.

Figure 2.2 — Information Economy Impacts — Output and Employment by Industry Sector (percentage deviation from base)

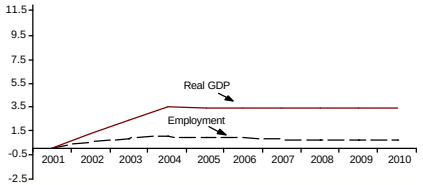
4.3(a) — Agriculture & Mining



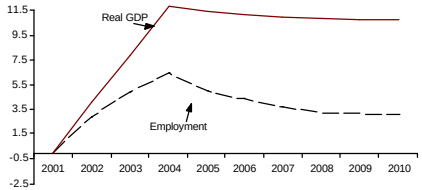
4.3(e) — Wholesale & Retail Trade



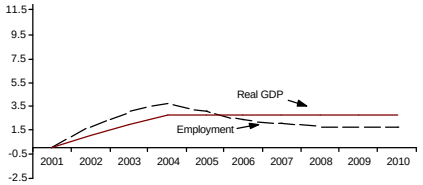
4.3(b) — Manufacturing



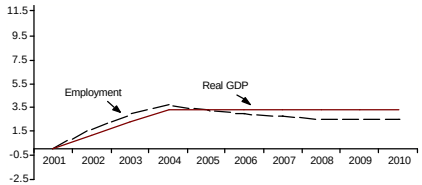
4.3(f) — Communications



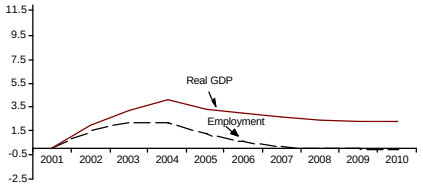
4.3(c) — Utilities



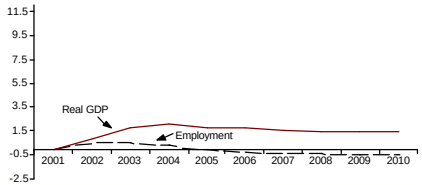
4.3(g) — Finance, Insurance, Property & Business Services



4.3(d) — Construction & Transport



4.3(h) — Other



Source: MONASH model simulations

2.2.4 *Construction and Transport*

The construction and transport sector experiences modest growth in output, but over time experiences no change in employment compared to the base case. The lack of change in employment over time implies that the underlying employment growth in the sector, which has been in evidence for some years, can still be expected but that it would be slightly lower.

The driving force behind this forecast is that certain sub-components (in particular, transport sub-components) of this sector experience disintermediation from increased growth of the Information Economy. The productivity gains experienced by other sectors can be viewed as being, in some way, savings derived at the expense of the transport sub-sectors. Another factor driving the employment outcome for this sector is that its productivity gains are larger than the increases in demand that arise from the expansion in overall economic activity.

2.2.5 *Wholesale and Retail Trade*

Output peaks in 2004-05 at 1.9 percent, however employment in this sector is lower than the base case where there is not increased participation in the Information Economy. There are two offsetting influences in this sector. Output increases due to the increased productivity from increased use of the Information Economy, however due to the small increase in output and the disintermediation, employment decreases.

2.2.6 *Communications*

The communications sector is forecast to obtain the largest increase in output and employment. Output increases by around 11.8 percent by 2004–05, and remains high thereafter. The sector also expands employment (peaking with an increase of 6.5 percent). The expansion in employment is moderated when an increase in wages occurs. Employment in the sector remains above the base case because of expansion in the underlying size of the sector (ie, after increase investment in a more rapidly growing sector).

The communications sector has two strong drivers underlying this growth. Firstly it will experience strong productivity growth. Secondly, it is a major input into the growth and use of the Information Economy.

2.2.7 *Finance, Insurance, Property and Business Services*

Similar to communications, this sector obtains a boost from productivity gains and an increase in demand, with output peaking at 3.2 percent and employment peaking at 3.7 percent in 2004-05. This is not as large as in the communications sector due to the fact that not every sub–component of the sector is a substantial supplier to the Information Economy (the business services are the main areas that benefit from Information Economy demand). The pattern of peak and easing to a long run level of employment growth reflects delayed changes in wages and an expansion in the sector.

2.2.8 *Other*

There is hardly any change in the other industries. The picture for this sector is complicated because it is an amalgam of a range of diverse activities (most of which are services), and in particular contains public activities which are subject to special constraints. While there is scope to make productivity gains in activities such as defence, public administration, health and education, these activities may not experience an increase in demand due to public sector budget constraints.

Greater use of the Information Economy provides further momentum towards greater use of services and other impacts. These changes in the structural composition are apparent in Figure 2.2 which illustrates the different economic growth and employment predictions for the various sectors.

Section Three

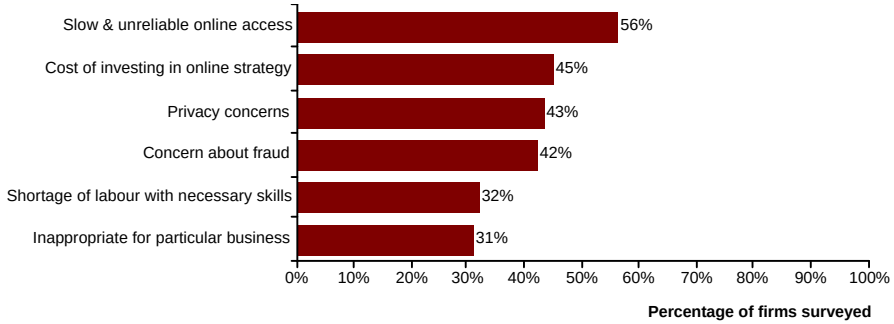
Key Risks

What are the potential impediments to the economic gains that greater use of the Information Economy is expected to bring? This section reviews the risk factors identified by business and others.

3.1 Some Observations

The Allen Consulting Group conducted a survey of Australian businesses (both within and outside the Information Economy) about which factors, if any, they regarded as barriers to greater involvement in the Information Economy. The findings are summarised in Figure 3.1.

Figure 3.1 — Barriers to Greater Involvement in the Information Economy



Source: The Allen Consulting Group Database of Australian businesses

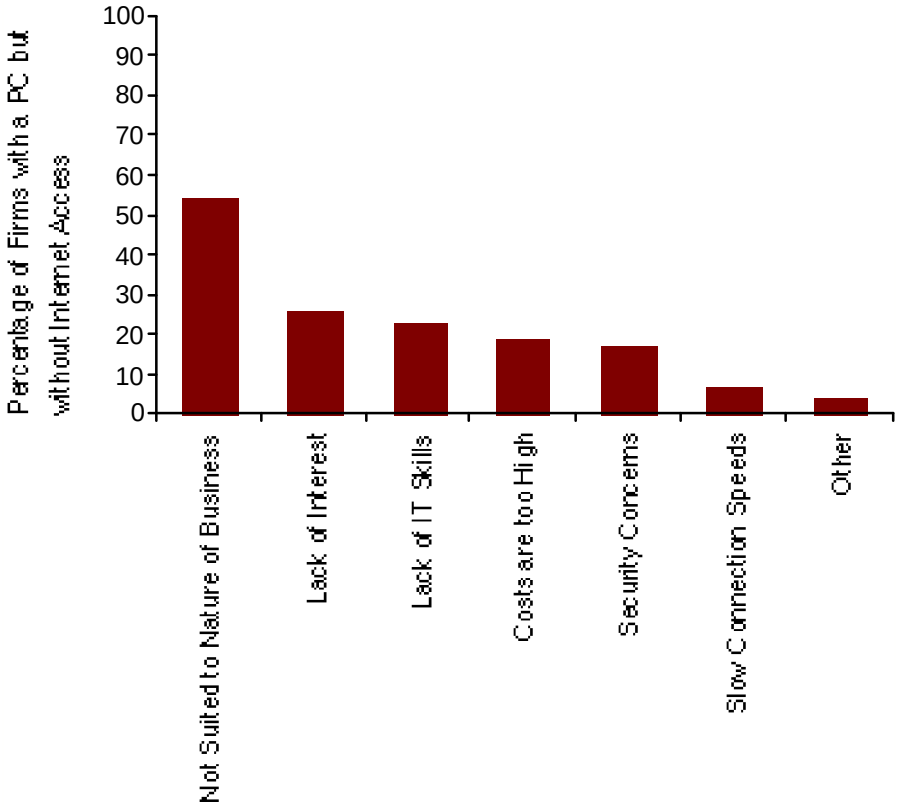
The key points from this data are that:

- Slow and unreliable access to the Internet was mentioned most frequently as a barrier — in fact, over half of the businesses surveyed identified this as a barrier.
- The cost of investing in online capabilities was also seen as a major impediment for nearly half of the companies surveyed.
- Additional concerns identified include threats to privacy and security, and the potential for fraud as a result of increased use of the Internet.
- A shortage of labour with the necessary IT skills was cited by only a third of businesses surveyed, although it was rated more highly as a barrier by businesses that were already in the Information Economy.

The Australian Bureau of Statistics (ABS) has also surveyed Australian businesses to identify barriers to Internet access.[13] See Figure 3.2 on the following page for a summary of the ABS survey findings.

Concerns about the IT skills shortage, security and bandwidth issues (slow internet connection and high costs) are featured in the ABS findings. However these concerns appear to be overshadowed by a sense that the Internet is not suited to the business. However, reference to earlier studies by the ABS indicates that concerns about the suitability of using the Internet are shrinking rapidly. The generality of the ABS findings are also somewhat constrained because their sample was limited to businesses that do not yet have Internet access.

Figure 3.2 — ABS Identified Barriers to Business Internet Access in 1999–2000



Source: Australian Bureau of Statistics, *Business Use of Information Technology,* Catalogue 8129.0, 1999-00.

3.2 Key Impediments to be Modelled

Given the major impediments identified by both businesses and consumers, this study will seek to estimate the economic implications of the three potential risks that appear consistently in independent surveys seeking views about potential barriers to greater use of the Information Economy. These impediments include:

- a lack of affordable high speed broadband Internet access;
- a persistent shortage of people with the relevant IT skills; and
- concerns about privacy and security on the Internet.

These factors are far from new. Industry and government are working to address these factors and reduce the risk that they will in fact become sustained barriers.

The consultants have not attempted to estimate the probability of these factors or concerns being well founded, or if they are likely to defy policy measures that are currently in place. Instead, this study traces out the broader implications of these risk factors if they materialise through the analysis of differing scenarios.

Section Four

Broadband Internet Access

What does it mean for the economy if there are limitations in the speed and reliability of Internet access and if these limitations are sustained? Can we gauge the impact upon forecast GDP growth and employment?

From an economic perspective, the central issue about broadband Internet access is the price. If reliable, fast, and 'always on' broadband access is not viewed as being affordable, businesses may have little option than to continue to use slow and unreliable access even if they grumble about it. If business and the wider community do not have broadband Internet access, the development of applications and content for the broadband environment will be stunted.

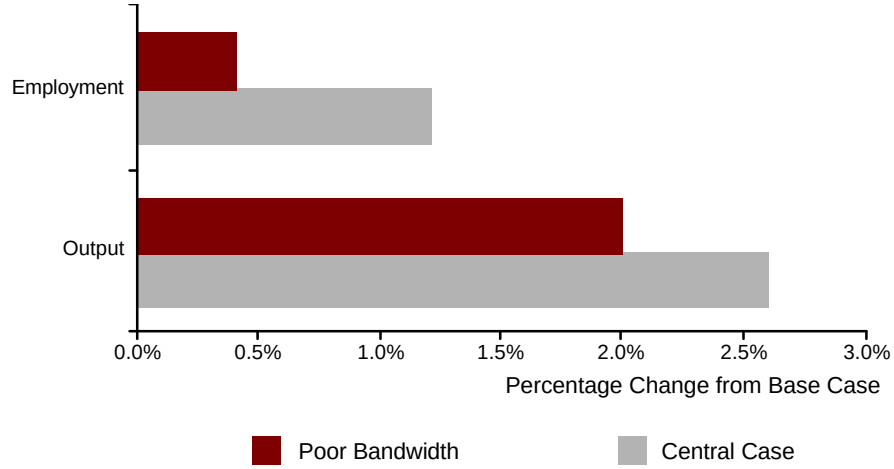
The central case forecast of greater involvement in the Information Economy was based on the expectation of fully competitive markets over the longer run. It is feasible, however, to use the MONASH model to simulate the outcome in less than perfectly competitive markets so as to determine what happens to output and employment if the price for broadband is higher than otherwise.

4.1 Poor Broadband Access Scenario

For this scenario all of the earlier 'shocks' apply. That is, there are still substantial potential efficiency gains in the pipeline from greater involvement in the Information Economy. In addition, the costs in order to develop capacity for wider participation in the Information Economy remain the same. What is different is that the price of telecommunications services for commercial broadband Internet use for firms operating in the Information Economy is assumed to be 25 percent higher (than the perfectly competitive situation). This could reflect a hypothetical outcome where incumbent services providers exercise sufficient market power to take advantage of additional demand for their services by restricting supply and raising prices.[14]

The benefits from greater involvement in the Information Economy are sharply reduced with higher telecommunications prices. The main findings are summarised in the charts and commentary below.

Figure 4.1 — With and Without Widespread Broadband Internet Access (percentage deviations from central case)



Source: MONASH model simulations

4.1.1 Output

While GDP increased with increased participation in the Information Economy, poor access to affordable bandwidth has the effect of restricting growth. The trajectory of the increase in GDP is broadly the same as in the central case except the increment peaks at 2.0 percent rather than 2.6 percent. The peak year results are plotted in Figure 4.1.

The increase in GDP with poor access to broadband is equivalent to about $12 billion in the peak year.

The expansion in output is forecast to plateau in this scenario for much the same reasons as it does in the central case. The stimulus of initial productivity gains are offset over time as labour costs rise, among other adjustments.

4.1.2 Employment

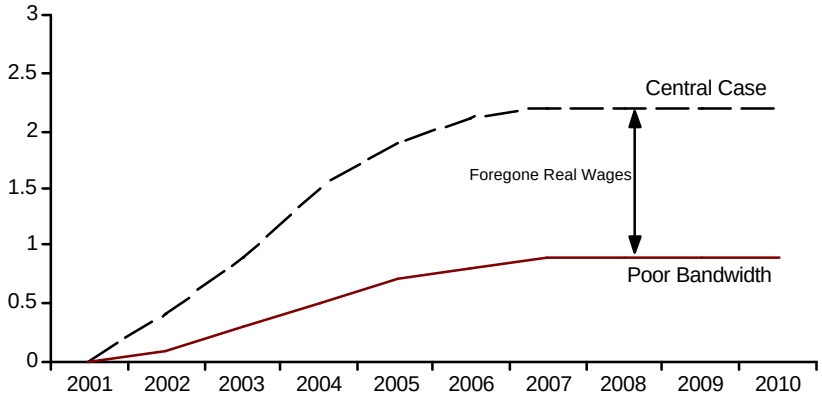
The employment outlook is not as upbeat with less affordable broadband access. Whereas employment increased in the short run (up to 2004-05) by about 1.2 percent or around 110,000 jobs in the central case simulation, the increase is restrained to 0.4 percent in the poor bandwidth scenario or about 37,000 jobs — see Figure 4.1 on next page.

4.1.3 Real Wages

Figure 4.2 shows a fundamental difference between the scenarios. Higher telecommunications costs with poor access to affordable bandwidth results in lower real wages than would otherwise be achieved (reflected in the solid line in the Figure). This may not be felt as an actual fall in real wages. It is likely that real wages will simply not grow as quickly as they would otherwise. In contrast employees are better off in the central case (the dotted line) with sustained higher wages.

The value of the real wages gap between the two scenarios has a net present value of about $10,280 per employee over the ten years. That is, Australian employees on average would forgo this amount if policy settings and decisions taken within the telecommunications industry result in sustained relatively high broadband prices.

Figure 4.2 — Change in Real Wages



Source: MONASH model simulations

4.1.4 Industry Outcomes

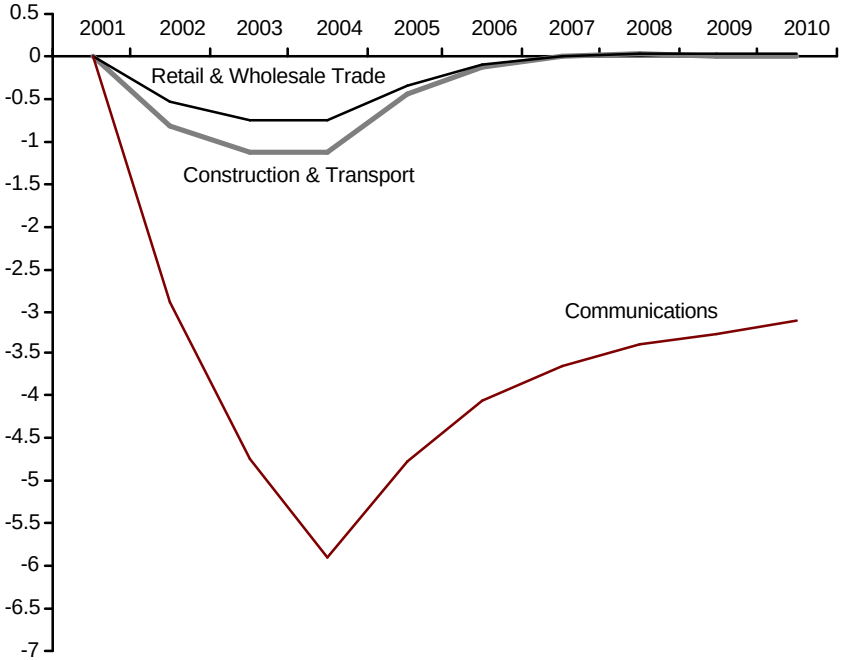
Activity on an industry-by-industry basis follows much the same trajectory as in the central case simulation except that the increases tend to be lower in proportion with the overall reduction in activity.

A forecast of employment within industry sectors also generally exhibits a proportional change with a few exceptions. Employment in the communications, construction and transport, and retail and wholesale trade sectors are forecast to see a pronounced dip compared to central case forecasts — see Figure 4.3 overleaf.

The dip in the wholesale and retail trade sector makes the outlook for that sector even bleaker, deepening the contraction in the sector forecast in the central case.

The strong dip when comparing the forecasts for the communications sector reflects in part scenario assumptions that restrict telecommunications output (and hence employment in that sector) as well as lower economy wide growth and demand for telecommunications as an input into other industries' products and services.

Figure 4.3 — Employment by Selected Industry Sectors (percentage deviations from the central case)



Source: MONASH model simulations

Section Five

The IT Skills Shortage

Would a shortage of IT skills present a material threat to the expected economic gains from the Information Economy?

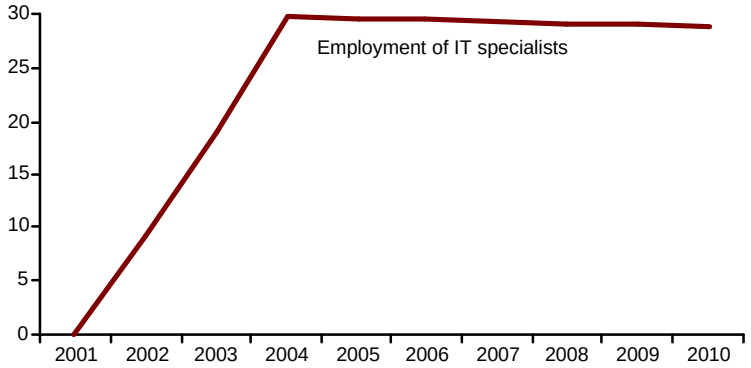
One premise of the central case forecast of growth in economic activity as a result of greater participation in the Information Economy is that the labour force keeps pace with industry needs. Broadly, over the long run, it is supposed that people acquire skills that are in demand as signalled by higher wages.

Sometimes, however, practical issues stand in the way of market outcomes and good educational planning. Skills gaps can persist over many years.

There is some reason to suspect that the central case may be vulnerable to an IT skills bottleneck. The MONASH model has a unique ability to assess changes in the numbers of people employed in the differing occupations that make up the workforce. This reflects the model's development as a tool to assess structural change in the economy over time. Using this capability it was found that the growth foreshadowed in the central case is dependent upon a 30 percent increase in the employment of people in key Information Economy occupations — see Figure 5.1.

The feasibility of a 30 percent increase in IT specialist numbers is open to some doubt given current strident industry concerns about a shortage of skilled people, concerns which have been sustained in key network/Internet areas despite the cyclical downturn in the IT industry. Estimates about the size of the gap vary but one of the most conservative studies recently released by the Australian Information Industry Association stated "…the skills gap is believed to be large, in the order of 27,500 ICT graduates over five years".[15]

Figure 5.1 — Central Case Change in Employment of IT Specialists (percentage deviation from base)



Source: MONASH model simulations

5.1 Simulating A Skills Shortage Scenario

Constructing a useful forecast about the number of additional IT specialists that are likely to be available to industry without substantial policy change is a very complex task. Inevitably estimates are going to be contentious.

One reasonable approach to estimate the impact of this potential barrier, if it is in fact realised, is to assess what would happen if Australian industry was able to obtain only half the increase in people with IT skills required to obtain the full potential gains forecast in the central case. This was performed by halving the B2B gains, which were estimated and applied for the central case simulation. The entire B2C gains were unchanged.

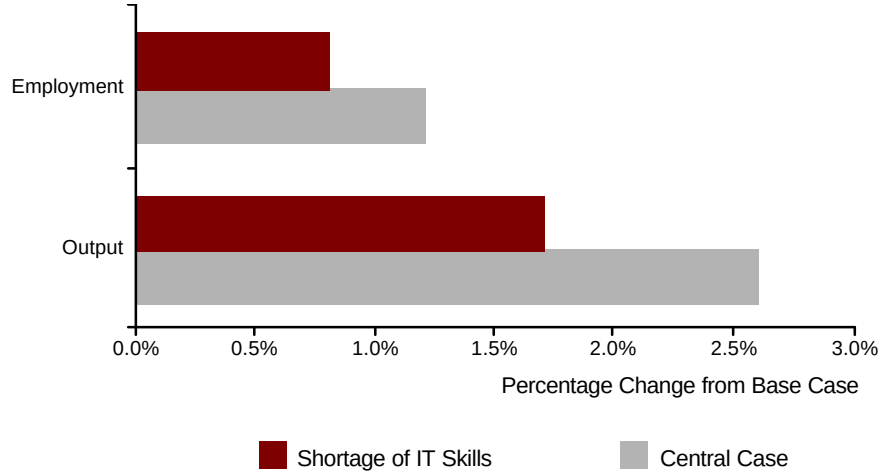
The results of a MONASH simulation that builds on the central case simulation with the additional IT skills constraint are reported below.

5.1.1 Output and Employment

Analysis of this scenario suggests that a sustained shortage of people with the IT skills required by industry would have a deleterious impact upon the

potential increase in output (real GDP) that could be obtained from greater participation in the Information Economy. The increase in output would be limited to a maximum of 1.7 percent in this scenario compared to 2.6 percent in the central case — see Figure 5.2.

Figure 5.2 — With and Without a Shortage in IT Skills (percentage deviations from base case)



Source: MONASH model simulations

Forecast employment growth is also reduced in this scenario. Employment does increase by 0.8 percent in the year in which the gains peak (2004-05), some 40 percent less than the increase expected under the central case.

5.1.2 Real Wages

Smaller increments in activity and employment lead to a reduction in the potential increase in real wages per employee. The real wages gap in this scenario compared to the central case has a NPV of $5,185 per employee over ten years.

Section Six

Privacy And Security Issues

Concerns about the threat to privacy linked with increased use of the Information Economy for commercial and other purposes have been flagged for many years. This report provides a quantified assessment of the economic implications of failing to address these concerns.

While it is hard to measure the economic impact of intangibles such as privacy and data security, it is easier to envisage the implications from the lack of them. If concerns regarding threats to privacy and data integrity linger it can be expected that the people in the community, consumers, will be reluctant to take fullest advantage of the facilities available in an Information Economy. Basically this can be viewed as a threat to B2C Information Economy activity.

Meanwhile it is not clear that such concerns would pose a sustained barrier for businesses trading and engaging with other businesses over the Internet. Businesses appear to have a greater preparedness to balance the gains against perceived risks to privacy and data security. Certainly many Australian businesses were engaged in large scale EDI networks which were the precursor to the Internet. This implies that taken broadly B2B Internet economic activity would not be impeded in the longer term.

By halving the B2C Information Economy gains, the MONASH model simulated the economic implications of the scenario where privacy and security issues are not addressed effectively and the community retains residual concerns about engaging with the Information Economy. The direct B2B impacts are left unaltered in this scenario.

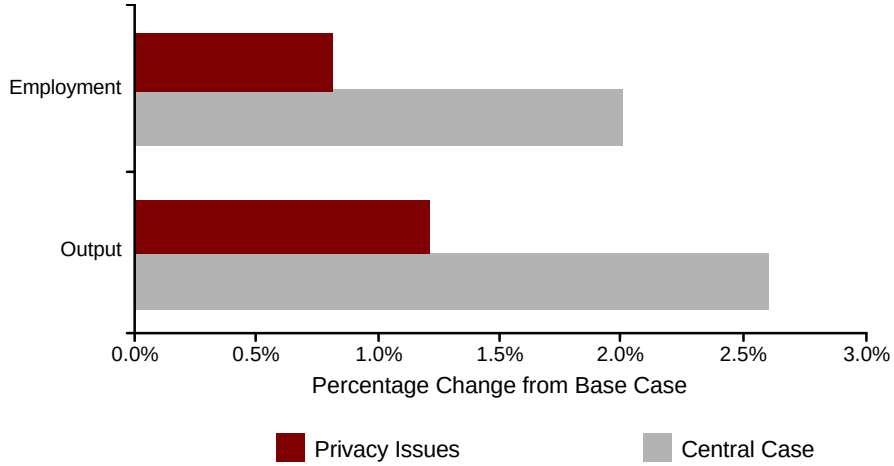
MONASH model simulation results for this scenario are discussed below.

6.1 Privacy and Security Simulation Results

Reductions in the general involvement in the Information Economy because of concerns about privacy and data security pose a significant threat to the potential output and employment gains that could be obtained from the Information Economy.

The increase in output could be trimmed to about half of those expected in the central case, while the increase in employment would be well under half — see Figure 6.1.

Figure 6.1 — With and Without Privacy and Security Concerns (percent deviations from base case)



Source: MONASH model simulations

6.1.1 Real Incomes

The real wages gap in this scenario has a NPV of $4,146 per employee over the next ten years.

The implications for B2C Information Economy activity can, in fact, be applied more broadly. That is, similar observations would apply to any factor which may constrain widespread participation in the information economy by consumers, such as consumer protection concerns, literacy constraints, low consumer awareness and low IT skills for consumers, along the same lines as those discussed in this section.

Section Seven

Conclusion

The Information Economy is expected to bring substantial economy-wide gains. Given what we know about the underlying structure of the economy (captured in the National Accounts and the MONASH model) combined with what businesses have said about what they see happening as a result of participation in the Information Economy (through an nation wide survey), the Australian economy can expect to see higher output and employment than otherwise.

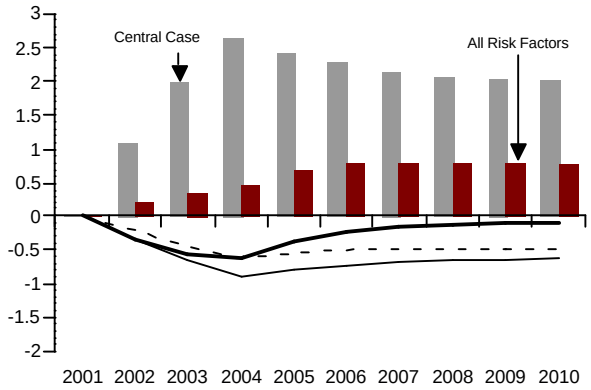
Even if the Australian economy does slip into a cyclical downturn over the next few years, the point is that this slip should not be as severe as would otherwise be the case without this positive impetus.

The risks to this outlook, however, are also significant. The key risk factors are well known and include: the IT skills gap, privacy and security concerns and a shortage of affordable broadband Internet access. The study provides some additional evidence about the potential economic significance of these risks.

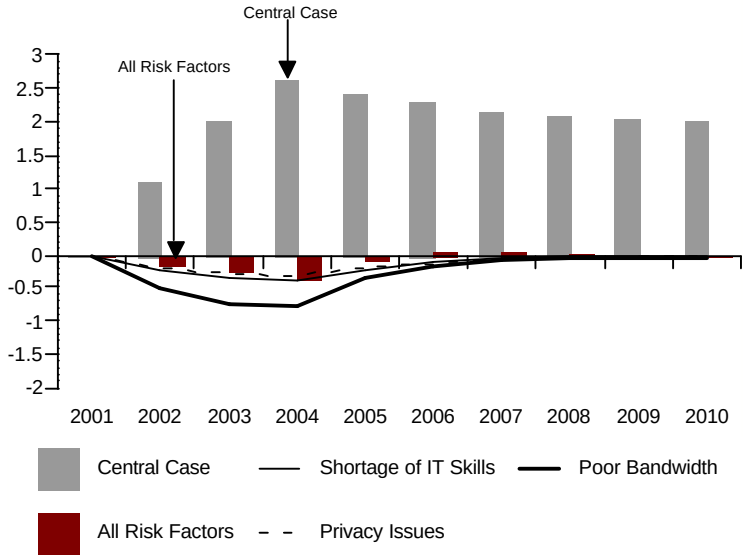
Further the MONASH model simulation of these risk factors indicates that they are all significant. As indicated in Figure 7.1 summarising MONASH model simulations, on the basis of some fairly reasonable assumptions about the nature of the main potential barriers to more widespread economic use of the Internet, the gains would be much reduced if all inhibiting factors or barriers are allowed to play out fully.

Figure 7.1 — Information Economy Impacts

(a) Changes in Output (Real GDP)



(b) Changes in Employment



Source: MONASH model simulations

The grey bars in Figures 7.1(a) and (b) represent the central case that illustrates the positive changes in output and employment from greater involvement in the Information Economy. The red bars (or dark bars) represent the changes in output and employment whereby greater involvement in the Information Economy is not realised as a result of all of the identified risk factors, including:

- a lack of affordable broadband Internet access;
- a continued IT skills shortage; and
- sustained privacy and security concerns.

The lines below the bars report the change in output and employment from the central case scenario as result of each identified risk factor — that is, each risk factor's contribution to the reduction in output/employment growth compared to the central case scenario. In other words, the risk factors (the lines) subtract from the grey bars and when they are all combined they equal the red bars.

Figure 7.1(a) reveals that the overall increase in output could be reduced to around a fifth of the potential growth premium from the Information Economy if every risk factor applies.

The risk in terms of employment impacts may be more significant. An inherent challenge to employment with substantial productivity gains is that these gains can displace labour. The overall outcome depends on the extent to which the productivity gains stimulate sufficient increases in economic activity to absorb labour displaced by structural change.

The simulation results summarised in Figure 7.1(b) indicate that while the outlook is very positive for employment if the risk factors for the Information Economy are addressed completely by effective policy measures, or do not materialise for other reasons. However, the outlook if the risks do materialise is for a small contraction in employment in the medium term, becoming more balanced over time. The key message is that within the normal degrees of uncertainty associated with forecasting the future, a reduction in employment could not be ruled out in the worst–case scenario where it transpires that every risk factor remains as a sustained barrier to participation in the Information Economy.

Appendix A

Forecasting Structural Change With The Monash Model

A.1 The Challenge

Evaluating the wider economic significance of involvement in the Information Economy is a daunting task. Earlier research provides evidence to suggest that the change is already underway and that its effects will be profound and pervasive.

Much of the final outcome from greater involvement in the Information Economy is likely to be shaped by factors that are only partly quantifiable. This study concentrates on the aspects that are most easily quantified, by largely focusing on productivity gains and the infrastructure investment required to facilitate growth in the Information Economy.

Very often, change results in winners and losers. Some businesses and some industries grow, some contract. Increased productivity in one industry might, for example, mean that some businesses products are used less or that they are no longer even needed (where they are disintermediated from a supply chain). Knowing which category an industry is in is very often of importance for people employed in it.

The heavily interconnected nature of a developed economy with long and complex value chains adds to the challenge. Even if some businesses or economic sectors of activity do not become participants in the Information Economy, their suppliers, customers and competitors will. Thus fundamental parameters such as the cost of some key inputs, or labour, or capital will change for everyone.

Possibly the biggest challenge is in assessing the ultimate impacts of change within a responsive market system. Feedback effects are often at work to bring the system into balance. Effects such as an increase in exports that follows a downturn in the value of the dollar are well known and often anticipated. There are many others. Broadly, the point is that businesses and households change quality and prices in the goods and services they use in response to changes, and the overall net effect is complex to work out.

Finally, it often takes the economy some time to fully adjust to change. Even in cases where it is thought that the economy is moving to an overall improvement in performance it can be important to track changes over time to see if there are transitional complexities and costs.

A.2 Modelling Approaches

What is needed is a framework for analysis that is not as complex as the real world, but is sufficiently sophisticated to reflect these real world challenges.

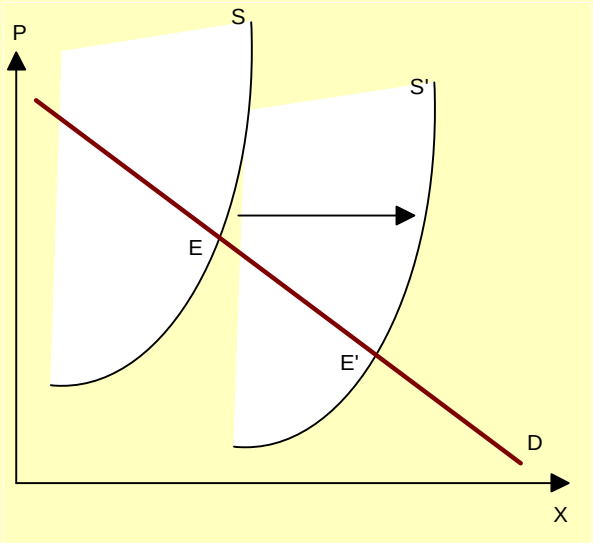
Computable General Equilibrium (CGE) models can be a helpful tool to analyse implications of the Information Economy. These types of models specifically look at the economy as an interconnected series of markets. CGE models are used regularly by Government and business to analyse the economy wide impact of policy changes and underlying structural change.

Box A.1 explains one way in which the Information Economy can be modelled using a CGE model.

Box A.1 — Direct B2B impacts of the Information Economy

Utilisation of the tools provided by the Internet by business can be thought of as a technological innovation, which improves the economic efficiency at the firm and industry level, which brings about a reduction in production costs, hence an increase in supply.

The Figure below shows in graphical form, the shift in the supply curve at the industry level results in an increase in the production and a reduction in the equilibrium price of good X.



This graphical illustration only refers to a partial equilibrium setting. In practice, changes in this market would spill over into other markets in terms of changes in the demand for and price paid for labour, capital and other intermediate goods. The full flow-on impacts can be modelled in a broader content using a general equilibrium model. This is 'general' because it would specify the behaviour of many or all economic agents. 'Equilibrium' refers to the prices of goods and factors (labour and capital) adjusting to market conditions.

Source: UNCTAD, Building Confidence in Electronic Commerce and Development, 2000, p.28.

CGE models have recently been used to analyse aspects of e–commerce. The United Nations Conference on Trade and Development (UNCTAD) used a CGE model in an analysis of the impact of e–commerce upon the global economy. They found that e–commerce could raise GDP in developed countries by up to 1.4 percent, exert downward pressure on prices and substantially enhance welfare.[16] NOIE recently published the *E–commerce Beyond 2000* report that used the MONASH CGE model to evaluate the macroeconomic and industry impacts of greater use of e–commerce in Australia. Simulation results reported in that study indicated that the net impact could be a 2.7 percent increase in the level of output over the next decade.[17]

The CGE results from these e-commerce simulations seem to be more conservative compared to the findings of analysts using different techniques. Brookes and Wahhaj have used a model (Multimod, used by the International Monetary Fund) that organises time–series of data on many countries into complex models of the individual macro economies as well as their global interrelationships. Their simulations indicate that GDP in developed countries could be almost 5 percent higher after 10 years.[18]

A.3 Drivers of Change

Based on previous research, key dimensions of the Information Economy have been identified as impacts which could be quantified and modelled. They are:

- expected increases in business productivity from B2B participation in the Information Economy — these B2B gains were estimated in Cisco's *Built For Business* report;
- gains that could be expected to be obtained by consumers through B2C participation in the Information Economy — these B2C gains were derived from NOIE's *Beyond 2000* report; and
- increases in resources required to support the Information Economy.

These impacts were separately identified and applied in an additive fashion to the MONASH model to obtain a central case simulation of the scenario where greater involvement in the Information Economy is forecast.

A.3.1 Productivity Gains (B2B)

Productivity gains are expected from greater involvement in the Information Economy as a combined consequence of better information flows around the economy and between firms, and less 'friction' between buyers and sellers undertaking transactions in the value–chain. Confirmation of these productivity gains, or rejection of the theory that they are occurring, is an empirical question. The consultants sought to obtain an answer through the conduct of a nation wide survey of businesses.

It is difficult to ask survey questions that get directly to technical measures of productivity such as total factor productivity or multifactor productivity and obtain reliable answers. Based on experience and a trial survey, the full survey used for this study involved asking companies a range of questions about cost savings, revenues, and their employment patterns. There were also questions seeking forecasts about key dimensions, looking out to the next three years. Other questions were included to ascertain each respondent's status regarding participation in the information economy.

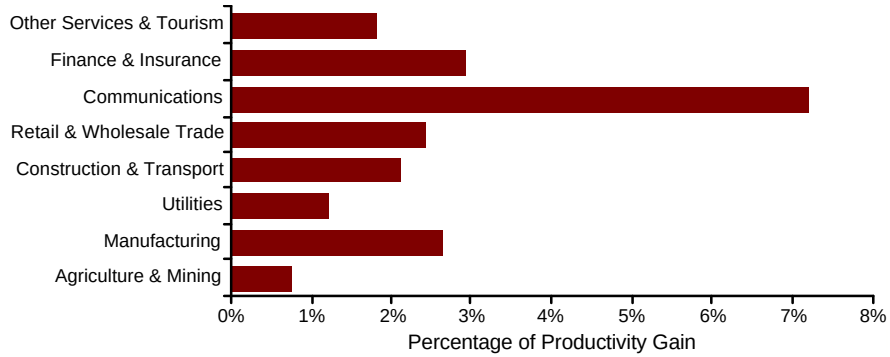
The range of indicators produced provided consistent evidence that companies in the information economy are more productive than those that are not. In particular, it was found that companies in the information economy generate 52 percent more output (ie, revenue) per employee than companies not in the information economy.

Obtaining statistically significant survey results about productivity gains at the industry level was challenging in some industries, including communications and utilities, where the industries are dominated by a few large players and sample sizes are very small. Therefore the findings about productivity gains by industry using each measure were not all statistically significant. The consultants therefore elected to apply the average productivity gain obtained from the entire sample because this measure was statistically significant and provided a conservative value.

It is also necessary to adjust the forecast to take into account the expected increase in the level of information economy activity in each industry (and to ensure that existing levels of information economy activity are excluded). A forecast increase in information economy activity by industry sector was generated with reference to the difference in present and forecast information economy revenue as a percentage of total revenue for each sector. These estimates were more consistently statistically significant than the industry productivity data.

The average estimated productivity gain for each industry sector as firms become more involved with the information economy is quantified as the product of the productivity factor and the proportional increase in information economy activity in each sector provides — see Figure A.1 below.

Figure A.1 — Productivity Gains from 2001 to 2004 By Industry



Source: The Allen Consulting Group Survey

Thus, for example, as indicated in the Figure above, based on survey results, the average increase in productivity in the manufacturing sector is forecast to be 2.6 percent. This is a combination of the sample–wide weighted average productivity gain per company when companies enter the

information economy of 52 percent, times the forecast increase of a 1.7 percent increase in information economy participation in this industry sector (measured by reference to growth in information economy revenues as a portion of the sector's total revenue).

This 2.6 percent indicator for manufacturing is used in the MONASH modelling to mean that over the period 2001 to 2004, firms in the manufacturing sector will increases their involvement in the information economy enabling them to produce 2.6 percent more output per unit of labour and capital input. Alternatively, because of increased information economy integration, manufacturing firms will be able to produce 2.6 percent more output with no change in their inputs of capital and labour.

A.3.2 Consumer Gains (B2C)

Just as greater involvement in the Information Economy in economic activity leads to efficiency gains in the supply chains between businesses and their suppliers, it also leads to efficiency gains in the final demand transactions between producers and consumers. This is largely driven by distintermediation through B2C Information Economy transactions. There is some evidence that this leads to price reductions for consumers.

The potential for electronic commerce to disintermediation or bypass costs that add no value to consumers was flagged in the earlier *Beyond 2000* published by NOIE. The *Beyond 2000* assumptions factor in reductions in the relatively small retail margins that exist as costs between buyers and sellers for most products and services. The reduction in margins range from between 0 to 30 percent, depending on an assessment of the future potential for goods or services to be involved in Information Economy activity into the medium term.

These assumptions appear to have been reasonably robust. There has been no recorded criticism of this as an approach to reflecting the gains that consumers should be able to obtain from electronic commerce and Information Economy activity, that the consultancy team has been able to identify.

Therefore, for this study these identified B2C gains were factored in by assuming that greater use of the Information Economy results in a reduction in retail margins (which are only a small part of the final price) of those goods and services that were identified in the *Beyond 2000* study as being amenable to being purchased over the Information Economy by consumers. That is, the B2C gains were factored in as a means of reflecting consumer gains that are independent of the direct productivity gains obtained by businesses.

A.3.3 Information Economy Expenditures

There is no such thing as a free lunch. Substantial productivity gains are rarely available without cost. In this case, industry has to increase its costs in order to facilitate greater participation in the Information Economy. The second direct impact is to account for these resources.

An indication of the additional costs likely to be incurred in order to support greater involvement in the Information Economy has been derived from the nation wide survey of businesses that underpins this study. Broadly, respondents indicated that they expect to increase their on–line costs by between 1.7 percent to 21.2 percent. Once again agriculture and mining formed the lower bound while the communications sector is the leader.

The composition of on–line cost differs by industry. According to ABS data, many industries spend about two thirds of their on–line costs on communications inputs (including the communications sector itself). Many other industries spend about a quarter to a half of their online costs on IT equipment. The rest is used to purchase professional services (ie, software services and other advice).

A.4 Model Shocks

The above drivers of change are probably not yet fully factored in to general forecasts about Australia's economic outlook. While businesses have reported their views, participants in the economy do not appear to be aware of the aggregate picture. Certainly the authors are not aware of any other credible forecasting studies that factor in a change of this magnitude.

In the analysis to follow the outlook is examined by comparing forecasts with and without these changes. In other words, the changes form inputs or 'shocks' that the economic system responds to over time.

A.5 Guide to the MONASH Model

Since 1993, the Centre of Policy Studies (CoPS) has developed MONASH, a dynamic computable general equilibrium (CGE) model of the Australian economy designed for forecasting and policy analysis. Like its predecessor, ORANI, MONASH has a high level of microeconomic detail. Unlike ORANI, it has a strong forecasting capability. This is due to:

- a more detailed specification of intertemporal (i.e. dynamic) relationships;
- greater use of up-to-date data; and
- enhancements that allow the model to take on information from specialist forecasting organisations and from recent historic trends.

The key to generating reasonable forecasts is to use detailed information available from expert groups, specialising in the analysis of different aspects of the economy. MONASH forecasts incorporate a wide variety of information including:

- macro forecasts from the Commonwealth Treasury and Access Economics;
- export forecasts from ABARE and the Tourism Forecasting Council; and
- forecasts of changes in technology and consumer tastes derived from trends calculated at CoPS.

Using this information, the model generates projections for 113 industries and 115 commodities. These can be transformed into projections for 860 sub-commodities, 341 labour occupations, 56 regions and many types of households.

The initial applications of MONASH were made for State and Commonwealth Government departments requiring detailed employment forecasts. The model continues to be used for this purpose. However, in the last three years the main enhancements to the model have been directed at dynamic policy analysis. In dynamic policy simulations, we are concerned with the effects on the economy of changes in tax rates, technology, consumer tastes, etc. These effects are calculated as deviations from two alternative projections for the economy, one generated without the shock in question, the other with the shock in place. Deviations are produced for all of the common macro economic indicators such as GDP, employment, consumption and the CPI, as well as for structural variables such as industry output, exports and imports. The two alternative projections can also be used to analyse issues like labour market dislocation or adjustment costs that other CGE models, which do not have a year-to-year capability, are unable to address.

A.5.1 The Structure of MONASH

The core equations of MONASH are based on the equation system of ORANI. ORANI is transformed into MONASH via the addition of: (1) dynamic equations relating capital to past investment and investment to expected rates of return; and (2) mechanisms that facilitate dynamic policy simulations such as allowing for a sticky real-wage response to an employment-damaging/enhancing policy shock.

The basic theoretical assumptions made in the MONASH model are as follows.

A.5.2 The Nature of Markets

Markets are assumed to be perfectly competitive. Competition guarantees that a level of output is produced in each industry at a point where the producer's price equals marginal costs and where zero pure profits are earned. Demand is assumed to equal supply in all markets except in the market for labour where oversupply is allowed. The government intervenes in a market by imposing sales taxes on commodities. This puts a wedge between the price paid by the purchaser and price received by the producer. The model also recognises nine margin commodities (wholesale trade, retail trade, road transport, rail transport, water transport, air transport, transport services, insurance and restaurants), which are required for each transaction involving a commodity or service. The costs of the margins are included in the price paid by the purchaser.

A.5.3 Input Demand for Industry Production

Two broad categories of inputs to the production process are recognised, intermediate inputs and primary factors (labour of various occupations, capital, agricultural land and working capital). Intermediate inputs are distinguished by commodity type and by source (domestically-produced and imported). Firms in each industry are assumed to choose a mix of inputs that minimises the costs of production for given input and output prices and for a given level of output. They are constrained in their choice of inputs by a production technology that combines intermediate and primary inputs to produce output.

A.5.4 Household Demand

The household determines the composition of consumption by choosing commodities (distinguished by source) to maximise a utility function subject to an expenditure constraint. A consumption function determines overall household expenditure as a function of household disposable income.

A.5.5 Input Demand for Investment

Given a level of investment expenditure, an industry chooses inputs (distinguished by type and by source) to minimise the costs of capital creation. The input-demand functions to capital creation are analogous to the input-demand functions for current production, with the exception that there are no primary factor inputs to capital creation.

A.5.6 Government Demands for Current Production

There is no explicit theory determining governments' consumption expenditures. These can be determined in one of three ways: (1) endogenously, by a rule such as moving government expenditures with household consumption expenditure or with overall domestic absorption; (2) endogenously, as a policy instrument which varies in order to accommodate an exogenously determined policy target such as a required outcome for the government's budget deficit; or (3) exogenously.

A.5.7 Foreign Demand (international exports)

MONASH is a single country model, and hence cannot explicitly model all of the determinants of foreign demand for Australian products. It handles export demand by imposing for each exported commodity a foreign demand schedule. These schedules, which relate the volume of exports to the foreign currency price of Australian products, are downward sloping. Hence, export volumes and foreign-currency prices can respond to changes in Australian supply conditions.

A.5.8 Capital Stocks, Investment and Rates of Return

MONASH allows for two broad treatments of capital and investment. The first, involving explicit assumptions about movements in rates of return and investment/capital ratios, is suitable for comparative-static simulations. In such simulations, we are concerned with the effects of a policy or other shock after considerable time, say seven years. In these circumstances, MONASH allows the user to assume that the shock under examination does

not affect rates of return. Thus, industries favoured by the shock attract capital until their rates of return are driven down to their initial levels and that industries for which the shock is unfavourable lose capital until their rates of return increase to their initial levels. Having, in this way, tied down the long-run effect of the shock on capital stocks, the effect on investment by industry can then be determined by assuming no change in investment/capital ratios.

The second broad treatment of capital and investment in MONASH involves explicit capital supply functions, and is used in year-to-year simulations, i.e., simulations tracing out the paths of variables for years t, t+1, t+2, etc. While the assumption of no change in rates of return may be suitable for long-run analysis, it is unrealistic to assume that movements in an industry's rate of return are eliminated by year-to-year movements in the industry's capital stock. In each year of year-to-year simulations, industries' capital growth rates (and thus investment) are determined according to functions which specify that investors are willing to supply increased funds to industry j in response to increases in j's expected rate of return. However, investors are assumed to be cautious. In any year, the capital supply functions in MONASH limit the growth in industry j's capital stock so that disturbances in j's rate of return are eliminated only gradually.

A.5.9 Equations for Facilitating Dynamic Policy Simulations

There are a number of mechanisms in MONASH introduced to facilitate dynamic policy simulations. Probably the most important mechanisms relate to wage and employment adjustment in the labour market. In comparative static analysis, one of the following two assumptions is made about the operations of the labour market: (1) real wages adjust so that any policy shock has no effect on employment; or (2) real wages are unaffected by the shock and employment adjusts.

MONASH, however, allows an intermediate position for year-to-year policy simulations. In MONASH, 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. More specifically, for year-to-year policy simulations it is assumed that the deviation in the real wage increases in proportion to the deviation in employment from its base case-forecast level. The coefficient of adjustment is chosen so that the employment effects of a shock are largely eliminated after eight to ten years. This labour market is consistent with macroeconomic modelling in which the non-accelerating inflation rate of unemployment (NAIRU) is exogenous.

A.5.10 Detailed Modelling Results

The MONASH simulations consists of two parts: a base case forecast run and a policy run. The policy run includes changes in technology, changes in consumer preferences, changes in world commodity prices and changes in numerous other variables that are imposed in the base case forecast run. In addition, the policy run includes extra changes in variables reflecting the policy under analysis. For example, if we are interested in the effects of cuts in tariffs, then the policy run includes tariff cuts as extra imposed shocks. By comparing the results from the policy run with those from the base case forecast run, we can deduce the effects of the policy.

Therefore, all of the results produced by the Centre of Policy Studies are presented as percentage deviations from the base case.

ENDNOTES

[1] The Information Economy was defined as being comprised of four layers: Layer One — Internet Infrastructure Providers; Layer Two — Internet Applications Infrastructure Providers; Layer Three — Internet Facilitators' and New Intermediaries Market; and Layer Four — Firms that Undertake Electronic Commerce.

[2] Cisco, *Built For Business*, report prepared by The Allen Consulting Group, 2001.

[3] Organisation of Economic and Cooperative Development, 'The Internet and Business Performance', *Science Technology Industry — Business and Industry Forum Series*, 20 September 2001, p.11.

[4] National Office of the Information Economy, Advancing with E-commerce. Accessed from www.noie.gov.au on 8 April 2002.

[5] University of Texas, *Measuring the Information Economy*, 6 June 2000, p.2.

[6] Shiffman, A, 'Online is big cost-cutter for airlines', *The Australian Financial Review*, 19 December 2001, p.47.

[7] Brynjolfsson, E., and Smith, M., 'Frictionless Commerce? A Comparison of Internet and Conventional Retailers', Working Paper, MIT Sloan School, 1999.

[8] Organisation of Economic and Cooperative Development, *The Economic and Social Impacts of E-commerce: Preliminary Findings and Research Agenda*, 1999, p.63.

[9] NOIE, *E–commerce Beyond 2000*, Department of Communications, Information Technology and the Arts, Canberra, 2000.

[10] *Op cit*.

[11] Model results are reported as variations from base case unless indicated otherwise. That is, the difference between the central case scenario reflecting greater participation in the Information Economy and a scenario which reflects earlier forecasts about economic trends.

[12] The study has regrouped ANZIC industry classifications shortening the list from 17 sectors to 8 (ABS, Australian and New Zealand Standard Industrial Classification, Catalogue No 1292.0). This greatly simplified the underlying national survey of Australian businesses and presentation of the results. The actual MONASH analysis and results was conducted based on 113 separate commodities with findings aggregated to conform to the 8 industry sectors used in this study.

[13] Australian Bureau of Statistics, Business *Use of Information Technology*, Catalogue 8129.0, 1999-00 and 1997-98.

Similarly to The Allen Consulting Group's survey, business could identify more than one barrier to Internet access.

[14] For modelling purposes it is assumed that telecommunications input prices rise by 25 percent for information economy businesses. This is viewed as reflecting their increased dependence upon telecommunications inputs, especially broadband Internet access, and the market power of suppliers. The consultants were unable to find empirical evidence about the difference between fully competitive prices and prices with imperfect competition in telecommunications and bandwidth in Australia at present.

[15] Centre for International Economics, *Breaking the Skills Barrier*, Report prepared for the Australian Information Industry Association, Canberra, April 2001.

[16] United Nations Conference on Trade and Development, *Building Confidence: Electronic Commerce and Development*, UNCTAD/SDE/MISC.11, 2000.

[17] *Op cit*.

[18] Brookes, M., and Wahhaj, Z., *The Shocking Effect of B2B*, Goldman Sachs Global Economic Paper No 37, Global Economics Week (3 February), 2000.