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Submission to

The Parliament of Australia

House of Representatives

Standing Committee on Economics

Inquiry into
Raising the level of productivity growth in the Australian Economy

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1. Introduction

This is a submission to the House of Representatives Standing Committee on Economics' "*Inquiry into Raising the level of productivity growth in the Australian Economy*", from the Centre for Law and Economics (CLE) at the ANU College of Law, the Australian National University. It is made in response to a letter of 30 June 2009 from Stephen Boyd, Secretary of the House of Representatives Standing Committee on Economics, to Ian Chubb, Vice Chancellor of the Australian National University, inviting submissions from academics who have an interest in the topic of the committee's inquiry

The Terms of Reference of the Inquiry is attached as an annex. This submission seeks to respond on key issues raised by the terms of reference. The submission draws on research being conducted at the Centre for Law and Economics (CLE) at ANU on the determinants of productivity in Australia. CLE's research has a particular focus on the contribution of law, regulation and policy. The microeconomic reforms implemented during the 1990's are widely regarded to have enhanced economic growth. In order to isolate their effect however one needs to ground any analysis in sound economic theory, and control for other factors, including for example the advent of the internet which took hold over approximately the same period. The internet is a major innovation associated with the Information and Communications Technology (ICT) Industry the significance of which has been compared to the advent of railroads in the 19th Century.

The Committees terms of reference notes "The factors responsible for Australia's current lower rate of productivity growth should be examined, with the objective of identifying key 'levers' which will assist in returning the Australian economy to a trajectory of robust growth in productivity".

Key relevant points arising from our research include:

- The gap between Australia & US Labour productivity (GDP/Hour worked) worsened between 2000 and 2003
- Non- ICT capital differences play little role in explaining this difference (i.e. Non ICT physical capital and public infrastructure may play little role)
- Increasing returns to scale play a significant role (17-18%) - given the larger US economy
- Differences in ICT capital and its diffusion 'explained' around 44% of the Australia-US productivity gap in 2000. By 20003 this had fallen to 28%.
- Of this 28% the key driver is not ICT capital deepening (i.e. more capital)
- The key driver is what we call ICT spillovers, or network effects
- Surprisingly we find on ICT spillovers that
    - The key driver is NOT Telecom investment which barely accounts for 2% of the difference with the US
    - The key driver is IT Penetration which accounts for 26-34% of the difference

The message that emerges is that despite the catch up on ICT over the period post 2000, the slowing of microeconomic reform seems to have led to a slip in Australia's competitiveness. Our research on Productivity and the role of ICT, law and policy is ongoing and we would be happy to provide further information and assistance to the Committee.

In what follow we:

- first briefly outline the nature of our research
- second summarise key results relevant to the Committee's terms of reference

2. The CLE Productivity Research Programme in Outline

Productivity[1] is the long-term driver of income growth and the prosperity of nations. Productivity depends on the quantity and quality of the factors of production available to a country and the social framework and institutions[2] in which they operate.

To evaluate the effect of law and policy, and control for the impact of ICT over the last nearly 30 years, CLE's research has been examining growth of output and productivity using data from 18 OECD countries (EU-14, US, Canada, Australia, NZ) for the period from 1980 - 2005. This is being done through an international collaboration between the Centre for Law and Economics (CLE) at the Australian National University (ANU), and members of The Digital Transformations Programme at the London Business School (LBS) including Professors Len Waverman and Mel Fuss.

CLE's research extends present insights on productivity growth in Australia in two main ways:

a) First, as noted the study introduces data on Australia to a unique cross country data set including 18 OECD countries, and covering the period 1980 to 2005. Present studies using Australian data at best use within country, cross-sectoral analysis, and are unable to isolate features of the Australian context that may be uniquely impacting productivity. As a result the studies are unable to explain important differences that exist between countries and regions.

b) Second the study controls for the effect of ICT in innovative ways. First it controls for the endogenous nature of ICT diffusion and adoption. Prior econometric studies of the role of ICT in the macro economy fail to control for reverse causality, in that as GDP increases, demand for ICT increases to the extent demand for ICT is income elastic. Failure to control for this effect may lead to an overestimate of the effect of ICT on GDP. Second our study examines not only the impact of a larger stock of ICT capital on productivity (ICT capital deepening), but also the potential spillover network and externality, effects of ICT (ICT spillovers). Recognising that the *networking of computers*, in for example the internet, rather than simply the growth of ICT capital may be the important characteristic to focus on.

To do this we use an econometric model that estimates the relationships that drive productivity so as to analyse the sources of productivity differences, the factors explaining observed differences in productivity between Australia and other countries, and how this changes over time.

[1] Productivity is generally measured in two main ways – output per hour worked called labour productivity, and output per total input (i.e. labour and capital) called total factor productivity (TFP).
[2] That framework includes basic property rights, rule of law, openness, and sector specific issues such as regulation

3. Trends & Determinants

In this section we address the following 5 items of the committees' terms of reference:

a) trends in Australia's productivity growth rate during the past 20 years and reasons for the recent trending decline and
b) trends in productivity growth rates against other OECD countries;

d) the contribution made by microeconomic reform to the permanent improvement in the growth rate of productivity and the continuing effectiveness of the microeconomic reform agenda;

f) the adequacy of the level of investment in physical capital;
g) the adequacy of the level of investment in public infrastructure;

We shall start with the trends over the past 20 years then turn to their determinants.

Our research on Productivity and the role of ICT law and policy is ongoing and we would be happy to provide further information and assistance to the Committee.

Over the past 20 years one can identify three distinct periods in Australia's productivity growth rate

1) Australia like most western economies began to experience a productivity slowdown post 1973. Australia's productivity growth slowed to its weakest rate in the 1980s, with labour productivity averaging 1.7 per cent a year and the rate of multifactor productivity (MFP) growth being 0.7 per cent a year. In the US, measured growth in economy-wide productivity, [3] averaged just 1.5 % in the period 1973– 1995, well below the averages of the proceeding decades.
2) However, beginning in around 1995 in the US, and possibly earlier in Australia both labour productivity and MFP began to surge. Although with the lags in data availability and analyses, it was not until the landmark study of Jorgenson and Stiroh in 1999 that economists recognised that something unusual began occurring in US economy-wide productivity in the mid 1990s - with similar realisations occurring in Australia thereafter.
3) More recently it appears that trend productivity growth returned to long term averages, declining from the high growth of the 1990s. The most recent work by Treasury researchers suggests that average productivity growth from September 2000 to June 2008 was at or below the long run average4 Our work further shows that the gap between Australia & US Labour productivity increased between 2000 and 2003

To understand the recent trend decline it helps to understand

1) What caused the slowdown in the first period post 1973? and
2) What caused the explosion in the middle period during the 1990's?

On this basis one is likely to better understand why we have seen the return to the long run average over the recent past.

[3] labour productivity and total factor productivity (TFP),
[4] See J Rahman, D Stephan and Gene Tunny "Estimating Trends in Australia's Productivity" Treasury Working paper 2009 -01 February 2009

It is widely agreed by economists that the style of economic management which had taken hold by the 1970's contributed to the slow productivity growth in the first period identified above. Problems with economic management included

- high trade barriers protecting the tradeable sector from international competition and thereby lowering tradeable sector productivity;
- weak competitive pressure on the non-tradeable sector as a result of extensive state ownership and licensing of otherwise commercial trading entities - lowering non-tradeable sector productivity
- poor macroeconomic management, including poor government management of fiscal and monetary policy, creating uncertainty and distorting investment signals;
- poor human resource development, with protectionism effectively providing subsidies to unskilled labour, reducing returns to skill development and as a result leading to low labour productivity.

Starting in the early and mid 1980's a microeconomic reform process took hold globally which initially had a dislocating effect. In many countries previously subsidised and protected industries entered into sharp decline as they were exposed to competition. There was then typically a lag before new industries established themselves and were finally able to attract the resources and find the markets required to grow. Gradually more efficient use of resources in existing activities, and the surge of investment in new and more productive activities (e.g. ICT) under the newly reformed environment, gave rise to a faster rate of economic and productivity growth in the 1990's .

Jorgenson (2000) summarised the productivity growth literature for the US in 2000 as follows:

> "The vaulting contribution of capital input since 1995 has boosted growth by close to a percentage point [in the U.S.]. The contribution of investment in IT accounts for more than half of this increase. Computers have been the predominant impetus to faster growth, but communications equipment and software have made important contributions as well".

The role of IT investment in the productivity surge is notable. During the first period of low productivity growth, there were also large capital investments made in Information Technology (IT) and there was an increase in labour skills accompanying the spread of the new computer technology – yet there was no apparent effect on productivity. This led Nobel Prize Laureate in Economics Robert Solow indeed to comment in 1987 that one saw "computers everywhere but in the productivity statistics."

A moment's reflection makes one realise that it is not simply the spread of computers that will generate productivity increases, but the incentives and capability to use them effectively which the microeconomic reforms allowed – including the enormous investments in modern communication systems following privatisation and deregulation of telecommunications globally. These in turn provided the ability to interconnect computers via the telephone system to the world, through 'The Networked Computer.'

There are a number of reasons to think that both the microeconomic reforms and 'ICT networking' aspects are important. First, productivity did not slowly increase from year to year but seemed to 'explode' from the early to mid 1990's. What caused this explosion? Second, we know of significant advances in communications networks – digitisation of exchanges and the spread of fibre optic transmission that made it possible and economic to transmit huge data flows among firms, offices and locations – which unleashed the "networked computer".

As we shall Australia "caught up" considerably on ICT post 2000. So to explain the reasons for the recent trending decline post 2000 one must turn to stalled economic reform. Treasury researchers probably accurately conclude:

> *"The surge in trend productivity growth over the late 1990s, while delivering real benefits and permanent increases in living standards, weakened in the current decade. To the extent that the 1990s reflect the benefits of past reforms ongoing reforms that strengthen productivity in areas such as transport, infrastructure and health services have the potential to increase economic growth coupled with low and stable inflation in the medium-term."*[5]

c) Trends in productivity growth rates against other OECD countries;

Our research is based on data for 18 OECD countries since 1980, which enables us to make detailed comparisons between Australia and other OECD countries.

Table 1 below summarises the results for recent years during the trend decline. We explain the table in more detail below but key points to note are:

- The gap between Australia & US Labour productivity (GDP/Hour worked) worsened between 2000 and 2003
- Non- ICT capital differences play little role in explaining this difference (i.e. Non ICT physical capital and public infrastructure may play little role)
- Increasing returns to scale play a significant role (17-18%) - given the larger US economy
- Differences in ICT capital and its diffusion 'explained' around 44% of the Australia-US productivity gap in 2000. By 20003 this had fallen to 28%.
- Of this 28% the key driver is not ICT capital deepening (i.e. more capital)
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- Surprisingly we find on ICT spillovers that
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The message that emerges is that despite the catch up on ICT over the period post 2000, the slowing of microeconomic reform seems to have led to a slip in Australia's competitiveness.

Focusing in more detail on the data in table 1, in 2003, labour productivity (GDP per hour worked) in the US was calculated to be 16.5% higher than in Australia. 17% of this labour productivity gap in 2003 was attributed to the US enjoying greater returns to scale than Australia. The combination of ICT capital deepening and ICT spillovers however accounted for 28% of the US's labour productivity advantage. Production in the US in 2003 was more ICT capital intensive than production in Australia (capital deepening). In addition personal computer penetration, our indicator of the spread of ICT technology, was greater in the US than in Australia (ICT spillovers). Australia recorded a slight advantage in telecommunications penetration.

[5] Ibid page23

Table 1: Differences in Labour Productivity Australia Compared to US

	2000		2003	
	Percentage	% of Difference	Percentage	% of Difference
Difference	15.9%		16.5%	
Contributions				
Non-ICT Capital Deepening	-5.6%	-35%	-4.2%	-25%
Scale Economies	2.9%	18%	2.8%	17%
ICT (of which)	7.0%	44%	4.7%	28%
ICT Capital Deepening	1.3%	8%	0.8%	5%
ICT Spillovers (of which)	5.7%	36%	3.8%	23%
Telecom Penetration	0.3%	2%	-0.4%	-2%
IT Penetration (of which)	5.4%	34%	4.2%	26%
PC Penetration	4.4%	28%	3.4%	21%
Digital/PC Interaction	1.0%	6%	0.8%	5%
Unexplained by Above Factors	11.7%	73%	13.2%	80%

Consistent with our research for other countries, it appears that ICT spillover effects play a greater role in explaining productivity differences than the direct ICT capital deepening effect. For example, ICT capital deepening accounted for 5% of the Australia- US labour productivity gap, whereas ICT spillovers accounted for 23% of the gap. Thus although both were important, we estimate that the Australia-US difference in the spread of ICT technology throughout the economy was a more important source of the labour productivity gap than the difference in ICT capital accumulation.

Most of the impact of ICT spillovers is due to what we are calling IT penetration. This phenomenon is modelled as the penetration of personal computers plus the interaction of this spread with the digitalisation of the telecom network. We attribute 26% of the 16.5%Australian labour productivity disadvantage in 2003 to the fact that the US had a greater IT penetration than Australia. This disadvantage is offset to a small degree by Australia slight advantage in terms of telecommunications penetration.

As noted over the 2000 to 2003 period there was a slight deterioration in Australia's relative labour productivity position compared with the US. The gap in labour productivity with the US rose from 15.9% in 2000 to the 16.5% labour productivity gap by the year 2003 noted above. Of the 15.9% difference in 2000, 18% was due to the US scale advantage, which is similar to the 17% contributed by returns to scale in 2003.

Although ICT remained the most important component of the Australia-US labour productivity differential between the years 2000 and 2003, its role or significance declined due to an improvement in Australia's relative position on ICT. Thus whereas ICT accounted for 44% of the productivity disadvantage in 2000, this had fallen to 28% in 2003. The reduction in the ICT gap from 2000-2003 was due mainly to the ICT capital deepening effect, in that it appears there was a higher growth in real ICT capital per hour in Australia than in the US over the 2000-2003 period. ICT spillovers accounted for 36% of the labour productivity difference in 2000, compared to 23% in 2003.

We now turn to a comparison of labour productivity between Australia and Europe for the years 2000 and 2003. "Europe" in this comparison is a population weighted average of all western European countries in the database. The results are contained in Table 2. In this table we present contributions in percentage points

Table 2: Differences in Labour Productivity
Australia Compared to Europe

	2000	**2003**
Percentage difference in labour productivity (Europe - Australia)	14.5%	9.4%
Non-ICT Capital Deepening	2.7%	2.6%
ICT	-9.8%	-12.3%
ICT Capital Deepening	*-0.4%*	*-0.9%*
ICT Spillovers	*-9.3%*	*-11.3%*
Telecom Penetration	*0.7%*	*0.5%*
IT Penetration	*-10.1%*	*-11.8%*
PC Penetration	*-8.2%*	*-9.6%*
Digital/PC Interaction	*-1.9%*	*-2.2%*
Unexplained by Above Factors	21.5%	19.1%

Turning to a comparison of labour productivity between Australia and Europe[6] for the years 2000 and 2003, in 2000 Australia had a labour productivity disadvantage of 14.5% compared with Europe. By 2003 Australia had narrowed that gap to 9.4%. This improvement is associated with a substantial gain in the relative contribution of ICT. While the productivity gap relating to non-ICT capital deepening moved only slightly, Australia closed the gap by 2.5 percentage points through greater ICT deepening and ICT spillovers effects. Australia's productivity gap with Europe is quite different to the gap with the United States.

Compared with Europe Australia is behind in non-ICT capital deepening but significantly ahead in ICT capital deepening, and benefits substantially from ICT spillovers. In 2003, 2.6 percentage points of the 9.4% gap with the Europe can be attributed to greater non-ICT capital deepening in Europe. In contrast, Australia is ahead in terms of ICT contribution to labour productivity. In 2003, Australia had a 12.3 percentage point advantage in terms of ICT contribution to labour productivity over and above that of Europe.

Our study highlights the importance of the spillover effects caused by the penetration of ICT and in particular computing technology. Figure 1 shows the penetration rate of mobile + fixed lines in Australian and other countries. In recent years there has been very significant growth particularly in Europe brought on by the addition of mobile phone technology. Australia penetration in terms of telecoms is comparable with that of other countries.

[6] "Europe" in this comparison is a population weighted average of all western European countries in the database.

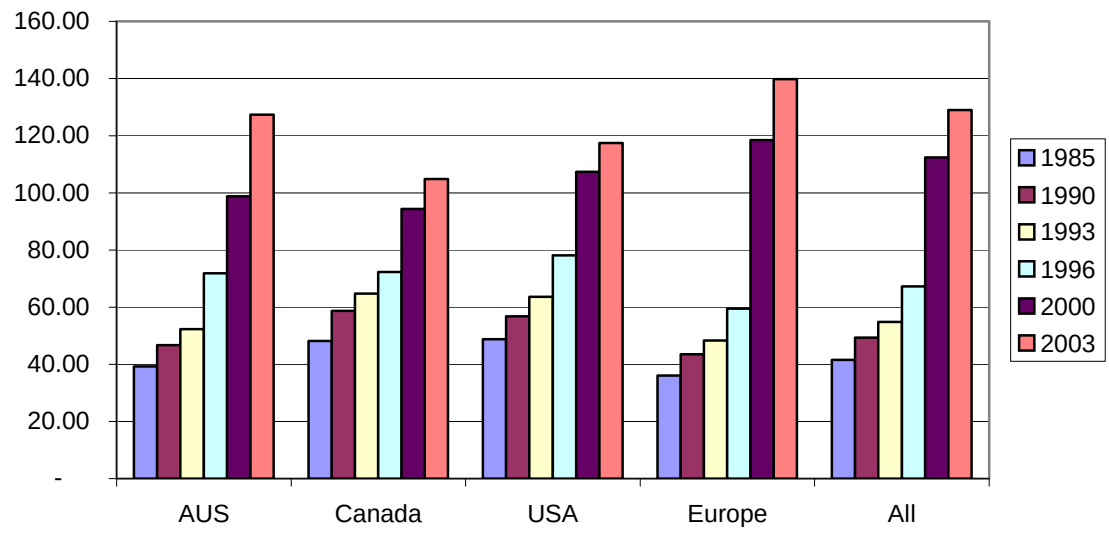

Figure 1: Telecom Penetration

In terms of computing, Australia is significantly above the average (Figure 2). Of the countries sampled, Australia has consistently ranked 4th (Behind the US, Sweden and Denmark) in terms of PC penetration.

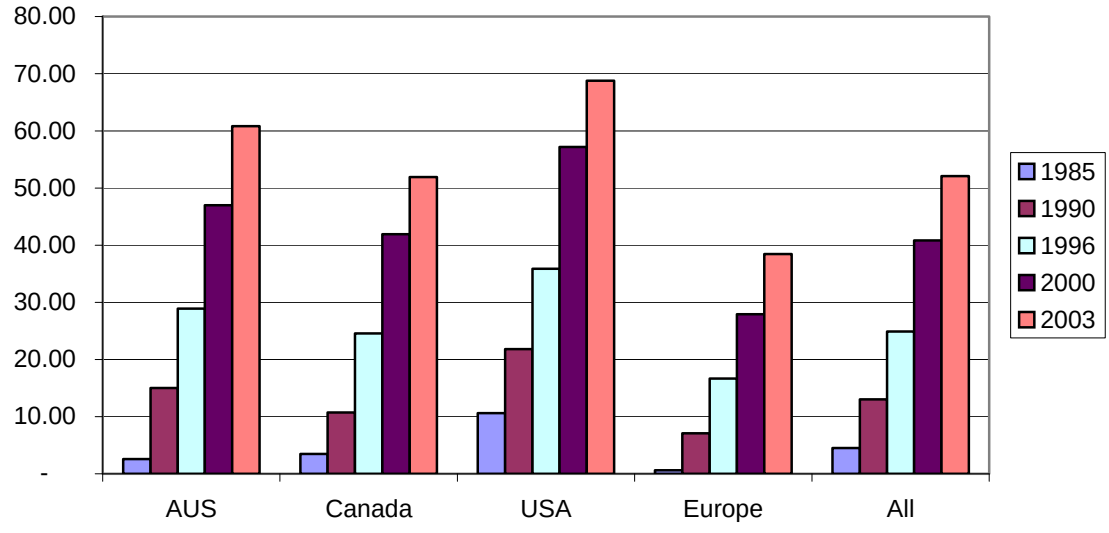

Figure 2: Personal Computer Penetration

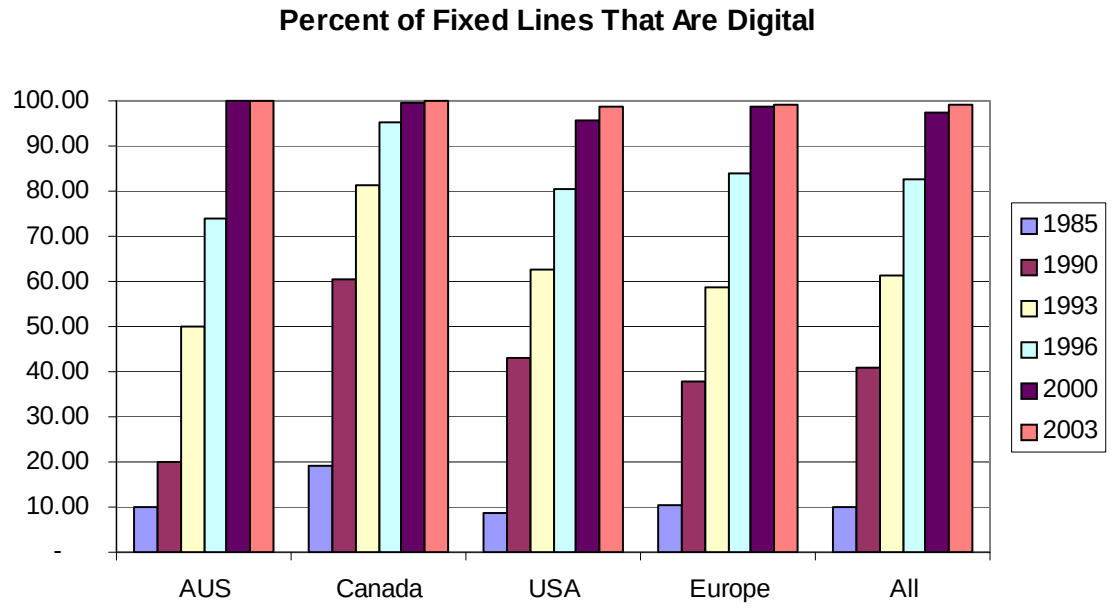

Figure 3: Digitalisation

We now turn to 4 where we analyse Total Factor Productivity (TFP) growth for four example countries over the period 1998-2003. [7]Over the five year period 1998-2003, we estimate that TFP grew by 13.5% in the Australia, by 12.4% in the US, by just over 10% in Canada and just under 10% in Europe. In common with other researchers, we find that over this period the US and Australia had a particularly impressive TFP growth record. The higher TFP growth rate in the US and Australia is attributed to a higher cumulative contribution of ICT spillovers: 14.9% in Australia, 13.8% for the US, compared with 12% in Canada and the 11.3% average for Europe.

The last column of 4 represents the average annual growth rate of ICT capital over the 1998 to 2003 period. Australia's high contribution of ICT to TFP growth is matched by a high annual growth in ICT capital of 17.2% per annum. Interestingly the growth rate of ICT capital was lower in the US (14.5% per annum), which in turn was only slightly greater than that of Europe (14.2% per annum). Despite the similarities in ICT capital growth rates the US experienced higher ICT spillovers. Suggesting that ICT capital accumulation in the US may have been more effective than in Europe over the 1998 to 2003 period.

Table 4: TFP 1998-2003

		Sources			
	TFP Growth	Scale Economies	ICT Spillovers	Time Trend	Annual Growth of ICT capital
Australia 1998 to 2003	0.135	0.001	0.149	- 0.015	17.2%
US 1998 to 2003	0.124	0.000	0.138	- 0.015	14.5%
Canada1998 to 2003	0.107	0.001	0.120	- 0.015	13.0%
Europe 1998 to 2003	0.099	0.000	0.113	- 0.015	14.2%

[7] In this table the entries for TFP growth and its sources are cumulative logarithmic growth rates over the five year period.

4. Conclusions

We have shown the importance of ICT capital in fostering productivity growth. Our analysis highlights the importance of the diffusion of ICT technology throughout the economy. Our indicators of this diffusion are the spread of PC's, the spread of telephones including mobile phones, and the spread of digitalisation of telecom networks.

The message that emerges is that despite the catch up on ICT over the period post 2000, the slowing of microeconomic reform seems to have led to a slip in Australia's competitiveness.

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Appendix One

Terms of Reference

Increased economic productivity has been responsible for much of the improvement in Australia's living standards over the last 25 years. However, Australia's productivity has declined since the 1990's.

The factors responsible for Australia's current lower rate of productivity growth should be examined, with the objective of identifying key 'levers' which will assist in returning the Australian economy to a trajectory of robust growth in productivity.

The Committee will inquire into, and report on, the key factors influencing Australia's productivity growth rate, focusing on, but not limited to:

h) trends in Australia's productivity growth rate during the past 20 years and reasons for the recent trending decline
i) trends in productivity growth rates against other OECD countries;
j) the adequacy of productivity growth measures;
k) the contribution made by microeconomic reform to the permanent improvement in the growth rate of productivity and the continuing effectiveness of the microeconomic reform agenda;
l) the willingness and ability of small and medium enterprise to adopt best practice technology;
m) the adequacy of the level of investment in physical capital;
n) the adequacy of the level of investment in public infrastructure;
o) the level of resources devoted to research and development;
p) the adequacy of resources devoted to training and development of the labour force; and
q) the key reforms and measures that can be undertaken to lift Australia's permanent rate of productivity growth.