

STATEMENT 4: BOOSTING AUSTRALIA’S PRODUCTIVE CAPACITY: THE ROLE OF INFRASTRUCTURE AND SKILLS

This statement outlines some of the major influences on Australia’s productive capacity, with a focus on the role of infrastructure and skills. The statement outlines key elements which could contribute to an improved policy and institutional framework to achieve better outcomes in infrastructure and skills, education and training and boost Australia’s productive capacity.

- Introduction4-3**
- The productive capacity of the economy4-4**
 - Growth accounting frameworks for analysing productive capacity 4-4
 - Factors influencing expansion in productive capacity 4-5
- Achieving better outcomes in infrastructure4-7**
 - Trends and emerging challenges in infrastructure 4-7
 - Policies to improve the efficiency of infrastructure development and use 4-10
 - Broad principles for public infrastructure investment 4-15
- Achieving better outcomes in education, training and skills4-15**
 - Perspectives on skill shortages 4-15
 - Trends and emerging challenges in workforce skills 4-16
 - The role of policy in response to skill shortages 4-18
 - A policy framework for better outcomes in education and training 4-21
- Conclusion4-26**
- References4-28**

STATEMENT 4: BOOSTING AUSTRALIA'S PRODUCTIVE CAPACITY: THE ROLE OF INFRASTRUCTURE AND SKILLS

INTRODUCTION

The Australian economy is in its 17th year of expansion, with average growth of 3.6 per cent per annum over this period. This robust performance reflects the boost to productive capacity from the microeconomic reforms of the past quarter-century, the economy soaking up spare capacity, and a rise in aggregate labour force participation to historical highs, reflecting, among other things, the 'baby boom' generation moving into the 'prime working age' cohorts (Australian Government 2007).

However, the economy is now pushing up against its 'full capacity' levels of production and employment and this has been associated with an acceleration in inflation and more rapid wages growth in some regions and industries. Sustaining the economy's growth rate in the future will depend on increasing its productive capacity, rather than any further soaking up of spare capacity. This statement examines how Government policy can help to expand Australia's productive capacity and support growth over the medium term.

The ultimate test of economic reforms is in their effect on the wellbeing of the Australian people. A more efficient economy, with high levels of productivity and participation, provides the means to deliver higher incomes and a more equitable society.

It is now widely recognised that the comprehensive reforms to labour, capital and product markets and improved frameworks for macroeconomic policy introduced over the past quarter-century underpinned the length and stability of the current growth cycle. The challenge for economic policy now is to build on those reforms by expanding the productive capacity of the economy and to operate it as closely as possible to that capacity. An important issue for policy is to assess whether there are areas in which capacity constraints are more binding or restrictive than others, and how to improve policy or institutional frameworks to ensure investment contributes to stronger economic growth with low inflation over the medium term.

The impact of a once-in-50 years boom in Australia's terms of trade at a time of little 'spare' capacity in the economy has highlighted the importance of the microeconomic response to shocks. As noted in Statement 2, there has been a substantial rise in business investment, particularly in mining and construction, in response to the rapid rise in the terms of trade. On the other hand, questions have been raised over the response of the economy's physical infrastructure and the skills of the workforce to these changed circumstances.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Accordingly, in this statement the main focus is on the scope for improved policy and institutional frameworks for infrastructure investment, and investment in skills and training, as these are areas where there would appear to be significant scope to lift Australia's productive capacity.¹

THE PRODUCTIVE CAPACITY OF THE ECONOMY

The productive capacity of the economy can be thought of as the maximum level of production of goods and services that can be generated, given the economy's resource endowments, physical capital stock, population, labour force and technology, while maintaining reasonably stable inflation rates and wages growth.

Growth accounting frameworks for analysing productive capacity

It is important to have a framework that allows us to analyse the economy's productive capacity. While there is a range of such frameworks², the framework employed by the Treasury disaggregates real economic output (GDP) into three components: population, participation and productivity (the '3Ps').

Each of the 3Ps can, in turn, be further disaggregated to reflect a range of demographic and economic factors. The demographic factors relate to fertility, mortality and migration, which affect the number of people of working age (population) as well as the composition of the population by age and gender. Because employment and hours worked differ substantially across age-gender cohorts, changes in the composition of the population also significantly affect participation. In this decomposition, the labour productivity measure used is output per hour worked.

Employing the 3Ps, the *Intergenerational Report 2007* highlighted the importance of demographic factors for Australia's future growth.³ Real annual GDP growth for the next 40 years was projected to average 2.4 per cent, down from an annual average of 3.5 per cent over the past 40 years. This primarily reflects projected lower growth in population. Australia's population growth was projected to fall from the annual average rate of 1.4 per cent over the past 40 years to 0.8 per cent over the next 40 years,

-
- 1 In this statement, the term 'infrastructure' refers to the underlying physical capital in a society, including roads, transport systems, communications, water and sewerage, electricity, gas and ports. These facilities are often collectively termed 'hard infrastructure' or 'economic infrastructure'. The important contribution of 'soft infrastructure' or 'social infrastructure', such as schools, universities, research facilities, hospitals, and libraries to the development of Australia's human capital is addressed in the context of the discussion on skills, education and training.
 - 2 See for example Solow (1956), Swan (1956), Barro and Sala-i-Martin (1995) and Mankiw (1995).
 - 3 The Productivity Commission employed a similar approach in its study into the economic impacts of Australia's ageing population (PC 2005a).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

reflecting falls in fertility rates starting in the 1970s. Real annual growth in GDP per capita was projected to fall from 2.1 per cent over the past 40 years to 1.6 per cent over the next 40 years, reflecting the impact of a projected decline in the share of the population of traditional working age (15-64 years) on participation.

For this statement, it is useful to re-arrange the 3Ps framework slightly to provide a greater focus on the role and importance of the capital stock – including public and private infrastructure – and skills, education and training to Australia's GDP growth. Australia's productive potential is largely driven by the interactions between and combined effects of the following:

- The rate at which the volume and quality of Australia's physical capital stock increases. This, in turn, will reflect trends in the size and economic efficiency of both the business or private capital stock, and public sector infrastructure.
- The rate at which the size and skill base of Australia's workforce increases, including the rate of overall population growth, the changing age structure of the population, the rate of active participation in the labour force across age groups and genders, and changing levels of education and training and attainment.
- The extent of 'pure' productivity, or multi-factor productivity, growth.⁴ This represents improvements in allocative and dynamic efficiency that are not already captured in the elements discussed above.

This breakdown of the components of GDP growth highlights the role of particular factors that affect both productivity and participation. Well targeted investment in physical infrastructure can increase productivity by both increasing the capital stock and improving the efficiency of other factors of production. Sound investment in education and training results in a workforce with a better mix of skills leading to higher productivity, higher participation, lower unemployment and increased incomes and living standards.

Factors influencing expansion in productive capacity

Efficient investment in new capacity and the optimal utilisation of existing capacity are critical factors in raising an economy's productive capacity. A third factor, well-functioning markets with effective price signals, is necessary to support the first two. These factors provide a conceptual framework for assessing the appropriate role of government in improving outcomes in infrastructure and skills markets.

Efficient investment

The expected return on investment is generally relied upon to guide commercial investment decisions, with respect to how much to invest and in which areas. Expected

4 See for example: Banks (2002), Parham et al. (2001) and PC and ANU (1998).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

social rates of return can be used as a major guide in decision making with respect to public infrastructure projects, to help ensure that both the level and composition of public infrastructure investment are consistent with achieving maximum possible wellbeing. Only public infrastructure projects which at least meet a minimum benchmark social rate of return – determined through rigorous cost-benefit analysis, including ex post evaluation and review – should be funded, and relative social rates of return above the minimum benchmark should be used to prioritise the funding of projects. While there are differences between the private and public components of the physical capital stock, there is a clear role for expected rates of return to drive investment decisions in both cases.

Expected rates of return on investment, both private and public, should also play a critical role in guiding investment decisions in the area of education and training. One challenge for policy is to ensure that expected private rates of return play an important role in guiding private decisions on whether to undertake higher education or training and in which areas. This requires appropriate price signals in the labour market and education and training institutions which are flexible and responsive to changing demands.

In some instances, however, private rates of return will not capture the full spectrum of benefits to investment in physical infrastructure or education and training. Infrastructure often involves ‘network’ effects, where one project has large effects (positive or negative) on other infrastructure. Problems may arise if these network effects are not recognised during the planning of infrastructure projects, and this may require coordination across a number of infrastructure providers.

There is also the potential for positive ‘spillovers’ stemming from education and training. Early childhood, primary and secondary school education play a critical role in increasing social cohesion in addition to their role in giving students the skills to enter the workforce. The possibility that the social returns to physical infrastructure and education and training potentially exceed the private returns has critical implications for assessing the appropriate level of, and allocation of, public funding for physical infrastructure and education.

Utilisation of existing capacity

Even with efficiently targeted investment, the long economic life of infrastructure assets means that it is also important for Australia to make the most efficient use of the existing stock of infrastructure at any point in time. Similarly, it is important to make efficient use of the skills of the workforce.

A number of reforms have improved efficiency across a range of areas of Australia’s public infrastructure over the past two decades. The resulting increases in the productivity of Australia’s stock of infrastructure, in turn, helped to raise Australia’s

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

potential level of output. Analysis by the Productivity Commission has highlighted that there are further gains to be made through additional infrastructure reforms.⁵ Similarly, the Productivity Commission (2005b, 2007, 2008) has noted the important role played by reforms designed to make more efficient use of the existing stock of skills in the workforce in meeting identified shortages in a range of areas.

Effective price signals

A key mechanism that guides investments in infrastructure and education and allocates existing labour and capital to different uses is a market determined set of relative prices and relative wages. Above average wage growth in recent years in the engineering, construction and energy sectors has reflected increased demand for skills in those areas. Such differential rates of wages growth across industries and occupations are a sign that market signals are working to address areas of shortage, both by helping to efficiently allocate existing workers and by providing incentives for new workers to train in those areas.

In practice, problems can arise that mean that price signals do not always operate effectively in infrastructure and skills markets. Ensuring that the Australian economy has the appropriate level of skills and infrastructure requires effective solutions to these problems.

ACHIEVING BETTER OUTCOMES IN INFRASTRUCTURE

The physical infrastructure of the economy is an important component of Australia's productive capacity. The above framework can be applied to infrastructure in a way that ensures infrastructure funding and provision respond appropriately to changes in demand, albeit with substantial challenges given the characteristics of infrastructure.

Trends and emerging challenges in infrastructure

While there is no definitive summary measure of infrastructure adequacy, a range of data, including historical trends, international comparisons, and survey based information, can be used as possible pointers to the adequacy of Australia's infrastructure stock and investment performance over time.

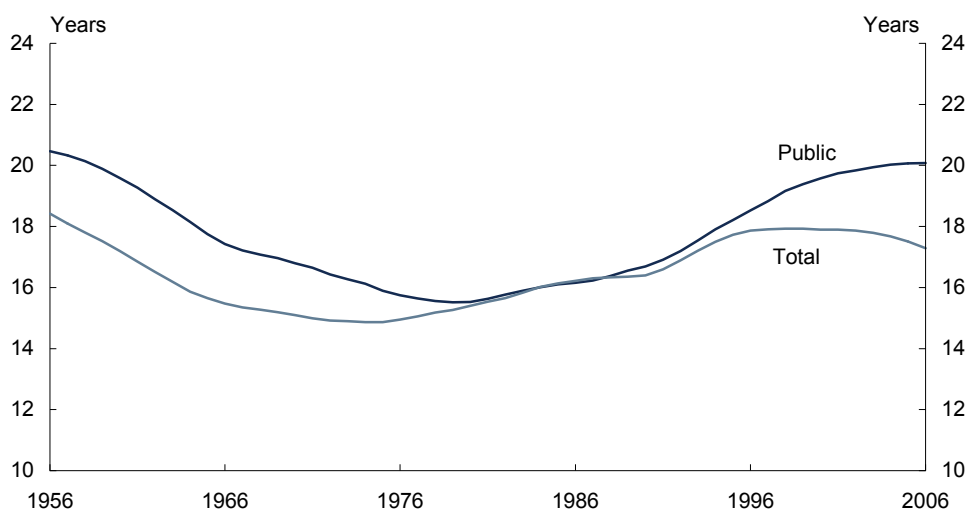
5 The Productivity Commission (2006) estimated that improving productivity and efficiency in energy, transport, infrastructure and other activities could, after a period of adjustment, increase GDP by nearly 2 per cent.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Total investment in economic infrastructure, comprising both public and private investment, has increased as a share of GDP over the past 20 years, from around 2.2 per cent of GDP in 1988 to around 3.2 per cent in 2007.⁶ It is important to recognise that this measure does not, in itself, directly measure costs and benefits or rates of return and therefore does not provide conclusive evidence about the adequacy of infrastructure. The contribution of private investment in economic infrastructure has increased strongly in recent decades to now account for around half of total infrastructure investment. This change in composition can, in part, be attributed to competition based reforms which have resulted in the privatisation of government owned businesses.

As physical infrastructure tends to have a long economic life, the flow of investment is unlikely to be a reliable indicator of infrastructure adequacy. The average age of Australia's public sector infrastructure has generally been rising since the 1970s (Chart 1), providing some support for the view that we are approaching, or past, the point where much of the large amount of public infrastructure put in place in the 1950s and 1960s will need to be renewed or replaced.⁷

Chart 1: Average age of infrastructure



Source: Coombs and Roberts (2007).

The different mix in public and private ownership of infrastructure between countries makes direct international comparisons difficult with respect to trends in infrastructure investment. However, a survey of a wide range of countries indicates

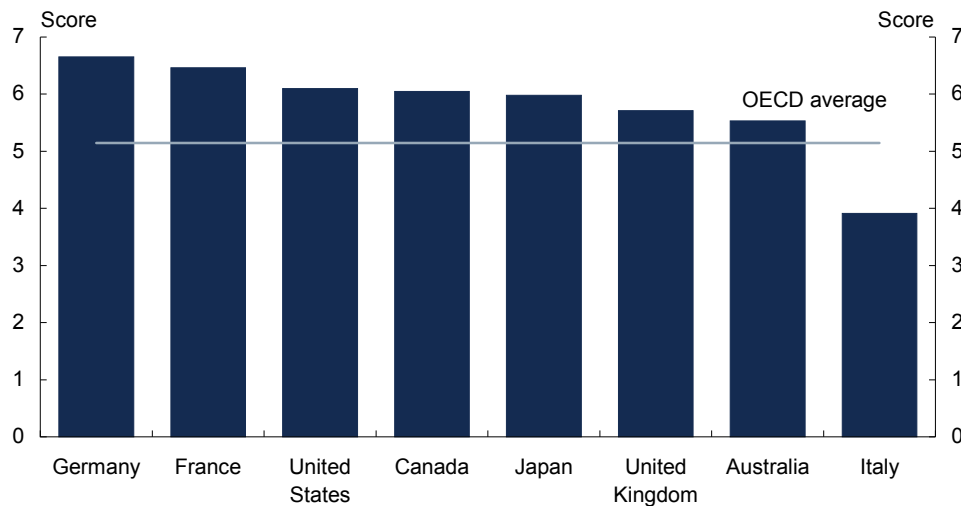
6 Series based on Coombs and Roberts (2007) revised to include updated data (ABS cat. no. 8762.0) and includes: bridges; electricity generation, transmission and distribution; harbours; pipelines; railways; roads, highways and subdivisions; sewerage and drainage; and telecommunications.

7 This issue is discussed in more detail in Coombs and Roberts (2007).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

that while Australia is slightly above the OECD average in terms of the perceived ability of infrastructure to support economic activity (Chart 2), it is below the average of leading advanced economies (World Economic Forum 2007).

Chart 2: Index of the ability of infrastructure to support economic activity



Source: World Economic Forum (2007). Countries included comprise Australia and the G7.

Emerging challenges: Infrastructure bottlenecks and the terms of trade boom

The Australian economy has recently been operating closer to full capacity than it has been for many years. A number of studies have examined the question of whether constraints such as infrastructure bottlenecks and congestion are likely to impact on the productive capacity of the Australian economy as a whole and in particular industries and sectors.

The Business Council of Australia (BCA 2005, 2007), for example, highlighted concerns about infrastructure bottlenecks in a range of areas, including bulk and container ports, intermodal transport hubs, rail freight networks, urban roads, urban and agricultural water supply, and electricity networks. In 2005, the Export and Infrastructure Taskforce (the Fisher Taskforce), reported that there seemed to be export infrastructure constraints in some areas which had emerged in the context of the sharp increase in world demand for Australia's resource commodities. Although the Taskforce noted that these constraints were localised in nature, it also suggested that without policy action, significant additional bottlenecks in key areas could occur in the next 5 to 10 years (Fisher et al. 2005).⁸

8 The areas of principal concern identified in the study were port channels, road and rail access to major ports and rail track. The study also noted that new water supply infrastructure, electricity generation plants and gas pipelines would also be needed.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

These concerns reflect a view among commentators that the economy's physical infrastructure has not responded quickly enough to the shift in demand for our commodity exports reflected by the new highs in the terms of trade. Edwards (2007, p. 37), for example, noted that:

The lesson of the new decade is that failures of supply can be as damaging as failures of demand. ... Policies that influence supply ... include the removal of infrastructure bottlenecks, the provision of additional infrastructure to meet expected demand, programs in education, and training and retraining that increase the supply of skilled workers.

Concerns over Australia's infrastructure constraints and export performance in recent years were key factors in the Government's announcement in February 2008 of a review into Australia's export policies and programs, to be chaired by Mr David Mortimer AO. (Transport infrastructure bottlenecks are discussed in Box 1.)

Policies to improve the efficiency of infrastructure development and use

Effective policies to address identified capacity constraints or infrastructure bottlenecks should encompass both efficient investment by the private and public sectors and efficient utilisation of existing capacity. The long lead times and illiquid nature of much infrastructure investment highlight the importance of governments providing certainty around policy frameworks.

While Australia has made substantial progress in reforming its infrastructure markets, most notably through the adoption of National Competition Policy (NCP) in 1995, a range of impediments to the operation of efficient and competitive infrastructure markets remain (PC 2006). These impediments inhibit timely and efficient infrastructure development and use and highlight the need to adopt further measures that facilitate the efficient allocation of scarce resources and minimise waste. Such measures range from pricing and regulatory reforms that encourage private sector participation and promote efficient and competitive outcomes, through to the development of methodologies for improving the efficiency and transparency of individual investment decisions.

Price signals

Effective price signals in infrastructure provide investors and governments with an important guide as to where further investment is required. They are also an important mechanism for improving the efficiency of infrastructure use. The Australian Government is pursuing a range of policy initiatives in this area.

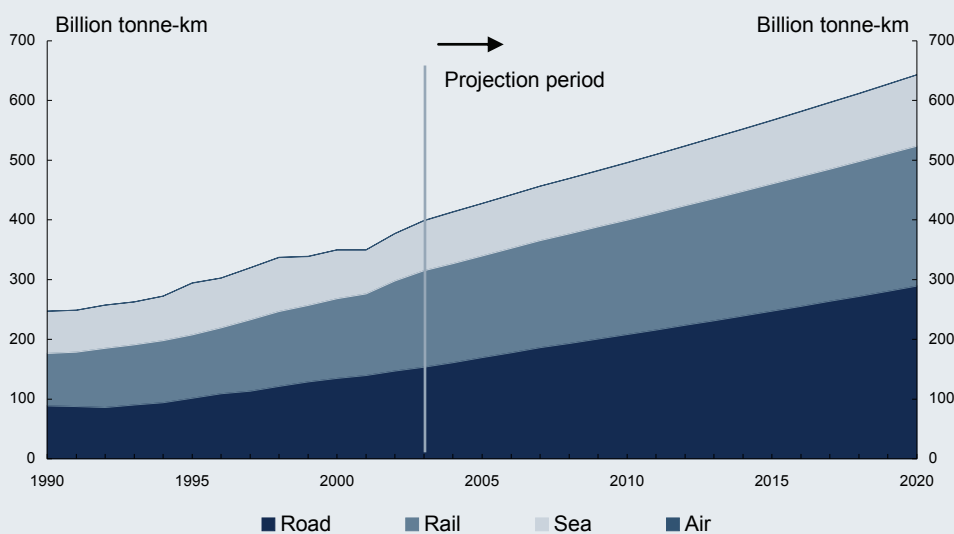
In transport, the Australian Government is working with its State and Territory counterparts through the Council of Australian Governments (COAG) to implement key pricing reforms in freight infrastructure, including the recent agreement amongst the nation's transport ministers to introduce a more efficient heavy vehicle pricing regime.

Box 1: Transport congestion, bottlenecks and future demands

The surge in global demand for resource and energy commodities that began in 2002-03 led to an increased call on Australia's port and rail infrastructure. On several occasions during 2007 and early 2008, a large number of ships sat off the coast between Newcastle and Dalrymple Bay in Queensland awaiting coal loadings. Subsequent efforts to address bottlenecks at port facilities then served to highlight constraints in the supporting rail networks. To a significant extent, these constraints are the result of large rises in global demand for iron ore and coal, experienced by Australia (Fisher et al. 2005) and other exporting countries. They highlight the challenges for Australia's infrastructure systems when there are large demand shifts in infrastructure dependent industries. More recently there have been initiatives to coordinate investment and logistics along the separate Queensland and New South Wales coal supply chains. Coordination bodies have been established that take a whole-of-system approach and involve all operational stakeholders along the mine to port supply chain.

More generally, with the bulk of Australia's population concentrated in large cities, urban transport congestion has considerable economic costs in terms of lost productivity and environmental impacts. As Australia's cities are also transport hubs (for rail, road, sea and air) urban transport congestion has wider impacts on the efficiency and cost of freight and long-distance passenger movement. The Bureau of Transport and Regional Economics (BTRE 2007) projects that the avoidable social costs of congestion to the nation will double from \$9.4 billion in 2005 to \$20.4 billion in 2020. These estimates are based on aggregate modelling, rather than on detailed network-based location-specific models, and as such, they provide 'order-of-magnitude' estimates of congestion costs rather than precise estimates. Domestic freight transport is also expected to increase substantially between now and 2020 (Chart A), placing pressure on existing transport infrastructure.

Chart A: Australian freight trends



Source: Freight measurement and modelling in Australia, BTRE (2006).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

The new heavy vehicle pricing arrangements mark a first significant step in a program of road pricing reforms that seek to improve the efficiency and productivity of the transport sector. Under the regime, the cost of provision of the road network attributable to the heavy vehicle industry will be fully recovered to ensure all heavy vehicles pay their fair share of road infrastructure costs, including construction and maintenance. The new road pricing arrangements are being phased in over time to enable the trucking industry to make necessary adjustments and help mitigate any short-term inflationary pressure associated with the reforms. The broader adoption of efficient pricing signals in the transport sector would be expected to significantly reduce urban congestion (see Box 1).

Reforms to the national electricity market have enabled the creation of a spot market with prices set every half hour according to supply and demand. These prices provide signals to the market regarding new investment in generation, whether through base-load capacity for reliable and continuous supplies or peak capacity which can respond at short notice to high levels of demand. Further improvements could flow from improved market signals for transmission investment and from retail price signals that better reflect the costs of electricity generation at peak times.

There is also scope for pricing reform in water infrastructure. Australia is the world's driest inhabited continent and the recent drought has placed significant pressure on Australia's urban and rural water supplies due to nearly a decade of below average rainfall. Water restrictions have been introduced in most urban centres and water allocations to irrigators have been cut dramatically.

Water supply involves three basic phases; storage in dams and reservoirs, delivery via pipes and pumping stations and the removal of wastewater. Well functioning markets in water would fully account for both its scarcity value and the costs incurred in each phase, through price signals to guide investments in additional supply capacity and the use of existing capacity.

The National Water Initiative (NWI) includes a range of measures to promote well-functioning water markets. To date there have been some gains in rural water reform under the NWI, but progress has been slow, and COAG has recently agreed to accelerate and broaden the water reform agenda.

Optimal government decision making

Where the social return from infrastructure investment is high but the direct financial return is insufficient to generate private-sector involvement, and improving price signals is not possible or practical, there can be a role for government in infrastructure provision.⁹ This can be done through direct investment by government or in

⁹ For example, ensuring the provision of public goods, and other cases where there are broader positive benefits and clearly established market failures that cannot be addressed effectively through other means such as improved regulatory frameworks.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

partnership with industry (for example, through public-private partnerships). Where governments invest in infrastructure assets, it is essential that they seek to achieve maximum economic and social benefits, determined through rigorous cost-benefit analysis including ex post evaluation and review.

The Government will establish three funds to invest in Australia's productive capacity – the Building Australia Fund (BAF), the Education Investment Fund (EIF) and the Health and Hospitals Fund (HHF). The Government will provide an initial allocation in the order of \$40 billion, largely from the 2007-08 and 2008-09 surpluses, for future capital investment in transport and communications infrastructure, education and health. Both the capital and earnings of the funds may be drawn down over time after specific infrastructure projects have been identified. This arrangement ensures substantial funding is available for capital investment in infrastructure over the next few years. All spending from the funds will be subject to rigorous evaluation criteria. The Government will make further contributions from future surpluses as appropriate.

To improve processes around the assessment of infrastructure investment decisions, the Australian Government established Infrastructure Australia (IA) to advise governments on nationally significant infrastructure. IA's advice will be based on rigorous analysis of the costs and benefits of various infrastructure proposals. IA will identify strategic investment priorities and policy and regulatory reforms to facilitate timely and coordinated delivery of infrastructure investments of national importance between all levels of government and industry. IA's immediate priority is to complete a National Infrastructure Audit by the end of 2008, and develop an Infrastructure Priority List for COAG consideration in March 2009. It is also to develop best practice guidelines for Public Private Partnerships for COAG consideration by October 2008.

The Government is planning infrastructure feasibility studies with the States on high-priority projects, at a cost of \$75 million in 2007-08. These feasibility studies will feed into the National Infrastructure Audit to be completed by IA.

Another key challenge is to ensure that infrastructure investment decision making takes into account the impact of the broader macroeconomic environment on infrastructure development. When the economy is at full capacity this would reduce expected social rates of return on investments, pointing to the need for rigorous prioritisation.

A range of measures introduced by Australian governments are supporting the coordinated development of infrastructure capacity and its efficient use.

In the area of transport, COAG has agreed that governments adopt national guidelines to support improved, and nationally consistent, approaches to strategic planning and appraisal of transport initiatives and, as part of a series of road and rail reforms, commit to examining alternative institutional arrangements for better linking road-freight revenues to investment and enhancing decision-making.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

COAG has also agreed to a staged approach for the roll out of electricity smart meters. Smart meters will allow consumers to monitor their energy usage in real time. The roll out of smart meters is an important reform because it will help consumers to better manage their energy use and greenhouse gas emissions. Smart meters will also allow for possible future reforms such as the introduction of time of day pricing. Time of day pricing would improve the efficiency of energy usage and assist with reducing the volatility in demand for electricity.

Climate change and the responses to address climate change will have impacts across most areas of infrastructure. Actions being developed through COAG under the National Adaptation Framework will help policymakers factor climate change considerations into decisions regarding long-lived investments such as infrastructure.

To address water shortages, governments have recently commenced significant new water infrastructure investment (particularly in urban areas), including desalination plants and piped irrigation channels. While responsibility for planning urban water investments rests with State and local governments, the Australian Government will help by providing \$1 billion in tax credits and grants to eligible projects. Eligible desalination, water recycling and stormwater harvesting plants in urban areas will receive a tax credit or grant equivalent up to 10 per cent of their capital value to a maximum of \$100 million per project.

Best practice regulation

A simple, timely and consistent national approach to the economic regulation of significant infrastructure is important to realising Australia's productive potential. This includes applying regulation only where it is necessary, setting out clear objectives that support commercially negotiated, economically efficient outcomes, and adopting approaches that are timely and consistent across jurisdictions. To achieve this, Australian governments, through COAG, have committed to a range of reforms to the regulation of key port infrastructure, nationally significant railways and other significant infrastructure.

COAG's energy market reforms have included the development of national regulations and governance for electricity and gas markets including the National Electricity Law and the National Gas Law. These reforms establish the Australian Energy Regulator as the national regulator and the Australian Energy Market Commission. Important ongoing work includes the development of a national framework for electricity retail policy.

The agreement reached on the operation of the Murray-Darling Basin provides for more effective regulation of a nationally significant water resource across jurisdictional boundaries. The agreement includes the imposition of a sustainable cap on surface and groundwater extractions and will allow for uniform trading and market rules, overseen by an independent authority. COAG has also agreed to progress issues in relation to urban water reforms.

Broad principles for public infrastructure investment

In summary, efficient public infrastructure investment requires the development of coordinated, objective and transparent processes for decision-making based on thorough and rigorous cost-benefit analysis. Adoption of high level best practice principles to inform the development of these processes will help governments achieve this. These broad principles would overlay a range of desired best-practice features as part of the investment process. Broad principles should include the following key elements.

1. A nationally coordinated approach to the development of significant strategic infrastructure.
2. The promotion of competitive markets.
3. Decision making based on rigorous cost-benefit analysis to ensure the highest economic and social benefits to the nation over the long term.
4. A commitment to transparency at all stages of the decision making process.
5. A public sector financial management regime with clear accountabilities and responsibilities.

ACHIEVING BETTER OUTCOMES IN EDUCATION, TRAINING AND SKILLS

The skill base of the workforce is a critical component of Australia's productive capacity. A workforce with a level and allocation of skills in tune with those required in the labour market will make better use of available stocks of physical capital and be more productive.

Perspectives on skill shortages

Changes in the supply of and demand for occupational skills are normal features of market economies. In a competitive economy, with price and wage flexibility, these changes can be expected to be reflected in relative wage movements which then assist labour markets for particular skills or in particular regions to clear over time. To achieve this, it is important to have a labour market where wages are set with reference to productivity and where adjustment can occur as smoothly as possible.

However, even with a relatively flexible labour market, adjustment processes do not always happen quickly, which means that some employers can be left with a shortage of the skills they require in the short term. A range of factors can contribute to such inertia in labour markets. For example, it can take time for firms to respond to a shortage of available workers by offering higher wages. Similarly, workers take time to respond to the new wage rates. Delays in recognition of the changing demand patterns can also occur in education and training institutions. During the adjustment process,

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

employers are likely to report shortages, skills gaps and recruitment difficulties (Shah and Burke 2003).

Employers, employees and policy analysts often have varying perspectives on what is meant by the term skill shortages. At one level it is important to differentiate between the concepts of scarcity and shortage. In the case of skills, scarcity could be thought of as a situation where the wage rate for a particular skill in a given region or occupation is relatively high, with demand for and supply of that skill matched at that high wage rate. A shortage, on the other hand, occurs where there is excess demand for skills at the prevailing wage rate.

Skills shortages of a more lasting duration can also occur due to institutional or other rigidities that impede price signals and adjustment mechanisms. In such instances, costs to productive capacity can be substantial and ongoing if not addressed and are therefore an important focus for policy.

Trends and emerging challenges in workforce skills

There has been increasing focus in recent years on the growth and composition of skills across the workforce (NCVER 2008; DEEWR 2008a; PC 2008).

One commonly used source of data to assess the skill requirements of the economy is the DEEWR annual list of skills shortages in professional and trade occupations. This list is based on a combination of employer surveys augmented by market information. It provides qualitative information on skills in demand in each State and Territory and helps inform business and policy makers. It is also used in the preparation of the biannual Migration Occupations in Demand List (MODL) which shows occupations in demand for migration purposes.

An examination of MODL data over the past five years indicates that two key areas of skills demand are highly represented (Table 1). These are trade-related occupations – including carpenters, boilermakers, chefs, electricians, plumbers, mechanics, hairdressers; and health-related occupations – including general and specialist practitioners, nurses, pharmacists, and a range of health professionals.

Sudden changes in demand for skills can necessitate large changes in wage rates to elicit the additional labour sought by the affected industries. An important recent example of has been the labour market responses to the terms of trade boom.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

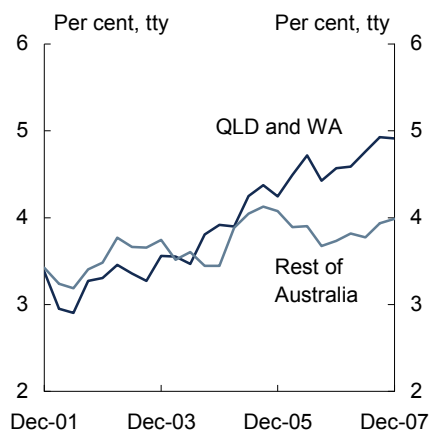
Table 1: Occupations listed in the Migration Occupations in Demand List in the five years to 2007

Listed in all years	Listed in four of the past five years	Listed in three of the past five years
Medical imaging professionals – Radiographer – Sonographer	Medical practitioner (includes GPs and specialist practitioners) Sheetmetal Worker (First Class)	Medical imaging professional – Radiation Therapist Dental practitioner
Nursing professionals – Nurse – Midwife – Mental Health	Automotive Electrician Fitter Furniture Upholsterer	– Dentist – Dental specialist Engineer
Occupational Therapist Physiotherapist Pharmacist – Hospital – Retail	Metal Fabricator (Boilermaker) Metal Machinist (First Class) Motor Mechanic Welder (First Class)	– Chemical – Civil – Mining – Petroleum Podiatrist
Chef Hairdresser Refrigeration Airconditioning mechanic	Panel Beater Pastrycook Accountant Toolmaker Vehicle Painter	Speech Pathologist Bricklayer Cabinetmaker Carpenter and Joiner Cook Electrical trade (Powerline) Electrician Electronic equipment trade Fibrous and solid plasterers Plumber

Source: Commonwealth of Australia Gazette (various years).

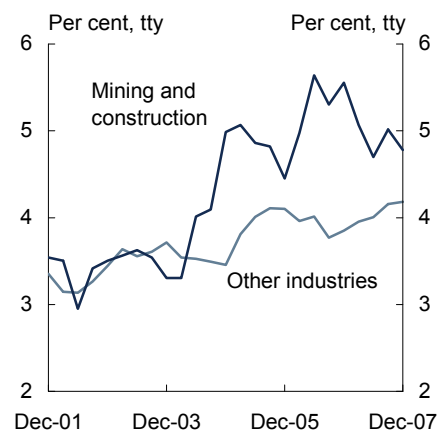
As outlined in Statement 2, the terms of trade boom has resulted in increased demand for skills in affected industries. Occupations in demand include mechanical, electrical, project and geotechnical engineers, geologists, accountants, project managers, and surveyors. This increased demand has been reflected in above average increases in wages in the affected industries and states in recent years (Charts 3 and 4).

Chart 3: Wages growth by state



Source: ABS cat. no. 6345.0.

Chart 4: Wages growth by industry

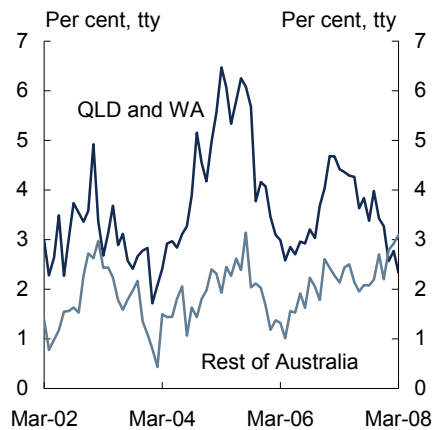


Source: ABS cat. no. 6345.0.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

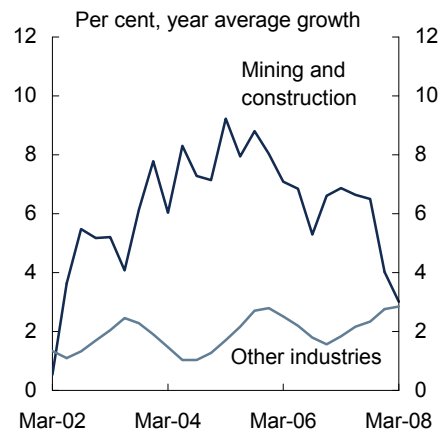
These higher wages have been associated with strong employment growth in the resource related sectors of mining and construction over much of the period, indicating that higher relative wages have helped to attract workers into these industries (Charts 5 and 6).

Chart 5: Employment growth by state



Source: ABS cat. no. 6202.0.

Chart 6: Employment growth by industry



Source: ABS cat. no. 6291.0.

While skills shortages pose a range of challenges to business and may highlight areas in need of policy action, a tight labour market can mean lower adjustment costs for employees. There are a number of adjustment costs associated with a firm's closure to both individuals and the macroeconomy. For individuals, these adjustment costs are both financial (including lost wages, costs of job search and moving costs) and non-financial (for example, the emotional costs associated with unemployment, change and dislocation). These costs tend to be lower and less enduring when labour markets are tight. In particular, workers with higher skills and experience are highly sought after in an economy with a tight labour market. The alternative, a surplus of skilled labour, has costs for the welfare of individuals and the overall economy.

The role of policy in response to skill shortages

In many cases skill shortages will resolve themselves over time through adjustments in relative wage levels and the subsequent responses of employers and employees. Nevertheless, an appropriate policy and institutional framework is important to facilitate this process.

Skilled migration

Immigration can be used as a policy instrument to alleviate specific skill shortages relatively quickly.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

In recent decades skilled migrants have come to comprise an increasingly important component of total permanent migration, accounting for just under half of total gross migration in 2006-07. These were mostly concentrated in professional occupations, tradespersons, managers and administrators, and associate professionals. In addition, the number of skilled migrants under the temporary business long-stay visa has also been growing. Temporary migration of skilled workers complements the permanent migration program, in particular in assisting in responding to short term demands for skills in particular areas. In the medium to longer-term, the level of net overseas migration plays an important role in maintaining sustainable economic growth. Migration can reduce the rate of population ageing because new migrants are younger on average than the resident population.

Immigration will continue to be an important contributor to labour supply, with skilled migration in particular helping to address Australia's skill needs in the short-term while also delivering fiscal benefits. To this end, the Government will increase the skilled stream of the Migration Program by 31,000 places from 2008-09 and is intending to improve the integrity and responsiveness of temporary business long-stay visas.

The scope for better outcomes in education and training

The scope for achieving better outcomes in Australia's early childhood and school education, vocational and educational training (VET) and higher education sectors are examined below.

Early childhood and schools

The effectiveness of the early childhood and school education system is an important factor affecting overall skill levels of the Australian workforce. Basic literacy and numeracy provide the necessary foundation for developing higher-order skills that contribute to a more productive workforce.

There is also evidence that early childhood education can play a role in improving long-term developmental outcomes, particularly for children from disadvantaged backgrounds (Heckman and Masterov 2007). The Government will work with the States and Territories to ensure universal access to 15 hours per week of high quality early childhood education for four year olds by 2013. This and a number of other related initiatives outlined in Statement 1 are intended to play a role in improving children's educational outcomes later in life.

Australia's upper secondary attainment rates are lower than several other OECD countries. Following rapid increases through the 1980s and early 1990s, Year 12 retention rates in Australia have remained relatively constant at around 75 per cent over the past 15 years. Completing Year 12 is important not only as a pathway to further education, but because Australians who have not reached this level of attainment are significantly more likely to be unemployed than those who have (Kennedy 2007). Indeed, improving upper-secondary education attainment was one of

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

the five policy priorities the OECD identified for Australia in *Going for Growth* (OECD 2008).

Literacy and numeracy achievement is the most influential factor in Year 9 students staying on to complete Year 12 and the strongest predictor of tertiary entrance performance (McMillan and Marks 2003). Students with low levels of literacy and numeracy achievement are also more likely to leave school earlier. The teaching of literacy and numeracy in schools is therefore a critical element in improving participation and productivity to boost potential growth in the medium- and longer-term.

While there is a range of research indicating that teacher quality is a critically important factor in improving educational outcomes,¹⁰ there is evidence that the literacy and numeracy achievement of teachers has been falling (Leigh and Ryan 2006). Given this, a key reform challenge is to improve the quality of teaching that takes place in the classroom. This means ensuring that well trained high quality people are both attracted to and retained in the teaching profession.

There is also scope to improve the quality of new teachers entering the profession. Ensuring that teacher training is evidence based and grounded in the practical skills required of teachers in the classroom is important. And reducing barriers to entry into teaching from highly skilled members of other professions could be expected to improve the overall quality of the field of candidates seeking to enter the teaching profession. The long and costly process required to obtain the necessary qualifications to teach, over and above existing academic qualifications, may discourage large numbers of potentially gifted teachers from entering the profession.

Finally, public reporting of student and school performance, along with greater school autonomy and demand side pressures from parents to enhance school performance is likely to have significant positive impacts on student performance (Hanushek and Wößmann 2007). OECD (2006) research finds that students in schools that publicly release their performance results performed substantially better than students in schools that did not, even after accounting for the demographic and socioeconomic background of students and schools. The study also found that students in educational systems that give more autonomy to schools to formulate the school budget and to decide on budget allocations within the school tend to perform better.

Vocational education and training

Within the VET sector there is evidence that the effectiveness of training is variable. Many of the trades with low completion rates are also occupations that regularly appear on the national skill shortages list discussed earlier in this statement (NCVER 2006).

¹⁰ See for example, Leigh (2007), Rivkin, Hanushek and Kain (2005) and Rowe (2003).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

While it is not possible with the available evidence to attribute low completion rates to the training or to broader workforce issues, it is clear that increasing the number of people participating in training alone is unlikely to be a cost-efficient way of addressing reported skills shortages in these areas. Hence, the vocational training system requires reform to ensure that greater investment will deliver more responsive, higher quality training that will contribute to higher productivity growth.

To maximise the effectiveness of vocational education and training in Australia, a fundamental principle should be that those institutions that offer the highest quality and most relevant training to employers and industry should not be excluded from competing for government funding. More competition should be a goal in a more contestable training market.

Higher education

The Government recently announced a major review of Australia's higher education system, which will examine and report on the future direction of the higher education sector, its ability to meet the needs of the Australian community and economy and the options for ongoing reform. Two important challenges for future higher education policy relate to achieving optimal funding levels and funding mechanisms, and ensuring that institutions have sufficient autonomy and flexibility to deliver the best mix of high quality research and educational outcomes.

Private rates of return should play an appropriate role in guiding decisions taken by individuals as to whether to undertake higher education, and, if so, in which area. University graduates (especially in some occupations) earn substantially more on average over their lifetimes than non-university graduates that form the majority of the taxpaying public. A related question is what the balance for university funding should be between taxpayers on the one hand and the students who will benefit from their education on the other. Another important principle in determining the appropriate funding balance is that equity remain a key feature of the system so as to not deter individuals from less privileged backgrounds from attending university. This is a particularly attractive aspect of the HECS-HELP system in Australia, where students can elect for their fees to be payable on an income contingent basis.

It is important that universities have as much flexibility as possible to determine their own particular role to allow diversity and specialisation among institutions. Some universities could be better off specialising as research orientated institutions while others would have a more vocational focus and specialise in teaching. Other institutions might have a more regional specialisation and focus on serving their particular local community.

A policy framework for better outcomes in education and training

There are a number of policy challenges in ensuring Australia's education and training systems are effective and responsive in providing the skills development needed by

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

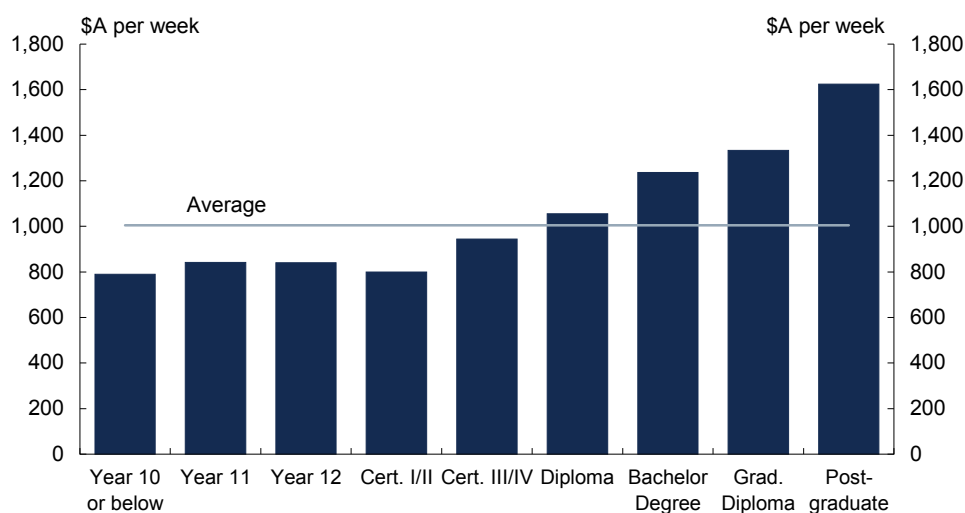
individuals and firms. Improved regulatory and policy structures that allow the labour market to better match existing skilled labour to demand provide some safeguards against skill shortages arising and assist in ameliorating any that do arise.

Price signals

Studies for Australia and OECD countries generally indicate high positive private rates of return to education and training. For example, in Australia the latest available data indicate that average weekly full-time earnings for people with Certificate III level qualifications and above are at least 10 per cent above, and up to double, those without these qualifications (Chart 7). Educational attainment is also strongly related to labour force participation and a lower probability of unemployment over an individual's lifetime (Kennedy 2007).

In view of this, the challenge for policy is to ensure that educational institutions deliver high quality education and training services and are responsive to changing student demands, which in turn, reflect students' response to shifts in relative wage signals in the market place. Achieving this goal does not necessarily involve simply increasing public expenditure. Evidence for Australia and other high income countries indicates that, while there is a minimum resource level required to ensure that students achieve at a basic level, the evidence is less clear as to whether additional public spending on education by itself will lift student achievement.¹¹

Chart 7: Average weekly full-time earnings by level of qualification, May 2005



Source: ABS cat. no. 6278.0.

¹¹ See for example, Hanushek and Wößmann (2007), McKinsey (2007) and Leigh and Ryan (2008).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Lack of appropriate price signals is likely to be one of the reasons for the consistent listing of health-related occupations in the MODL. For some health related professions, wages and employment conditions appear to be flexible in response to skill shortages as is generally the case in many other labour markets. However, in many areas of notable skill shortage such as nurses, institutional and other factors limit the degree of labour market flexibility.¹² Another group of public sector workers that would also fall into this category are teachers (Box 2).

Box 2: Skills shortages among teachers and nurses

Reported skills shortages in some areas – for example, teachers and nurses – are not always a reflection of a lack of suitably qualified people. Australian Bureau of Statistics data indicate that there are around 450,000 people aged between 15 and 64 who are trained as teachers, with only around 280,000 working as teachers. In nursing the situation is similar, with around 200,000 people working as nurses from a pool of around 340,000 people of working age with nursing qualifications (ABS cat. no. 4221.0, 6227.0 and unpublished data). To the extent that there are reported shortages in these areas, this does not reflect an absolute shortfall in suitably qualified people, but rather, a choice by many of them not to work in these fields. Given the competing demands for labour, solving skills shortages within schools clearly involves more than simply boosting the number of people qualified as teachers.

Population ageing is likely to see a dramatic increase in the demand for nurses due to changing burdens of disease, higher incomes and consequent expectations of the health system. However, many qualified nurses will be retiring just as the impact of ageing begins to place increased pressure on the health system. Currently, around 46 per cent of nurses are over 45 years of age. While demographic changes do not pose the same challenges on the demand for education services, the age profile within the teaching profession is even more pronounced than that of the nursing profession, with around 49 per cent of primary school teachers and 50 per cent of secondary school teachers over 45 years of age (DEEWR 2008b).

The public sector is often more constrained than the private sector in its ability to respond to staff and skill shortages by paying higher wages. Even so, there is still scope to improve relative price signals in these occupations to make better use of public resources. Research on attitudes to teaching as a career indicates that current pay arrangements are a factor in deterring high-quality graduates from entering teaching and deterring high-quality teachers from staying in the profession.¹³ Leigh and Ryan (2006) find that pay dispersion in teaching has stayed the same, or declined,

12 For a discussion of the impacts of institutional factors and the role of professional associations on Australia's health workforce see PC (2005c).

13 DEST (2006), OECD (2005), Lewis and Butcher (2002).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

over the past thirty years, while wage dispersion has increased in many alternative occupations. The Productivity Commission (2007, p 252), notes that:

[P]rice signals have not been able to communicate the shortages in the teaching profession due to the inflexible nature of teachers' pay structures ... providing greater flexibility in pay and reward structures would help to address the ongoing shortages.

The MODL lists also regularly include some other types of professionals, such as engineers and accountants, who are employed predominantly in the private sector, without the same restrictions on wages and employment conditions as is the case for nurses and teachers. Their inclusion in the MODL lists may broadly reflect the time it takes to train workers in these skills when demand for them increases sharply. To the extent that this is the case, there may only be limited scope for government intervention to address these shortages from domestic sources in the short term.

A key role for policy is to identify and reduce, as far as practicable, impediments to geographic mobility including regulatory barriers such as recognition of qualifications across States and Territories (Regulation Taskforce 2006). An example of this would be the introduction of a national registration and accreditation system for health professionals agreed to by COAG at its March 2008 meeting.

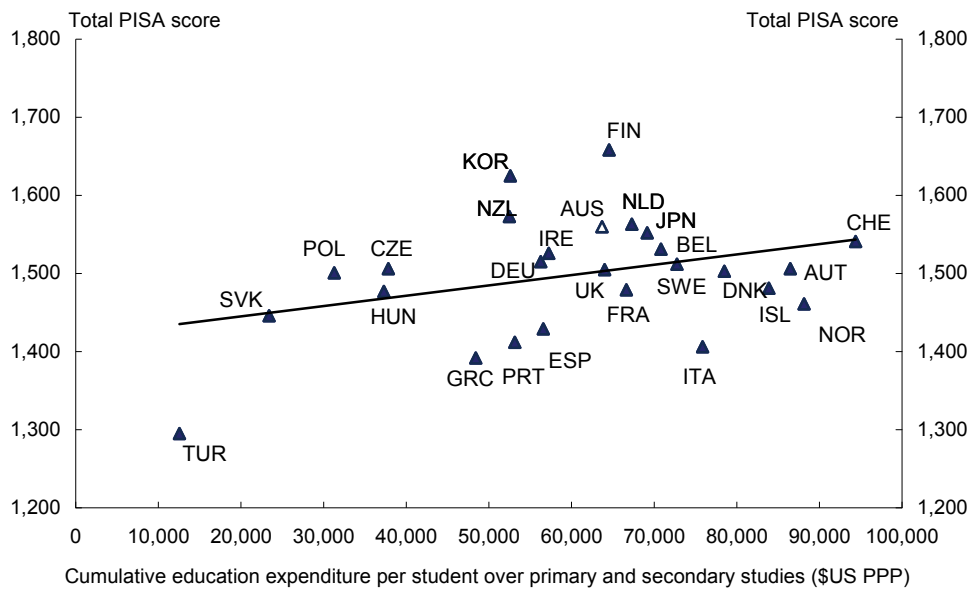
Optimal government decision making

The OECD Programme for International Student Assessment (PISA) data indicate only a weak relationship between expenditure and educational outcomes across all OECD countries, and no relationship for high income countries (including Australia, Chart 8). McKinsey (2007) also highlights the weak relationship between expenditure and education outcomes among high income OECD countries. The OECD (2007, p 61), concludes that: 'While spending on educational institutions is a necessary prerequisite for the provision of high quality education, spending alone is not sufficient to achieve high level outcomes'.

Hence, in increasing expenditure on education it is critical to assess the likely effectiveness of such investment. For example, one common approach that governments have introduced to try to improve the quality of teaching in recent years has been to reduce class sizes, requiring substantial additional government expenditure. However, research indicates that reducing class sizes across the board generally has minimal impact on educational outcomes, apart from the very early years (Dee and Keys 2005, Krueger 1997).

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Chart 8: PISA 2006 test scores and cumulative education expenditure



Source: OECD (2007).

The importance of a well functioning vocational and educational training (VET) sector is highlighted by the high representation of trade-related occupations in skills in demand lists. This sector is characterised by a relatively low level of competitive pressures, with varying degrees of autonomy and incentives for publicly funded technical and further education institutes (TAFEs) to be flexible and responsive to the needs of students and industry. In addition, employers may not have the right incentives to provide training while employees (apprentices who receive a low wage in conjunction with a training commitment from the employer) would often have access to higher paying employment opportunities.

The Government's recently announced policy, *Skilling Australia for the Future*, adopts a demand driven approach to training delivery, in contrast to past supply driven approaches. As part of this policy, the Productivity Places Program will provide up to 630,000 new training places targeted at occupations facing skills shortages over the next five years. Up to 392,000 of these places will be for employers to train workers already in the workforce and up to 238,000 places will be targeted at job seekers.

A new body, Skills Australia, will provide the Australian Government with advice on the training needs of industry to help ensure that training is delivered in a way that responds to demand for skills. In particular, Skills Australia will undertake research and analysis on skills and workforce development needs; widely distribute this research and analysis to entrepreneurs, businesses and workers; advise the Government on current and future skills needs; and build relationships with State and Territory bodies associated with vocational education and training.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

The Government will implement a reformed employment services system from 1 July 2009 with total funding of \$3.7 billion over three years. The reformed system will better target assistance to the most disadvantaged job seekers, improve linkages with education and training, create greater flexibility for employment services providers to deliver assistance tailored to job seeker needs and encourage greater engagement with employers.

Under the reformed system, employment services providers will be encouraged to refer job seekers to education or training, including from the 238,000 additional training places (including apprenticeships) available for job seekers under the Government's *Skilling Australia for the Future* policy. Improving the skills of job seekers will boost their opportunity to gain sustainable employment.

CONCLUSION

This statement has identified areas where reform of Government policy can help to expand Australia's productive capacity over time, with the objective of building a more efficient and equitable economy, with high levels of productivity and participation, that is able to deliver a higher level of overall wellbeing.

The focus has been on some of the broad elements which could contribute to an improved policy and institutional framework for better utilising Australia's existing infrastructure stock and skill base, and for improved investment decisions in these areas in future years.

The discussion has emphasised the importance of rigorous cost-benefit analysis in informing infrastructure investment decisions. The discussion has also emphasised the value in enhancing market arrangements so that relative price and wage signals play the maximum possible role in guiding resource allocation. For infrastructure, this means a greater use of market mechanisms as determinants for both the efficient use of existing assets at any point in time and investment in infrastructure to improve longer term productive capacity. For educational and training institutions, there is also a need to be flexible in responding to changing demands in the nature and content of training.

The Productivity Commission (2006) estimated that improving productivity and efficiency in energy, transport, infrastructure and other activities could, after a period of adjustment, increase GDP by nearly 2 per cent. It also estimated that achievement of a 5 per cent improvement in the productivity of health service delivery could add up to 0.4 per cent of GDP in the longer term. Enhancement of workforce participation and productivity through education and work incentives was estimated to result in increases in GDP of up to 3 per cent.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Economic reforms are challenging and will take a period of years to implement and bear fruit. Nevertheless, the Government has moved quickly to establish two new institutions to deliver some elements of these reforms – Infrastructure Australia and Skills Australia. The payoff from successful reform will be a boost to Australia's productive capacity over the medium term – in other words, low and stable inflation accompanied by stronger growth in incomes and living standards.

REFERENCES

- Australian Government 2007, *Intergenerational Report 2007*.
- Banks, G 2002, *The drivers of Australia's Productivity Surge*, Presented at Outlook 2002, Canberra.
- Barro, R and Sala-i-Martin, X 1995, *Economic growth*, McGraw Hill, New York.
- Bureau of Transport and Regional Economics 2007, *Estimating urban traffic and congestion cost trends for Australian cities*, Working Paper no. 71, BTRE, Canberra.
- Bureau of Transport and Regional Economics 2006, *Freight Measurement & Modelling in Australia*, Report 112, BTRE, Canberra.
- Business Council of Australia 2005, *Infrastructure Action Plan for Future Prosperity*, report prepared by the Business Council of Australia, Melbourne.
- Business Council of Australia 2007, *Infrastructure: Roadmap for Reform*, report prepared by the Business Council of Australia, Melbourne.
- Coombs, G and Roberts, G 2007, 'Trends in Infrastructure', *Economic Roundup*, Summer 2007, pp 1-16.
- Dee, T and Keys, B 2005, 'Dollars and Sense', *Education Next*, vol 5, no. 1, Winter, pp 60-67.
- Department of Education, Employment and Workplace Relations 2008a, *Skills in Demand: State and Territory Lists*, www.workplace.gov.au/workplace/Publications/LabourMarketAnalysis/Skillsindemand.htm.
- Department of Education, Employment and Workplace Relations 2008b, *Staff in Australia's Schools 2007*, report prepared by McKenzie, P, Kos, J, Walker, M and Hong, J, January 2008, DEEWR, Canberra.
- Department of Education Science and Training 2006, *Attitudes to Teaching as a Career: A synthesis of attitudinal research*, report prepared by the Department of Education Science and Training, Canberra.
- Edwards, J 2007, 'Export Weakness, Investment Strength', in *Competing from Australia*, Committee for Economic Development of Australia, pp 28-41.
- Fisher, B, Moore-Wilton, M and Ergas, H 2005, *Australia's Export Infrastructure*, Report to the Prime Minister by the Exports and Infrastructure Task Force.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Hanushek, E and Wößmann, L 2007, 'The Role of School Improvement in Economic Development', *National Bureau of Economic Research Working Paper* no. 12832, Cambridge, January.

Heckman, J and Masterov, D 2007, 'The Productivity Argument for Investing in Young Children', *Review of Agricultural Economics*, vol 29, no. 3 pp 446-494.

Kennedy, S 2007, *Full Employment in Australia and the Implications for Policy*, Address to the NSW Economic Society, 11 December.

Krueger, A 1997, 'Experimental Estimates of Education Production Functions', *National Bureau of Economic Research Working Paper* no. 6051, Cambridge, May.

Leigh, A 2007, *Estimating Teacher Effectiveness From Two-Year Changes in Students' Test Scores*, Australian National University, Canberra.

Leigh, A and Ryan, C 2006, *How and Why has Teacher Quality Changed in Australia?*, Australian National University Centre for Economic Policy Research Discussion Paper no. 534.

Leigh, A and Ryan, C 2008, *How Has School Productivity Changed in Australia?*, Australian National University.

Lewis, E and Butcher, J 2002, *Why Not Teaching? Senior Students Have Their Say*, Paper presented at AARE Conference, Brisbane.

Mankiw, G 1995, 'The Growth of Nations', *Brookings Papers on Economic Activity*, vol 1, pp 275-326.

McKinsey & Company 2007, *How the world's best-performing school systems come out on top*, report prepared by Barber, M and Mourshed, B for McKinsey and Company, Chicago.

McMillan, J and Marks, G 2003, *School Leavers in Australia: Profiles and Pathways*, LSAY Research Report no. 31.

Moretti, E 2005, 'Social Returns to Human Capital', *NBER Reporter: Research Summary*, Cambridge, Spring.

National Centre for Vocational Education and Research 2006, *Australian Vocational Education and Training Statistics: Apprentices and Trainees 2006 – annual report* prepared by NCVET, September, Adelaide.

National Centre for Vocational Education and Research 2008, *A well-skilled future: Tailoring VET to the emerging labour market – About the research*, report prepared by NCVET, Adelaide, March.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Organisation for Economic Co-operation and Development 2005, *Attracting, Developing and Retaining Effective Teachers*, OECD Paris.

Organisation for Economic Co-operation and Development 2006, *Economic Survey of Australia 2006*, OECD Paris.

Organisation for Economic Co-operation and Development 2007, *Programme for International Student Assessment (PISA) 2006: Science Competencies for Tomorrow's World*, OECD Paris.

Organisation for Economic Co-operation and Development 2008, *Going for Growth*, OECD Paris.

Parham, D, Roberts, P and Sun, H 2001, *Information Technology and Australia's Productivity Surge*, Productivity Commission Staff Research Paper.

Productivity Commission 2002, *Review of Automotive Assistance*, Report No. 25, Canberra.

Productivity Commission 2005a, *Economic Impacts of an Ageing Australia*, Research Report, Canberra.

Productivity Commission 2005b, *Review of National Competition Policy Reforms*, Report No. 33, Canberra.

Productivity Commission 2005c, *Australia's Health Workforce*, Research Report, Canberra.

Productivity Commission 2006, *Potential benefits of the National Reform Agenda*, Canberra.

Productivity Commission 2007, *Public Support for Science and Innovation*, Research Report, Canberra.

Productivity Commission 2008, *Annual Report 2006-07*, Canberra.

Productivity Commission and Australian National University 1998, *Microeconomic reform and productivity growth*, Workshop Proceedings, AusInfo, Canberra.

Regulation Taskforce 2006, *Rethinking Regulation: Report of the Taskforce on Reducing Regulatory Burdens on Business*, report to the Prime Minister and the Treasurer (Gary Banks, chairman), Canberra, January.

Rivkin, S, Hanushek, E and Kain, J 2005, 'Teachers, Schools and Academic Achievement,' *Econometrica*, vol 73, no. 2, pp 417-458.

Statement 4: Boosting Australia's Productive Capacity: Infrastructure and Skills

Rowe, K 2003, *The Importance of Teacher Quality as a Key Determinant of Students Experiences and Outcomes of Schooling*, background paper to keynote address presented at the ACER Research Conference, Melbourne, October.

Shah, C and Burke, G 2003, *Skill shortages: concept measurement and implications*, Centre for the economics of education and Training, Working Paper no. 52, November 2003.

Solow, R 1956, 'A Contribution to the Theory of Economic Growth', *Quarterly Journal of Economics*, vol 70, no. 1, pp 65-94.

Swan, T 1956, 'Economic Growth and Capital Accumulation', *Economic Record*, vol 32, pp 334-361.

World Economic Forum 2007, *Global Competitiveness Report 2007-2008*.

