Comparing Australian and United States productivity

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Despite a series of broad and deep macroeconomic and microeconomic reforms boosting Australia's productivity growth, the level of Australia's GDP per capita remains well below that of the United States. A continuing gap in the levels of productivity plays a central role in explaining Australia's GDP per capita relative to the US. This paper reviews various explanations for the Australia-US productivity gap and finds that the productivity gap can at least in part be explained by a combination of: differences in human capital as represented by educational attainment; differences in product and labour market policies; and the geographic and historical context in which the Australian economy operates. Differences in physical capital per worker and industry structures do not appear to be primary explanations for the productivity gap.

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1 The author, is from Macroeconomic Policy Division, the Australian Government Treasury. This article reports on some of the outcomes of a Treasury work programme directed at better understanding drivers of Australia's growth performance. The paper has benefited from comments and suggestions provided by Graeme Davis, Ben Dolman, Paul Fischer, David Gruen, John Hawkins, Paul O'Mara, David Parker, Martin Parkinson and Gene Tunny. The views in this article are those of the author and not necessarily those of the Australian Government Treasury.

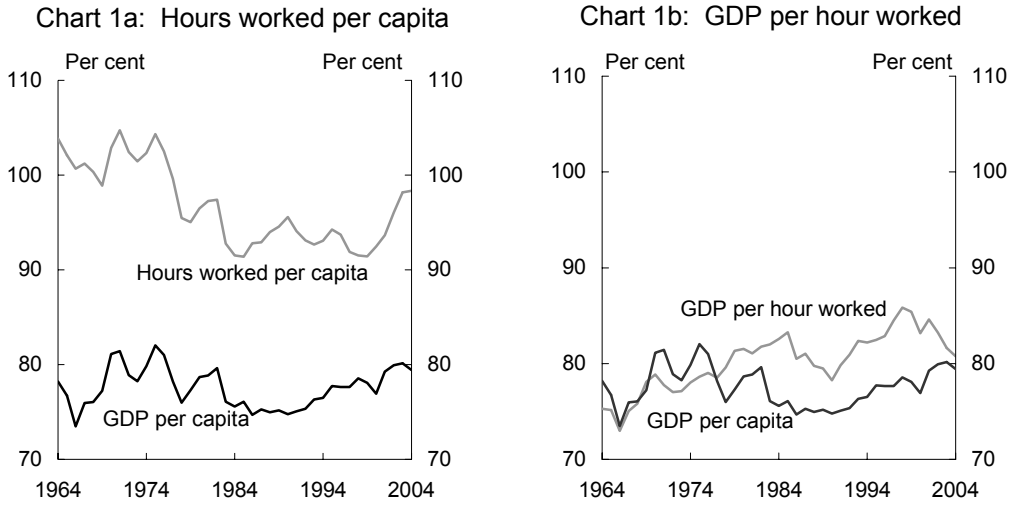
Reasons for analysing the Australia-US productivity gap

One way to analyse Australia's economic performance is through a comparison with the United States. Australia's GDP per capita is currently nearly 80 per cent of that of the US, having risen from around 75 per cent in the mid-1980s.

To provide a simple decomposition of the long-term evolution of GDP per capita, the Australian Treasury often uses the '3 Ps' framework. This framework breaks GDP per capita into three components — population, participation and productivity. Population is the proportion of the population that are of working age. Participation is the average number of hours worked by those of working age. Population and participation can be summarised together as hours worked per capita. The final P in this framework is labour productivity, represented by a standard measure — GDP per hour worked. The components of the '3 Ps' framework are multiplied together to give GDP per capita.

Australia's hours worked per capita have been between 90 and 105 per cent of those of the US over the past 40 years (Chart 1a). Over this period, Australia's GDP per hour worked has been mostly between 75 and 85 per cent of that of the US (Chart 1b).

Chart 1: Australia's GDP per capita relative to the US — decomposed using the 3 Ps framework



Source: Groningen Growth and Development Centre (GGDC) and The Conference Board, January 2005.

If Australian workers were as productive as their peers in the US in terms of output per hour, then hours worked per capita would determine GDP per capita relative to the US. Similarly, if Australian and US workers worked similar hours, then relative labour productivity would determine relative incomes. Chart 1 thus shows that the level of productivity plays a central role in explaining the Australia-US difference in

GDP per capita. For illustrative purposes, if Australia's labour productivity had been the same as that of the US in 2002, other things being equal, Australia's GDP per capita would have been about $7,900 higher.[2]

A key implication is that because the productivity gap is the main determinant of Australia's income gap with the US, there may be scope for future GDP per capita gains in Australia from catching up with the global productivity frontier represented by the US. A better understanding of the causes of the Australia-US productivity gap can help shed light on how much further productivity in the Australian economy may be able to catch up with that in the US, and the role that further policy reforms may play in any such catch-up.

This paper surveys various explanations for the Australia-US productivity gap. The explanations can be classified into three broad groups: relative factor intensities; differences in product and labour market policies; and, differences in the geographic and historical context in which the two economies operate. The three main sections of the paper are devoted to these groups.

First discussed are relative factor intensities. The analysis suggests that differences in the average level of human capital may explain part of the Australia-US productivity gap, but differences in physical capital per hour worked do not appear to be a major explanation for the gap. Whether differences in product and labour market policies can explain the productivity gap is explored next. A survey of the existing literature suggests that Australia could narrow the productivity gap by as much as one-sixth by further reforms of product and labour market regulations.

That said, differences in the geographic and historical context in which the two economies operate are likely to inhibit Australia's ability to close fully the gap with the US level of productivity. There are strong reasons to believe that part of the Australia-US productivity gap may be due to geography and history. Nonetheless, there remains much scope for future research to measure the importance of these factors on the productivity gap.

Before exploring these explanations for the Australia-US productivity gap in detail, the next section notes that there are substantial statistical and measurement issues surrounding international comparisons of productivity levels.

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2 Productivity data are volatile, cyclical and susceptible to revision. This is why 2002, rather than 2004, productivity levels are used for illustrative purposes.

Statistical and measurement issues

Measuring any economic variable is prone to error and international comparisons are often difficult. These problems are particularly acute for measurement of productivity. Part of the observed productivity gap between Australia and the US can probably be attributed to statistical and measurement issues inherent in cross-country comparisons. Some of these issues are briefly discussed below.

It is not easy to measure output and inputs separately in some industries. Methods of measuring output for many industries are different across countries or depend on uncertain links with wages. This is why the Australian Bureau of Statistics focuses on labour productivity in the market sector, which includes manufacturing and retail trade but not government administration. Similarly, the US Bureau of Labor Statistics publishes data for the private business sector.

Measuring output is particularly difficult for some sectors of the economy. Consider the health sector as an example. The ultimate output from the health sector is presumably good health. Australians enjoy longer, healthier lives than the populations of many countries including the US. Statistics imply that the US has more real economic resources devoted to, and more measured output from, the health sector. Clearly then, cross-country comparisons of output from health sectors are fraught with difficulties.

Another difficulty in cross-country analysis of productivity levels involves the choice of the exchange rate used to compare national data. Using market exchange rates is problematic for this purpose as market exchange rates do not always reflect relative price differences between countries. For instance, if an industry had lower prices in Australia than in the US, then output per hour worked in that industry would be understated in Australia relative to the US. The standard method used in international comparisons, which this paper also uses, is to convert national currency estimates of productivity into purchasing power parity (PPP) US dollar equivalents using standard PPP exchange rates.

Labour productivity is calculated as a ratio of output to hours worked. This makes labour productivity data susceptible to revisions in output and hours worked data. Hours worked data are strongly affected by cyclical factors, making cross-country comparisons particularly difficult. This means that the precise estimate of the Australia-US productivity gap at a particular point in time is likely to be affected by different stages of the business cycle in the two economies.

The issues discussed above suggest that the observed gap between the productivity levels in Australia and the US is only an approximation of the actual productivity gap.

Relative factor intensities and the productivity gap

This section discusses how much of the Australia-US productivity gap can be explained by differences in capital intensities — the amount of capital available to each worker. While there are significant limitations in the data, and hence a need for careful interpretation, differences in physical capital per hour worked seem unlikely to explain much, if any, of the Australia-US productivity gap. On the other hand, the data suggest that the average level of human capital is lower in Australia than in the US, primarily due to lower educational attainment among older workers. This difference may account for part of the productivity gap.

Capital-labour ratio

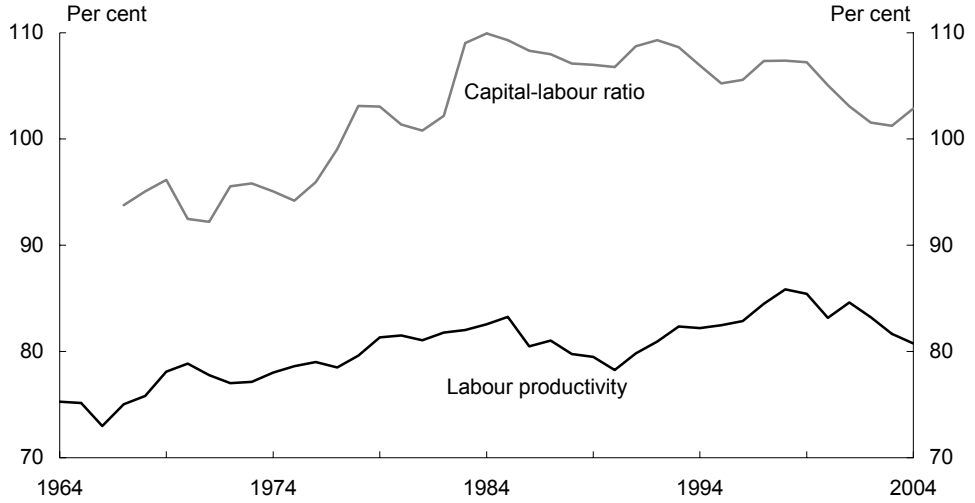
Australia's labour productivity level, measured as GDP per hour worked, was around 83 per cent of that of the US in 2002, compared with about 75 per cent in the late 1960s. However, labour is only one input into production. Labour productivity might be lower in Australia than in the US if the capital-labour ratio were lower in Australia (that is, if Australia used more labour-intensive production methods to produce the same good).

In addition to the various statistical and measurement issues mentioned above, international comparison of the contribution that capital per worker makes to labour productivity is difficult because comparable time series data on the physical capital stock for the whole economy are not available. This analysis draws on the *OECD Economic Outlook* (no. 76) data on capital stock in the business sector.

The business sector's share of GDP is lower in Australia than in the US (based on the *OECD Economic Outlook* national accounts). The difference in the business sector share of GDP is adjusted for by dividing the capital stocks in each country by their respective business sector's share of GDP. This implicitly assumes that in both countries, government sector capital intensity is identical to the corresponding business sector capital intensity.

This assumption allows us to estimate the contribution that the difference in capital-labour ratios makes to the gap in labour productivity. Chart 2 shows Australia's labour productivity and physical capital per hour worked relative to the US over the past four decades.

Chart 2: Australia's labour productivity and capital-labour ratio relative to the US



Source: GGDC and The Conference Board, January 2005; OECD Economic Outlook December 2004; the author's calculations.

It appears that the difference in capital-labour ratios does not account for much, if any, of the Australia-US productivity gap. Indeed, Australian workers seemed to use more capital per hour worked than their US counterparts in 2002.

The difference in labour productivity that is not explained by the difference in capital-labour ratios can be viewed as the Australia-US multi-factor productivity (MFP) gap. The Australia-US MFP gap captures the efficiency with which inputs of capital as well as labour are used in Australia relative to the US. It appears that the difference in MFP is a major driver of the Australia-US labour productivity difference, and more broadly the difference in GDP per capita.

Average level of human capital

The average level of human capital refers to the skills and knowledge of individual workers and their ability to use these skills and knowledge in the wider economy. A recent strand of economic growth literature stresses the importance of human capital in the production process (Mankiw, Romer and Weil 1992).

Differences in the average level of human capital may partly explain why productivity is lower in Australia than in the US. The ideal analysis would measure Australia's human capital stock relative to the US. However, it is very difficult to calculate the contribution of human capital in the production process. International comparisons are even more problematic.

Measures of educational attainment are often used as a proxy for human capital. Mankiw, Romer and Weil (1992) use the fraction of working age population that is in secondary school as a measure of investment in human capital. Adult literacy rates, life expectancies at birth and average years of schooling among the adult population are some other measures of human capital used in economic growth literature (Sachs and Warner 1997).

Dowrick (2003) uses the average years of schooling among the working age population as a proxy for human capital. His survey of the literature suggests that if the average years of schooling of young people in Australia were to rise by one year, real GDP would rise by up to eight per cent over about forty years. This result can be used to think about the effect that a rise in average years of schooling in Australia would have had on GDP.

Average years of schooling in the working age population have been around half a year lower in Australia than in the US over the period 1971 to 1998 (Bassanini and Scarpetta 2001). Had Australia instead achieved similar average years of schooling to the US over this period, then Dowrick's result suggests that by 1998 Australia's GDP might have been around 2 to 3 per cent higher than was actually recorded. This gives a back-of-the-envelope estimate of the contribution of education to the productivity gap (although the result does depend on assumptions about the effect of education on participation in the labour force).

The US has traditionally placed more emphasis on the achievement of at least an upper secondary education. Table 1 shows the effect of this emphasis. Five in six Americans aged 55 to 64 have at least an upper secondary qualification. In comparison, fewer than half of Australians aged 55 to 64 have at least an upper secondary qualification. The Australia-US gap in educational attainment has however narrowed in the most recent cohorts. As Australia's relative qualifications profile continues to improve with better educated cohorts entering the labour force, the productivity gap should narrow in the future (other things being equal).

Table 1: Highest qualification obtained, 25- to 64-year old population, (per cent by age group), 2002

	25-34	35-44	45-54	55-64	Total
Australia					
Tertiary	35.8	31.2	30.5	22.5	30.8
Upper secondary(a)	36.7	30.7	27.3	23.2	30.2
Lower secondary	27.5	38.1	42.2	54.3	39.1
United States					
Tertiary	39.3	38.6	39.7	33.2	38.1
Upper secondary(a)	47.5	49.8	49.4	50.4	49.2
Lower secondary	13.1	11.6	10.9	16.4	12.7
Difference(b)					
Tertiary	-3.5	-7.4	-9.2	-10.7	-7.3
Upper secondary (a)	-10.8	-19.1	-22.1	-27.2	-19.0
Lower secondary	14.4	26.5	31.3	37.9	26.4

(a) Includes post-school non-tertiary qualifications.
(b) Percentage points.
Source: OECD Labour Force Statistics database; the author's calculations.

Educational attainment is only a proxy for the stock and accumulation of human capital in an economy. The ability to use particular skills and knowledge in the production process, not merely acquiring them, is what really matters for productivity and income. This is particularly important when inferring policy prescriptions from analysis that links differences in human capital per worker and GDP per capita. Education policies that aim to raise output in the economy should focus as much on incentives to use skills and knowledge as merely to acquire them.

Increasing educational attainment might particularly spur productivity when incentive structures in the economy promote innovation. An economy that encourages innovation is more likely to reward higher education than one that is not conducive to innovation. Unfortunately, the available measures of innovation are even more nebulous than the measures of human capital.

Innovation can take many forms. For tractability, empirical analyses often focus on business sector R&D intensity and patents as proxies for innovation. However, for a small open economy such as Australia, making effective use of ideas generated overseas may also be important. For example, while Australia is not a large producer of the information and communication technologies (ICT), Australia is one of the leading economies in the OECD in using ICT to achieve MFP gains (Treasury 2003).

Product and labour market policies and the productivity gap

After stagnating during the 1980s, Australia's labour productivity accelerated during the 1990s, outpacing the 'new economy' of the US (Table 2). Australia's productivity has continued to grow strongly in the current decade while the productivity growth rate in the US has increased since 2000 (see Box 1).

Table 2: Drivers of labour productivity growth in Australia and the US (1985-2004)

	Australia			United States		
	Annual average growth in:			Annual average growth in:		
	Labour productivity	GDP	Hours worked	Labour productivity	GDP	Hours worked
1985-90	0.1	3.5	3.4	1.3	3.3	1.9
1990-95	2.2	3.2	1.0	1.1	2.5	1.3
1995-2000	2.3	3.9	1.5	2.1	4.1	1.9
2000-04	2.2	3.4	1.2	2.9	2.5	-0.4

Source: GGDC and The Conference Board, January 2005.

This section considers how product and labour market policies affect the Australia-US productivity gap. The impact of the structural reforms of recent decades on the productivity gap is discussed first. The issue of whether further changes to Australia's product and labour market regulations might affect the Australia-US productivity gap is considered next.

Acknowledging various shortcomings in data and specifications of models, a survey of existing literature suggests that the productivity gap can be narrowed by as much as one-sixth by further changes to Australia's product and labour market regulations. While this might not appear to be large in terms of the productivity gap, if Australia had similar product and labour market regulations to the US, GDP per capita might have been as much as $1,300 higher in 2002.

Box 1: Is Australia's productivity falling behind that of the US?

Australia's labour productivity growth rate has been lower than that of the US in recent years, but Australia has achieved a higher MFP growth rate than the US since 1990 and in the data to 2002 this shows no sign of slackening (Table 3). This suggests that the recent widening of the labour productivity gap does not reflect a structural fall in Australia's productivity relative to the US.

Table 3: MFP growth in Australia and the US (1985-2002)

	Using national price indices for ICT goods		Using 'harmonised' price indices for ICT goods	
	Australia	US	Australia	US
1985-90	0.3	0.8	0.3	0.8
1990-95	1.4	0.8	1.4	0.8
1995-2000	1.5	1.3	1.5	1.3
2000-02	1.6	1.3	1.7	1.3

Source: The OECD productivity database, December 2004.

Australia's labour productivity was 81 per cent of that of the US in 2004, compared with 85 per cent in 2001. The recent widening of the productivity gap largely reflects the different stages of the business cycle in the two countries, with Australia recording stronger employment growth on average over this period.

Table 2 above shows that the recent widening of the Australia-US labour productivity gap is largely due to a rapid increase in labour productivity growth in the US, rather than a sustained slowing in Australia's productivity growth. The acceleration in US labour productivity between 2000 and 2004 has been accompanied by a 1.6 per cent fall in total hours worked. Hours worked per worker in the US fell by about 3.3 per cent in this period, more than offsetting a 1.7 per cent increase in total employment.

The weakness in the US labour market followed the 2001 recession. While it was one of the mildest recessions on record in terms of output, in labour market terms it was one of the worst since the Great Depression (Kennedy and Harris 2004). The unusually weak US labour market conditions accompanied the post-2000 labour productivity acceleration.

Structural reforms and the productivity gap

Australia's productivity revival since the early 1990s occurred despite a general slowing in labour productivity growth across the OECD, suggesting that it was largely due to the easing of domestic constraints on productivity growth. Australia's productivity revival can be conceptualised as consisting of three elements: an outward shift of the steady-state relative level of productivity; faster convergence to that level; and, an outward movement of the global technological frontier.

Policy settings affect a country's steady-state relative level of productivity. Alesina et al (2003) suggest that regulatory reforms, especially those liberalising entry, are likely to spur investment. Nicoletti and Scarpetta (2003) find that in countries with lower entry barriers and fewer state controls, firms adopt best-practice technologies more quickly. In Australia's case, policy settings changed dramatically through a series of broad and deep macroeconomic and microeconomic reforms during recent decades.

Key macroeconomic reforms include: liberalising Australia's foreign exchange regime; a medium-term inflation target through an independent central bank; and adopting a fiscal policy that achieves budget balance over the economic cycle. Key microeconomic reforms include: liberalising Australia's foreign trade, foreign investment, financial markets and workplace relations regimes; tax reform, including reforms of the indirect tax system and targeted incentives to work and save; corporate law reform; and a broad-ranging structural reform agenda.

These reforms are likely to have increased Australia's steady-state relative level of productivity. Further, the ICT-related innovations have probably resulted in a faster outward movement of the global technological frontier since the mid-1990s. These 'new economy' innovations may have also increased Australia's steady-state relative level of productivity by removing some of the constraints that geographic and historical context place on productivity.

There is a broad agreement that the reforms spurred the productivity revival witnessed since the 1990s. Productivity Commission (2005) modelling on the economy-wide impact of competition policy suggests that observed productivity and price changes in selected infrastructure industries have boosted Australia's GDP by 2.5 per cent. The OECD's latest economic survey of Australia notes that 'competition policy and other microeconomic reforms have played a central role in Australia's productivity surge'.

Labour and product market regulations and the productivity gap

Ongoing attention to structural reform should help continued growth in Australia's productivity over the medium term. Since 1990, Australia's labour productivity has grown by about 2 per cent per year. According to Bernanke (2005), future annual growth in labour productivity of about 2 to 2½ per cent probably represents a good baseline assumption for the US over the medium term. The issue of whether a realignment of Australia's product and labour market regulations to the US stance will help Australia achieve faster productivity growth than the US is discussed below.

Product market regulations

There have been a number of attempts to estimate the effects of product market regulation on output. In a much-cited study, Scarpetta and Tressel (2002) find that

further deregulation of Australia's product market would reduce Australia's MFP gap with 'the frontier economy' by 7.5 per cent.

The authors compute the 'frontier' by aggregating over industry-level technology leaders. Different countries are technological leaders in different industries, and no individual country is actually the frontier economy. This makes it difficult to use the authors' result to determine whether additional changes to Australia's product market regulations would further narrow the productivity gap between Australia and the US.

Table 4 suggests that Australia's product market regulations are already quite similar to those in the US. Even if the US is assumed to represent the 'frontier economy', an overestimate of the US level of efficiency, the Scarpetta and Tressel (2002) estimates suggest substantial reforms of Australia's product market regulations would narrow the productivity gap by around 1.5 percentage points.

Table 4: Product market regulations in Australia and the US

(Scale of 0-6 from the least to the most restrictive)				
	Australia		US	
	1998	2003	1998	2003
Economy-wide product market regulations	1.3	0.9	1.3	1.0
State control	1.4	0.6	1.4	1.2
Barriers to entrepreneurship	1.4	1.1	1.5	1.2
Barriers to trade and investment	1.0	0.9	1.1	0.7

Source: Conway, Janod and Nicoletti (2005).

However, Australia's regulatory stance in the product market is already quite liberal. Along with the UK, Australia's economy-wide product market regulations were the least restrictive in the OECD in 2003 (Conway, Janod and Nicoletti 2005). While this may mean that more deregulation may not spur productivity by as much as past reforms, it could nonetheless deliver a worthwhile increase in living standards.

Labour market regulations[3]

Studies aimed at estimating the effects of labour market regulations typically focus on labour market outcomes such as the unemployment rate. However, labour market regulations, particularly employment protection legislation, can also affect productivity.

Gust and Marquez (2002) point to a potential link between employment protection legislation and the productivity gap. According to their model, more restrictive employment protection legislation in Australia (Table 5) leads to slower adoption of

3 This paper was finalised prior to the recent Australian Government announcement of further workplace relations reforms.

new technology, and a widening of the Australia-US productivity gap. This suggests that one area where further labour market deregulation and workplace relations reform can bring productivity improvements is through technology adoption.

Table 5: Employment protection legislation in Australia and the US

(Scale of 0-6 from the least to the most restrictive)

	Australia		US	
	Late 1990s	2003	Late 1990s	2003
Regular employment	1.5	1.5	0.2	0.2
Temporary employment	0.9	0.9	0.3	0.3

Source: OECD Employment Outlook 2004.

How big might the impact of restrictive employment protection legislation be for Australia? Gust and Marquez (2002) link labour productivity growth to ICT adoption, and ICT adoption to employment protection legislation. Using their results suggests that if Australia were to substantially deregulate the labour market by removing all employment protection legislation, the annual labour productivity growth rate would be about a quarter of a percentage point higher.

Any empirical link between ICT adoption and productivity depends on how ICT adoption is measured. As Bernanke (2005) notes:

> … to realize the benefits of its ICT investments, Walmart had to reorganize work assignments, retrain workers, develop new relationships with suppliers, and modify its management systems. Although investments in intangible capital are (for the most part) not counted as capital investment in the national income and product accounts, they appear to be quantitatively important.

Scarpetta and Tressel (2002) consider the impact of employment protection legislation on MFP. They find that a substantial liberalising of employment protection legislation would reduce Australia's MFP gap with 'the frontier economy' by 10.8 per cent. This implies that, subject to the above caveats, reforming Australia's employment protection legislation may reduce the productivity gap by about 2 percentage points, with likely significant beneficial impacts on living standards.

Possible effects of changing product and labour market regulations

Acknowledging the difficulties involved in estimating the impact of potential reforms on the Australia-US productivity gap, on balance the estimates outlined above suggest that further deregulation of Australia's product and labour markets might narrow the gap by as much as one-sixth.

The benefits of narrowing the productivity gap by this magnitude could be substantial in terms of increased income. For illustrative purposes, a one-sixth reduction in the

productivity gap with the US in 2002 would have raised Australia's GDP per capita by about $1,300.

Geography, history and the productivity gap

The reforms implemented over the recent decades have resulted in a gradual narrowing of Australia's productivity gap with the US. Nonetheless, a sizeable productivity gap remains. The persistence and size of the gap suggest that there are more than just differences in policy between the two countries that determine differences in GDP per capita. There might be something in the geographic and historical context of the Australian economy that inhibits its ability to achieve the US level of productivity.

The Australian economy operates in a particular geographic and historical context. In contrast to the US, Australia is a long way from the centre of world economic activity, and is also a geographically large country with a relatively small population. This section discusses these contextual factors. There are strong reasons to believe that part of the Australia-US productivity gap is likely to be explained by geography and history. Nonetheless, there remains much scope for future research to measure the importance of these factors on the productivity gap.

Australia is remote from the majority of the world's economic activities. Indeed, it is the second most remote economy in the OECD, just ahead of New Zealand. This is despite the recent rapid economic development in Asia. From the 1950s to the 1990s, the proportion of world GDP within 12,000 kilometres of Sydney increased from about 26 per cent to nearly 38 per cent (Ewing and Battersby 2005). In comparison, over 85 per cent of world GDP was within 12,000 kilometres of New York in both the 1950s and the 1990s.

This remoteness affected Australia's economic history compared with that of the US. The US was fighting its War of Independence long before large-scale settlement commenced in Australia. Australia's population was about 1.8 million in 1870, when with over 40 million people, the US was already larger than most other countries in the world (Maddison 2001). Even today, Australia's population is only about one-fourteenth of that of the US, even though Australia is nearly four-fifths of the US in terms of area.

Partly as a result of nineteenth century history, Australia's population is concentrated in a few large cities situated hundreds of kilometres apart. Cities are much more closely situated in the US. As a result, while the average Australian lives in cities of similar size to their US peers, the US has nearly eight times as many cities of substantial size as Australia in a given area. McLean and Taylor (2001) provide a vivid

illustration — no two Australian cities with a population of over one million people are within 600 kilometres of each other, compared with California, whose 34 million people live mainly between San Diego and Sacramento, a distance of only around 800 kilometres.

The dispersed nature of the population discourages labour mobility within Australia. Australians are only half as likely to move interstate as their US peers (ABS 2001 and Franklin 2003). Further, almost half of the people who move interstate in the US move between the broad US regions: North East, South, Mid-West or West. In contrast, Australians typically do not move long distances. Between 1991 and 1996 the median distance moved by Australians was about 16 kilometres (Bell and Hugo 2000).

Differences in geography and history mean that Australia misses many of the benefits of proximity that accrue to the US. These benefits include the economies of scale, intensity of competition, and low transportation costs that are available in more densely populated markets. As a result, these factors might lower Australia's steady-state relative level of productivity.

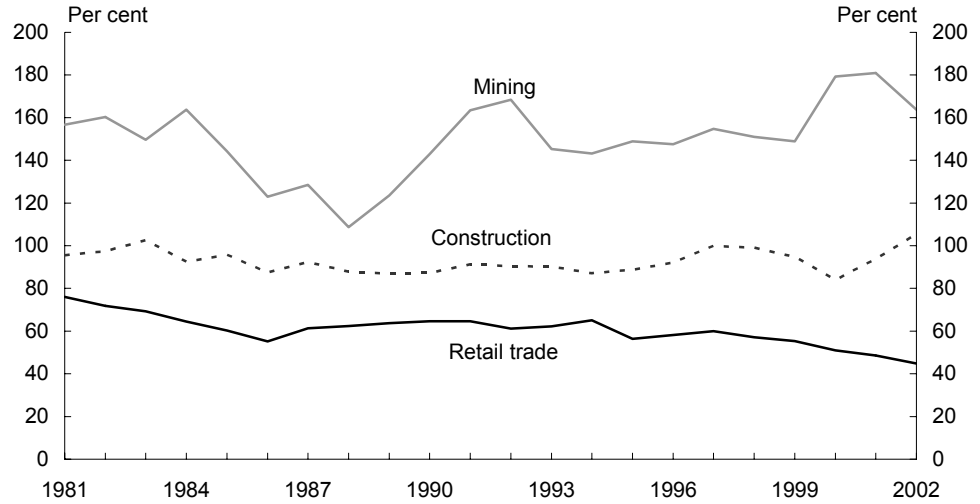
Economic growth literature suggests that over the long term, geography is a major underlying determinant of economic prosperity (Sachs and Warner 1997). One implication of this literature is that being an island or being remote is likely to lower a country's income, other things being equal. Redding & Venables (2002) suggest that Australia's GDP would have been nearly 7 per cent higher if, rather than being an island, it had land borders with significant trading partners. Concentrating specifically on the Australia-US productivity gap, Battersby (2005) finds that nearly two-fifths of the gap may be explained by Australia's remoteness.

The geographic and historical factors might shape the structure as well as the size of an economy. Some industries form a bigger part of the overall economy in Australia than in the US. To what extent are the overall productivity differences related to industry structures? To explore this question, industry structure is defined as the distribution of total hours worked between industries using the data from the Groningen Growth and Development Centre 60-industry database.

To determine the effect of industry structure on Australia's productivity relative to the US, US shares of hours worked in each industry are multiplied by Australian labour productivity in those industries. This results in a productivity level that is very similar to that with Australia's existing industry structure. That is, Australia's industry structure does not appear to make a major difference to the aggregate productivity gap. This suggests that the productivity gap between the two countries arises mainly from productivity levels within industries.

Analysis at the industry level is subject to considerable uncertainty due to significant data issues. It suggests that Australia's productivity level relative to the US differs markedly across industries (Chart 3). Australia's mining sector for instance is much more productive than that of the US, reflecting Australia's abundant natural resource endowment. On the other hand, some of the service sectors in Australia have measured productivity levels that are much lower than their US counterparts.

Chart 3: Australia's productivity in selected industries relative to the US



Source: GGDC and The Conference Board, January 2005; the author's calculations.

Retail trade provides an example of a sector where Australia's productivity level might be lower than that in the US as a result of geography and scale. The US retail trade sector has experienced rapid productivity improvement since the mid-1990s. This productivity surge can be attributed almost entirely to the entry of more productive firms that displaced much less productive existing retailers (Foster, Haltiwanger and Krizan 2002). The entering firms were usually large discount operations — the 'big-boxes' like Wal-Mart. These stores are more productive because of their size, which allows them to exploit economies of scale, efficiently use warehousing, better manage inventories and implement other innovative operation practices (Gordon 2004).

Australia's retail trade sector witnessed substantial productivity improvement in the 1990s. Regulatory reforms, adoption of new technology, and competition and rationalisation in the industry drove the productivity improvement (Johnston et al 2000). This rationalisation notwithstanding, Australian retailers have not adopted the 'big-box' format to the same extent as the US. Further, despite improvements over the 1990s, Australia's productivity level in the retail trade sector has fallen relative to the US. It may be that Australia's geography and size make the

integration of supply chain and better inventory management harder, and make the adoption of the 'big-box' format less profitable.

One way to explore the link between the contextual factors and the productivity gap empirically is to focus on industry- and firm-level data. Another way is to look to the burgeoning literature on the link between economic geography, market structure and policy choices (Syverson 2004, Winters and Martins 2004, Evans and Hughes 2003 are some examples of this literature). This literature does not specifically focus on Australia, but analysing their implications will illuminate how contextual factors affect market structure and productivity.

Concluding remarks

Australia's productivity gap with the US explains the bulk of the Australia-US income gap. This paper surveyed various explanations for the Australia-US productivity gap, and found that the productivity gap can at least in part be explained by a combination of: differences in human capital as represented by historical educational attainment; differences in product and labour market policy settings; and, the geographic and historical context of the Australian economy. Differences in physical capital per worker and industry structures do not appear to be primary explanations for the productivity gap. Nonetheless, there remains much scope for future research to measure the importance of these factors on the productivity gap. Future research will also benefit from using industry- and firm-level data.

Further research into the causes of the productivity gap will provide tangible benefits to policymakers. Measuring the importance of the difference in the average level of human capital on the productivity gap may assist in shaping education policy. Better estimates of the impact of workplace relations reform on the gap may illuminate a benefit of a flexible labour market that is not usually highlighted. Finally, a better understanding of the way geography and history affect the productivity gap will help illuminate how much further productivity in the Australian economy may be able to catch up with that in the US.

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