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# OVERVIEW

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## Key points

- Investment in capital is important for economic growth. But capital is not just physical assets; firms also invest in 'soft' capital such as knowledge, firm-specific skills, and better ways of doing business. This investment results in accumulation of 'intangible assets'.
- Intangible assets have been categorised as computerised information, innovative property (including R&D) and economic competencies (including firm-specific human capital and organisational capital), and most are difficult to measure. These assets can depreciate more rapidly than physical capital, but they are investments nonetheless, delivering benefits over time, not just in the period the expenditure was made.
- Many elements of spending on intangibles are treated as a current expense in the national accounts rather than as an investment. This leads to an understatement of investment in the economy. It also may affect measures of multifactor productivity (MFP) growth.
- Applying the methodology of Corrado, Hulten and Sichel (2006) found that intangible investment currently is almost half the size of tangible investment in the market sector of the Australian economy. While experimental in nature, the estimates suggest that:
  - market sector investment in intangibles was \$57 billion in 2005-06, 80 per cent of which is currently not treated as investment in the national accounts
  - average annual growth in intangible investment has been about 1.3 times that of tangibles since 1974-75
  - including intangible investment in total investment largely removes the past downward trend in the market sector ratio of investment to output (gross value added)
  - investments in organisational capital (strategic planning, adaptation and reorganisation) and computerised information have grown at relatively high rates — making up 27 and 13 per cent of intangible investment in 2005-06.
- Treating investment in intangible assets as capital raises measured final output *and* measured capital inputs *and* alters the capital-labour ratio, hence the effect on measured MFP growth is complex. However, in Australia, adjusting for intangible investment not currently included in the national accounts does not have a large direct effect on the level or pattern of conventionally-measured MFP growth.
  - The contribution of these intangibles was 8 per cent of conventionally-measured MFP growth (0.09 of a percentage point) in the last productivity cycle (1998-99 to 2003-04) and 5 per cent (0.13 of a percentage point) in the period of the productivity surge (1993-94 to 1998-99). (This does not include any indirect effects, such as those arising from complementarities between intangibles and other inputs.)
  - This contrasts with the United States, where intangibles accounted for a large share of the productivity acceleration from the mid-1990s, and the United Kingdom, where a slowdown in MFP growth in the 1990s became an acceleration after adjusting for intangible investment.

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# Overview

Investment in capital is important for economic growth. But capital is not just physical assets — firms also invest in ‘intangible assets’, such as knowledge, firm-specific skills and better ways of doing business. Some commentators have suggested that structural and technological changes in economies have increased the importance of investment in intangibles as a source of economic growth. It has also been suggested that the observed diversity in productivity improvements (across firms, industries and countries) is linked to investment in intangibles and its complementarities with other assets, such as information and communication technologies (ICTs).

Despite this increase in prominence, intangibles are relatively poorly measured and understood. Focus has been on a small number of intangibles, such as computer software and scientific R&D. And only a few intangibles are measured as investment in national accounts. Excluding investment in intangibles means investment is underreported, and this may distort measures of growth in capital services and consequently productivity.

Measuring intangibles is not easy. However, Corrado, Hulten and Sichel (CHS 2005, 2006) developed an experimental methodology for measuring investment in a wide range of intangibles. They then used this in a growth accounting framework to explicitly identify the contribution of intangibles to conventional productivity measures. Originally applied to US data, it has now been applied to a number of countries with a range of results.

This paper continues this work by applying the approach to Australia. The paper addresses two questions. Has the composition of investment (including intangibles) changed over time? And does excluding intangible investment result in a distorted view of the dynamic changes in economic growth and productivity? The paper applies the CHS methodology to data for the market sector of the Australian economy to estimate the level and growth of investment in a range of intangibles. It also examines the direct contribution to conventionally-measured productivity growth of those intangibles not currently treated as investment.

Given the experimental nature of the methodology, the assumptions required, measurement challenges and data limitations, the estimates should be interpreted as only indicative. With this caveat, the paper finds that Australia has large and

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growing levels of investment in intangibles. Notably, the inclusion of intangibles investment largely flattens the declining trend in the ratio of investment to gross value added for the market sector, and is a growing share of total investment. Nevertheless, only a small amount of conventionally-measured multifactor productivity (MFP) growth in recent periods is accounted for by the direct contribution of services from intangible assets. And unlike the results for some other countries, accounting for intangibles does not have a large effect on the pattern of productivity growth in Australia.

## Measuring intangibles is not easy

‘Intangible assets’ have been variously defined but the common thread of the definitions is that these assets provide future benefits but do not have a physical embodiment. This lack of ‘visibility’ makes many intangibles difficult to measure. This is part of the reason for the treatment of many elements of spending on intangibles as current expenses, rather than investments, in conventional measures of output and productivity.

There are two main ways in which researchers have tried to quantify intangibles — financial market valuation (the difference between market values of firms and the value of tangible assets of firms) and direct expenditure-based measures of individual types of intangibles. CHS take the latter approach, defining and quantifying three main categories of intangibles (made up of a variety of specific intangibles).

- *Computerised information* is the knowledge embedded in computer programs and databases.
- *Innovative property* includes the relatively familiar scientific R&D (reflecting scientific knowledge embedded in patents, licences and general know-how) but is much broader — including non-scientific R&D or creative property (innovative and artistic content in commercial copyrights, licences and designs).
- *Economic competencies* include brand equity (for example, investment to retain or gain market share and investment in brand names), firm-specific human capital (employee skill building) and organisational capital (investments in strategic planning, adaptation and reorganisation).

The research used the CHS categorisation, to collate a range of data to create a set of experimental estimates for intangibles in Australia (box 1). For some intangibles, such as firm-specific human capital, it has been very difficult to construct reliable measures over time. It has also been necessary to make a number of assumptions based on limited available information. There is much scope for improvement and

refinement of the measures. However, these estimates provide a starting point and the first attempt (as far as can be ascertained) to apply the CHS methodology to measure the range of intangibles for Australia.

**Box 1 Measurement of intangibles**

CHS (2006) identified 3 main groups of intangibles, covering 13 individual intangibles. The measures and data sources used for the Australian estimates are listed below. The percentages of expenditure assumed to be investment are based on CHS (2006) — the extent to which some of these assumptions are somewhat arbitrary, given limited available evidence, is discussed in chapter 3 and appendix A.

<b>Type of intangible</b>	<b>Investment measure and main data source</b>
<b><i>Computerised information</i></b>	
Computer software; Computer databases	Investment from ABS national accounts
<b><i>Innovative property</i></b>	
Scientific R&D; Social sciences R&D (Business R&D)	Expenditure on R&D from ABS business R&D survey
Mineral exploration	Investment from ABS national accounts
Copyright and licence costs (Artistic originals)	Investment from ABS national accounts
Other product development, design and research	
New product development in financial industry	20 per cent of all intermediate purchases by Finance industry — from ABS supply-use tables
New architectural and engineering designs	50 per cent of sales of architectural and consulting engineering services — from ABS industry surveys
<b><i>Economic competencies</i></b>	
Brand equity	
Advertising	60 per cent of advertising expenditure — from advertising industry survey
Market research	60 per cent of sales of market research services (doubled to account for own-account research) — from ABS industry survey
Firm-specific human capital	Direct costs and wage costs of employee time in training — from ABS training surveys
Organisational capital	
Purchased	80 per cent of sales of management consulting services — from ABS industry survey
Own account	20 per cent of salaries of Managers & administrators — from ABS Labour Force Survey

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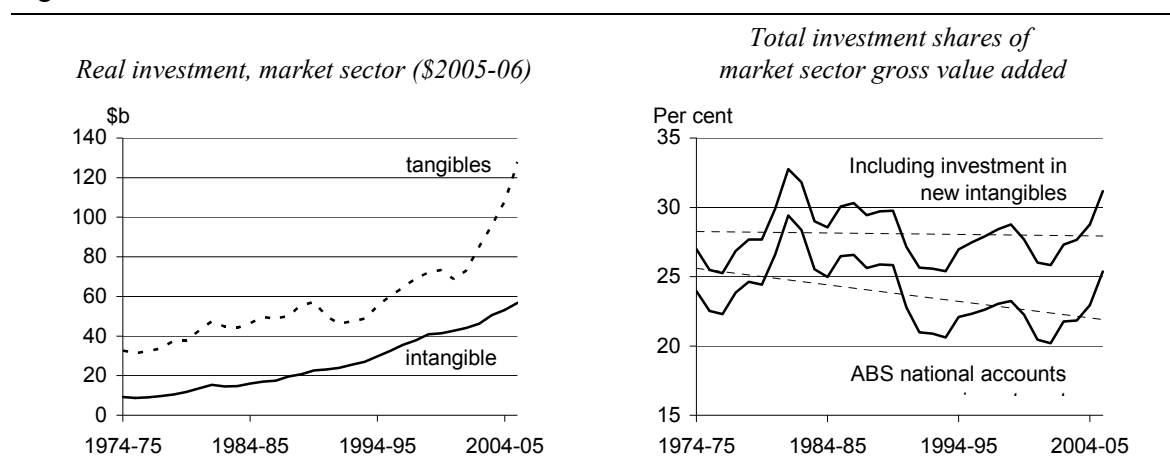
## Intangibles are a growing share of total investment

Australian market sector investment in intangibles is large and has grown considerably over time. In 2005-06, market sector nominal investment in intangibles is estimated to have been \$57 billion — almost half the size of investment in tangibles (figure 1). Since 1974-75 investment in intangibles as a percentage of market sector gross value added has doubled from about 5 per cent to 10 per cent (in nominal terms).

### Investment in intangibles ‘flattens’ the trend in investment

Including expenditure on ‘new’ intangibles (that is, those not currently treated as investment in the national accounts) within total investment largely flattens the declining trend in the market sector ratio of total investment to gross value added seen in the Australian national accounts (figure 1).

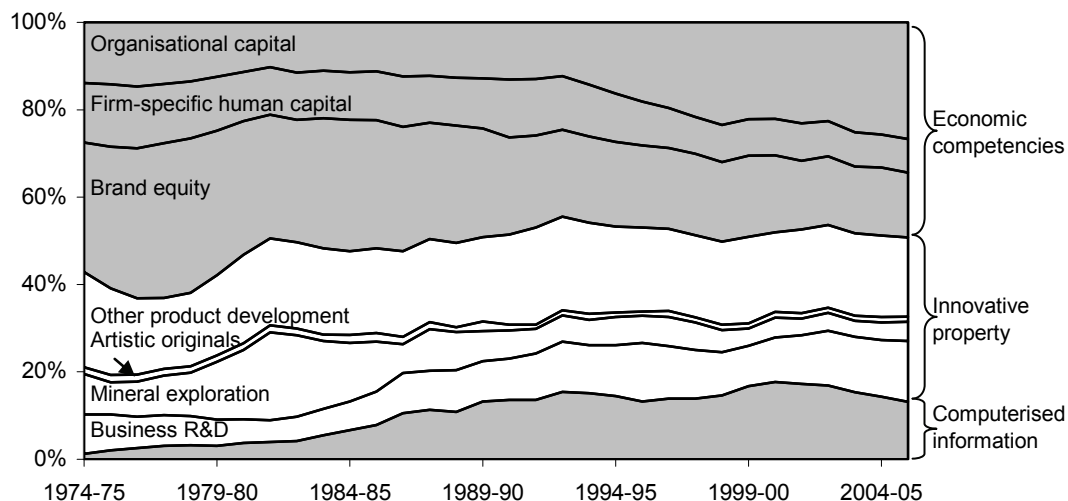
Figure 1 **Market sector investment**



### The composition of intangible investment is changing

Over the last thirty years, there has been a shift towards investment in organisational capital and computerised information (figure 2). In 2005-06, around 50 per cent of intangible investment was in economic competencies, 38 per cent in innovative property and 13 per cent in computerised information. Around 80 per cent of total intangible investment was in ‘new’ intangibles.

**Figure 2 Shares of nominal total intangible investment, by asset type**  
Per cent



### The intangible capital stock is growing

The intangible capital stock of the market sector has also grown considerably over the last thirty years (despite the assumption that intangibles are relatively short lived compared with most tangible assets).

In 2005-06, the nominal intangible capital stock is estimated to have been \$189 billion or around 17 per cent of the tangible capital stock.

- Of this, around 57 per cent was innovative property, 31 per cent economic competencies and 12 per cent computerised information. Seventy per cent of the intangibles stock was ‘new’ intangibles not already treated as capital in the national accounts.
- Some individual ‘new’ intangibles are now as large as more traditional intangibles — organisational capital is larger than computerised information and around the same size as each of mineral exploration and business R&D.

Growth in the real intangible capital stock is estimated to have averaged almost 5.5 per cent a year since 1974-75. In capital services terms, the flow of services from intangibles grew at an average of almost 6 per cent a year, around twice the rate for tangible capital services.

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## Box 2      **Standard growth accounting framework**

This paper uses the growth accounting (or sources of growth) framework, the theoretical foundations of which were first laid out in Solow (1957). This framework is an accounting exercise that breaks down output growth into input growth and attributes the residual to technological change. It examines *growth* in output rather than the *level* of output. It only accounts for the *direct* effect of inputs, not any indirect or spillover effects, such as from complementarities between different types of capital.

When output is measured as gross value added (total production less intermediate inputs), the growth accounting framework says that value added growth is equal to a weighted average of capital growth and labour growth plus a residual not explained by growth in combined inputs. The residual is commonly referred to as multifactor productivity (MFP) growth, rather than technological change.\* As MFP growth is calculated as the residual, it will not only include pure technological change but will also include the effect of any approximations in measurement of output and inputs and violations of underlying assumptions.

The assumptions of the growth accounting framework include:

- constant returns to scale in the underlying production function
- output markets are competitive
- inputs markets are competitive (that is, factor inputs are paid their marginal products)
- inputs are fully divisible
- inputs are fully utilised
- the economy is in long-run equilibrium.

In the ABS official estimates of MFP growth for Australia, output is measured as gross value added (total production less intermediate inputs). Whether expenditure on intangibles is treated as an intermediate input or as an investment will have an effect on both value added and the total capital input, affecting growth accounting estimates (see box 3).

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\*Growth accounting can also be done in terms of labour productivity growth (growth in output per hour worked) rather than output growth, in which case labour productivity growth is equal to income share weighted growth in the capital labour ratio (capital deepening) plus MFP growth.

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## Accounting for intangibles as investment affects the sources of measured growth

Ignoring intangible assets as a source of capital services can result in bias in the estimates of MFP growth. For example, a slowdown in MFP growth in the 1990s in the United Kingdom became an acceleration after adjusting for intangible investment (Marrano, Haskel and Wallis 2007). For the United States, an important part of the productivity acceleration since the mid-1990s has been attributed to intangible assets (CHS 2006). The second half of this paper uses growth accounting to estimate the effect of treating intangible assets as capital on Australian MFP measures.

### Growth accounting shows the direct contribution of inputs to output growth

Growth accounting is used to show what proportion of output growth is attributable to increases in labour and capital inputs, with the residual growth explained by other factors (such as technological progress). It is this residual that is considered a measure of MFP. Conventional growth accounting (box 2) treats expenditure on intangibles as current expenses, rather than as investments. This can result in biased measures of MFP (box 3).

#### Box 3 Growth accounting with intangibles treated as capital

Treating intangibles as capital within the growth accounting framework can have a number of effects on both the output and input sides of the accounting exercise, with a consequent effect on measured MFP growth as the residual that depends on the relative changes in output and input growth.

*Measured output* — treating expenditure on intangibles as an investment, instead of an intermediate input, increases the level of measured output (gross value added) by the amount of intangible investment. But the change in *growth* in measured total output depends on growth in investment in intangibles relative to growth in other outputs. For total output growth to be higher, growth in investment in intangibles must be higher than growth in other outputs.

*Measured capital inputs* — intangibles investment increases the level of the capital stock and the services from that capital stock. This is the direct effect and does not measure any indirect or spillover effects from that investment. But whether *growth* in total capital services is higher (lower) depends on whether intangible capital services is growing faster (slower) than tangible capital services.

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Box 3 (continued)

*Capital and labour shares of total inputs* — the increase in measured capital increases the capital *share* and decreases the labour *share* of total inputs, although the return to labour and volume of labour do not change. Combined input *growth* (the weighted average of capital growth and labour growth) will rise (fall) if capital growth is higher (lower) than labour growth.

*Measured MFP growth* — the effect on measured MFP growth can be positive or negative depending on the relative size of the effects on output and input growth, that is, the difference caused by intangible investment (part of output not previously measured) and by intangible capital inputs (the services of the stock of capital not previously measured). This effect on MFP growth depends not just on the relative growth rates of outputs and capital inputs, but also the combined input growth rate which changes as the capital and labour shares of total inputs change.

### The effect on productivity growth for Australia is small

Intangible assets *directly* account for a small but notable amount of conventionally-measured MFP growth for the Australian market sector. (This does not account for any *indirect* spillovers captured in MFP growth from, for example, complementarities between ICTs and particular types of intangible capital.)

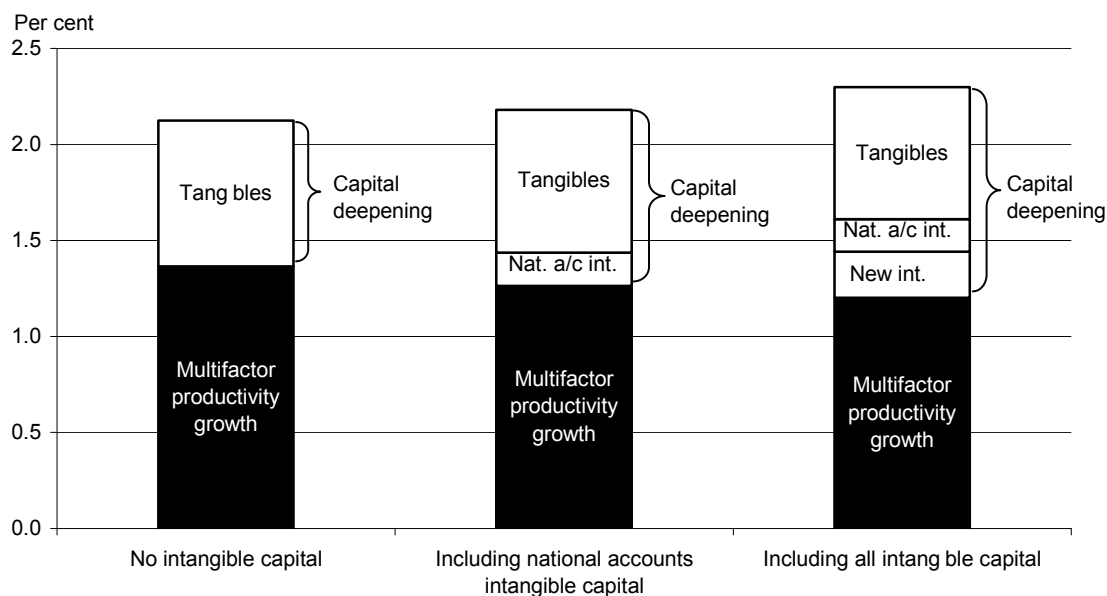
Growth accounting estimates for the Australian market sector are presented for three definitions of capital — including all intangibles, only the national accounts intangibles and no intangibles.<sup>1</sup> Labour productivity (LP) growth (growth in gross value added per hour worked in the market sector) is decomposed into the contributions of capital deepening and MFP growth (figure 3).

The effect of treating intangibles as capital is to raise measured labour productivity growth and to shift the relative importance of the sources of growth — towards capital deepening and away from MFP growth (the residual). When all intangibles are capitalised, on average they contribute 37 per cent of total capital deepening and 17 per cent of LP growth between 1974-75 and 2005-06.

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<sup>1</sup> The estimates in this paper for the ‘national accounts’ case are slightly different from the ABS official estimates due to differences in methodology necessitated by limited intangibles data. The national accounts case was re-estimated for comparability with the other estimates in this paper.

**Figure 3 Decomposition of average annual labour productivity growth, 1974-75 to 2005-06**  
Per cent per year



Compared with the case of no intangibles

- LP growth is 0.16 of a percentage point (or 8 per cent) higher
- capital deepening is 0.32 of a percentage point (or 41 per cent) higher
- MFP growth is 0.16 of a percentage point (or 12 per cent) lower (this is the amount of MFP growth under the no intangibles case that is actually attributable to unaccounted for intangible capital).

These results are based on experimental estimates for investment in intangibles and a range of assumptions related to the growth accounting parameters (such as depreciation rates and rates of return). However, sensitivity testing suggests that the finding that capitalising intangibles increases the importance of capital deepening relative to MFP growth as a source of growth is robust to a range of changes in the underlying estimates and assumptions within the reasonable bounds tested.

### **Accounting for the ‘new’ intangibles does not change the pattern of MFP growth in Australia**

Some intangibles (software, mineral exploration and artistic originals) are already capitalised in the ABS national accounts. Not capitalising the ‘new’ intangibles affects the national accounts estimates of MFP growth.

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- On average, 0.06 of a percentage point or 5 per cent of conventionally-measured annual average MFP growth is attributable to the new intangibles between 1974-75 and 2005-06.
  - However, looking at the MFP peak-to-peak periods (which control for influences of the business cycle), the amount attributable to new intangibles ranges from -1 per cent to 8 per cent of conventionally-measured MFP growth. In the most recent cycle, 1998-99 to 2003-04, it is 8 per cent (0.09 of a percentage point).

National accounts intangibles have a larger effect on MFP growth than the new intangibles. While the new intangibles have a larger effect than national accounts intangibles on capital deepening and LP growth, these are largely offsetting so the effect on MFP growth is limited.

Overall, capitalising the new intangibles does not change the length of the MFP growth cycles or the periods in which acceleration/deceleration occurs (although the extent of the change is affected). And only a small proportion of Australia's MFP growth is directly attributable to intangibles.

## **International comparisons**

Comparing measures across countries always raises issues of the extent to which the comparisons are legitimate. Even using measures based on the same methodology, as is the case in this paper, many differences remain because of variations in underlying data and data limitations. The extent to which differences between the estimates in this paper and those in the other country studies represent real differences rather than measurement differences is not known. Any real differences between countries should also be interpreted carefully. Country-specific circumstances will affect their appropriate level and type of intangible investment — the country with the highest ratio of intangibles to output should not be regarded as a benchmark. And the growth accounting approach does not provide information about the causal links between intangible investment and productivity growth.

### **Australian rates of investment in intangibles are mid-range**

Although it is not possible to draw strong conclusions from these international comparisons, there are a number of notable features about the estimates. Experimental estimates based on the CHS methodology suggest that Australia has a ratio of intangible investment to output that is around mid-range of the estimates for other countries (table 1). Australia has a lower ratio than Finland, the United States, the United Kingdom, France, Japan and Germany but a higher ratio than Canada, the Netherlands, Italy and Spain.

**Table 1 Intangible investment as a share of adjusted output**  
 Percentage of output (including intangible investment) for the sector for which intangibles were measured

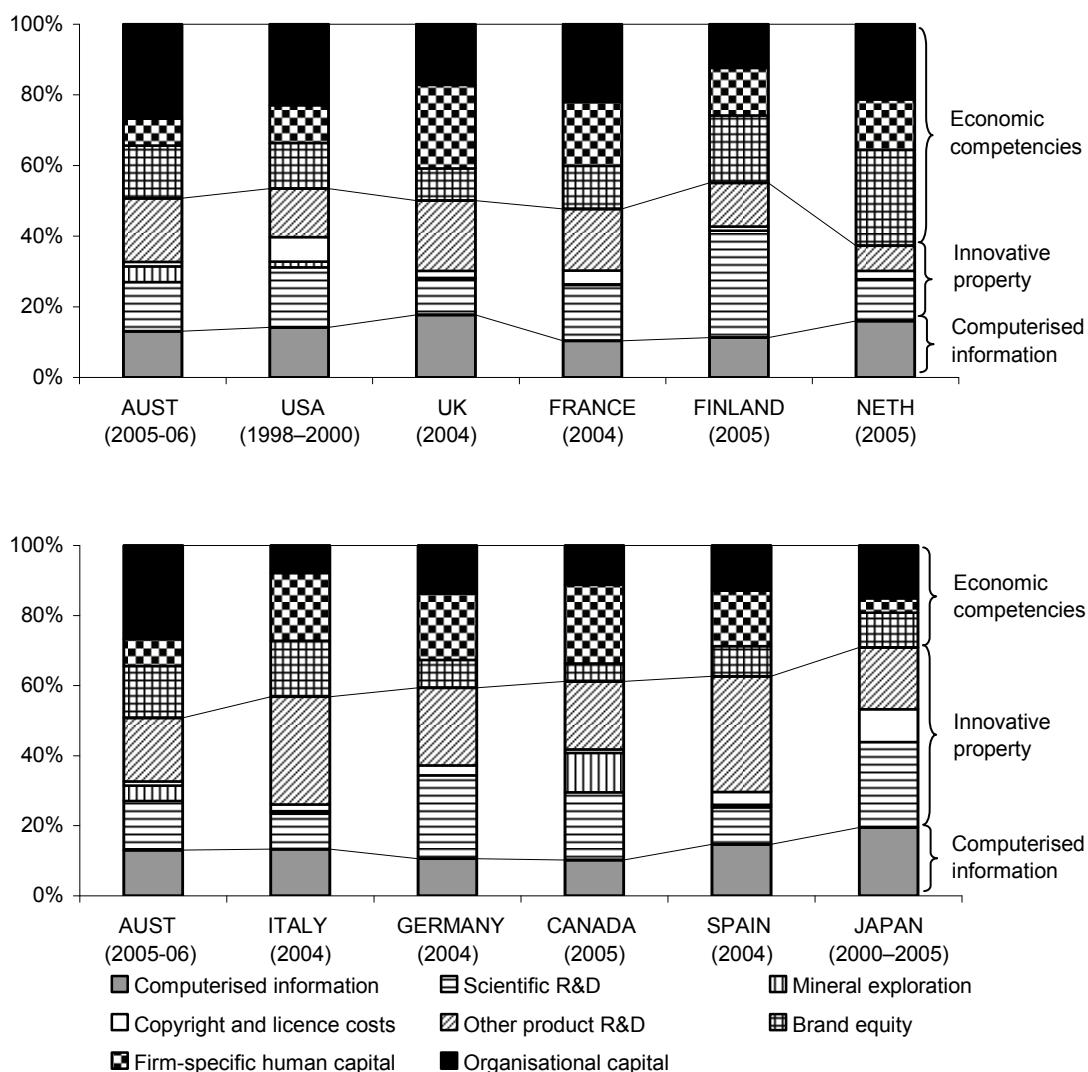
	<i>Australia</i> - market sector (2005-06)	<i>USA</i> - non-farm business (1998-00)	<i>UK</i> - market sector (2004)	<i>Japan</i> - total economy (2000-05)	<i>Neth.</i> - total economy (2005)	<i>Finland</i> - non-fin. business (2005)
Computerised information	1.3	2.0	2.3	2.0	1.3	1.6
Innovative property	3.6	5.3	4.2	5.4	1.7	6.4
Scientific R&D	1.3	2.3	1.3	2.6	0.9	4.3
Mineral exploration	0.4	0.2	0.0	0.0	0.0	0.0
Copyright and licence costs	0.1	0.9	0.3	1.0	0.2	0.2
Other product development, design and research	1.7	1.8	2.6	1.8	0.6	1.8
Economic competencies	4.7	6.2	6.5	3.1	4.9	6.6
Brand equity	1.4	1.7	1.2	1.0	2.2	2.7
Firm-specific human capital	0.7	1.4	3.1	0.4	1.1	1.9
Organisational capital	2.6	3.1	2.2	1.6	1.7	1.8
<b>Total</b>	<b>9.6</b>	<b>13.5</b>	<b>13.0</b>	<b>10.5</b>	<b>7.9</b>	<b>14.6</b>
Intangible to tangible investment ratio	0.44	1.2	1.1	0.6	0.5	1.2

	<i>Australia</i> - market sector (2005-06)	<i>France</i> - market sector (2004)	<i>Germany</i> - market sector (2004)	<i>Italy</i> - market sector (2004)	<i>Spain</i> - market sector (2004)	<i>Canada</i> - total economy (2005)
Computerised information	1.3	1.3	1.1	1.0	1.1	0.9
Innovative property	3.6	4.7	4.9	3.2	3.5	4.6
Scientific R&D	1.3	2.0	2.4	0.8	0.8	1.8
Mineral exploration	0.4	0.0	0.0	0.1	0.1	1.0
Copyright and licence costs	0.1	0.5	0.3	0.1	0.3	0.1
Other product development, design and research	1.7	2.2	2.2	2.3	2.4	1.8
Economic competencies	4.7	6.6	4.1	3.2	2.7	3.5
Brand equity	1.4	1.5	0.8	1.2	0.6	0.5
Firm-specific human capital	0.7	2.3	1.9	1.4	1.2	2.0
Organisational capital	2.6	2.8	1.4	0.6	0.9	1.0
<b>Total</b>	<b>9.6</b>	<b>12.6</b>	<b>10.1</b>	<b>7.4</b>	<b>7.3</b>	<b>9.1</b>
Intangible to tangible investment ratio	0.44	0.9	0.8	0.3	0.4	0.9

Australia has a very similar composition of intangible investment (in terms of the three main categories) to the United States and United Kingdom and France — with economic competencies the dominant type of intangible (figure 4). Actual levels of Australian investment are less in each of these categories of intangibles by similar amounts, rather than investment in any one type being relatively low.

**Figure 4 Composition of intangible investment**  
Percentage share



### Adjusting for intangibles affects the pattern of MFP for some other countries

The nature of the effect of capitalising intangibles in the growth accounting is the same across most countries for which estimates are available — an increase in LP growth and capital deepening and a decrease in MFP growth. However, the size of the effect varied across countries. For the period of the mid-1990s to the early 2000s, including all intangible capital (compared with the case of no intangible capital) lowered average annual MFP growth by 0.3 of a percentage point in the United States and Australia, 0.2 for France, and 0.1 for Germany, Finland (for new intangibles only) and the United Kingdom. The exceptions were the Netherlands

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and Italy, for which there was no change in MFP growth, and Japan and Spain, for which MFP growth rose after capitalising intangibles.

Treating intangibles as capital does not have a large effect on the pattern of growth over productivity cycles for Australia. This contrasts with the United Kingdom, for which a deceleration in MFP growth between the early and late 1990s cycles became an acceleration after capitalising intangibles (Marrano, Haskel and Wallis 2007). For the Netherlands, the reverse was found — an acceleration in average MFP growth between 1996–2000 and 2001–2005 became a deceleration after capitalising intangibles (van Rooijen-Horsten et al. 2008).

While this paper does not explore or provide any measures of the indirect effects, it does add to the scope for international comparisons of the size of intangibles with potential complementarities. Fukao et al. (2008b) note that differences in the accumulation of intangible assets that play a complementary role to ICT capital might explain differences in productivity growth — and the results for Japan, particularly in terms of lower organisational capital, provide some support to this as a potential explanation. It is also the case that Australia (like the United States) has higher levels of organisational capital and higher levels of productivity growth than Japan.

## Further research

Estimates in this paper are exploratory and, as is acknowledged by the authors of the other country studies, much work could be done to improve them. There are also alternative methodologies for the measurement of intangibles that could be explored. The development of improved measures (and data collections to support them), in conjunction with national statistics agencies, would be required before such intangibles could be considered for formal identification into the national accounts or even inclusion in a separate dataset focused on growth accounting.

However, beyond these direct measurement issues there is a range of other possible areas for further research.

- *Organisational capital.* The experimental estimates suggest that investment in organisational capital in Australia is now larger than business R&D, which the ABS intends to capitalise in the Australian national accounts. There are currently no plans to capitalise organisational capital — and this would be difficult since it is relatively poorly measured. However, the size of the estimates indicate that the measurement and effects of organisational capital (including complementarities with ICTs) warrant further investigation.

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- *Industry level estimates.* Intangibles are likely to be relatively more important in some industries than others. For example, a relatively high rate of intangible investment was found in the financial services industry in the Netherlands (van Rooijen-Horsten et al. 2008). For Japan, the services sector had a lower rate of intangible investment relative to the manufacturing sector (Fukao et al. 2008b). Subject to data limitations, estimates for selected Australian industries or sectors would enable a closer examination of the links between intangibles and growth.
  - *Econometric analysis of intangibles.* As the number of country studies using the CHS methodology increases it may be possible to undertake some econometric analysis of intangibles by pooling the data. This may enable the indirect spillovers from intangible assets to be examined.