6 International comparisons

This chapter examines the estimates of Australian intangibles in an international context. As noted in earlier chapters, the Corrado, Hulten and Sichel (CHS) methodology has also been used to measure intangible investment and its effect on productivity for the United States, the United Kingdom, Japan, Finland, the Netherlands, France, Germany, Italy and Spain, and intangible investment only for Canada.[1]

Estimates based on the same methodology provide a reasonable basis for making international comparisons. However, there are a few points to note about the comparisons in this chapter.

- National statistical systems differ from country to country and this affects comparability of the underlying data. (Differences in data sources are discussed in appendix A.)
- Although the basic methodology for measuring intangibles is quite similar, data limitations have led to some differences in its application across countries. (These are noted in the comparisons below.)
- The implementation of the growth accounting differs across countries. For example, the US and UK results use capital services indexes based on endogenous rates of return, while the results for the Netherlands are based on an exogenous rate of return. Results for Australia have been estimated using an endogenous rate of return with a exogenous floor rate of return (which in practice leads to an exogenous rate in the majority of years) and sensitivity tested using a purely endogenous rate.
- The proportion of the total economy for which intangibles is measured is different in each country — the market sector for Australia (62 per cent of the total economy); the market economy for France (65 per cent), Germany (70 per cent), Italy (72 per cent) and Spain (75 per cent); the non-financial business

[1] The United States in CHS (2005, 2006), the United Kingdom in Marrano and Haskel (MH 2006) and Marrano, Haskel and Wallis (MHW 2007), Japan in Fukao et al. (2007) and Fukao et al. (2008b), Finland in Jalava, Aulin-Ahmavaara and Alanen (JAA 2007), the Netherlands in van Rooijen-Horsten, van den Bergen and Tanriseven (RBT 2008) and van Rooijen-Horsten et al. (2008), France, Germany, Italy and Spain in Hao, Manole and van Ark (2008) and Canada in Belhocine (2008).

sector for Finland (72 per cent); the non-farm business sector for the United States (77 per cent); the market sector for the United Kingdom (89 per cent); and the whole economy for the Netherlands[2], Canada and Japan (100 per cent).[3] Data availability is one reason for this. The other reason is that the focus of the studies is on identifying the contribution of intangibles in measured MFP, and MFP is measured for different sectors of the economy in each country.

- The estimates do not cover the same time period for each country. This limits the comparability and the ability to examine differences between sub-periods.
- The periods for which data are available do not necessarily coincide with the peak-to-peak growth periods[4] that provide the most accurate view of growth.

There are also a number of other points to note about the interpretation of the international comparisons in this chapter.

- In addition to the differences in application of the methodology across countries, the limitations of the underlying methodology also mean that the relativities between countries are only indicative. (For example, the proportions of intangible expenditure that are treated as investment are assumed because of limited information and are uniform across countries.)
- Country-specific circumstances will affect the appropriate level and type of intangible investment for a particular country — the country with the highest ratio of intangibles to output should not be regarded as a benchmark. As with any other investment, it is allocative efficiency that counts for maximising its benefits for productivity and living standards. More is not necessarily better.
- The growth accounting approach does not provide information about the *causal* links between intangible investment and productivity growth.

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2 In some cases, data are available for the commercial sector as well as the total economy for the Netherlands. However, the estimates reported in van Rooijen-Horsten et al. (2008) for the commercial sector are less disaggregated by intangible type than those for the total economy. Therefore section 6.1 focuses on the total economy results, while the growth accounting results in section 6.2 are for the commercial sector.

3 Australian market sector share of gross value added (GVA) at basic prices in 2005-06 (ABS Cat. no. 5204.0); US non-farm business GVA as a share GDP in 1998–2000 (BEA 2008); UK market sector share of GVA at basic prices in 2004 (ONS 2006); Finnish non-financial business sector share of GVA at basic prices in 2005 (Statistics Finland 2008); and France, Germany, Italy and Spain market economy share of value added at basic prices in 2004 (EU KLEMS 2008). These shares are only indicative as they are measured on varying bases and use recent national accounts data — due to revisions this data may differ from that which underlies the intangibles estimates in the individual country studies.

4 Calculating productivity trends from 'peak to peak' is one way of overcoming the spurious influences of business cycles in estimates of productivity growth. Business cycles will affect the utilisation of existing capital stocks but because of insufficient information, productivity estimates are based on the assumption of constant utilisation of capital.

6.1 Intangible investment as a share of output

To compare the importance of intangible investment across countries, it is necessary to scale this investment to a common measure, for example, output. Intangible investment as a percentage of GDP was reported in each of the country studies and has therefore been estimated for Australia (table 6.1). Based on this measure, Australia has a relatively low proportion of intangible investment to output — about half that of the United States and Japan, 56 per cent of the United Kingdom, 60 per cent of Canada, 65 per cent of Finland, 70 per cent of the Netherlands[5], 71 per cent of France and 83 per cent of Germany. Australia has a higher proportion than Spain and Italy (by 13 per cent).

This provides one perspective on the relativities between countries. However, it is distorted to some extent because, as noted above, the proportion of the total economy for which investment has been measured differs across countries. An alternative perspective is to consider intangible investment as a percentage of output of the sector for which the investment is estimated — that is, intangible investment as a percentage of the output it is used to produce. From this perspective, Australia's relative position rises.

Table 6.2 shows intangible investment as a share of the adjusted output (including investment in intangibles) of the sector for which intangibles are measured[6] — the market sector for Australia, the United Kingdom, France, Germany, Italy and Spain, non-farm business sector for the United States, the non-financial business sector for Finland, and the total economy for Japan, the Netherlands and Canada. The intangible investment share for Australia increases to 66 per cent of that for Finland, 71 per cent of the United States, 74 per cent of the United Kingdom, 76 per cent of France, 91 per cent of Japan, and 95 per cent of Germany. Australia also has a higher share than Canada (by 5 per cent), the Netherlands (by 22 per cent)[7], Italy (by 30 per cent) and Spain (by 32 per cent).

5 This percentage rises to 82 per cent if the results for the commercial sector of the Netherlands are used for comparison.

6 Estimates have been derived using a number of sources with some variation in measures remaining (see notes to table 6.2) and may therefore be only indicative.

7 This percentage falls to 3 per cent higher if the result for the commercial sector of the Netherlands is used for comparison.

Table 6.1 **Intangible investment as a share of GDP, by country**

Percentage of existing GDP

	Australia - market sector (2005-06)	*USA - non-farm business (1998–00)*	*UK - market sector (2004)*	*Japan - total economy (2000–05)*	*Netherlands[a] - total economy [commercial] (2005)*	*Finland - non-fin. business (2005)*	*France - market sector (2004)*	*Germany - market sector (2004)*	*Italy - market sector (2004)*	*Spain - market sector (2004)*	*Canada - total economy (2005)*
Computerised information	0.8	1.7	1.9	2.2	1.4 [1.2]	1.0	0.9	0.8	0.7	0.8	1.0
Innovative property	2.2	4.6	3.4	5.9	1.8 [1.4]	4.0	3.1	3.5	2.3	2.5	5.0
Scientific R&D[b]	0.8	2.0	1.1	2.8	1.0	2.7	1.3	1.7	0.5	0.6	1.9
Mineral exploration	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
Copyright and licence costs	0.1	0.8	0.2	1.1	0.2	0.1	0.3	0.2	0.1	0.2	0.1
Other product development, design and research	1.1	1.6	2.1	2.0[c]	0.6[d]	1.1[e]	1.5	1.6	1.6	1.7	1.9
Economic competencies	2.9	5.4	5.2	3.4	5.2 [4.6]	4.1	4.4	2.9	2.2	2.0	3.8
Brand equity	0.9	1.5	1.0	1.1	2.3	1.7	1.0	0.6	0.8	0.4	0.5
Firm-specific human capital	0.4	1.2	2.5	0.5[c]	1.2	1.2	1.5	1.3	1.0	0.8	2.2
Organisational capital[f]	1.6	2.7	1.8	1.7[c]	1.8	1.1	1.8	1.0	0.4	0.7	1.1
Total	**5.9**	**11.7**	**10.5**	**11.5**	**8.4 [7.2]**	**9.1**	**8.3**	**7.1**	**5.2**	**5.2**	**9.8**

Components may not add to total due to rounding. [a] Results for the Netherlands are available for the total economy and the commercial sector, although the data for the latter are less disaggregated. [b] Includes R&D in social sciences for Australia, Finland, the Netherlands, France, Germany, Italy and Spain. R&D in social sciences is included in Other product development, design and research for the USA, UK, Japan and Canada. [c] Fukao et al. (2008b, p. 14) note that this is likely to be an underestimation due to lack of reliable data. [d] Includes a narrower scope of financial services R&D. [e] Relates to the non-financial business sector so does not include financial services R&D. [f] Differences in scope and data sources across countries (see table A.3).

Sources: UK from MHW (2007) and MH (2006); USA from CHS (2005, table 3; 2006, table 1); Japan from Fukao et al. (2008b, tables 2, 4); Finland from JAA (2007, table 2); Netherlands from van Rooijen-Horsten et al. (2008, tables A2, A4); Canada from Belhocine (2008, table 1); France, Germany, Italy and Spain from Hao, Manole and van Ark (2008, table 1); authors' estimates for Australia.

Table 6.2 **Intangible investment as a share of adjusted output, by country**

Percentage of adjusted output[a]

	Australia - market sector (2005-06)	*USA - non-farm business (1998–00)*	*UK - market sector (2004)*	*Japan - total economy (2000–05)*	*Netherlands[b] - total economy [commercial] (2005)*	*Finland - non-fin. business (2005)*	*France - market sector (2004)*	*Germany - market sector (2004)*	*Italy - market sector (2004)*	*Spain - market sector (2004)*	*Canada - total economy (2005)*
Computerised information	1.3	2.0	2.3	2.0	1.3 [1.6]	1.6	1.3	1.1	1.0	1.1	0.9
Innovative property	3.6	5.3	4.2	5.4	1.7 [1.8]	6.4	4.7	4.9	3.2	3.5	4.6
Scientific R&D[c]	1.3	2.3	1.3	2.6	0.9	4.3	2.0	2.4	0.8	0.8	1.8
Mineral exploration	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.0
Copyright and licence costs	0.1	0.9	0.3	1.0	0.2	0.2	0.5	0.3	0.1	0.3	0.1
Other product development, design and research[c]	1.7	1.8	2.6	1.8	0.6	1.8	2.2	2.2	2.3	2.4	1.8
Economic competencies	4.7	6.2	6.5	3.1	4.9 [6.0]	6.6	6.6	4.1	3.2	2.7	3.5
Brand equity	1.4	1.7	1.2	1.0	2.2	2.7	1.5	0.8	1.2	0.6	0.5
Firm-specific human capital	0.7	1.4	3.1	0.4	1.1	1.9	2.3	1.9	1.4	1.2	2.0
Organisational capital[c]	2.6	3.1	2.2	1.6	1.7	1.8	2.8	1.4	0.6	0.9	1.0
Total	**9.6**	**13.5**	**13.0**	**10.5**	**7.9 [9.3]**	**14.6**	**12.6**	**10.1**	**7.4**	**7.3**	**9.1**
Intangible to tangible investment ratio	0.44	1.2	1.1	0.6	0.5 [1.0]	1.2	0.9	0.8	0.3	0.4	0.9

Components may not add to total due to rounding. [a] Percentages from table 6.1 scaled by reported ratios of total investment in intangibles to relevant output adjusted to include intangibles not already included in output: adjusted non-farm business sector output for USA (CHS 2006, fig. 2); adjusted market sector GVA for UK (MHW 2007, p. 11); adjusted non-financial business sector GVA for Finland (JAA 2007, p. 12); adjusted total economy VA for Japan (Fukao et al. 2008b, tbl. 2). Where adjusted ratios not reported, derived using data from additional sources: adjusted GDP and adjusted commercial sector VA for the Netherlands (derived from value of intangible investments on pp. 27 and tables A2; and percentage of unrevised GDP in tables A3 and A4 of van Rooijen-Horsten et al. 2008); adjusted market economy VA for France, Germany, Italy and Spain (derived from market economy VA at basic prices from EU KLEMS 2008 and value of intangible investment from Hao, Manole and van Ark 2008, tbl. 2); and adjusted total economy GDP (derived from percentage of unadjusted GDP in Belhocine 2008, tbl. 1 and value of GDP from Statistics Canada 2008). The Australian estimate is total intangible investment as percentage of adjusted market sector GVA (market sector GVA at basic prices plus investment in new intangibles). [b] Results for the Netherlands are available for the total economy and the commercial sector, although the data for the latter are less disaggregated. [c] Comparisons affected by lack of data for some intangibles or differences in scope. See notes to table 6.1 and table A.3.

Sources: Derived from MHW (2007) and MH (2006); CHS (2006); Fukao et al. (2008b); JAA (2007); van Rooijen-Horsten et al. (2008); Belhocine (2008); Hao, Manole and van Ark (2008); authors' estimates for Australia.

The ratio of intangible investment to tangible investment is around one for the United States, the United Kingdom, Canada, Finland, France and Germany but is around 0.5 for Japan, the Netherlands[8], Italy, Spain and Australia. Fukao et al. (2008b) note that while this ratio is low for Japan, intangible investment as a share of GDP in Japan is not that far behind the United States. The lower ratio is attributed to considerably higher tangible investment in Japan, which has been explained as a consequence of their financial system.

> In Japan, financial institutions such as banks play a major role in the provision of corporate funds and they typically require tangible assets as collateral to provide financing. As a result, Japanese firms have preferred to accumulate tangible assets which can be used as collateral. In addition, small firms have been hampered in their growth because they often possess insufficient tangible assets to increase borrowing. These mechanisms as a result of Japan's financial system are likely to be important reasons why the ratio of intangible to tangible investment is low in Japan. (p. 7)

Australia's lower ratio reflects both a lower rate of intangible investment *and* a relatively high rate of tangible investment to output (26 per cent). For example, the rate of tangible investment was lower in Japan and Italy (22 per cent); Netherlands and Finland (20 per cent); United States and Germany (18 per cent); and United Kingdom (17 per cent).[9]

There are remaining distortions in the international comparability of these estimates related to industry coverage and measurement issues for specific intangibles (see appendix A for details). The studies do not measure intangibles for the same group of industries in each case. If the rates of investment in intangibles differ across industries, the average rate will be affected by the differences in industry coverage across countries. And differences in the scope of the measures for individual intangibles, particularly computerised information, R&D in social sciences, other product development and purchased organisational capital, may partly explain differences between the rates of intangible investment in Australia compared with other countries. It has not been possible to determine the extent of any relative underestimation or overestimation.[10]

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8 This is for the total Netherlands economy — for the commercial sector the ratio rises to one.

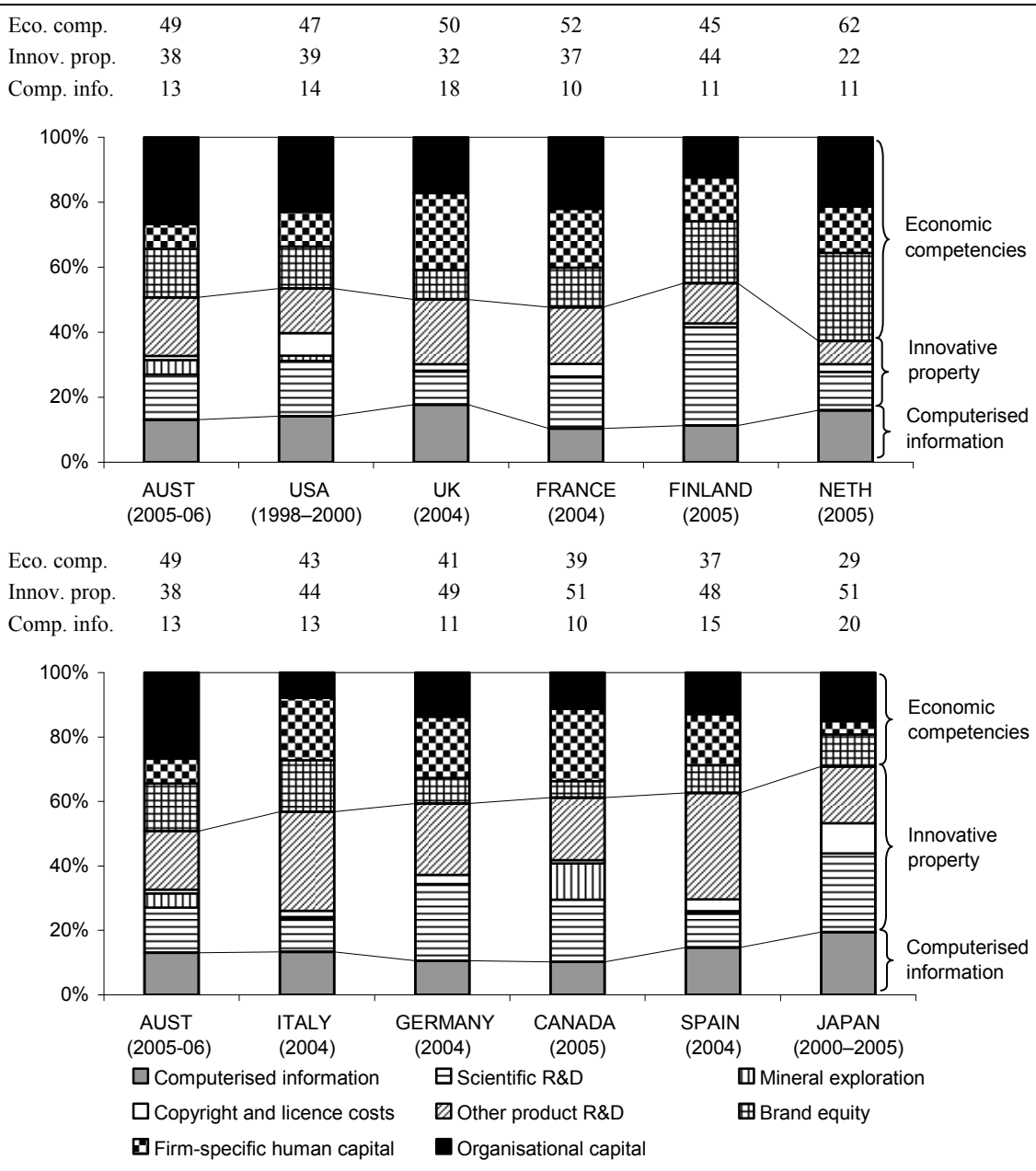
9 Gross fixed capital formation excluding software for the total economy as a share of total value added (at basic prices) (EU KLEMS 2008) for the years in table 6.2. Equivalent data for Canada and Spain are not available from the EU KLEMS database.

10 The estimates for some of the other countries do not include the same coverage of intangibles (see notes to table 6.1 and appendix A). Sensitivity testing of the Australian results to the size of investment in particular intangibles is reported in appendix D.

While the overall rate of intangible investment differs considerably across countries, there is less variation in the composition of that investment (figure 6.1). On the basis of the broad types of intangibles (computerised information, innovative property and economic competencies) the United States, United Kingdom, France and Australia are fairly similar.

Figure 6.1 **Composition of intangible investment, by country**

Percentage share



a Organisational capital and firm-specific human capital for the United States have been derived from information in CHS (2005, 2006). **b** Total economy, not commercial sector, estimates for the Netherlands.

Data sources: CHS (2005, 2006); Fukao et al. (2008b); MH (2006), MHW (2007); JAA (2007); van Rooijen-Horsten et al. (2008); Hao, Manole and van Ark (2008); Belhocine (2008); authors' estimates.

- Australia has a very similar composition of intangible investment to the United States in terms of the three main categories of intangibles.
  - Australia's lower rate of investment in intangibles relative to the United States reflects a lower rate in each of the main groups of intangibles, rather than a concentration of investment in any one of these groups.
- The United Kingdom is also fairly similar but with a lower proportion in innovative property than the United States.
  - The UK's lower rate of investment in total intangibles relative to the United States is virtually all attributable to a lower rate of investment in innovative property.
- By comparison, the other countries have quite different compositions of investment to Australia.
  - For most of these countries, investment is more heavily concentrated in innovative property and less concentrated in economic competencies than Australia. The exception is the Netherlands for which the opposite is the case — with the highest share in economic competencies and the lowest share in innovative property.

At a more disaggregated level of intangibles there is more variation in composition.

- Within innovative property, there is considerable variation in the investment shares of most individual intangibles.
  - The scientific R&D investment share ranges from 10 per cent (United Kingdom and Italy) to 30 per cent (Finland) — Australia is mid-range (15 per cent), along with the United States and France.[11]
  - Mineral exploration is negligible for most countries — for Australia the share is 4 per cent, putting it between the United States (2 per cent) and Canada (11 per cent).
  - Copyright costs are around 2-3 per cent for most countries — the exceptions are Japan (9 per cent) and the United States (7 per cent).
  - The other product development share ranges from 7 per cent (Netherlands) to 33 per cent (Spain) — Australia is mid-range (18 per cent), along with most of the other countries.

[11] This comparison is affected by scientific R&D also including R&D in social sciences, except in the case of the United States, United Kingdom, Japan and Canada (where it is included in other product development). This measure of scientific R&D for each country also takes no account of any spillovers from R&D done in other countries.

- It is a similarly varied picture for economic competencies.
  - The brand equity share of total intangible investment ranges from 5 per cent (Canada) to 28 per cent (Netherlands) — Australia lies mid-range at 15 per cent.
  - For firm-specific human capital the range is 4 per cent (Japan) to 24 per cent (United Kingdom). For Australia it is 8 per cent, with the United States at around 10 per cent. Fukao et al. (2008b) suggest that Japan's particularly low share is partly due to the CHS method not including on-the-job training, which is often utilised in Japan.[12]
  - Australia has the highest organisational capital share (27 per cent), while the United States, the Netherlands and France have shares around 20 per cent. The United Kingdom[13], Japan and Germany have a share of around 15 per cent, just ahead of Canada, Finland and Spain (around 12 per cent). Italy has the lowest share (8 per cent). However, there is considerable variation across countries in the data sources used to measure organisational capital.

Some of the differences in composition between Australia and the other countries are to be expected or are already documented.

- Differences in industrial composition will lead to different types of intangible investment.
  - For example, the mining industry is a larger share of GDP in Australia than in most of the other countries.[14] Therefore Australia might be expected to have a higher share of its intangible investment in mineral exploration.
- Differences in business expenditure on R&D (BERD) between countries are already documented (see, for example, PC 2007), with Finland, Japan, the United States, Germany, France and Canada having a higher rate of investment in BERD than Australia and the United Kingdom.[15]

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12 Fukao et al. (2008b, p. 11) cite a 2007 survey estimating that Japanese workers spend about 9.9 per cent of their time on on-the-job training.

13 MH (2006, p. 13) note this is consistent with the UK's poorer investment (compared with the United States) in organisational capital suggested by micro-comparisons of management and findings of higher firm-specific training based on other datasets.

14 Mining value added averaged 1 per cent of US GDP over the period 1998 to 2000 (BEA 2008). The comparable figure for Australia for 2005-06 was 7 per cent (and around 4 per cent in 1998-2000). In 2005, the equivalent measure was 2.3 per cent in the UK, 3 per cent in the Netherlands, 0.3 per cent in Finland and 0.1 per cent in Japan (EU KLEMS 2008). In Canada, mining was 5 per cent of GDP at basic prices in 2005 (Statistics Canada 2007).

15 In 2002, BERD intensity (business expenditure on R&D as a percentage of total value added) was 0.8 per cent in Italy and Spain, 1.2 per cent in Australia, 1.5 per cent in the Netherlands and 1.8 per cent in the United Kingdom compared with 3.6 per cent in Finland, 3.0 per cent in Japan, 2.6 per cent in the United States and Germany, 2.2 per cent in France and 1.6 per cent in Canada

- Differences in the level of executive remuneration between countries will affect own account organisational capital.
  - Fukao et al. (2008b) found that remuneration of Japanese executives is lower than in the United States. Australian managers are also paid less on average than those in the United States.[16]

Growth in investment

Figure 6.2 shows the growth in investment in intangibles relative to output (and the composition of that growth) by country.[17] These are cumulative charts so that the top line shows the share of total intangible investment in output. The gap between the lines is the share of each category of investment (in these figures mineral exploration is included in Scientific R&D). The total line shows the rising importance of nominal intangible investment in each case. In general, brand equity has been relatively constant, while computerised information and firm-specific resources (firm-specific human capital plus organisational capital) have shown the most marked increases. The exceptions are Finland and Japan, where scientific R&D has increased its share more than firm-specific resources, and Canada, where all shares have been relatively constant (for a relatively short period for which data are available).

The rate of growth of intangible investment relative to output has varied over time and across countries. However, most countries had a period of relatively high growth in the latter half of the 1980s and the latter half of the 1990s.

In the latter half of the 1980s, firm-specific resources and computerised information were the main contributors to growth in this ratio in the United Kingdom and the United States. Non-scientific R&D and computerised information were the largest contributors in Japan. This was also the case in Australia in the first half of the 1980s (a period of higher growth for Australia than the latter half of the 1980s). This period was also the one of highest growth in the 1980s in Finland — with scientific R&D contributing around half of total growth.

(PC 2007, p. 575). (The first group of countries is that with a relatively low share of intangible investment in scientific R&D compared with the second group of countries.) These differences have also been attributed, in part, to differences in industry structure (see PC 2007, appendix C).

16 For example, average annual earnings for Managers and administrators in Australia was A$67 704 in 2006 (ABS Cat. no. 6310.0) compared with Management occupation annual earnings of A$121 347 for the United States (US$91 930 from BLS 2008 at an average exchange rate of US$0.757 to A$1).

17 Equivalent time series for France, Germany, Italy and Spain were not reported in Hao, Manole and van Ark (2008).

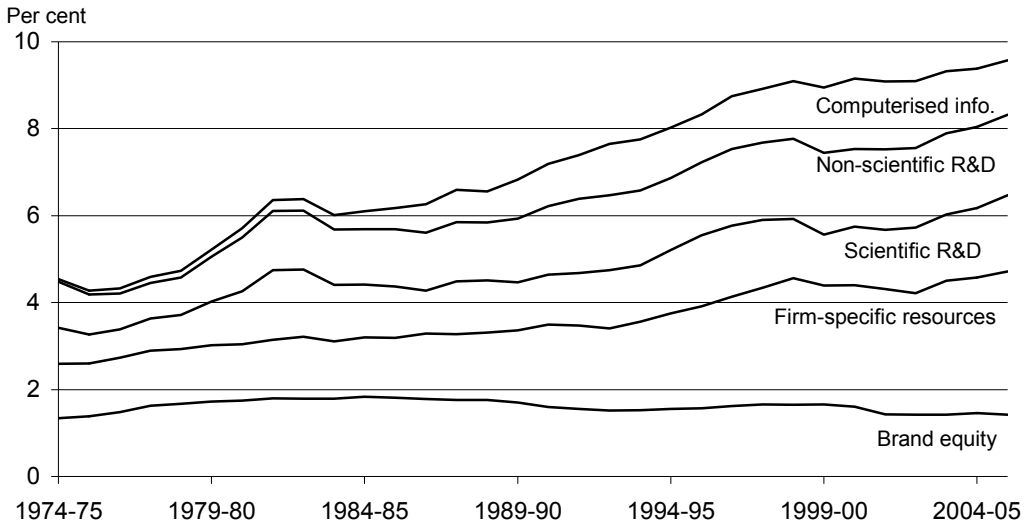
In the latter half of the 1990s, firm-specific resources and computerised software were again the main contributors to growth in the ratio of intangible investment to output in the United Kingdom and the United States. These intangibles were also the largest contributors in the Netherlands. Finland was an exception, with scientific R&D accounting for around two-thirds of growth. For Australia, the first half of the 1990s was a higher growth period than the second half, with firm-specific resources contributing almost half of this growth.

Hao, Manole and van Ark (2008, pp. 6–7) examined France, Germany, Italy and Spain between 1991 and 2004. The share of intangible investment in GDP was relatively stable in Germany and France, while it grew faster in Spain and Italy (from a lower base). The growth in Italy was across the three main categories of intangible, with little change in the composition of intangible investment. For Spain, the growth was in computerised information and innovative property, with the share of economic competencies falling. The share of economic competencies also fell in France and Germany, with growth in the share of investment in computerised information in France and Germany and in innovative property in Germany.

Figure 6.2 **Intangible investment shares of output[a], by country**

Per cent

Australian investment in intangibles as a share of adjusted market sector gross value added



United Kingdom investment in intangibles as a share of adjusted market sector gross value added

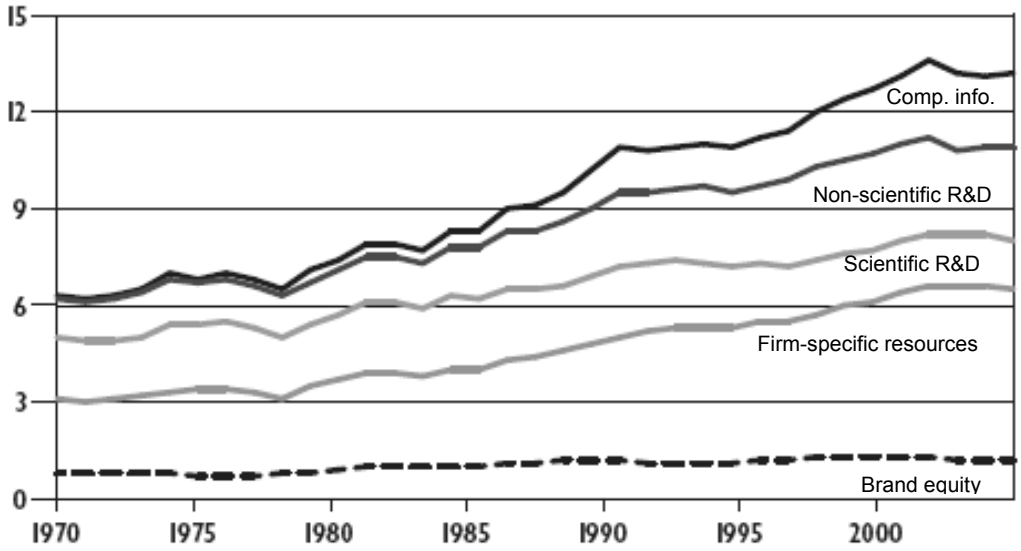


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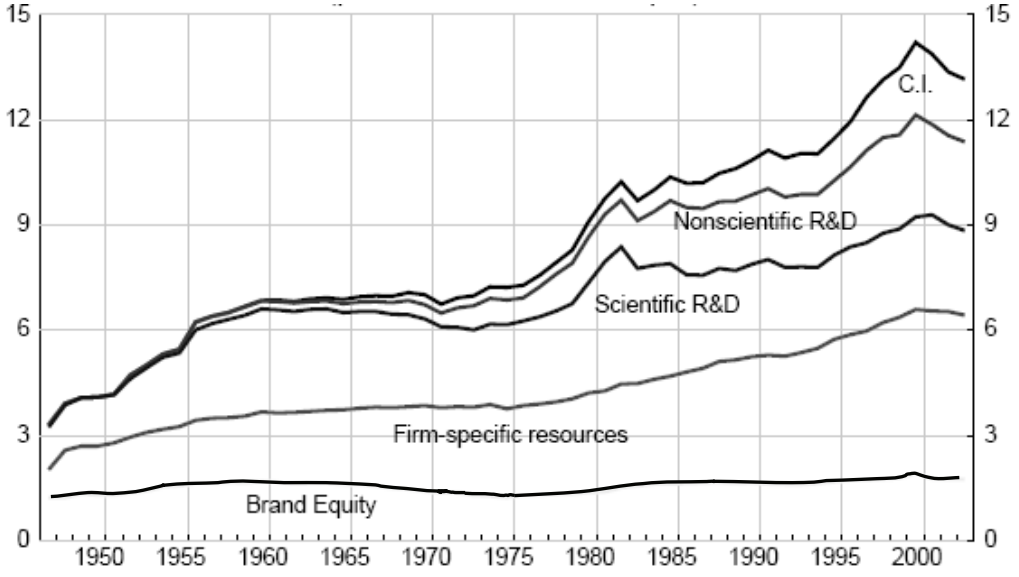
Figure 6.2 **(continued)**

United States investment in intangibles as a share of adjusted non-farm output



Note: C.I. = Computerized information

Finnish investment in intangibles as a share of adjusted business gross value added

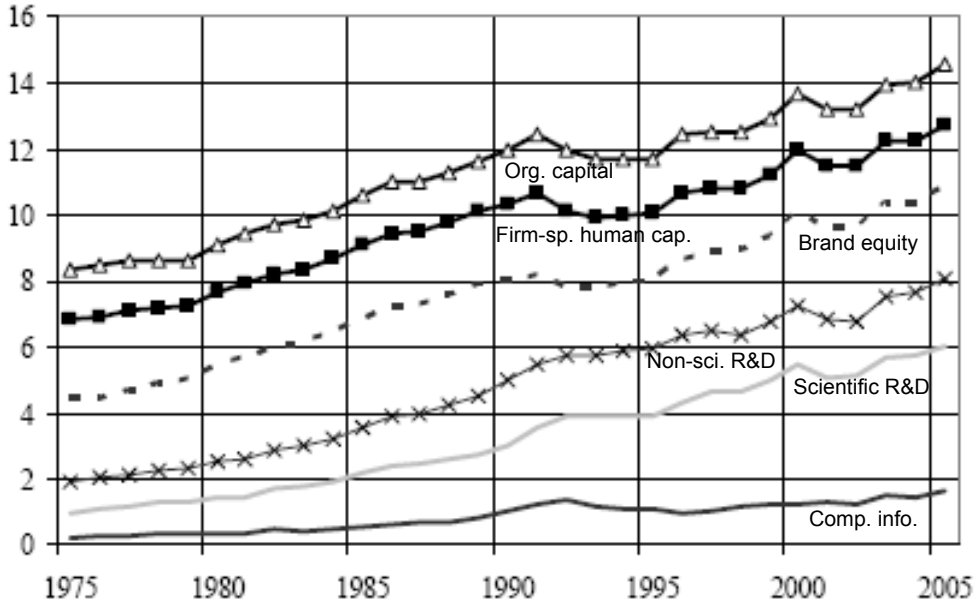


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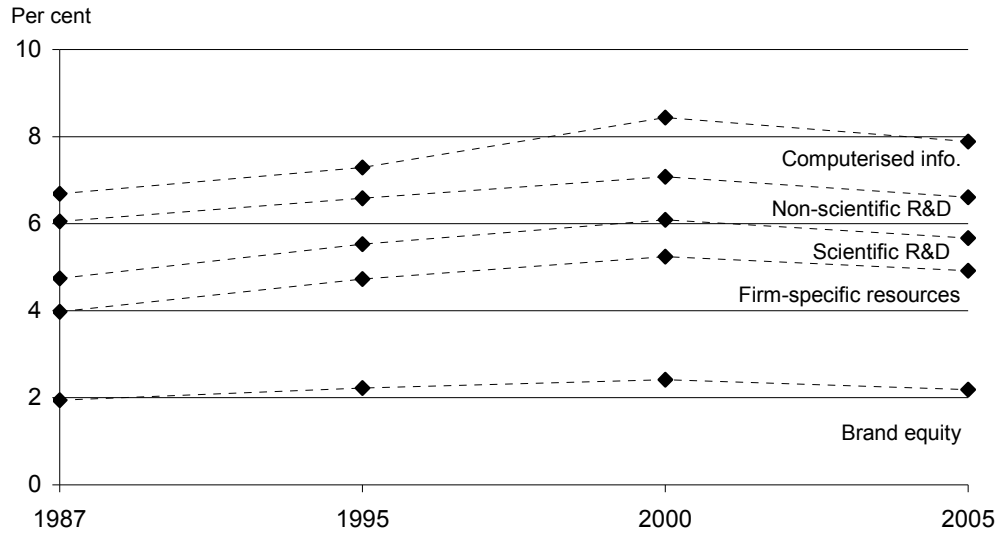
Figure 6.2 **(continued)**

Netherlands investment in intangibles as a share of adjusted GDP



Japanese investment in intangibles as a share of unadjusted value added[b]

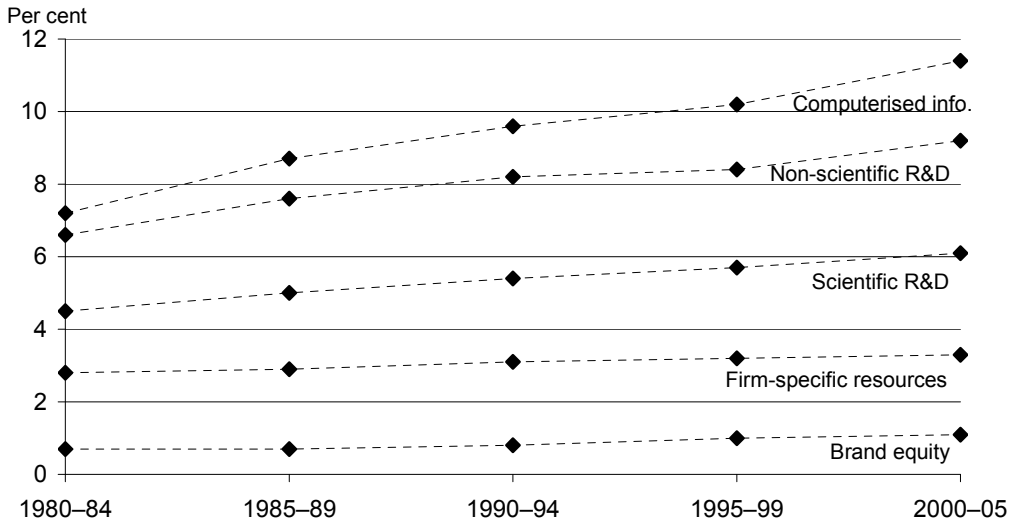


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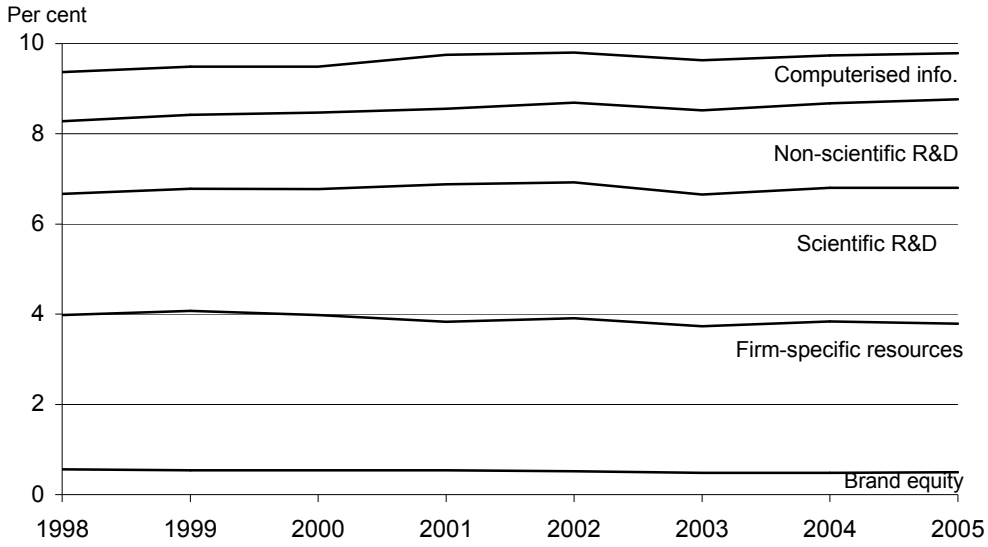
Figure 6.2 **(continued)**

Canadian investment in intangibles as a share of unadjusted GDP[c]



[a] Investment for sector of the economy listed in table 6.1 (total economy not commercial sector for the Netherlands). Output differs across countries: adjusted market sector gross value added (market sector GVA at basic prices plus market sector investment in new intangibles) for Australia; adjusted market sector GVA for United Kingdom; adjusted non-farm business output for the United States; adjusted business GVA for Finland; adjusted GDP for the Netherlands; unadjusted VA for the total economy for Japan; and unadjusted GDP for Canada. Mineral exploration is included in Scientific R&D for all countries. It also includes R&D in social sciences for Australia, Finland, the Netherlands, France, Germany, Italy and Spain. [b] Japanese estimates are based on the share of unadjusted VA and will therefore be larger than if calculated using adjusted VA (which includes intangible investment), as used for the other countries. Data are averages for five periods. [c] Canadian estimates are based on the share of unadjusted GDP and will therefore be larger than if calculated using adjusted GDP (which includes intangible investment), as used for the other countries.

Sources: Data sources are authors' estimates for Australia; derived from van Rooijen-Horsten et al. (2008, table A2) for the Netherlands; derived from Fukao et al. (2008b, table 4) for Japan; and derived from Belhocine (2008, table 1) for Canada. Figures are reproduced (with additional labels added) from Corrado, Hulten and Sichel (2006, figure 2) for the United States; Giorgio Marrano, Haskel and Wallis (2007, chart 3.1) for the United Kingdom; and JAA (2007, figure 4) for Finland.

6.2 Growth accounting results compared

As noted above, the periods for which data are available differ across countries. For this reason, only a single period is discussed in this section — the mid-1990s to the early 2000s. Estimates for this period are available from all the country studies that have identified intangibles in growth accounting analysis.[18] The MFP growth

[18] For the Netherlands the full decomposition of labour productivity growth is not available, but MFP growth results are reported for the commercial sector. Growth accounting results for earlier periods are reported in the country studies for the United States, the United Kingdom and Japan. Results for later periods are reported in the country studies for Japan, the Netherlands, Finland, France, Germany, Italy and Spain.

estimates presented in this chapter have been adjusted for labour composition change for all countries except the Netherlands.

It should also be noted that the results for Australia presented in this chapter are for a different time period to those in chapter 5. The series has been truncated to 2003 to match the majority of other countries. The period 1994-95 to 2002-03 is not a peak-to-peak period for Australia and may be affected by the influences of business cycles. This caveat also applies to the periods reported from the other country studies.[19]

Comparison of the importance of intangibles

Intangibles capital deepening, and capital deepening in total, made a relatively small contribution to Australian labour productivity (LP) growth compared with most of the other countries — the largest contribution was from multifactor productivity (MFP) growth (table 6.3).

- The contribution of intangibles capital deepening to LP growth was 5-10 percentage points lower in Australia than most of the other countries.
  - The contribution in Finland (16 per cent) was lower than Australia (19 per cent). Most of the other countries had a contribution in the range of 20-27 per cent. For Spain it was 38 per cent, while for Italy intangible capital deepening was greater than LP growth (which was negative).

19 The closest peaks for Australia are 1993-94 and 2004-05. The MFP index for 1994-95 is higher than 1993-94 and 2002-03 is slightly lower than 2003-04. So while not ideal the periods examined are at least not distorted by being peak to trough. JAA (2007, p. 14) note that the Finnish data for 1995–2000 are affected by the cyclical effects from exiting the early 1990s recession. For the United States, the cycle period is 1995–2003 (Dolman, Parham and Zheng 2007, p. 63). MHW (2007, p. 23) note that for the United Kingdom 1990–2000 is a full peak-to-peak cycle period (Kneller and Young 2001). Fukao et al. (2003) note that Japan's official business cycle peaks are May 1997 and October 2000.

Table 6.3 **Productivity growth after accounting for all intangibles[a], by country**

Per cent per year (percentage contribution to LP growth)

	Australia	*USA*	*UK*	*Neth.*	*Finland*	*Japan*	*France*	*Germany*	*Italy*	*Spain*
	1994-95 –2002-03	*1995 –2003*	*1995 –2003*	*1996 –2000*	*1995 –2003*	*1995 –2000*	*1995 –2003*	*1995 –2003*	*1995 –2003*	*1995 –2003*
	Including all intangible assets[b]									
Labour productivity growth	3.01	3.09	2.93		4.12	1.78	2.34	2.07	-0.10	0.16
	(100)	(100)	(100)		(100)	(100)	(100)	(100)	(100)	(100)
Decomposition:										
Capital deepening	1.36	1.68	2.14		0.13	1.34	1.19	1.42	0.64	0.58
	(45)	(54)	(73)		(3)	(75)	(51)	(69)	(-640)	(363)
Tangible	0.81	0.85	1.54		-0.51	0.86	0.64	0.97	0.45	0.52
	(27)	(28)	(53)		(-12)	(48)	(27)	(47)	(-450)	(325)
Intangible[c]	0.57	0.84	0.60		0.64	0.48	0.55	0.45	0.19	0.06
	(19)	(27)	(20)		(16)	(27)	(24)	(22)	(-190)	(38)
Labour composition	0.24	0.33	0.31		0.06	na	0.29	0.04	0.15	0.49
	(8)	(11)	(11)		(1)		(12)	(2)	(-150)	(306)
MFP growth	1.51	1.08	0.48	0.83	3.93	0.44	0.87	0.60	-0.89	-0.91
	(47)	(35)	(16)		(95)	(25)	(37)	(29)	(890)	(-569)

a Market sector for Australia, United Kingdom, France, Germany, Italy and Spain; non-farm business sector for the United States; commercial sector for the Netherlands; non-financial business sector for Finland; and total economy for Japan. **b** Includes all intangibles as covered in table 6.1. **c** Does not include mineral exploration for the United States, which is included as part of the tangibles.

Sources: MHW (2007, table 5) for the United States and United Kingdom; Fukao et al. (2008b, table 9-1) for Japan; van Rooijen-Horsten et al. (2008, table A8); JAA (2007, table 3) for Finland; Hao, Manole and van Ark (2008, table 5) for France, Germany, Italy and Spain; authors' estimates for Australia.

- Although Australia (and particularly Finland) had lower contributions of *total* capital deepening to LP growth, intangibles were a relatively larger share of total capital deepening than in the United Kingdom, Japan and Germany (which had relatively high existing levels of tangible capital deepening).
  - Intangibles accounted for 42 per cent of total capital deepening in Australia compared with around a quarter in the United Kingdom. Intangibles accounted for around a third of total capital deepening in Japan and half in the United States. Intangibles contributed more than 100 per cent of total capital deepening in Finland because there was tangible capital shallowing.
- MFP growth (as the residual) was a larger share of LP growth in Australia and Finland than the other countries.
  - MFP growth was 47 per cent in Australia and 95 per cent in Finland, compared with around 35 per cent in the United States, France and Germany. For Japan it was around a quarter and for the United Kingdom it was 16 per cent. MFP growth was negative in Spain and Italy.

This comparison across countries is affected to some extent by the use of an exogenous floor rate of return for the Australian capital services estimates.[20] This differs from the US study, in which an endogenous rate of return is used. All of the other country studies also use an endogenous rate of return, except the study of the Netherlands (which uses an exogenous rate of return). As discussed in chapter 5, the Australian results were sensitivity tested to the rate of return assumptions. Using an endogenous rate of return, the effect on the Australian growth accounting estimates of treating all intangibles as capital is larger. The increase in capital deepening is larger and there is a correspondingly larger decrease in MFP growth (see appendix D for details of estimates using endogenous rates of return). In terms of comparisons with the US results:

- the contribution of intangible capital deepening to LP growth increases, to a level more similar to the United States
- the contribution of MFP growth to LP growth falls by about 5 percentage points, to levels more similar to the United States.

[20] This approach is used in this paper because it is used by the ABS in the Australian national accounts (see appendix C for details).

Contribution of each intangible asset

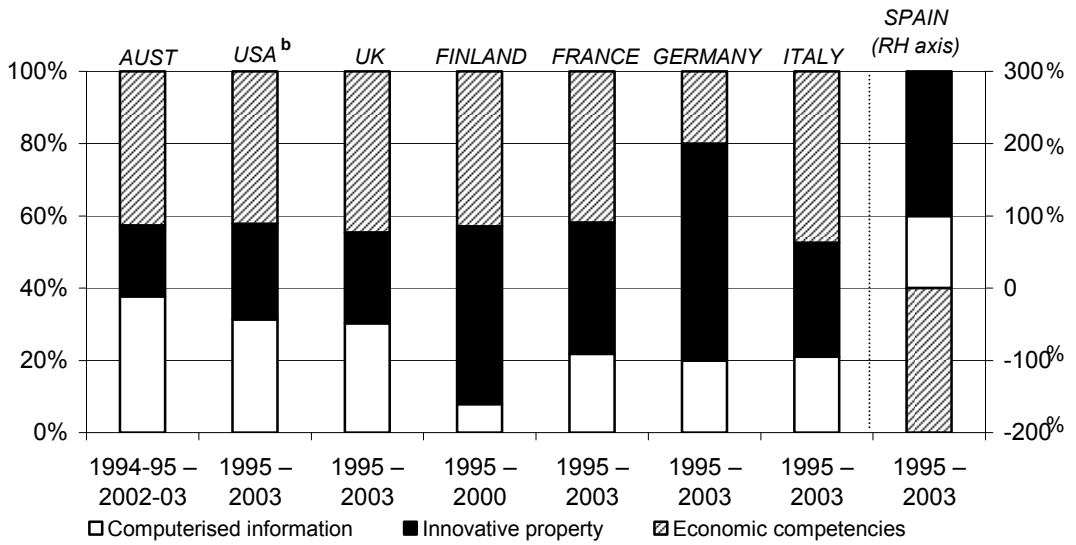
By broad asset type, Australia's pattern of contributions to total intangible capital deepening was most similar to the United States and United Kingdom (figure 6.3). — economic competencies made the largest contribution followed by computerised information and innovative property. Of all the countries shown in figure 6.3, Australia had the lowest contribution from innovative property and the highest contribution from computerised information.

The other countries had quite different patterns of intangible capital deepening. For France and Italy, economic competencies were also the main contributor but for these countries innovative property made a larger contribution than computerised information. For Finland, Germany and Spain, innovative property was the largest contributor. Computerised information was a particularly small share of total intangibles capital deepening in Finland and economic competencies made a negative contribution in Spain.

Figure 6.3 **Contributions of individual intangibles to total intangible capital deepening, by country[a]**

Percentage shares

Eco. comp.	41	42	45	42	42	20	47	-200
Innov. prop.	21	26	25	48	36	60	32	200
Comp. info.	38	31	31	8	22	20	21	100



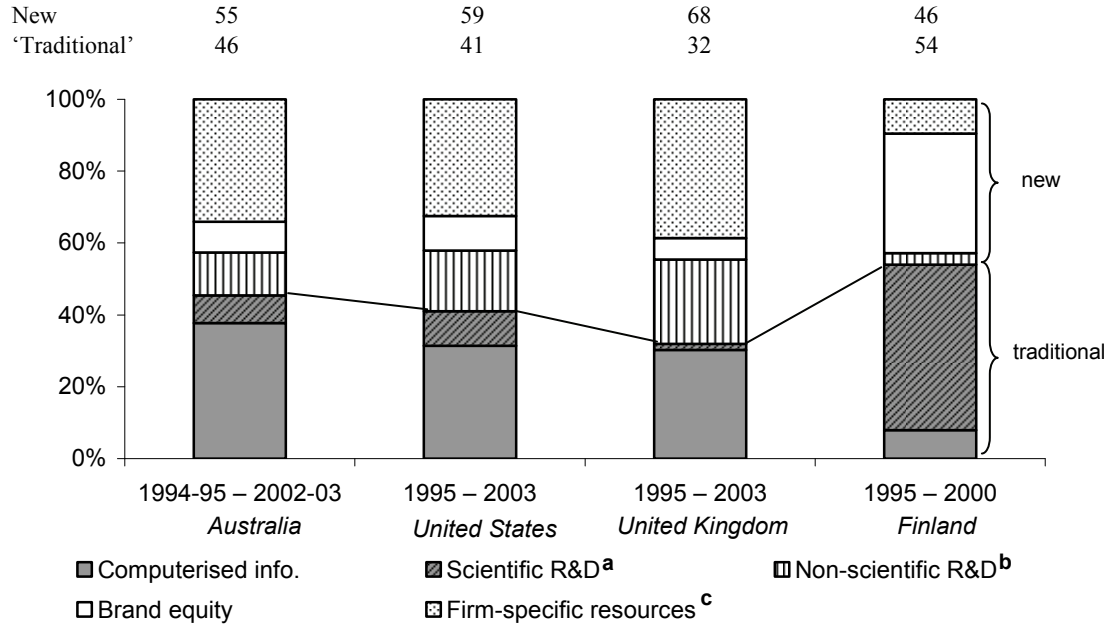
Components may not add to 100 due to rounding. [a] No comparable data were available for Japan or the Netherlands. [b] Does not include mineral exploration for United States — the growth accounting in CHS (2006) treats mineral exploration as a tangible asset.

Data sources: MHW (2007, table 6) for the United States and United Kingdom; JAA (2007, table 4) for Finland; Hao, Manole and van Ark (2008, table 5) for France, Germany, Italy and Spain; authors' estimates for Australia.

Figure 6.4 illustrates the significance in total capital deepening of the 'new' intangibles compared with the 'traditional' intangibles.[21] CHS (2006, p. 31) noted that growth accountants in the United States should not lose sight of the new intangibles that are just as large as the 'traditional' intangibles — computerised information (which is already capitalised) and scientific R&D (which is on the agenda to be capitalised). This point also applies to the United Kingdom, Australia and, to some extent, Finland.

Figure 6.4 **Contributions of new and 'traditional' intangibles to total intangible capital deepening, by country**

Percentage shares



Components may not add to 100 due to rounding. **a** Scientific R&D includes mineral exploration for the United Kingdom, Australia and Finland (it also includes R&D in social sciences for Australia and Finland, which is included in non-scientific R&D for the United Kingdom and the United States). It does not include mineral exploration for United States — the growth accounting in CHS (2006) treats mineral exploration as a tangible asset. **b** Non-scientific R&D includes other product development and copyright and licence costs. **c** Firm-specific resources includes firm-specific human capital and organisational capital.

Data sources: MHW (2007, table 6) for the United States and United Kingdom; JAA (2007, table 4) for Finland; authors' estimates for Australia.

21 Disaggregated data for France, Germany, Italy and Spain were not reported in Hao, Manole and van Ark (2008).

Firm-specific resources made a similar contribution to computerised information (slightly less in Australia and slightly more in the United States, Finland and United Kingdom). Non-scientific R&D contributed more than scientific R&D, except in Finland. The contribution of scientific R&D was 94 per cent of that for total R&D in Finland, compared with 7 per cent in the United Kingdom and 35 to 40 per cent in the United States and Australia.[22]

Comparison of the effect of adding intangibles

As discussed in chapter 5, capitalising rather than expensing intangibles expenditure results in a change to measured MFP growth. MFP growth can rise or fall, depending on the relative growth rates of current intangible investment on the output side and services from accumulated intangible capital on the input side.

Table 6.4 and figure 6.5 show growth accounting estimates for the three definitions of capital — including no intangibles, national accounts intangibles and all intangibles. For most countries examined in this chapter, the direction of effect of including intangible capital was the same — labour productivity growth rose by less than capital deepening, resulting in a fall in MFP growth (which is derived as the residual).[23] Input growth from including intangibles capital services generally outweighed the increase in output growth from including intangible investment. Intangibles therefore raised the importance of capital deepening and lowered the importance of MFP growth as sources of growth.

[22] MHW (2007, p. 21) note that this accords with discussion that in the United Kingdom 'design' is strong but scientific R&D lags behind the United States.

[23] The exceptions are the Netherlands (for which MFP growth was unchanged after capitalising the new intangibles), Japan (for which MFP growth rose after capitalising all intangibles) and Spain (for which MFP growth was unchanged after capitalising all intangibles).

Table 6.4 **Effect of intangibles on productivity growth, by country and intangible group[a]**

Per cent per year (percentage contribution to LP growth)

	Australia	*USA*	*UK*	*Neth.*	*Finland*	*Japan*	*France*	*Germany*	*Italy*	*Spain*
	1994-95 –2002-03	*1995 –2003*	*1995 –2003*	*1996 –2000*	*1995 –2000*	*1995 –2000*	*1995 –2003*	*1995 –2003*	*1995 –2003*	*1995 –2003*
	Excluding most intangible assets[b]									
Labour productivity growth	2.90	2.78	2.59			1.50	2.17	1.93	-0.24	0.10
	(100)	(100)	(100)			(100)	(100)	(100)	(100)	(100)
Decomposition										
Capital deepening	0.92	0.98	1.64			1.13	0.78	1.14	0.49	0.58
	(32)	(35)	(63)			(75)	(36)	(59)	(-204)	(580)
Labour composition	0.27	0.38	0.36			na	0.32	0.05	0.16	0.52
	(9)	(14)	(14)				(15)	(3)	(-67)	(520)
MFP growth	1.71	1.42	0.58			0.37	1.08	0.73	-0.89	-1.00
	(59)	(51)	(22)			(25)	(50)	(38)	(371)	(-1000)
	Including national accounts intangible assets[c]									
Labour productivity growth	2.94	2.95	2.73		3.64					
	(100)	(100)	(100)		(100)					
Decomposition										
Capital deepening	1.12	1.26	1.82		-0.48					
	(38)	(43)	(67)		(-13)					
Tangible	0.90				-0.53					
	(31)				(-14)					
Intangible	0.23				0.05[e]					
	(8)				(1)					
Labour composition	0.26	0.37	0.35		0.07					
	(9)	(13)	(13)		(2)					
MFP growth	1.56	1.32	0.56	0.83	4.05					
	(53)	(45)	(21)		(111)					

(continued on next page)

Table 6.4 **(continued)**

	Australia	*USA*	*UK*	*Neth.*	*Finland*	*Japan*	*France*	*Germany*	*Italy*	*Spain*
	1994-95 –2002-03	*1995 –2003*	*1995 –2003*	*1996 –2000*	*1995 –2000*	*1995 –2000*	*1995 –2003*	*1995 –2003*	*1995 –2003*	*1995 –2003*
	Including most intangible assets[d]									
Labour productivity growth	3.01	3.09	2.93		4.12	1.78	2.34	2.07	-0.10	0.16
	(100)	(100)	(100)		(100)	(100)	(100)	(100)	(100)	(100)
Decomposition:										
Capital deepening	1.36	1.68	2.14		0.13	1.34	1.19	1.42	0.64	0.58
	(45)	(54)	(73)		(3)	(75)	(51)	(69)	(640)	(363)
Tangible	0.81	0.85	1.54		-0.51	0.86	0.64	0.97	0.45	0.52
	(27)	(28)	(53)		(-12)	(48)	(27)	(47)	(450)	(325)
Intangible[f]	0.57	0.84	0.60		0.64	0.48	0.55	0.45	0.19	0.06
	(19)	(27)	(20)		(16)	(27)	(24)	(22)	(190)	(38)
Labour composition	0.24	0.33	0.31		0.06	na	0.29	0.04	0.15	0.49
	(8)	(11)	(11)		(1)		(12)	(2)	(150)	(306)
MFP growth	1.41	1.08	0.48	0.83	3.93	0.44	0.87	0.60	-0.89	-0.91
	(47)	(35)	(16)		(95)	(25)	(37)	(29)	(890)	(569)

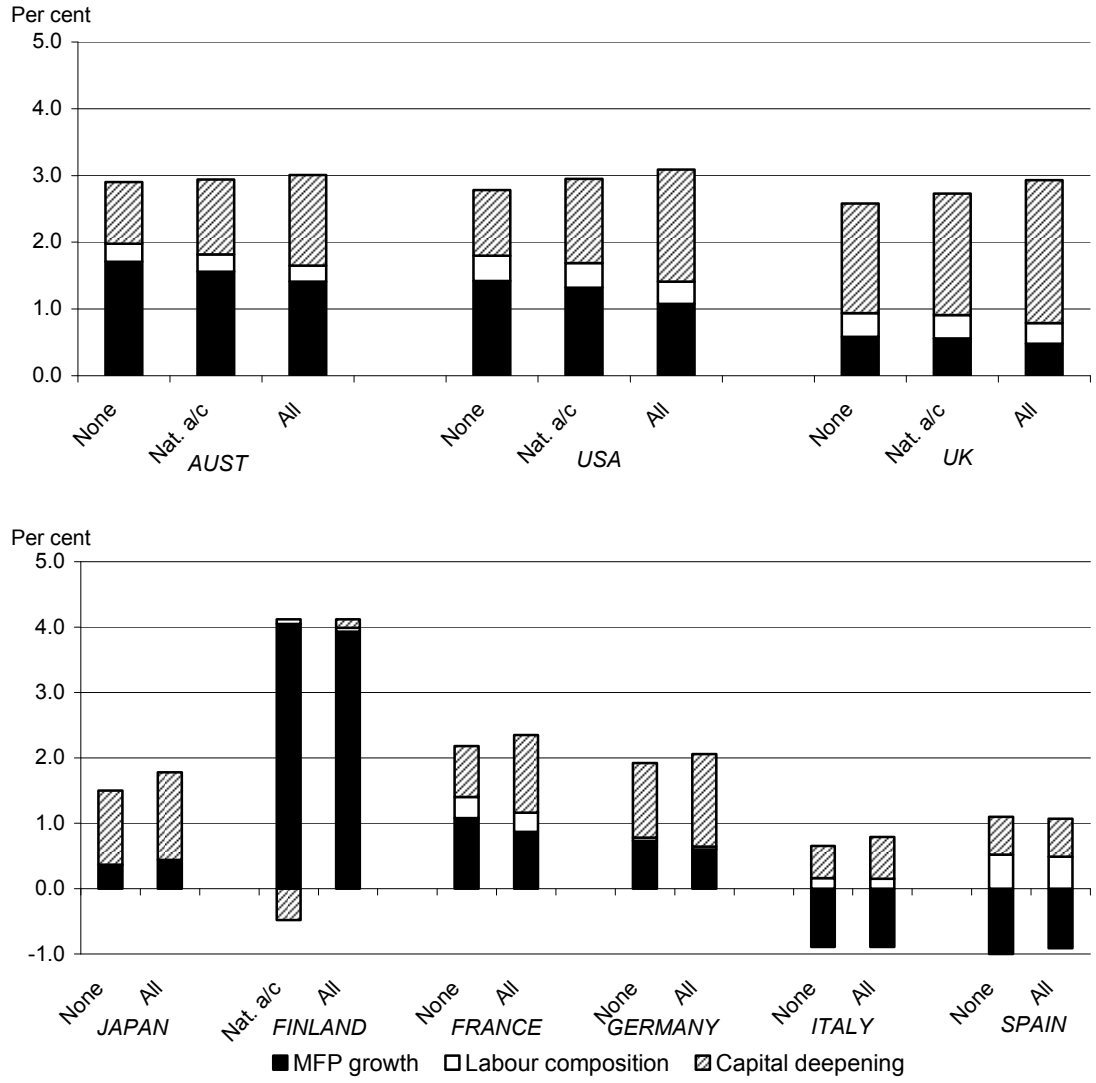
[a] Market sector for Australia, United Kingdom, France, Germany, Italy and Spain; non-farm business sector for the United States; commercial sector for the Netherlands; non-financial business sector for Finland; and total economy for Japan. [b] Computerised information excluded in all cases. The intangibles of mineral exploration and the architectural and design services embedded in equipment purchases are included for the United States. [c] For the United States, includes computerised information, mineral exploration and the architectural and design services embedded in equipment purchases. For the United Kingdom, includes computerised information. For Australia includes computerised information, mineral exploration and artistic originals — calculated using aggregate methodology rather than aggregating from industry estimates and will differ from ABS published estimates. [d] Includes all intangibles as covered in table 6.1. [e] Computerised information only. [f] Does not include mineral exploration for the United States, which is included as part of the tangibles.

Sources: MHW (2007, table 5) for the United States and United Kingdom; Fukao et al. (2008b, table 9-1) for Japan; van Rooijen-Horsten et al. (2008, table A8); JAA (2007, tables 3, 5) for Finland; Hao, Manole and van Ark (2008, table 5) for France, Germany, Italy and Spain; authors' estimates for Australia.

Figure 6.5 illustrates the differences between the three panels in table 6.4, that is the change in the decomposition of LP growth as different groups of intangibles are treated as capital.

Figure 6.5 **Decomposition of labour productivity growth, by country, by definition of capital[a], mid-1990s to early 2000s[b]**

Per cent per year



a 'None' is no intangibles treated as capital; 'National accounts' is national accounts intangibles treated as capital; and 'All' is all intangibles treated as capital. For Japan any labour composition effect is not separately identified. **b** 1994-95 to 2002-03 for Australia; 1995 to 2003 for the United States and the United Kingdom; 1995 to 2000 for Japan; 1995 to 2000 for Finland; and 1995 to 2003 for France, Germany, Italy and Spain.

Data sources: MHW (2007, table 5) for the United States and United Kingdom; Fukao et al. (2008b, table 9-1) for Japan; JAA (2007, tables 3, 5) for Finland; Hao, Manole and van Ark (2008, table 5) for France, Germany, Italy and Spain; authors' estimates for Australia.

Examining the effect of capitalising all intangibles (compared with the no intangibles case):

- labour productivity growth was higher in all countries
  - but in percentage terms, LP growth increased by less in Australia because of the relatively smaller contribution of intangible investment to output growth and/or a higher LP growth in the no intangibles case than the other countries
- the contribution of capital deepening to LP growth was higher in all countries (except Spain where there was no change)
  - the contribution of capital deepening to LP growth rose more (in percentage terms) in the United States, France and Australia than the United Kingdom and Japan (which already had high rates of capital deepening)[24]
- in most countries, the increase in capital deepening was greater than the increase in LP growth, so the contribution of MFP growth (as the residual) fell
  - the contribution of MFP growth to LP growth fell less (in percentage terms) in Australia (18 per cent) than the United States (24 per cent) and France (19 per cent), the same as in Germany (18 per cent) but more than the United Kingdom (17 per cent) and Spain (9 per cent). There was no change in Italy and in Japan the contribution rose 19 per cent.

Overall, capitalising all intangibles in the growth accounting (compared with capitalising none) generally shifted the sources of growth towards capital deepening and away from MFP growth. However, this shift was less pronounced in percentage terms for Australia than some of the other countries because of lower investment in intangibles and/or relatively high MFP growth. For Australia, even after the capitalising all intangibles, MFP growth remained a larger contributor to LP growth than capital deepening — this was not the case for most of the other countries.

Relative importance of 'new' and 'old' intangibles

As noted above, the national accounts already include some intangibles (mainly computerised information). This raises two questions:

- How do the contributions of the new intangibles compare with those of the existing intangibles?
- To what extent are the national accounts estimates affected by not treating the new intangibles as capital?

[24] MHW (2007, p. 22) noted that the effect in the United Kingdom is less than the United States because capital deepening is already quite high in the United Kingdom.

Figure 6.5 illustrates the progressive effect of capitalising the national accounts and the new intangibles for Australia, the United States and the United Kingdom (and the new intangibles for Finland). The answer to the first question is that over the period examined the 'new' intangibles affect the MFP results more than the 'old' intangibles[25], highlighting the importance of attempting to capitalise the new intangibles in the national accounts. For Australia, however, the difference between the 'new' and 'old' intangibles is small.

The answer to the second question varies across countries. Overall, in percentage terms, not treating the new intangibles as capital affects MFP growth in the Australian national accounts[26] less than it affects the national accounts of most of the other countries for which data are available (figure 6.5).[27] Australian MFP growth is overstated by 10 per cent (0.15 of a percentage point), compared with 18 per cent (0.24 of a percentage point) in the United States, 14 per cent (0.08) in the United Kingdom and 3 per cent (0.12) in Finland (table 6.4).

Overall, not capitalising all intangibles in the national accounts affects the picture of the relative importance of the sources of growth. Capital deepening is relatively more important and MFP growth relatively less important when the new intangibles are measured.

Effect on growth accounting results over shorter periods

The above results cover only one period but data for various shorter periods were examined in most of the country studies and the growth cycle periods were examined for Australia in chapter 5. While in many cases treating intangibles as capital altered the extent of any acceleration/deceleration in MFP growth between periods, in only two countries is it reported to have reversed the pattern of MFP growth.

- For the United Kingdom, the inclusion of the 'new' intangibles changed a deceleration in LP growth and MFP growth between the early and late 1990s to an acceleration in LP growth and MFP growth (MHW 2007, table 3).

25 The change in MFP growth from moving from a capital definition that includes no intangibles to one that includes the national accounts intangibles is less than the change in MFP growth from moving from a capital definition that includes national accounts intangibles to one that includes all intangibles.

26 The estimates for the national accounts definition of capital are not the same as ABS published estimates for Australia because of differences in methodology (see appendix C).

27 There are some differences across countries as to which intangibles are already treated as capital in the national accounts — the US estimates do not include artistic originals, which are included in the Australian and UK national accounts.

  - MHW (2007) suggest that the 'mystery' of the LP growth slowdown in the conventionally measured statistics was in fact a 'statistical illusion' caused by not accounting for investment in intangibles.
  - This was a period of rapid investment in intangibles that raised output growth more than input growth was raised by including intangible capital services as an input.
- For the Netherlands, capitalising intangibles resulted in a deceleration rather than an acceleration in MFP growth between 1996-2000 and 2001-05.
  - Capitalising intangibles left MFP growth unchanged in 1996-2000 but lowered it in 2001-05. The MFP growth rate therefore became higher in 1996-2000 than 2001-05, the reverse of the pattern before capitalising intangibles (van Rooijen-Horsten et al. 2008, p. 30).
- For Australia, as shown in chapter 5, there has been no change in the pattern of growth across the cycles (in terms of a switch from acceleration to deceleration).
  - In general, the lower levels of investment in intangibles means that treating intangibles as capital has a lesser effect on the growth accounting results than in some of the other countries. This also makes it less likely that the effect of treating intangibles as capital will be large enough to change the periods of acceleration and deceleration between cycles.

6.3 Summary

The estimates for Australia (and the other countries) are exploratory and have a number of identified deficiencies. And the international comparisons are further hampered by differences in coverage and underlying data used in the estimates. Even comparable estimates should be interpreted carefully — the country with the highest ratio of intangibles to output should not be seen as a benchmark. Country-specific circumstances will affect the appropriate level and type of intangible investment for a particular country. However, with these caveats in mind, there are a number of broad similarities and differences between Australia and the other countries that are of interest.

- Australia has a lower rate of intangible investment than the United States, United Kingdom, Japan, France, Germany and Finland but greater than the Netherlands, Canada, Italy and Spain (when measured as a share of adjusted output for the sector for which intangibles were measured).
  - But Australian investment in intangibles is still large — $57 billion or around 10 per cent of adjusted market sector gross value added in 2005-06.

  - And the pattern of growth has been similar to most of the other countries examined, including the United States and United Kingdom.

- Even though Australia (like Japan, Italy and Spain) has a relatively low ratio of intangibles to tangibles investment, compared with the United States, it is still around half the size of tangible investment.
  - And with higher growth in intangible investment than tangible investment over the longer term, this changes the trend in the Australian ratio of investment to output from a declining to relatively stable one.
- The composition of Australia's intangible investment is more similar to the United States than most of the other countries examined (particularly Japan).
  - The lower ratio of intangible investment to output is due to lower levels across the three main groups of intangibles rather than particularly low investment in any one group.
- While further analysis is required, the international comparisons suggest that the type of intangible investment may be important for growth performance.
  - For example, Japan has a higher share of its intangibles investment in computerised information than the United States or Australia but a lower share of investment in economic competencies. Fukao et al. (2008b) note that differences in the accumulation of intangible assets that play a complementary role to ICT capital (for example, organisational capital) might explain differences in productivity growth compared with the United States.
  - Other studies have suggested that Australian productivity performance has benefited from links between ICTs and organisational capital. Gretton et al. (2003) found significant interactions between ICT use and complementary organisational variables (including human capital, history of innovation, the use of advanced business practices and the intensity of organisational change) using an Australian firm-based longitudinal dataset. And Australia is one of the few countries to show evidence of MFP gains related to ICT use (OECD 2003). The differences between Australia and Japan in organisational capital investment (as measured using the CHS-methodology) also suggest that this is a potential explanation for some of the difference in MFP growth.[28]

[28] It should be noted that comparability of organisational capital measures across countries is affected by data limitations — the Japanese estimate is likely to be an underestimate (Fukao et al. 2008b) and the Australian estimate may be an overestimate (see chapter 3).

- In most countries, when intangibles are capitalised LP growth and capital deepening rise and MFP growth falls — that is, part of conventionally-measured MFP growth was actually attributable to previously unmeasured intangible assets.
  - The percentage contribution of 'new' intangibles to conventionally-measured MFP growth is relatively low in Australia compared with the United States and United Kingdom. This reflects a lower level of intangible investment and relatively high MFP growth in Australia. (However, it also reflects the use of an exogenous floor rate of return rather than endogenous rate of return, under which the contribution of intangibles to conventionally-measured MFP growth in Australia is larger.)
- Only a small proportion of Australia's relatively high MFP growth is *directly* attributable to intangibles and capitalising intangibles does not appreciably change the pattern of growth over the productivity cycles (unlike in the United Kingdom).
  - This does not rule out *indirect* effects from intangibles, such as complementarities with ICTs, contributing to MFP growth.