# 3 Structural change in output and investment

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| Key points |
| * The magnitude of structural change *between major sectors* during the 2000s was significant but not unprecedented. The Australian economy has experienced comparable levels of change in sectoral shares of output in previous decades. * In an historical context, changes in sectoral shares of *real* output were relatively modest in the 2000s, notwithstanding the significant impact of the terms of trade and the high Australian dollar on some individual industries. * Sectoral shares of nominal output and investment changed relatively quickly over the decade to 2012, reflecting the natural resources boom, as well as the longer‑term shift towards the production of services and the relative decline of manufacturing. * On some measures, however, there were record rates of structural change *between states and territories*. * Structural change in state and territory shares of *nominal* output and investment in the 2000s exceeded rates recorded at any time in the previous 40 years. * The natural resources boom and associated ‘multi‑speed’ economy appear to have had more pronounced effects on factor reallocation among states and territories than among sectors. * Rates of structural change in state and territory shares of *real* output, on the other hand, while large, were comparable to the peaks in previous decades. * The higher rates of change observed in nominal, rather than real, shares of output — by sector, as well as by state and territory — indicate that structural change in the 2000s reflected changes in relative prices (the high terms of trade and real exchange rate appreciation) more than changes in output volumes. |
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This chapter presents selected patterns of change in the composition of output and investment, across industries and regions. (Patterns of change in the composition of employment are covered in chapter 4.) These patterns chart the way in which the economy has responded, over time, to the interaction between the fundamental economic variables described in chapter 1 and the global and domestic forces of change (chapter 2). Section 3.1 examines structural change in output and section 3.2 structural change in investment. Section 3.3 analyses structural change across states and territories.

## 3.1 Structural change in output

Structural change in the Australian economy is apparent even at a relatively aggregated level, and several long‑term trends are discernible. First, the manufacturing and agricultural sectors’ shares of total output (nominal gross value added) have been in decline since at least the 1960s (figure 3.1). Most of the decline in manufacturing’s share of output preceded the 2000s natural resources boom. At its relative peak in the mid‑1960s, manufacturing accounted for over one‑quarter of total output, declining to about 14 per cent in 2000, and then to 9 per cent in 2011. Agriculture, for its part, began its long‑run decline even earlier than manufacturing — in 1950, it was responsible for one‑quarter of the nation’s total nominal output but, by 1990, this had dropped to 5 per cent. In the past two decades, its output share has been steady at about 3 to 4 per cent.

Second, the scale of the recent expansion of the mining sector is clearly in evidence in figure 3.1. Between 2000 and 2012, that sector’s share of total nominal output more than doubled from 5 per cent to 11 per cent, a larger share than reached in previous mining booms. The nominal output share of mining is now approximately back to where it was at the turn of the twentieth century (Battelino 2010).[[1]](#footnote-1)

Third, figure 3.1 reveals a steadily rising output share of services until the early 2000s, followed by a plateauing in the last ten years or so. This recent trend is likely to be due to a number of factors. First, the rapid growth in the value of mining output has, by definition, ‘crowded out’ the shares of the other sectors, including services. Second, the international competitiveness of some trade-exposed services industries such as higher education and tourism was affected by the strength of the Australian dollar, resulting in output reductions. Last but not least, the ABS measures outputs of ‘non-market’ services such as health and education via input costs, due to the absence of market valuation of those outputs.[[2]](#footnote-2) As labour accounts for the bulk of input costs in the production of those services, the relatively slow growth of nominal wages in the last decade (PC 2012a) constrained measured growth in the overall value of services.

Figure 3.1 Sectoral shares of output, 1949 to 2012**a, b**

Nominal gross value added

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a Data in nominal (current price) terms for year ended June. b Sectors and industries are defined in appendix A.

*Sources*: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0) and Connolly, E. (RBA, Sydney, pers. comm., 13 August 2012, unpublished data).

Overall, the broad sectoral shifts mentioned above are unsurprising, given the drivers of change mentioned in the previous chapter and the stylised sectoral patterns observed in other developed economies. On the supply side, globalisation and the specialisation by newly‑industrialising economies in the production of lower‑cost manufactures have coincided with a corresponding specialisation by developed economies in the production of services. Rapid technological advances, an increased stock of human capital, and the availability of cheaper imported consumer, capital and intermediate goods have all supported expansion of industries that are either relatively more capital‑intensive (Mining, Construction) or those intensive in skilled labour (‘knowledge’ services industries). On the demand side, demographic changes — such as population ageing and immigration — and higher incomes have contributed to increased final demand for services, relative to demand for goods (chapter 2).

The sectoral patterns illustrated in figure 3.1 are based on data in nominal terms (current price data), and so include the effect of changes in output prices. To focus instead on changes in output volumes, and at a more disaggregated level, sectoral growth rates and shares of real output (based on chain volume measures) are presented in table 3.1. This breakdown (across nine aggregated sectors, as defined in appendix A) reveals modest real growth in mining and strong growth in some, but not all, services sectors. Notably, mining recorded output growth of 4.3 per cent per year on average, between 1978 and 2002, but only 3 per cent, on average, in the decade thereafter, the period of the recent natural resources boom. As a result, the share of mining in total *real* output remained largely unchanged during the boom. The contrast between nominal and real output shares of mining reflects the dominance of value over volume effects over this period, due to the strong rise in the terms of trade and exchange rate. This was compounded by the lag between the resources construction boom and the anticipated output response. The magnitude of the investment effort undertaken by the natural resources sector in the past decade is reflected in the strongly growing share of the construction sector over that period.

Table 3.1 Sectoral growth rates and shares of real output, 1978 to 2012

Real gross value added by sectora, b

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Average annual growth rate | |  | Share of total output | | |  | Change in output share | |
|  | 1978 to 2002 | 2002 to 2012 |  | 1978 | 2002 | 2012 |  | 1978 to 2002 | 2002 to 2012 |
|  | % | % |  | % | % | % |  | Percentage point | Percentage point |
| Agriculture | 2.7 | 2.3 |  | 3.6 | 3.0 | 2.7 |  | ‑0.6 | ‑0.2 |
| Mining | 4.3 | 3.0 |  | 9.5 | 11.3 | 11.3 |  | 1.8 | ‑0.1 |
| Manufacturing | 1.7 | 0.4 |  | 17.3 | 11.3 | 8.6 |  | ‑6.0 | ‑2.7 |
| Utilities | 3.1 | 1.2 |  | 3.5 | 3.2 | 2.7 |  | ‑0.3 | ‑0.6 |
| Construction | 2.6 | 5.9 |  | 8.2 | 6.5 | 8.7 |  | ‑1.7 | 2.1 |
| Distribution services | 3.6 | 3.4 |  | 18.3 | 18.7 | 19.2 |  | 0.4 | 0.5 |
| Business services | 5.6 | 3.8 |  | 13.4 | 21.9 | 23.7 |  | 8.5 | 1.7 |
| Social services | 3.2 | 3.0 |  | 19.1 | 17.6 | 17.5 |  | ‑1.4 | ‑0.2 |
| Personal services | 3.0 | 2.0 |  | 7.1 | 6.4 | 5.7 |  | ‑0.8 | ‑0.7 |
| Total (9 sectors) | 3.5 | 3.1 |  | 100.0 | 100.0 | 100.0 |  | na | na |

a Chain volume measures (reference year 2010-11) for year ended June. Sectors are broad industry groupings, as defined in appendix A. Output shares are calculated by dividing real gross value added for the sector by the sum across the nine sectors. This sum is not the same as reported real gross domestic product, due to the way chain volume measures are calculated. b Shares may not add up, due to rounding. **na** Not applicable.

*Source*: ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0).

Figure 3.1 provides further illustration of the continuing relative contraction of the manufacturing and agricultural sectors. Even though both these sectors experienced real output growth between 1978 and 2012, their share of total real gross value added declined further over the period.

The picture provided by the remaining sectors — covering service activities — is diverse. The rapid growth in the share of business services stands out, particularly during the 1978–2002 period. Conversely, some service categories such as social and personal services, despite being largely non‑tradeable, have seen their output share fall in the last 30 years or so. For social services in particular, this may reflect in part the effects of input costs valuation of non-market services, already mentioned, as this sector comprises both the Education and training and Health care and social assistance industries.[[3]](#footnote-3) Despite the declining share of the overall social services sector in total real output, the individual share of the Health care and social assistance industry grew by 1.6 percentage points between 1978 and 2012 — from 5.3 per cent to 6.9 per cent (data not shown).

### Increased structural change reflects price effects

Price effects are apparent in structural change indexes (SCIs). These indexes are a commonly‑used method for measuring the rate of structural change, and have been used in previous Commission work (De Laine, Lee and Woodbridge 1997; PC 1998; Parham 2012) as well as by others (Connolly and Lewis 2010; Connolly and Orsmond 2011). The SCI shows the rate at which sectoral (or regional) shares of output (or employment or investment) are changing over time.

Following standard practice, structural change indexes presented in this chapter (and in chapter 4) are calculated as half the sum of the (absolute) five‑year change in the five‑year moving average of industry shares of output. Thus, an SCI value of 2 in a given year indicates that 2 per cent of total output has been ‘reallocated’ between sectors, on average, over the preceding five years. An increase in the index value over time implies an increased rate of change in sectoral shares of output. It should be noted that the index is sensitive to settings such as the level of disaggregation (greater disaggregation results in greater measured structural change) and the choice of time span (the longer the span, the ‘smoother’ the indicator). Further discussion of the calculation and use of SCIs is provided in appendix B.

In nominal terms, the rate of structural change in sectoral shares of output increased during the 2000s — reaching a peak in 2011 — but is nevertheless comparable with that observed in previous periods of rapid structural change (figure 3.2). By contrast, measured structural change in real output has been considerably lower in the past decade than in earlier periods. As shown in table 3.1, changes in most sectoral shares of real output were relatively small during the 2002–2012 period. This suggests that the rising nominal structural change index during that period predominantly reflected the effects of high commodity prices on the value of the natural resources sector’s output. Relatively slow volume growth in that sector also underlies the low rate of structural change in real terms (figure 3.2). However, once the recently‑installed mining and energy extraction capacity comes on stream, that measure of structural change could increase.

Figure 3.2 Structural change in sectoral shares of nominal and real output

Structural change indexes for an eight-sector aggregation of industriesa

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a Calculated as half the sum of the (absolute) five‑year change in the five‑year moving average of sectoral shares, with the final year indicated. The eight‑sector classification follows Connolly and Lewis (2010), footnote 8, and is described in appendix A. ‘Nominal output’ is factor income by industry, at current prices, for year ended June. ‘Real output’ is gross value added by industry in chain volume terms (reference year 2010-11) for year ended June.

*Sources*: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0) and Connolly, E. (RBA, Sydney, pers. comm., 13 August 2012, unpublished data).

The results in figure 3.2 suggest that the 1970s to early 1980s period was the ‘peak’ era for structural change in real terms, as measured through SCIs, in Australia’s recent past. Although it is beyond the scope of this supplement to examine the reasons for the much greater level of the measured real SCI in the 1970s–1980s, plausible contributing influences would have been energy price rises due to the multiple oil shocks, as well as natural resources discoveries, rural and minerals commodities booms, and trade reforms.

It should be noted that a comparison of structural change peaks over time is unavoidably influenced by the level of aggregation selected. If the five-sector aggregation of services used as part of figure 3.2 were replaced with the underlying 16 disaggregated service industries, structural change index values for each year would be higher. Moreover, the size of the various peaks, relative to each other, would change, as the scope for shifts in industry output shares would increase. For example, the adverse impact of the high Australian dollar on some trade-exposed components of the Education and training and Accommodation and food services industries would be more likely to be reflected in a 19-industry structural change index than in the 8-sector index in figure 3.2.

Nonetheless, the conclusion that the peak era for structural change in real output was in the late 1970s and early 1980s would not be affected by a move to a 19‑industry index.[[4]](#footnote-4)

### Goods‑producing industries

Due to the tradeable nature of their output, goods‑producing industries (agriculture, mining and manufacturing) tend to be more exposed to competition from overseas producers, in both domestic and foreign markets. The past decade has seen increasing price pressures on many manufacturing industries by lower‑cost overseas producers and an appreciation of the exchange rate — part of the ‘Dutch disease’ or ‘two‑speed economy’ concepts, as discussed in chapter 1 (box 1.4). These competitive pressures have contributed to low growth rates and declining shares of output in many manufacturing industries (table 3.2). The decline is most pronounced in the relatively labour‑intensive production of trade-exposed goods such as Textiles, clothing and footwear. Emerging economies such as China and other Asian countries (Malaysia, Thailand, Indonesia), with much larger endowments of low‑cost, lower-skilled labour, have a pronounced comparative advantage in these products. Recent decades have also seen significant reductions in tariff assistance to local manufacturers (PC 2012f).

Table 3.2 Manufacturing industries — growth rates and shares of real output

Real gross value added by sector, 1978 to 2012a, b

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| --- | --- | --- | --- | --- | --- | --- |
|  | Average annual growth rate | |  | Share of manufacturing output | | |
|  | 1978 to 2002 | 2002 to 2012 |  | 1978 | 2002 | 2012 |
|  | % | % |  | % | % | % |
| Food, beverage and tobacco | 1.9 | 0.1 |  | 20.1 | 21.3 | 21.5 |
| Textiles, clothing and other | 0.2 | ‑6.4 |  | 16.9 | 12.1 | 6.3 |
| Wood and paper | 0.9 | ‑1.4 |  | 8.9 | 7.6 | 6.6 |
| Printing and recorded media | 3.4 | ‑2.5 |  | 3.0 | 4.6 | 3.6 |
| Petroleum, coal, chemical and rubber | 2.2 | ‑0.7 |  | 15.8 | 18.0 | 16.9 |
| Non‑metallic mineral products | 1.7 | 2.1 |  | 3.5 | 3.5 | 4.3 |
| Metal products | 1.8 | 1.9 |  | 16.5 | 17.3 | 20.9 |
| Machinery and equipment | 1.7 | 2.4 |  | 15.4 | 15.6 | 19.9 |
| All manufacturing | na | na |  | 100.0 | 100.0 | 100.0 |

a Chain volume measures (reference year 2010‑11) for year ended June. Output shares are calculated by dividing real gross value added for each manufacturing industry by the sum of gross value added across all the manufacturing industries. This total is not the same as the reported gross value added for the manufacturing sector, due to the way chain volume measures are calculated. b Manufacturing sector classification is as per ABS Type of Activity Units, the disaggregation used in some national accounts data (discussed in appendix A). These units are not exactly the same as ANZSIC subdivisions, and so may differ from manufacturing sector classifications used in other parts of this supplement. **na** Not applicable, due to the fact that total output for the manufacturing sector is not equal to the sum of its components, because of the way in which chain volume measures are calculated.

*Source*: ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0).

The competitive pressures facing goods‑producing industries were manifest in the much slower relative growth in consumer prices of tradeables in the 2000s (figure 3.3). (Different trend inflation rates for tradeables and for non‑tradeables are expected, given that the latter are less exposed to international competition.) Some tradeable goods have been much more affected than others by declining relative prices since the 1990s — most notably clothing and footwear and motor vehicles (figure 3.4). For these two categories of goods, increased access to low‑cost imports has contributed to the stability of consumer prices since the 1990s, and to the decline in shares of real manufacturing output (table 3.2). In contrast, prices of food and non‑alcoholic beverages, also illustrated in figure 3.4, have climbed steadily in the past two decades. This assisted the food and beverage manufacturing industry with maintaining its share of manufacturing output (at about one‑fifth) over this period (table 3.2).

Figure 3.3 Consumer prices, tradeables and non‑tradeables, 1998 to 2012**a**

Consumer price index (1997-98=100)

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a Year ended June, annual averages of quarterly data.

*Source*: ABS (*Consumer Price Index, Australia*, *June 2012*, Cat. no. 6401.0).

Figure 3.4 Consumer prices: all groups, clothing and footwear, motor vehicles, food and beverages, 1973 to 2012**a, b**

Consumer price index (1989-90=100)

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a Denotes food and non‑alcoholic beverages. b Year ended June, annual averages of quarterly data.

*Source*: ABS (*Consumer Price Index, Australia*, *June 2012*, Cat. no. 6401.0).

Other manufacturing industries, most notably Machinery and equipment, bucked the manufacturing trend, to grow rapidly during the 2000s, perhaps reflecting the dynamism of mining‑induced manufacturing activities (Shann 2012; Bishop et al. 2013).

### Service‑producing industries

Among service‑producing industries, the past decade has seen strongest growth in the business services and construction sectors (table 3.1). The business services sector recorded average annual growth in real output of 3.8 per cent from 2002 to 2012, following rapid growth of about 5.6 per cent per year on average between 1978 and 2002. By 2012, the sector accounted for almost one‑quarter of the total value of output, compared to 14 per cent in 1978.[[5]](#footnote-5) Its expansion has been driven by growth in some ‘knowledge’ services industries, namely Finance and insurance services and Professional, scientific and technical services (data not shown). These two industries may have benefited in part from links with the mining industry, which has had increased requirements for specialised technical, engineering and financial expertise (Shann 2012; Bishop et al. 2013). The growth of the superannuation industry — prompted by the introduction of compulsory employer superannuation contributions for most employees from 1992 (PC 2012b) — has also played a role in the financial services industry’s rising output share. Major financial deregulation in the 1980s also contributed to strong growth in financial markets and in the finance industry’s share of economic activity in the ensuing years, according to the Reserve Bank of Australia (Battelino 2000).

The construction sector recorded average annual real growth of 5.9 per cent in the decade to 2012, more than double the average annual growth rate of 2.6 per cent over the period 1978 to 2002. In 2012, it was responsible for almost 9 per cent of total output, about the same as the output share of the manufacturing sector. The recent natural resources boom has driven strong growth in the engineering construction side of the industry, far outpacing growth in (mainly residential) building construction (figure 3.5).

Figure 3.5 Building and engineering construction, 1986 to 2012**a**

Real value of work done

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a Seasonally adjusted quarterly data, chain volume measures (reference year 2010‑11). Year indicated refers to September quarter.

*Source*: ABS (*Construction Work Done, Australia, Preliminary, September 2012*, Cat. no. 8755.0).

Engineering construction work includes the construction of large projects as diverse as roads, bridges, railways and pipelines, as well as infrastructure for natural resources industries including iron ore, coal and gas. However, the past two decades have seen substantial changes in the relative shares of these project types in total engineering construction, reflecting the dramatic increase in investment in the natural resources sector. Since 1986, the real value of engineering construction carried out for that sector has increased from 18 per cent of total engineering construction, to reach almost 55 per cent in 2012. As discussed in section 3.2 on investment trends, the construction phase of the resources boom appears to have peaked in 2013 (Barber et al. 2013).

The distribution services sector — which includes the Information media and telecommunications industry — has also grown strongly, at an average of 3.4 per cent per year in the decade to 2012. Rapid change in computer and telecommunications technology has driven the expansion of this sector. New technologies, and the availability of cheaper imported capital and intermediate inputs have significantly reduced the price of providing telecommunications services. In turn, lower prices have triggered the widespread adoption of these services by firms and consumers. Beginning in the 1990s, competition reforms to government enterprises — including privatisation and corporatisation — brought efficiency gains in rail transport services and utilities in the decade to 2006 (PC 2005c; 2006b). This is likely to have contributed to the sustained growth in distribution services as well as in utilities (although the latter has grown more slowly in recent years than previously, at an average annual rate of 1.2 per cent over the period 2002 to 2012 (table 3.1)).

Decreases in freight costs and the widespread use of Internet‑based technologies have also increased the substitutability of overseas online retail services for their traditional domestic retail counterparts. As noted in chapter 2, recent years have seen online retailers present a growing challenge to the dominance of traditional ‘bricks and mortar’ retail services. According to a survey by the National Australia Bank (NAB 2012), online retail sales to Australians — by both domestic and overseas retailers — amounted to $12.8 billion, or about 5.8 per cent of the value of traditional retail sales in the year ended November 2012. In December 2012, online retail sales increased by 23 per cent from the same month in 2011. By contrast, traditional retail sales increased by just 3.3 per cent year‑on‑year in November 2012 (2.5 per cent on a seasonally‑adjusted basis) (NAB 2013). Estimates of the penetration of foreign online retailers vary between 20 per cent and 50 per cent of total online purchases by value over the 2010‑11 period (National Retail Association 2012). For some goods, the percentage may be much higher, such as up to 80 per cent for books and media.

Moderate growth in the social services sector — 3.0 per cent per year in the past 10 years or so — reflects a combination of relatively slow growth in expenditure on public administration and education and faster growth in expenditure on health services. The health industry’s real output expanded by 4.6 per cent per year, on average, from 2002 to 2012 (data not shown), exceeding the average annual real growth rate of the mining industry over the same period (3.0 per cent). Increasing expenditure on health services has been driven in part by population growth and ageing. However, the main contributor to growth in health services has been new, improved and more services per person at any age (Daley 2013; PC 2005b). As their incomes increase, people demand more and better services, which results in higher expenditure. As discussed in chapter 2, newer technology often increases the average cost of treatment, treats entirely new conditions or enables a greater proportion of people to be treated. In this sector, supply and demand indirectly reinforce each other, as medical advances have increased average life expectancy, and so have had (and will continue to have) an impact on population age structure.

## 3.2 Structural change in investment

Capital goods are durable assets used to produce goods and services for intermediate and final consumption. Growth in an economy’s capital stock represents an increase in its productive capacity, so that investment (expenditure on capital goods) is a key determinant of current and future output. In the short run, output can usually be increased by augmenting the amount of labour (such as through increased participation rates, immigration programs and so on) used in combination with the existing capital base. In the long run, however, industries must replace and repair the capital base and invest in new capital to expand their productive capacity.

As noted in chapter 1 (box 1.2), net investment is a means by which firms can reallocate their capital goods, and alter the size and composition of their capital stock and the uses and activities to which their capital goods are devoted. In other words, investment is one avenue for structural adjustment. However, changes in sectoral patterns of investment can also be viewed as a leading indicator of changes in sectoral shares of output. For example, industries with good growth prospects will likely increase both their investment and employment, although rarely to the same degree. On the other hand, net investment could be a response by firms facing increased overseas competition and/or high wage costs. Such firms may elect to substitute capital for labour to reflect changing relative factor prices, and as a means of keeping unit costs down. (Outsourcing and offshoring — covered in chapter 2 — can be alternative strategies taken up by firms seeking to boost their international competitiveness.)

The mining industry’s share of nominal investment more than trebled during the past decade, from 9 per cent in 2002 to 32 per cent in 2012 (figure 3.6). This expansion was a response to the high export prices obtained for resources over the 2000s (figure 2.3). Investment of this magnitude substantially exceeds levels observed in previous mining investment booms. For example, mining accounted for almost 14 per cent of total nominal investment in 1971, and 16 per cent in 1983.

Also notable is the continued decline in manufacturing’s share of total investment: after decreasing from 19 per cent in 1960 to 11 per cent in 2002, it dropped to 6.6 per cent in 2012. This is a more modest decline than that observed in the output share of manufacturing, which is likely explained by capital deepening (discussed later in this chapter).

Figure 3.6 Sectoral shares of nominal investment, 1949 to 2012**a, b**

Nominal gross fixed capital formation

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a Data in nominal (current price) terms, for year ended June. b Sectors and industries are defined in appendix A.

*Sources*: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0) and Connolly, E. (RBA, Sydney, pers. comm., 13 August 2012, unpublished data).

### Long‑term shifts towards services and knowledge‑based capital

Changes in disaggregated sectoral shares of investment since 1978 also reflect the Australian economy’s long‑term re‑orientation away from agriculture and manufacturing towards the production of services (table 3.3). The large expansion in mining investment has meant that each of the other sectors’ shares of total investment declined slightly during the decade to 2012. For most services sectors, the past decade’s relative decline has been a consequence of the ‘crowding‑out’ effect of the resources boom, but for agriculture, the pattern has represented a continuation of the sector’s longer‑term relative decline in investment. Between 1978 and 2002, agriculture’s share of real investment halved from about 14 per cent to about 7 per cent. These changes are at least partly attributable to adjustment within this industry, with a trend towards greater concentration of production on fewer and larger farms (PC 2005d).

Table 3.3 Sectoral real investment, growth rates and shares, 1978 to 2012

Real gross fixed capital formation by sectora, b

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Average annual growth rate | |  | Share of total investment | | |  | Change in share | |
|  | 1978 to 2002 | 2002 to 2012 |  | 1978 | 2002 | 2012 |  | 1978 to 2002 | 2002 to 2012 |
|  | % | % |  | % | % | % |  | Percentage point | Percentage point |
| Agriculture | 1.4 | 6.1 |  | 13.6 | 6.8 | 5.1 |  | ‑6.7 | ‑1.8 |
| Mining | 3.9 | 19.9 |  | 4.6 | 10.7 | 31.5 |  | 6.1 | 20.8 |
| Manufacturing | 3.8 | 3.7 |  | 13.6 | 11.2 | 6.6 |  | ‑2.4 | ‑4.7 |
| Utilities | 2.9 | 7.8 |  | 16.8 | 8.9 | 7.8 |  | ‑7.9 | ‑1.1 |
| Construction | 4.3 | 7.7 |  | 0.9 | 2.1 | 1.8 |  | 1.2 | ‑0.3 |
| Distribution services | 4.2 | 6.0 |  | 20.5 | 24.9 | 18.2 |  | 4.4 | ‑6.7 |
| Business services | 9.3 | 7.1 |  | 1.4 | 15.1 | 12.4 |  | 13.7 | ‑2.8 |
| Social services | 4.5 | 7.8 |  | 13.0 | 15.7 | 13.8 |  | 2.7 | ‑1.9 |
| Personal services | 6.0 | 4.3 |  | 2.2 | 4.6 | 2.8 |  | 2.4 | ‑1.7 |
| Total (9‑sector) | 4.3 | 9.1 |  | 100.0 | 100.0 | 100.0 |  | na | na |

a Chain volume measures (reference year 2010‑11) for year ended June. Excludes ownership of dwellings. Sectors are broad industry groupings, as defined in appendix A. Investment shares are calculated by dividing real investment for the sector by the sum across the nine sectors. This sum is not the same as reported real gross fixed capital formation economy-wide, due to the way chain volume measures are calculated. b Shares may not add up, due to rounding. **na** Not applicable.

*Source*: ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0).

Meanwhile, the ‘construction boom’ in the natural resources sector has driven a large increase in that sector’s share of total real investment over the past decade — from less than 11 per cent in 2002 to almost 32 per cent in 2012, with average annual growth of about 20 per cent per year over that decade. As noted earlier, this in turn has resulted in strong growth in engineering construction, contributing to the almost 6 per cent annual increase in construction sector output (table 3.1). However, the expansion in mining investment appears to have reached a peak in the first half of 2013, according to the Bureau of Resources and Energy Economics. At April 2013, a total of 73 major investment projects in the resources and energy sector were considered to be at the ‘committed’ stage, with a total value of $268 billion (Barber et al. 2013). This total value was the same as that recorded at October 2012, but represented 14 fewer projects.

As was the case for output shares in table 3.1, it is difficult to discern an overall pattern of structural change in sectoral investment shares across time from table 3.3, which describes only end‑to‑end changes. Here too, SCIs prove to be useful summary measures. As illustrated in figure 3.7, the rate of structural change in sectoral shares of investment is greater (on average) than that in output shares (provided in the graph for comparison purposes). Investment shares have recorded an elevated rate of change at times in the 2000s, although not dissimilar from that observed in the late 1980s to early 1990s (which reflected, in part, the commercial property and finance boom of that period). The pace of structural change in real investment has generally been close to that in nominal investment although, in the early to mid‑2000s, real investment shares changed more quickly than nominal shares.

Figure 3.7 Structural change in sectoral shares of investment and output

Structural change indexes, 1958 to 2012a

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a Calculated as half the sum of the (absolute) five‑year change in the five‑year moving average of sectoral shares, with the final year indicated. Sectoral classifications are as described in Connolly and Lewis (2010), footnote 8. ‘Nominal investment’ is gross fixed capital formation at current prices, year ended June. ‘Real investment’ is gross fixed capital formation in chain volume measures (reference year 2010‑11) for year ended June. Output SCIs as defined in figure 3.2.

*Sources*: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0) and Connolly, E. (RBA, Sydney, pers. comm., 13 August 2012, unpublished data).

#### The nature of investment has changed over time

The profile of capital goods purchased by firms has changed over time (figure 3.8). From 1960 to 2002, investment was strong in traditional physical assets, such as buildings, machinery and equipment. Investment that adds to a firm’s intangible stock of income-generating information — mineral and petroleum exploration and research and development — also grew strongly.[[6]](#footnote-6) Since 2002, expenditure on research and development and machinery and equipment has accelerated, while that on mineral exploration has about halved. Over the same period, stocks of computer software, artistic original and weapons systems that have expanded the fastest. The strong rise, since 2002, in stocks of software, machinery and equipment and research and development may be viewed as stemming from the same structural adjustment process, that is, firms seeking to capitalise on improvements in technology and low-cost high‑technology imported inputs.

Figure 3.8 Average annual growth in net capital stock, by asset**a**

Chain volume measures, 1960 to 2012

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a Reference year for chain volume measures is 2010‑11. Growth rate for computer software and artistic originals calculated for the 2002 to 2012 period only, due to data availability. ‘Construction’ refers to non‑dwelling construction.

*Source*: ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0).

In the past decade, growth in the stock of computer software and research and development has been relatively strong in sectors not traditionally thought of as ‘knowledge‑based’ (figure 3.9). For example, the mining and utilities sectors have expanded their stocks of computer software by about 12 per cent and 9 per cent per year since 2002, respectively — at least as fast as in the business services and social services sectors. The agriculture, mining and construction sectors have also recorded strong growth in their net stocks of research and development. (Recent patterns in capital accumulation in the mining sector are presented in chapter 6.)

Figure 3.9 Average annual growth in net capital stock, by asset type and sector, 2002 to 2012**a**

Chain volume measures

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a Reference year for chain volume measures is 2010‑11. Sectors are broad industry groupings, as defined in appendix A. ‘Construction’ refers to non‑dwelling construction.

*Source*: ABS (*Australian System of National Accounts, 2011‑12*, Cat. no. 5204.0).

Among the services sectors, business services has also increased its stock of computer software relatively quickly, consistent with the suggestion that technological change has played a central role in the strong investment growth in this sector. Interestingly, the social services sector — which includes education, health and public administration — has recorded slightly higher annual growth in its stock of machinery and equipment than has the mining sector. Technological change has been a major contributor to increased expenditure on advanced equipment such as computer hardware in education and specialised medical devices in health.

#### Capital intensity has risen

As a result of net investment, rising capital intensity in production has been a pervasive trend in the past two decades or so, as measured by changes in real net capital stock per worker. This trend is likely to reflect some of the drivers of structural change that were identified in chapter 2. In particular, it is likely that improved technology, combined with the greater purchasing power over imports of the Australian dollar in the last ten years, have made it profitable for firms to substitute plant and equipment for relatively scarce labour.

The mining and utilities sectors, traditionally the most capital‑intensive, have become considerably more so since 1985 (figure 3.10). That said, their capital intensity declined slightly between 1998 and 2011, relative to the preceding period.

Manufacturing, traditionally more labour‑intensive, has followed a similar trend towards capital deepening, nearly doubling its capital–labour ratio since 1985. Moreover, virtually all manufacturing subdivisions consistently increased their capital intensity in the period from 1988-89 to 2007-08 (Barnes, Soames and Li, forthcoming).[[7]](#footnote-7) It is likely that, in the decade to 2012, the purchasing power of the Australian dollar over imported capital goods has provided businesses with incentives to invest. In some manufacturing industries, additional incentives were at work. In Petroleum, coal, chemical and rubber products, evidence suggests that investment surged from 2002 in order to meet tighter environmental standards imposed under the Commonwealth Government’s *Cleaner Fuels* program. In that industry and in Metal Products, investment was also undertaken to expand capacity in response to higher demand and prices (Barnes, Soames and Li, forthcoming).

It is noteworthy that parts of the services sector — traditionally regarded as labour‑intensive — are now at least as capital‑intensive as manufacturing. The rise in capital intensity has been particularly pronounced in business services and distribution services.

## 3.3 Structural change across states and territories

The geographic concentration of the natural resources boom is evident in the strong real output per capita growth observed during the 2000s in the resource‑rich jurisdictions of Western Australia, the Northern Territory and (to a lesser extent) Queensland (figure 3.11). The latter jurisdiction recorded average per‑capita output growth that was slightly lower in the period 2002 to 2012 than in the preceding decade. Nonetheless, the strong expansion of its mining sector is likely to have prevented that growth from dropping off to the extent experienced by New South Wales, Victoria and South Australia. (Although the mining sector also increased its activity in those jurisdictions during the 2002–2012 period, its growth was more subdued than in the resource-rich states.)

Figure 3.10 Real net capital stock**a** per worker,**b** by sector**c**

Selected yearsd

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a Net capital stock in chain volume measures (reference year 2009‑10), year ended June. b Total number of workers, seasonally adjusted, annual averages of quarterly figures. Figures for 1985 are averages of three quarters of data only (November 1984, February 1985 and May 1985) due to data availability. c Sectors and industries are defined in appendix A. d 1984‑85 data are the earliest available (for employment).

*Sources*: Productivity Commission estimates using ABS (*Australian System of National Accounts, 2010‑11*, Cat. no. 5204.0; *Labour Force, Australia, Detailed, Quarterly*, *May 2012*, Cat. no. 6291.0.55.003).

Figure 3.11 underscores the long‑term nature of structural change, with Western Australia enjoying the highest average output per capita growth of all jurisdictions in the last twenty years, and Tasmania the lowest.

Similarly, the resource‑rich jurisdictions have seen faster growth in real investment in recent years (figure 3.12). Investment in Western Australia expanded by about 12 per cent per year, on average, between 2002 and 2012. Consistent with that state’s mining expansion, the fastest rates of investment growth in the Western Australian private sector, in the past decade, have been with respect to expenditure on construction (almost 21 per cent per year, on average) and machinery and equipment (14 per cent) (data not shown).

Figure 3.11 State and territory real output per capita, 1992 to 2012**a**

Average annual growth rates

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a **‘**Output per capita’ refers to real gross state product per capita (real gross domestic product in the case of Australia), average annual growth rates from 1992 to 2002 and 2002 to 2012, years ended June. Chain volume measures (reference year 2010‑11).

*Sources*: ABS (*Australian National Accounts: State Accounts, 2011‑12*, Cat. no. 5220.0; *Australian Demographic Statistics, June 2012,* Cat. no. 3101.0).

Figure 3.12 State and territory investment, 1992 to 2012**a**

Real gross fixed capital formation, average annual growth rates

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a Chain volume measures (reference year 2010‑11).

*Source*: ABS (*Australian National Accounts: State Accounts, 2011‑12*, Cat. no. 5220.0).

### Geographic structural change reflects the concentration of the resources boom

The recent rates of structural change observed among states and territories, at least in terms of nominal investment and nominal output, have been unprecedented in the last 50 years (figure 3.13). This stands in contrast with the extent of structural change in sectoral shares of output and investment (economy wide), as observed earlier in this chapter. The historically high rates of measured structural change among states and territories confirm that the location of the additional output and investment linked to the resources boom has been concentrated geographically. As would be expected, regions with the richest endowments of minerals and energy increased their share of output and investment.

Figure 3.13 Structural change in state and territory shares of investment and output

Structural change indexes, 1963 to 2012a

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a Calculated as half the sum of the (absolute) five‑year change in the five‑year moving average of state and territory shares, with the final year indicated. State and territory classifications are as described in Connolly and Lewis (2010), footnote 8. ‘Nominal output’ refers to gross state product, at current prices. ‘Real output’ refers to gross state product in chain volume terms (reference year 2010‑11). ‘Nominal investment’ refers to gross fixed capital formation at current prices, year ended June. ‘Real investment’ refers to gross fixed capital formation in chain volume terms (reference year 2010‑11), year ended June.

*Sources*: Productivity Commission estimates using ABS (*Australian National Accounts: State Accounts, 2011‑12*, Cat. no. 5220.0) and Connolly, E. (RBA, Sydney, pers. comm., 13 August 2012, unpublished data).

The patterns observed in figure 3.13 are consistent with the three‑phase characterisation of the natural resources boom. The effect of the initial ‘price phase’ is apparent in the fact that measured structural change has been higher in nominal than in real terms, whereas the impact of the completed ‘construction phase’ is reflected in the observation that there has been greater structural change in investment than in output. This latter pattern might, in turn, be superseded during the emerging ‘production phase’, when the rate of measured structural change in real output would be expected to increase as a rising number of mining projects reach full production.

1. This share remains much lower than the 35 per cent recorded during the 1850s gold rush (Battelino 2010). [↑](#footnote-ref-1)
2. In the ABS classification, non-market services include, in addition to health and education, Public administration and safety services. [↑](#footnote-ref-2)
3. Between 2002 and 2012, nominal hourly wages grew at an average annual rate of less than 5 per cent in both the social and personal services sectors, lower than the 7 per cent growth recorded for nominal GDP over that period (data not shown). [↑](#footnote-ref-3)
4. A graph showing the structural change index in real output at the 19-industry level is provided in appendix B. While the index cannot be constructed prior to 1984, the index values for the late 1970s–early 1980s period would necessarily be higher than those observed subsequently. [↑](#footnote-ref-4)
5. Sectoral shares of ‘real output’ are measured as the ratio of each sector’s gross value added to the sum of gross value added across the nine sectors. That sum does not equate to reported real GDP, due to the way in which chain volume measures are calculated. [↑](#footnote-ref-5)
6. The ABS recognises expenditure on research and development as capital formation (investment) rather than consumption expenditure, in the sense that it increases the stock of knowledge. Similarly, it counts mineral and petroleum exploration in this category as it is expenditure needed to acquire knowledge about new reserves of these resources (ABS 2012b). In both cases, that is, the expenditure is incurred to increase the quantity and value of an intangible asset that is expected to yield future income. As a result, accumulated expenditure in these areas is counted as part of net capital stock in the national accounts. For a detailed exposition of investment in intangibles, see Barnes and McClure (2009). [↑](#footnote-ref-6)
7. The only exception was the Wood and paper products manufacturing subdivision, during the 1998-99 to 2003‑04 productivity cycle (Barnes, Soames and Li, forthcoming). [↑](#footnote-ref-7)