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Office of the Chief Economist

Australian Industry Report

2014

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Australian Industry Report

2014

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Foreword

The makeup and structure of the Australian economy is neither a product of design, nor historical accident. Rather, it reflects decades of economic and demographic pressures and the response to those pressures by Australian businesses, investors and workers – and by government.

Major technological improvements have changed the goods we buy, how they are produced and how we purchase them.

Australia has become increasingly integrated into the global economy and as a result businesses, whether they export or not, are exposed to highly competitive international markets.

The rapid rise of China sparked the mining boom of the last decade, a boom that has been astonishing in scale and drew upon resources from across the country.

Our population grows and ages every day, with more years spent in schooling and in retirement, requiring catering to the needs of both groups.

In the face of these forces, our economy has adapted. Government has helped that adaption, by lowering tariffs, promoting competition and developing skills and capabilities.

Australia has evolved into a highly skilled, knowledge-based economy, one where professional services and health care now employ more workers than manufacturing.

Every year around a million Australian workers change jobs and a quarter of a million businesses enter and exit the market.

The willingness of Australian businesses and workers to embrace change and seize upon opportunities has led to 23 years of continued economic growth. Through our collective acumen, we have created a diverse, responsive and resilient economy.

In this, the inaugural *Australian Industry Report*, we draw together the many threads of our ever-changing economy. It is an invitation to step back and observe how all the pieces are connected so we can better understand the economy's complexities and subtleties.

Australia will continue to be exposed to economic and demographic forces and we must therefore continue to adapt. It's the one certainty we have in a world of change.

Mark Cully
Chief Economist
Department of Industry

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Executive summary

The *Australian Industry Report* is a new initiative of the Department of Industry's Office of the Chief Economist. The report provides an overview and analysis of the major economic factors affecting Australia's industries.

This inaugural report comes at a time when the commodity boom has seen a rapid movement of workers and investment across the economy. Reflecting this, the focus of this year's *Australian Industry Report* is structural change.

Australians have experienced record levels in their standards of living. But achieving this has not come without its challenges. Structural change can result in negative outcomes for individuals and regions. Individuals who cannot find jobs nearby that match their skills and experience need to move or retrain—sometimes both. Regions that are dependent on declining sources of employment are likely to suffer if alternative sources fail to take their place.

The report also has an eye on the future. The Government's *Industry Innovation and Competitiveness Agenda* outlined five sectors where Australia has recognised competitive strengths. These being: Food and Agribusiness; Mining Equipment, Technology & Services; Oil, Gas & Energy Resources; Advanced Manufacturing; and Medical Technologies & Pharmaceuticals. These sectors reflect a mix of our comparative advantage in natural resources and our strengths in human capital and innovation and are reviewed in detail in this report.

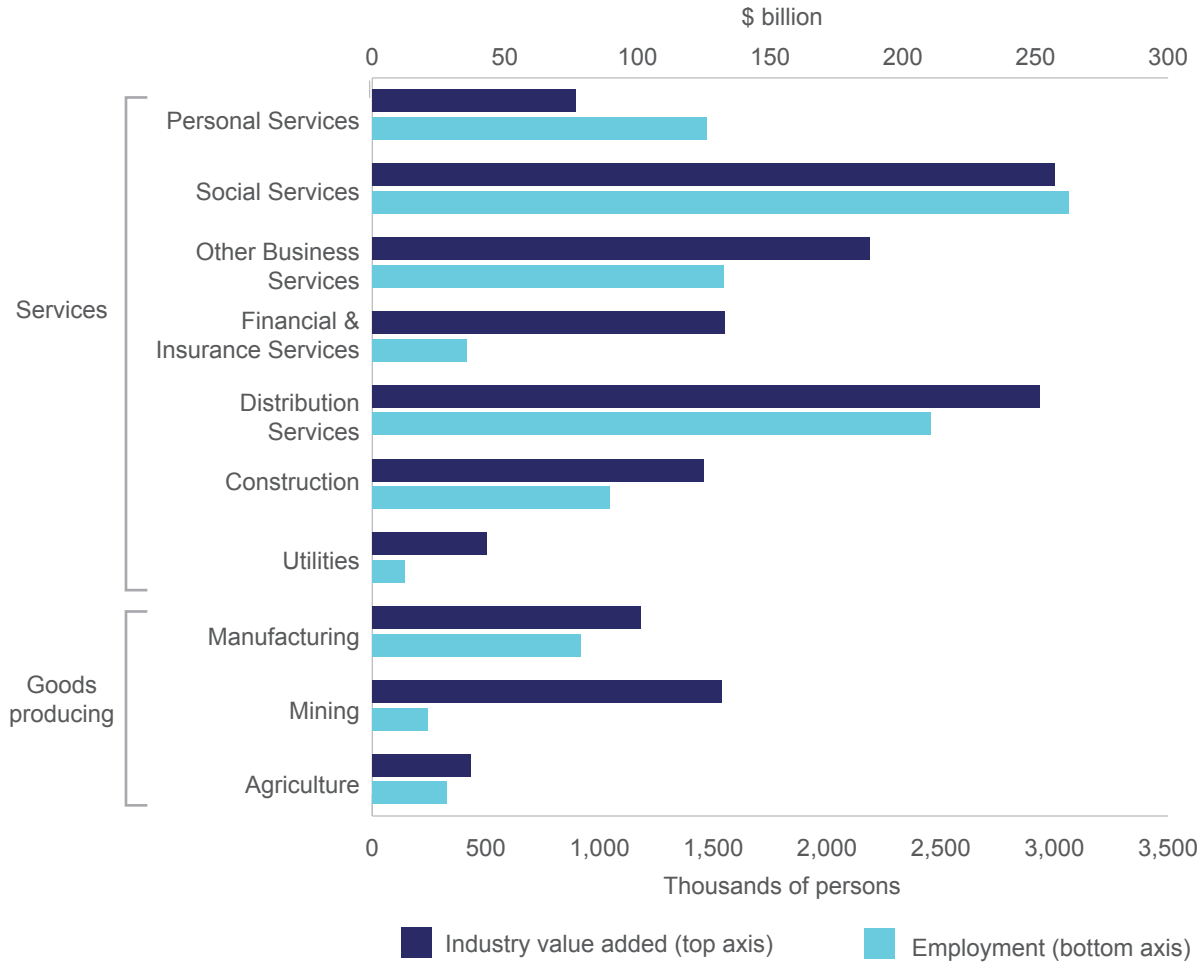
While the report is of an economic and analytical nature, it is intended to be relevant to a broad audience. The purpose of the report is to bring together in a single reference document an overview of the state of Australian industry, as well as the drivers of change and the associated implications.

The report begins with an analysis of current international and domestic economic conditions before addressing issues of structural change and the five key sectors highlighted above. The report also showcases how the department is utilising its administrative data holdings to improve its evidence base.

The Australian economy is resilient, but formidable challenges remain

As with most advanced economies, the Services sector in Australia remains important in terms of its contribution to industry value added and employment. Mining, however, has represented a disproportionally large share of Gross Domestic Product (GDP) growth in recent years due to high commodity prices and the resultant Mining investment boom.

Chart ES.1: Industry value added and employment, 2013–14



Source: ABS cat. no. 5204.0. & 6291.0.55.003; Thomson Reuters DataStream.
Note: Data for employment is in trend terms as at May 2014, GVA is in current prices.

The Australian economy recorded 23 consecutive years of economic growth in 2013-14 and continues to stand out as one of the best performers among Organisation for Economic Co-operation and Development (OECD) countries. This is good news for the over 11.5 million employed persons and more than 2 million actively trading businesses in Australia, and is a reflection of our economy's sound macroeconomic policies.

The economy, however, faces some challenges. The high Australian dollar for example, has impacted on the international competitiveness of Australia's trade-exposed industries like Manufacturing, while high unit labour costs have constrained business competitiveness overall. The economy will also need to respond to long-term trends, such as the rapid expansion of China, an ageing population and technological advances. How the economy responds will determine whether or not our strong performance continues.

There remains a noticeable divergence in industry performance. In particular, some industries have been significantly affected by the Mining boom, either as supplying industries or as trade-exposed industries that were impacted by the high dollar.

The decline in Mining investment, which was a strong contributor to GDP growth in the investment phase, is expected to continue. More diverse sources of economic growth are therefore needed from supporting industries, such as Construction and Professional, Scientific & Technical Services. There is some evidence of this already occurring in Construction—residential and non-residential construction activity has started to improve.

As technological progress continues to accelerate, it will have an impact on the demand for skills. There is considerable debate on which workers are most at risk of being displaced by technology. Views range from seeing technology as factor-neutral (benefiting all workers equally), to seeing technology as skill-biased (where an occupation's skill level is a significant indicator in determining how susceptible it is to automotive technologies). The challenges presented by more automation are not limited to low-skilled positions, as robots are increasingly replicating the tasks of medium and high-skilled workers. The silver lining is that higher productivity will eventually deliver cheaper goods and higher disposable incomes, as it did during the Industrial Revolution. The comparative advantages of being human — the ability to solve problems intuitively, improvise spontaneously and act creatively — as well as the unlimited needs and wants of humans suggest that the displacement of jobs due to automation is unlikely to be long term. Automation will allow for new technologies to develop and allow workers to utilise those comparative advantages in ways that are currently unimaginable.

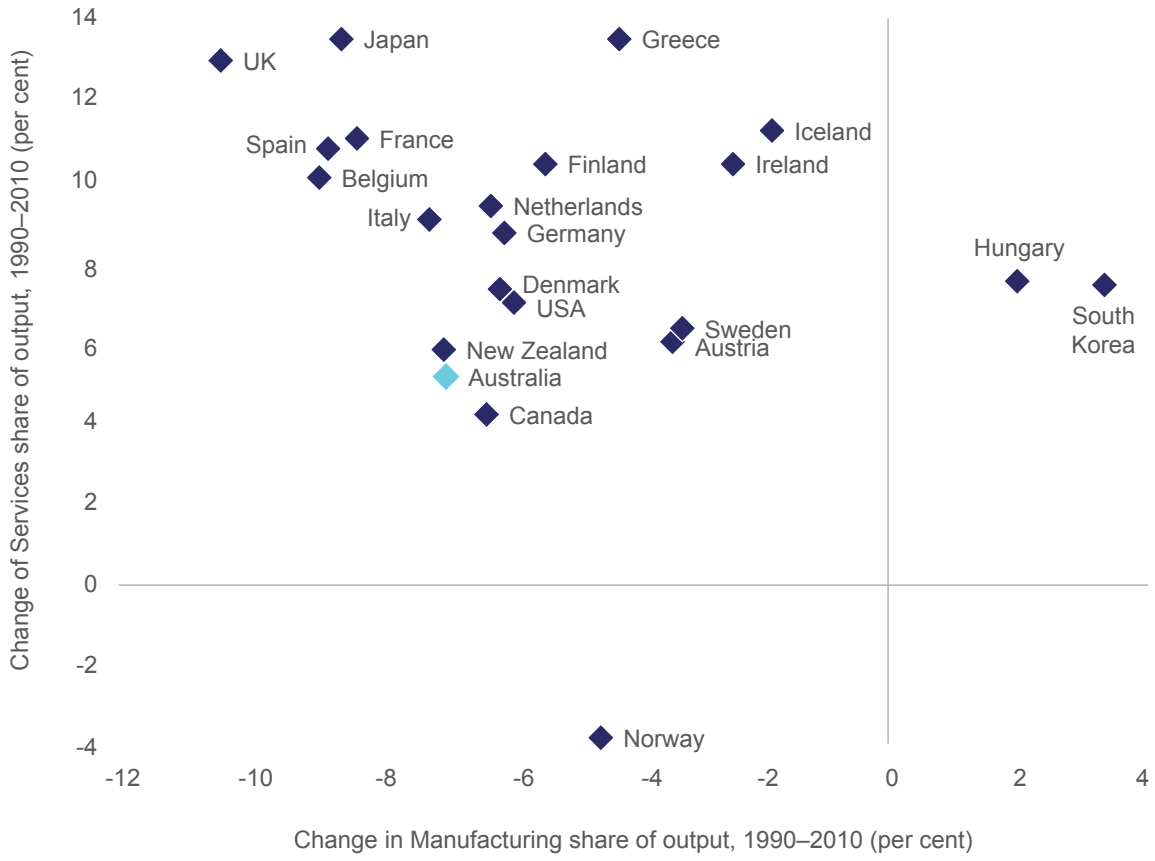
Australian industries are well placed to adapt to the changing circumstances. The terms of trade are expected to continue to fall, which should exert downward pressure on the Australian dollar, and provide some relief for trade-exposed industries. Productivity is expected to pick up as the economy transitions to the production phase of the Mining sector. Labour market conditions are softening, but due to flexibility in the labour market, this has had the upshot (for businesses) of reducing real wages and skills shortages. Unit labour cost pressures have also been subsiding, and, combined with some depreciation in the exchange rate, this has led to Australia's cost competitiveness improving moderately over the past two years.

Structural change has been fundamental to economic development

Structural change has been fundamental to Australia's economic development. Changes in the economy's sectoral composition reflect the reallocation of resources to their most productive uses. Structural change is therefore necessary for continued growth and prosperity, and crucial for the economy's ability to capitalise on opportunities. Indeed, high rates of business entries and exits, and turnover in the labour market, are hallmarks of a dynamic and resilient economy.

The current pace of this change is not unprecedented. The rate of structural change today is akin to what was seen in the late 1950s and 1970s. Moreover, the decline in the relative share of Manufacturing output and the accompanying increase in Services is a phenomenon shared by most major OECD economies.

Chart ES.2: Change in Services and Manufacturing shares of output, selected OECD countries, 1990-2010

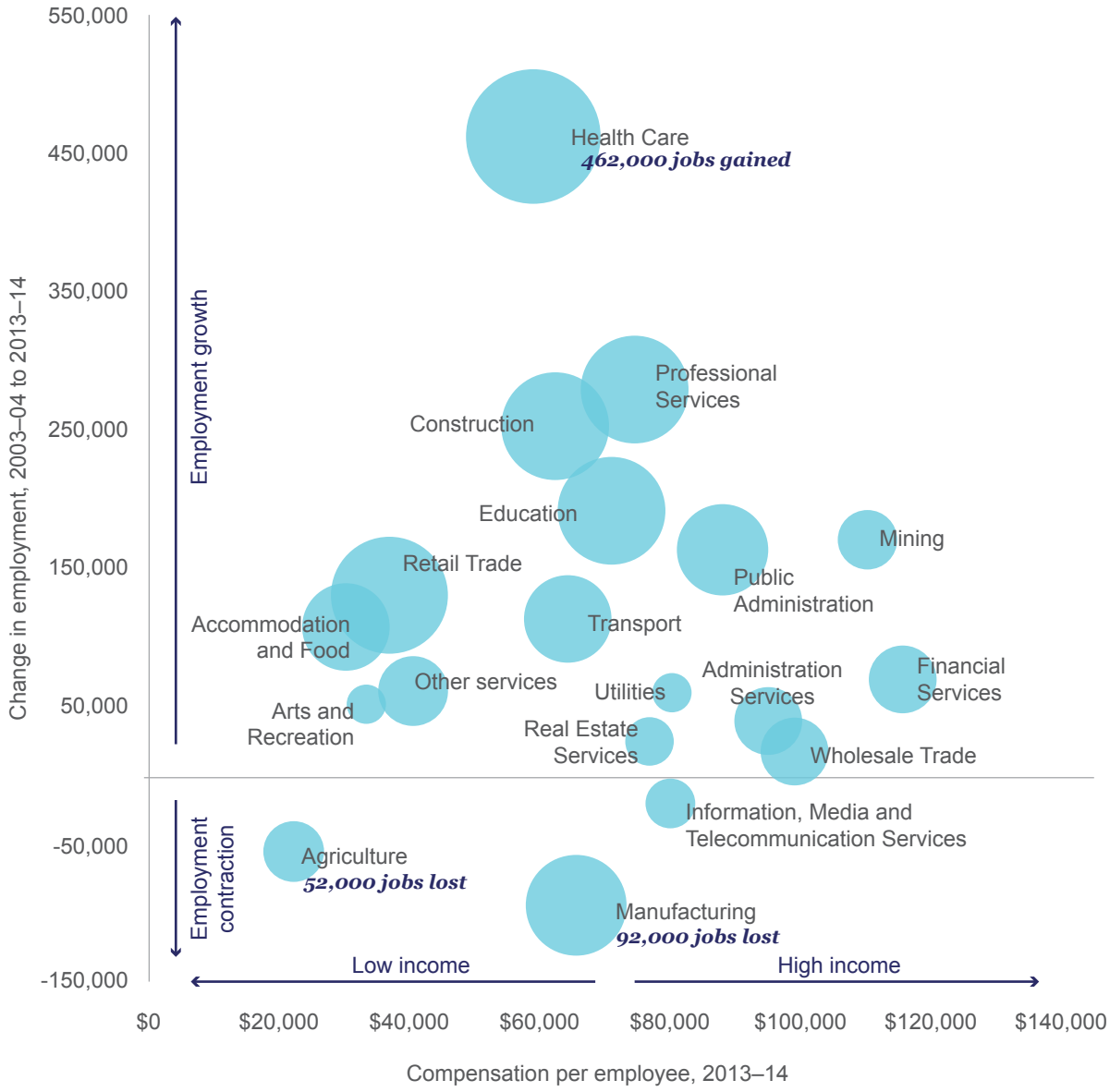


Source: EU KLEMS Database, OECD STAN Database, ABS cat. no. 5204,0, IMF World Economic Outlook, Statistics New Zealand Table SND005AA, Statistics Canada CANSIM Tables 3790023 & 3790029.

Note: Data for Germany and Hungary are for 1991-2010. Data for Greece, Iceland, Ireland, Japan, and Spain are for 1990-2009. Output is GVA at current prices.

The job losses over the last decade in Manufacturing, Agriculture, Forestry & Fishing and Information, Media & Telecommunications have been offset by more than a million job gains in higher paying industries. However, as well as bringing opportunities, structural change also creates challenges. It can impose costs on some workers and regions, particularly in declining sectors and if there are barriers to labour mobility.

Chart ES.3: Change in employment (2003-04 to 2013-14), employment and compensation per employee (2013-14) by industry



Source: ABS cat. no. 6291.0.55.003 cat. no. 5204.0

Note: Industry names have been abbreviated, Utilities is Electricity, Gas, Water & Waste Services.

While Manufacturing's share of output has decreased in recent years, in absolute terms output has grown steadily (at least up until the Global Financial Crisis). The pace of this growth however, has been slower than in the rest of the economy—resulting in Manufacturing's share of output declining in relative terms. That said, Manufacturing remains highly important to the economy given its contribution to overall productivity, its input to research and innovation, and its multiplier effects on growth.

Improved processes and investment in better equipment have seen Manufacturing employment decrease steadily over time. Manufacturing employees are generally less geographically mobile than in other industries. Nonetheless, regions have demonstrated considerable capacity to adjust in the face of the recent decline in Manufacturing employment. Employment outcomes for automotive workers, for example, have been generally positive.

Employment growth has been stronger in higher skilled occupations, and for individuals with higher levels of education. As the transition towards a knowledge-based service economy continues, it is reasonable to expect that these trends will continue.

Concerns that the shift towards services may stifle productivity and output growth tend to over-simplify the issue. Some Services industries for instance, have produced strong labour productivity growth in recent years. However, there is no doubt that the ever increasing employment share of the traditionally low-productivity social service industries does pose some challenges to Australia's future growth potential.

Structural change is a continual process. While the exact nature of structural change in the future is unknown, some inferences can be made as to the broader future trends. It is clear for example, that education, labour mobility, economy-wide productivity growth and the business environment are the key factors that will continue to determine how well Australia copes with future patterns of structural change.

Alignment of strategies and pooling of resources in sectors of strength will benefit the Australian economy

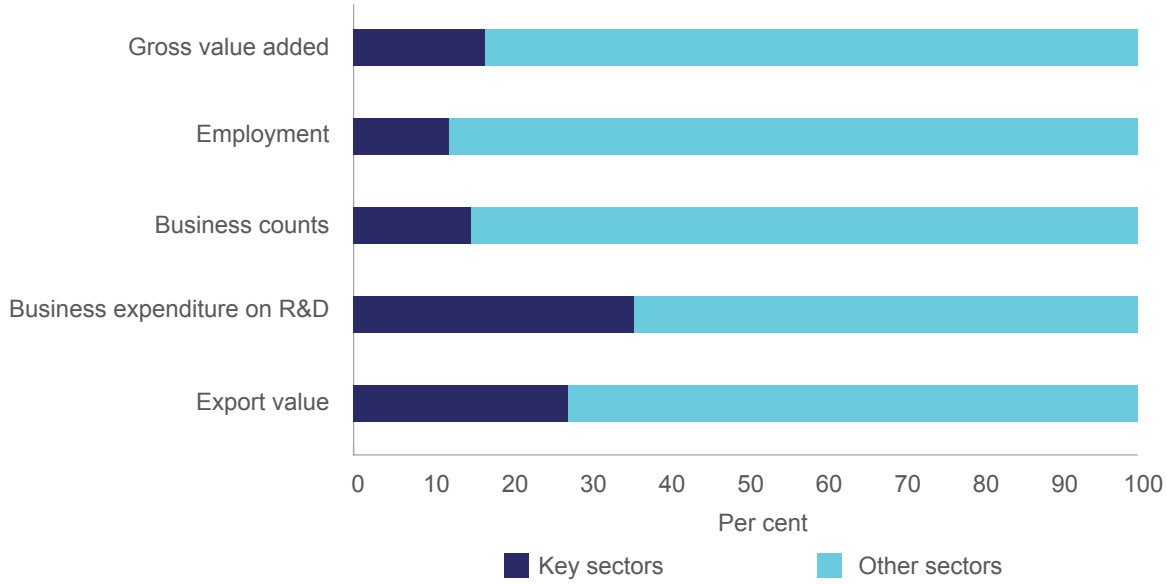
As the level of investment in the Australian resources sector eases back from historically unprecedented levels it will be important to generate new sources of growth across the economy. Long-run prosperity will depend on the ability of our domestic industries to be globally competitive and productive in the light of intensified international competition.

This report provides an overview of the sectors identified as having the most potential to contribute in this space. These sectors, Food & Agribusiness, Mining Equipment, Technology & Services, Oil, Gas & Energy Resources, Advanced Manufacturing, and Medical Technologies & Pharmaceuticals, are well positioned to take advantage of emerging opportunities and have strong prospects for future growth. A number of independent reports have also stated that these sectors are of strategic importance to Australia's economic prosperity.

The analysis of the five key sectors draws on a variety of information sources, including customised and experimental Australian Bureau of Statistics (ABS) data. The sectors were rigorously defined by the department based on the framework of the Australian and New Zealand Standard Industrial Classification (ANZSIC, 2006 edition).

The results, based on preliminary and experimental estimates, show that the five sectors differ in scale, business size composition and performance benchmarks. As at June 2013, the five sectors comprised around 14.9 per cent of the total business population in Australia. Their combined share of overall industry Gross Value Added (GVA) and employment in 2013-14 was around 16.0 per cent and 11.6 per cent, respectively. In 2011-12 (the latest available data), the five sectors jointly accounted for around 35.7 per cent of business expenditure on research and development, while their combined share in the value of exports was about 26.5 per cent.

Chart ES.4: Share of the five key sectors by various characteristics, latest available data



Source: ABS cat. no. 5206.0, 6291.0.55.003, 8104.0 and 5368.0, and Department of Industry calculations.

Notes: Value added (2013-14), Employment (2013-14), Business counts (June 2013), Business expenditure on R&D (2011-12), Export value (2012-13).

The survival rate of firms in these sectors is much higher than the national average. This may suggest that firms entering these sectors have particular strengths and are identifying market opportunities more accurately than those outside these sectors.

Preliminary estimates also show that in 2013-14 labour productivity (measured by GVA per hour worked) for the five key sectors ($81.30 per hour) was much higher than that of overall industry ($69.20 per hour). Labour productivity in 2013-14 was highest for Oil, Gas & Energy Resources ($203.20 per hour), Mining Equipment, Technology & Services ($87.30 per hour) and Medical Technologies & Pharmaceuticals ($72.20 per hour).

Results on individual sectors reveal that the five sectors differ in terms of their recent economic performance as well as in their intrinsic characteristics based on a range of industry benchmarks. Oil, Gas & Energy Resources and Mining Equipment, Technology & Services were the strongest performers in terms of GVA and employment growth over the five years to 2013-14. Over the same period, Food and Agribusiness and Advanced Manufacturing recorded the strongest average annual growth in labour productivity of 2.9 per cent and 2.2 per cent, respectively. Medical Technologies & Pharmaceuticals recorded the highest R&D intensity (9.7 per cent) in 2011-12, followed by Advanced Manufacturing (8.6 per cent) and Oil, Gas & Energy Resources (4.3 per cent). Oil, Gas & Energy Resources and Advanced Manufacturing displayed the highest export intensity as well as capital intensity in 2012-13.

The department continues to strengthen its evidence base

One of the aims of the *Australian Industry Report* is to showcase recent empirical research conducted by the department using its administrative data holdings. Many Australian Commonwealth and State and Territory departments are beginning to understand the potential for utilising their administrative data holdings for analysis and evidence-based policy development and evaluation, and have begun to improve their own data management capabilities. This inaugural report summarises recent initiatives taken by the department regarding its administrative databases. It also discusses the key considerations, challenges and limitations when using administrative data for research and analysis purposes. Finally, it presents the findings of recent research that analysed the characteristics and performance of business advice recipients.

CHAPTER 1
Economic and business conditions

In 2013–14, the Australian economy produced goods and services valued at $1.6 trillion,[1] employed over 11.5 million persons and was home to more than 2 million actively trading businesses. Like most developed countries, the majority of Australian economic activity occurs in Services industries—accounting for 67.8 per cent of Gross Domestic Product (GDP)[2] and 86.7 per cent of total employment.

Charts 1.1 and 1.2 show gross value added[3] (output) and employment by sector. Social Services is Australia's largest sector, using this method of disaggregation[4] (16.2 per cent of GDP), followed by Distribution Services (15.9 per cent), Other Business Services (11.8 per cent) and Financial & Insurance Services (8.4 per cent of GDP). Mining is Australia's largest 'goods producing' industry, at 8.3 per cent of GDP. For further information on the industry and sector classifications used in this report, see Appendix A.

By comparing Charts 1.1 and 1.2, it can be seen that Services (with the exception of Financial & Insurance Services and Utilities) are typically more labour intensive than 'goods producing' industries.

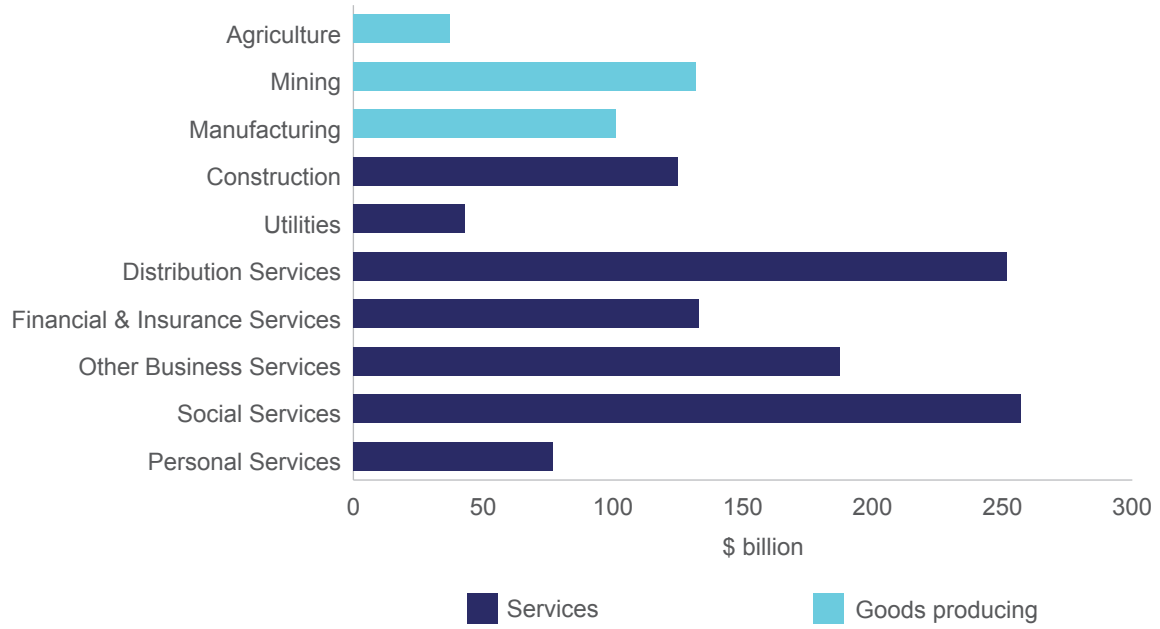
1 In current prices. In this chapter, level figures are quoted in current prices (nominal terms) and growth rates are quoted in chain volume measures (real terms), unless otherwise labelled.

2 Gross Domestic Product (GDP) is the total market value of goods and services produced in a national economy within a given period after deducting the cost of goods and services used up in the production process, but before deducting allowances for the consumption of fixed capital.

3 Gross Value Added (GVA) is the total value of goods and services produced by an industry, sector or area after deducting the cost of goods and services used in the production process. The terms GVA and output are often used interchangeably. GVA by industry or sector is used to measure the contribution of individual industries or sectors or to an economy's GDP. GDP is the sum of all industry or sector GVA plus taxes less subsidies on products plus 'ownership of dwellings'.

4 In this report, Australia's economy is classified into industries using the Australian and New Zealand Standard Industrial Classification (ANZSIC), which disaggregates the economy into 19 industries. Sixteen of these industries (i.e. those not classified as Manufacturing, Agriculture, Forestry & Fishing, and Mining) can be considered Services industries. At times in this report the 16 Service industries are amalgamated into seven sectors (as above), five sectors, or as one sector. See Appendix A for full details.

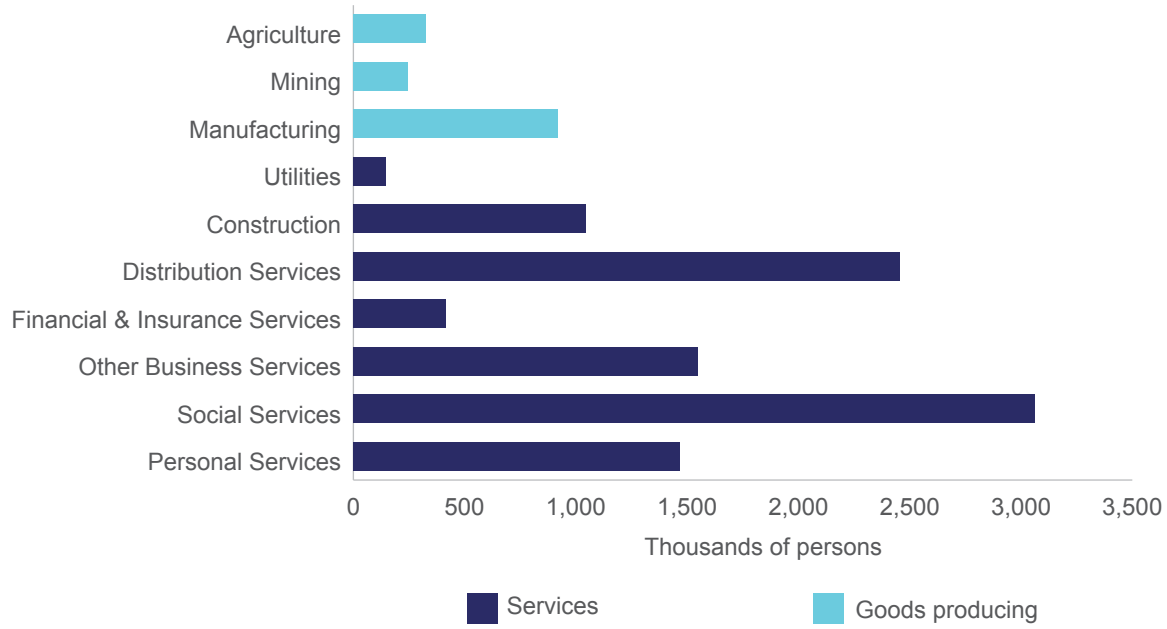
Chart 1.1: Gross Value Added (GVA), by sector, 2013–14[5]



Source: ABS cat. no. 5204.0.

Note: Data is in current prices.

Chart 1.2: Employment by sector, 2013–14



Source: ABS cat. no. 6291.0.55.003; Thomson Reuters DataStream.

Note: Data is in trend terms as at May 2014.

5 In this chapter, Utilities refers to the ANZSIC industry division Electricity, Gas, Water & Waste Services, and Agriculture refers to Agriculture, Forestry & Fishing.

The current composition of the Australian economy is the product of ongoing structural change over time, with the share of Services growing continuously over the years. Structural change is the focus of Chapter 2.

2013–14 marks the 23rd year of consecutive economic growth in Australia. Over this period, the Australian economy has been one of the most resilient economies in the Organisation for Economic Co-operation and Development (OECD), with its current run of economic growth unique in the OECD. The Australian economy, however, faces a number of challenges in the years to come. How the economy responds to a rising China, an ageing population and technological advances will determine whether or not our strong performance continues.

As the economy transitions away from the investment phase of the mining boom, income growth will continue to slow. However productivity,[6] which is essential for prosperity in the long run, should pick up as investment slows and output increases.

Australian industries are well placed to adapt to these changing circumstances. Recent falls in the Australian dollar provide some relief for trade-exposed industries, while pressures from wages growth and skills shortages have also subsided. Australia's international cost competitiveness will continue to improve as a result.

This chapter provides a snapshot of international and domestic economic conditions, developments faced by Australian industries and implications for the future.

6 Productivity is the ratio of output produced to inputs used in the production process.

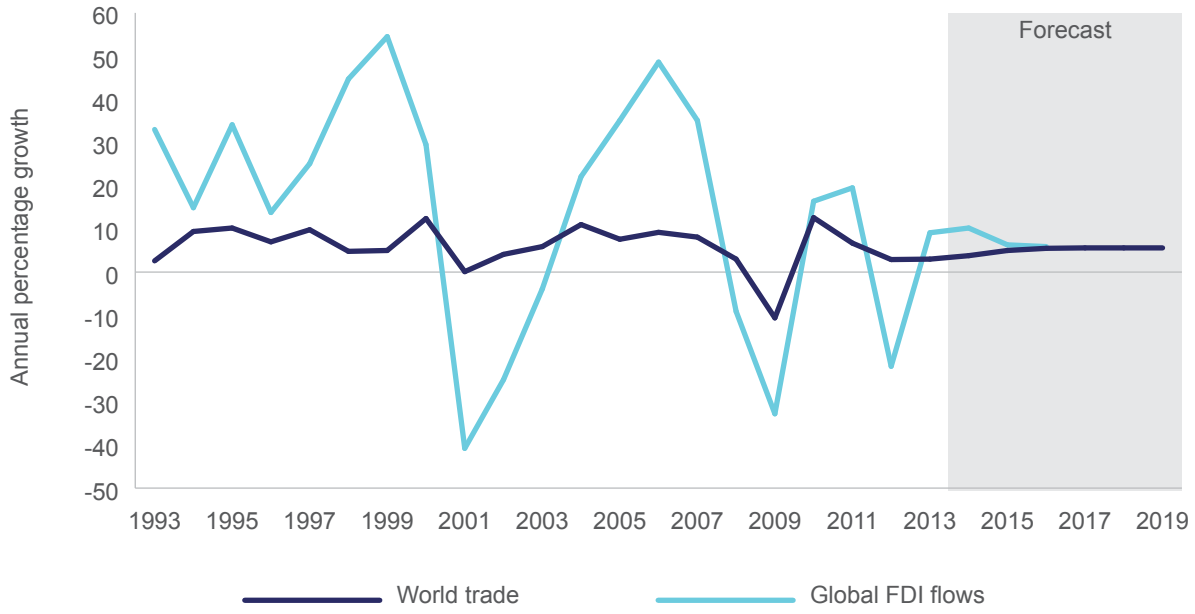
International economic conditions

Events in the rest of the world have a significant impact on the Australian economy. This section highlights recent economic developments in Australia's major trading partners and Australia's increasing linkages with China. The impact of global events on the value of the Australian dollar is discussed, as well as which industries are most trade-exposed.

Australia's economy does not operate in isolation

The impact of recent global economic events can be seen in global trade and foreign direct investment[7] (FDI) activity. FDI flows tend to be more erratic than trade flows, but they are often affected by the same events. As can be seen in Chart 1.3, the Global Financial Crisis (GFC) significantly affected both trade and FDI, with trade falling by 10.6 per cent in 2009 and FDI flows falling by 32.8 per cent in the same year. While both measures experienced sharp rebounds in 2010, activity has been mixed since then and remains below historical averages.

Chart 1.3: World trade volumes and foreign direct investment flows, 1993 to 2019



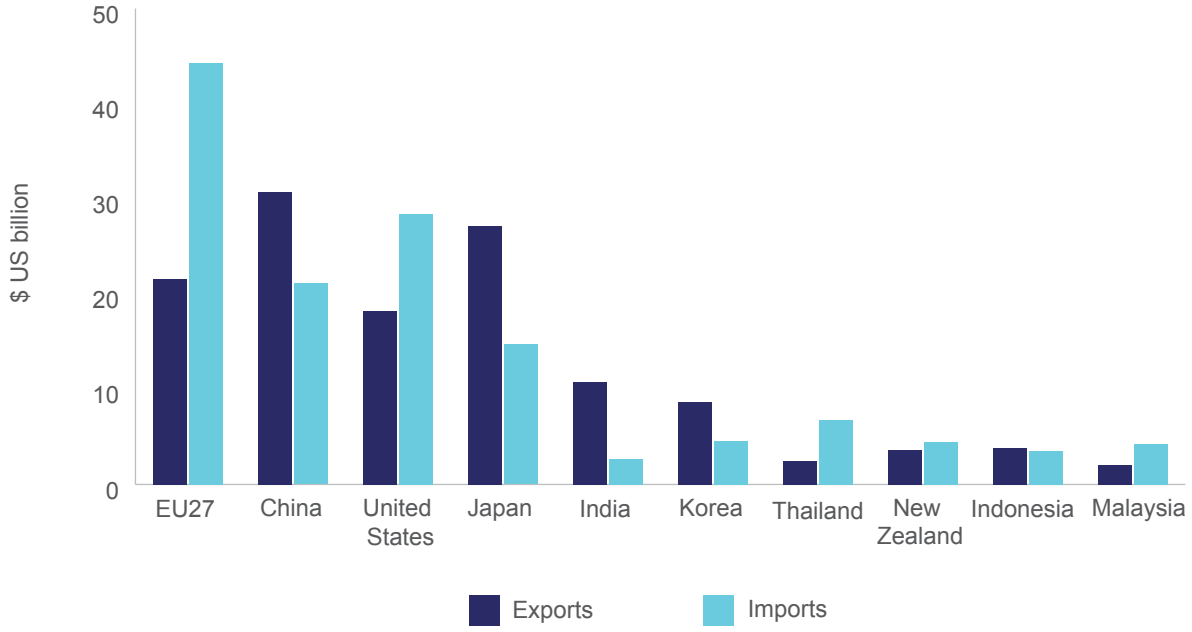
Source: UN *World Investment Report*; IMF *World Economic Outlook*; Thomson Reuters DataStream.
Note: Data is in US dollars.

Chart 1.4 shows Australia's major trading partners in terms of Australian GVA content in foreign country final demand. Trade in GVA, as opposed to conventional measures of trade, provides a better indication of what trade actually contributes to the Australian economy (in terms of value added exports) or to the foreign country (in terms of value added imports). Essentially, trade in value added

7 Foreign direct investment (FDI) is a controlling ownership in a business enterprise in one country by an entity based in another country.

takes into account the fact that when a product is exported to a country, that country may not be the final export destination. A trading hub such as Singapore is a good example of this—in conventional terms it is Australia's fifth largest trading partner, but by trade in value added it is only Australia's 11th largest trading partner.

Chart 1.4: Australia's largest trading partners measured by trade in value added by destination of final demand, 2009



Source: OECD-WTO Trade in Value Added Database (accessed at OECD.Stat).
Note: EU27 represents all members of the EU, as of 2014, excluding Croatia.

Conventional measures of trade show that China is both Australia's largest destination for exports and Australia's largest source of imports.[8] However, in terms of value added trade, Australia's largest two-way trading partner is the European Union (19.5 per cent), followed by China (15.4 per cent), the United States (13.8 per cent), Japan (12.4 per cent) and India (4.0 per cent). China is Australia's largest export market, but it is only the third largest source of Australia's imports. The European Union and the United States are both larger sources of imports by this measure. This reflects that while many products are made in China (for example, the iPhone), much of the component part production and research and development occurs in other countries.

An increasingly large share of Australia's trade in value added occurs through global value chains, where networks of production are located across multiple countries. The integration of Australian industries into global value chains is discussed in Box 1.1.

8 Australian Government (2014), *Composition of Trade 2013*, Department of Foreign Affairs and Trade, Canberra, p.12.

Box 1.1: Global value chains

Global value chains (GVCs) have become a dominant feature of the international business environment over the last few decades. GVCs—networks of production located across multiple countries—first emerged in the 1950s.[9] It was not until the 1990s, however, that their spread accelerated as companies—enabled by falling trade costs and new communications technologies—sought to achieve cost advantages by globalising their production networks. Today an estimated 80 per cent of world trade takes place within GVCs.[10] The proliferation of GVCs has led the World Trade Organisation (WTO) to comment that products are no longer 'made in Japan' or 'made in France', but instead 'made in the world'.[11]

The emergence of GVCs has important implications for the competitiveness of Australian industry. First, a world economy characterised by GVCs presents Australian business with opportunities to capture specific stages or niches within globalised production processes. Once they participate in GVCs, Australian firms may look to expand their operations to higher value activities in the value chain, a process known as 'upgrading'. A product assembly firm, for example, might expand its activities to product design.[12] In addition, the spread of GVCs presents Australian business with opportunities to import inputs that boost productivity, either because they are cheaper than domestically sourced inputs or because they are of higher quality.[13] Access to such inputs can also open up opportunities for domestic firms to innovate.

Yet, participation in GVCs comes with risks. The benefits that firms accrue from GVC participation may be limited if they only capture low value activities in supply chains.[14] Economies which are more integrated into GVCs may also be more vulnerable to external shocks.[15] Indeed, value chains were an important transmission mechanism for the GFC.[16]

So how, and to what extent, does Australian industry participate in GVCs? There are two main types of participation in GVCs. 'Forward participation' is the supply of inputs that are then used in another country's exports, while 'backward participation' is the import of foreign inputs which are then used in exports.[17] Chart 1.5 shows the contribution of different industries to Australia's total forward and backward participation in 2009 (the latest available data).

Australia's backward participation in GVCs is the second lowest in the OECD—only 12.5 per cent of Australian exports use foreign inputs. This is in part a function of Australia's export composition—countries with large natural resource exports generally have lower rates of backward participation because Mining production requires relatively few overseas inputs.[18]

9 OECD (2013), *The Rise of Global Value Chains*, Directorate for Science, Technology and Industry, Paris, p.4.

10 United Nations (2013) *World Investment Report 2013*, United Nations Conference on Trade and Development, Geneva, p.135.

11 World Trade Organisation (2011), *Trade Patterns and Global Value Chains in East Asia*, Geneva, p.3.

12 OECD (2013), *Interconnected Economies: Benefiting from Global Value Chains*, Paris, p.33.

13 OECD (2013), *Interconnected Economies: Benefiting from Global Value Chains*, Paris, p.18.; OECD (2013) *The Rise of Global Value Chains*, Directorate for Science, Technology and Industry, Paris, p.24. For a more detailed investigation of the relationship between productivity and imported intermediates see: OECD, *Trade in Intermediate Goods and Services*, pp.6, 29-33.

14 United Nations (2013), *World Investment Report 2013*, United Nations Conference on Trade and Development, Geneva, p.21.

15 OECD (2013), *Interconnected Economies: Benefiting from Global Value Chains*, Paris, p.5.

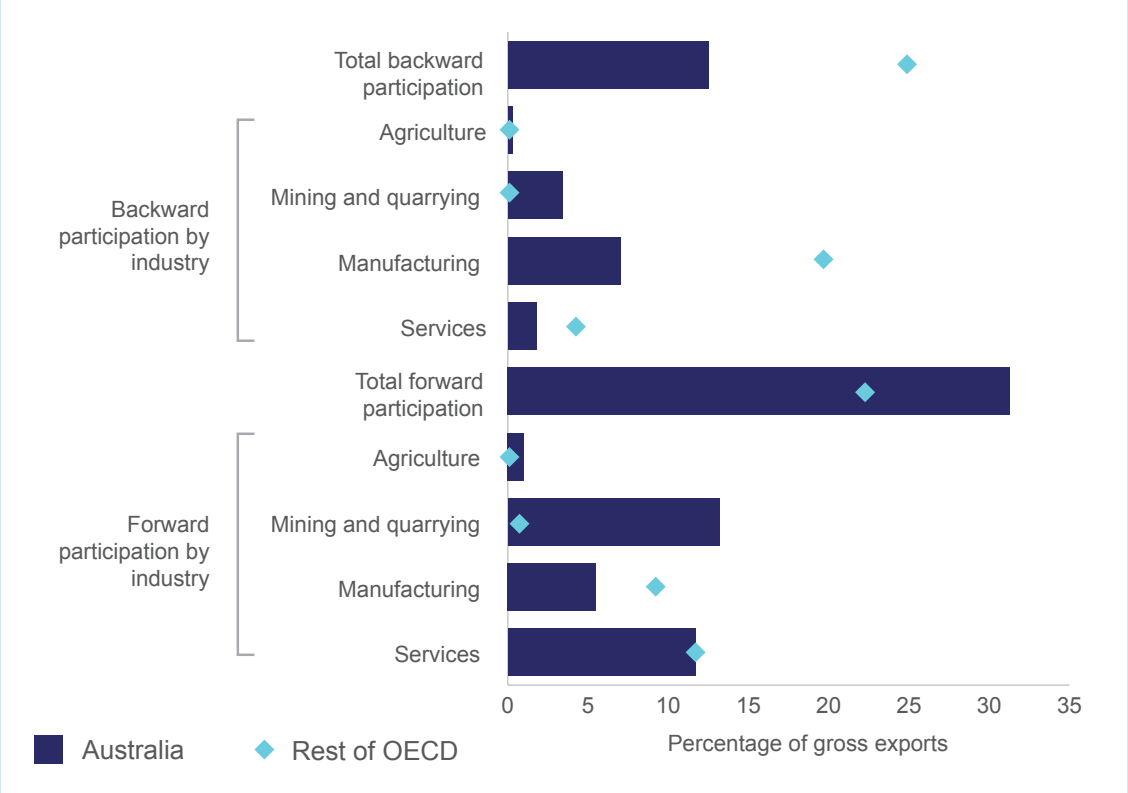
16 Cattaneo O, Gereffi G & Staritz C (2010), *Global Value Chains in a Post-crisis World: A Developmental Perspective*, World Bank, Washington D.C., p.xv.; Kean J (2012), The Governance of Global Value Chains and the Effects of the Global Financial Crisis Transmitted to Producers in Africa and Asia, *Journal of Development Studies*, 48:6, p.783.

17 OECD (2013), *Interconnected Economies: Benefiting from Global Value Chains*, Paris, p.8.

18 OECD (2013), *The Rise of Global Value Chains*, Directorate for Science, Technology and Industry, Paris, p.15.

Australia's forward participation (31.3 per cent) is significantly higher than the average for other OECD countries (23.5 per cent). Mining is the main driver of Australia's forward participation, accounting for 42.1 per cent of overall forward engagement. Among OECD countries, the manufacturing and services sectors account for the vast majority of both backward and forward participation.

Chart 1.5: Australian industry participation in GVCs, percentage of gross exports, 2009

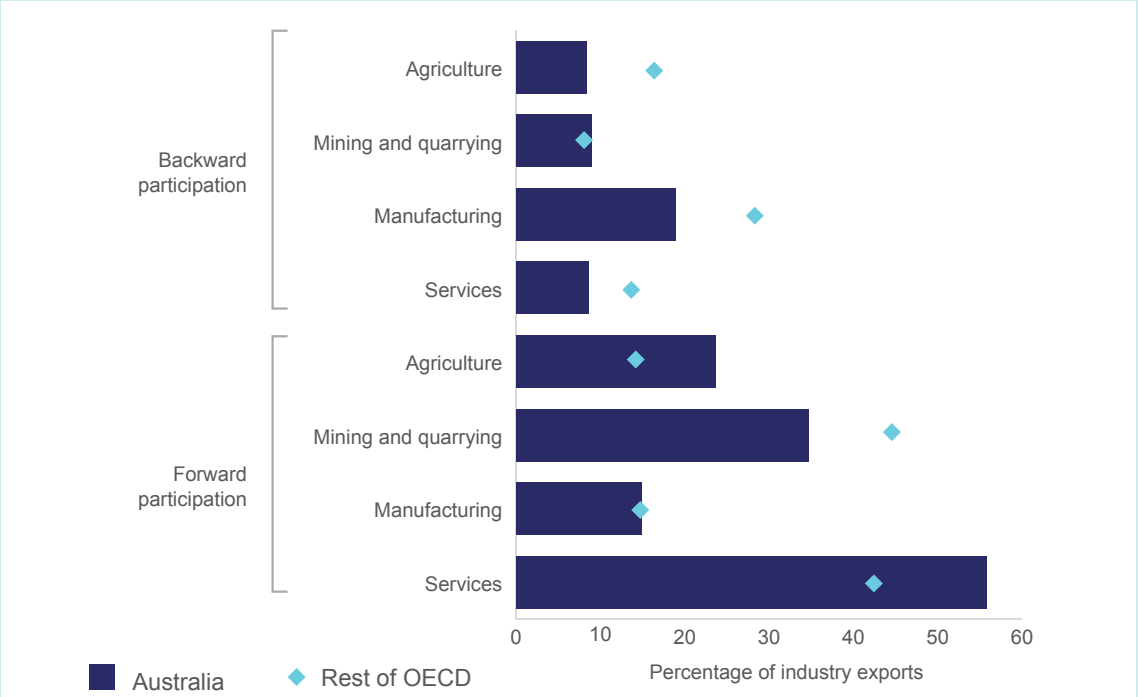


Source: OECD Global Value Chains indicators database.

The participation of Australian industries in GVCs can also be expressed as a percentage of each industry's exports (Chart 1.6), instead of Australian gross exports. This gives an indication of what proportion of an industry is integrated into GVCs, rather than an industry's contribution to Australia's total GVC participation.

Using this measure, Australian industries, except Mining, display a lower rate of backward participation than the average for other OECD countries. An explanation for Australia's low rate of backward participation might be its distance from global markets—the so-called 'tyranny of distance'—which raises the cost for firms of importing inputs from abroad. If so, this may signal opportunities. As the centre of economic gravity shifts towards Asia and technological advances continue to reduce transportation costs, Australian businesses may be better positioned to integrate into GVCs.

Chart 1.6: Australian industry participation in GVCs, percentage of industry exports, 2009



Source: OECD Global Value Chains indicators database.

In contrast, the forward participation of Australia's Agriculture and Services sectors is higher than the OECD average. Forward engagement is particularly strong in the Services sector, where it has risen most rapidly (from 35.8 per cent in 1995 to 55.8 per cent in 2009). Australian Manufacturing's forward participation (14.8 per cent) is only fractionally higher than the OECD average and varies substantially across the Manufacturing subsectors. Finally, the forward participation of the Australian Mining industry is lower than the OECD average. While Mining accounts for a large share of exports and thus contributes strongly to Australia's overall GVC participation, the proportion of the industry's exports integrated into GVCs is not high by OECD standards.

While it is possible to outline how Australia participates in GVCs in some detail,[19] it is more difficult to draw concrete conclusions about the economic benefits for Australia of this engagement. For example, forward participation could indicate a successful capture of niches in GVCs, but could also indicate a failure to capture segments of a value chain by not completing the production of a good domestically. Ultimately, a more precise understanding of the economic benefits flowing from GVCs requires an analysis of individual GVCs, and which party captures value at which stages.[20]

19 The Reserve Bank of Australia, for example, has examined the position of Australian industries in value chains using the measures of 'fragmentation' and 'upstreamness'. See Kelly G & La Cava G (2014) *International Trade Costs, Global Supply Chains and Value-added Trade in Australia*, Reserve Bank of Australia, p.14.

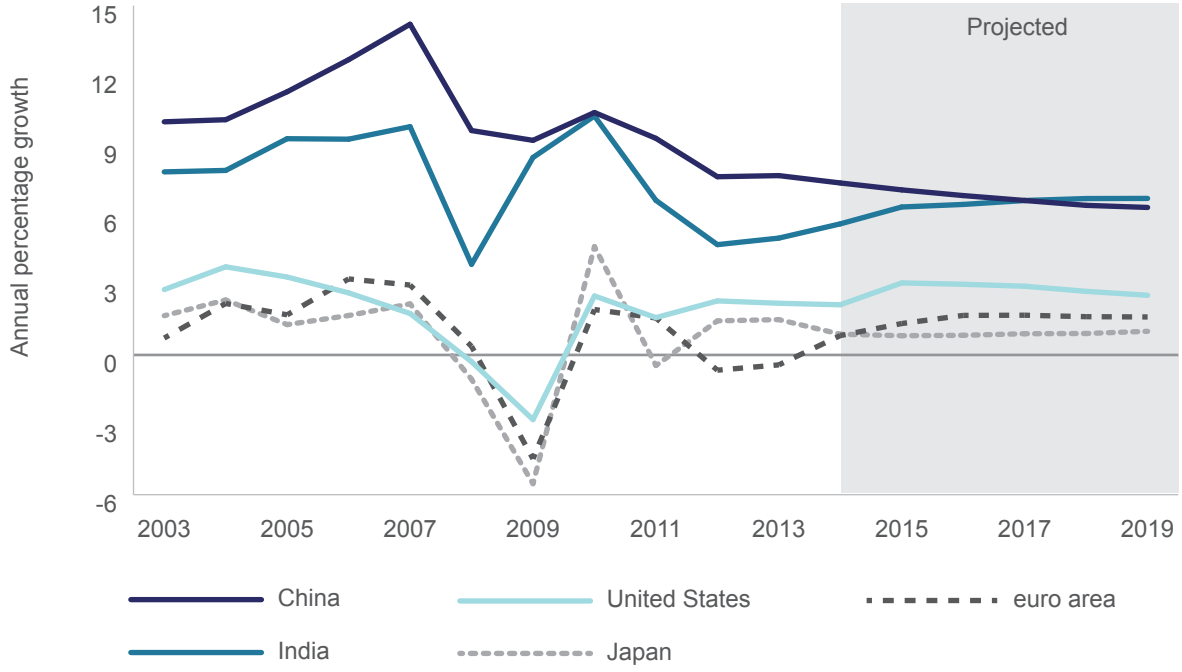
20 See for example, Kraemer, Linden and Dedrick, *Capturing Value in Global Networks: Apple's iPad and iPhone*.

The global economic recovery is gaining momentum, but growth is uneven and challenges remain

Global economic growth is projected to remain moderate, at 3.3 per cent in 2014.[21] The International Monetary Fund (IMF) projects global economic growth to accelerate to 3.8 per cent in 2015, although growth projections differ significantly between individual economies.

The varying economic conditions between the major developed and developing economies that trade with Australia can be seen in Chart 1.7. While growth in the United States is expected to pick up in 2015, growth in the euro area and Japan is expected to remain weak. In China, economic growth is projected to continue to slow, while growth is improving in India. The IMF projects India's economic growth rate to surpass that of China in 2018.

Chart 1.7: Annual GDP growth in key economies, 2003 to 2019



Source: IMF *World Economic Outlook*; Thomson Reuters DataStream.

Economic growth in the United States is rebounding, shaking off the legacy of the GFC. US GDP is projected to grow by 2.2 per cent in 2014, before accelerating to 3.1 per cent. As a result, the Federal Reserve ended its asset purchasing program, designed to lower long-term interest rates, in October 2014.

21 IMF (2014), *World Economic Outlook: Legacies, Clouds, Uncertainties*, October 2014, Washington D.C., p.2.

The United States is a key trade and investment partner for Australia, and weakness and volatility in the US economy have created downside risks for the Australian economy. In particular, persistent weakness (up to recently) of the US dollar has placed significant upward pressure on the Australian dollar, which remains high relative to the US dollar. US trade growth has been flat in recent years, increasing the relative importance of Asia for Australia. With domestic growth increasingly supported by a rapidly growing China and, to a lesser extent, India, growing linkages with Asia are likely to continue.

The euro area is projected to experience a weak recovery, with the IMF projecting growth of 0.8 per cent in 2014 and 1.3 per cent in 2015. Elsewhere in Europe, the United Kingdom's economy is projected to grow strongly, by 3.2 per cent in 2014 and 2.7 per cent in 2015. Prospects remain uneven within the euro area, with solid growth prospects for Spain, and weaker prospects for France and Italy. Germany, previously the economic powerhouse of the euro area, is losing momentum, with GDP falling by 0.2 per cent in the June quarter 2014.[22]

Unemployment is projected to remain a significant problem for the euro area, and is expected to remain above 11 per cent in both 2014 and 2015. Low inflation is also a problem for the euro area, with the distinct possibility of negative inflation (or deflation) if growth does not recover. Falling prices can lead to consumers delaying purchasing decisions in anticipation of lower prices as well as increasing the real value of debts, which could further slow economic activity. The European Central Bank (ECB) lowered its official interest rate to 0.05 per cent in September 2014 in an attempt to stave off deflation.

Japan is also facing low economic growth, with GDP projected to grow by 0.9 per cent in 2014 and 0.8 per cent in 2015. Inflation is lifting, following a long period of low inflation and deflation.

India's economic growth is projected to strengthen to 5.6 per cent in 2014 and 6.4 per cent in 2015, driven by exports and investment. High inflation remains a challenge in India, but the IMF expects that it will continue to moderate.

China's economy is transitioning from being investment-led to a more sustainable private-consumption-led growth and as a result growth is projected to ease but remain robust. The IMF projects that China will grow by 7.4 per cent in 2014, slowing to 7.1 per cent in 2015. This is in contrast to the average growth rate of 10 per cent over the past 30 years. The Chinese economy and its economic ties with Australia are discussed in further detail in Box 1.2.

22 Federal Statistics Office (2014), *Detailed gross domestic product results for the 2nd quarter of 2014*, Germany, www.destatis.de/EN/FactsFigures/NationalEconomyEnvironment/NationalAccounts/DomesticProduct/Current.html (accessed 12 November 2014).

Box 1.2: China's linkages with the Australian economy are increasing

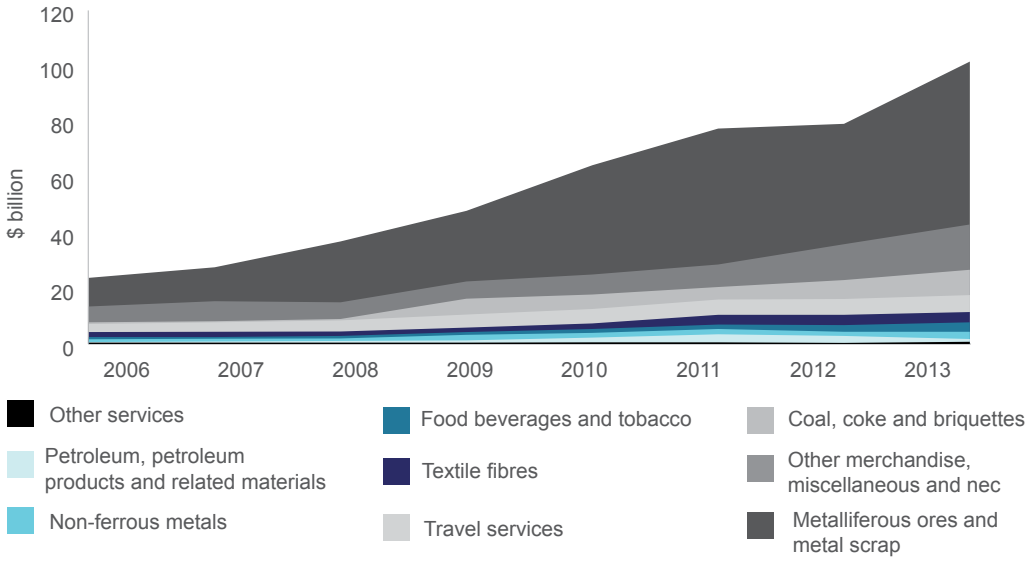
Australia's future economic prosperity is increasingly linked to China's. The Chinese economy, fuelled by investment and exports, has been booming in recent years. This has supported increased demand for raw materials, which has particularly benefited the Australian Mining industry.

The Chinese Government has stated its objective of transitioning the economy toward consumption-supported growth by fast-growing consumer incomes.[23] This process is gaining momentum, as people are moving from rural to urban areas in increasing numbers. China has the world's largest population, and, based on current projections, will be the world's largest economy in 2014.[24] The implications of this transition will therefore be far-reaching. The changing demography and growth of the middle class in China will create both challenges and opportunities for Australian businesses.

As the world's largest consumer of most mineral resources, a slower rate of economic growth in China will impact on commodities markets. There is mounting evidence that the current phase of the commodity price cycle is coming to an end, with global supplies catching up to the rapid demand growth of the past decade.

Despite this, demand for Australia's raw materials is expected to remain high, and the massive investments in Australia's mining capacity are expected to yield strong returns in coming years. Chart 1.8 shows the composition of Australia's goods and services exports to China, which has grown by an average annual rate of 22.5 per cent over the last five years to 2013. Over half of that growth was composed of iron ores and concentrates (included in Chart 1.8 under Metalliferous ores and metal scrap). China was Australia's largest export market (31.9 per cent of total goods and services exports) and its largest import source (15.0 per cent of total goods and services imports) in 2013.[25]

Chart 1.8: The value of Australia's goods and services exports to China, 2006 to 2013



Source: DFAT and ABS cat. no. 5368.0.55.004.

23 Jintao H (2012), *Report of Hu Jintao to the 18th CPC National Congress*, The 18th National Congress of the Communist Party of China, www.china.org.cn/china/18th_cpc_congress/2012-11/16/content_27137540_4.htm

24 According to purchasing power parity (PPP) valuation of GDP. PPP is the exchange rate at which one currency would have to be converted to another currency to buy the same amount of goods and services in each country. Source: IMF *World Economic Outlook Database*, October 2014.

25 Australian Government (2014), *Composition of Trade 2013*, Department of Foreign Affairs and Trade, Canberra, p.12.

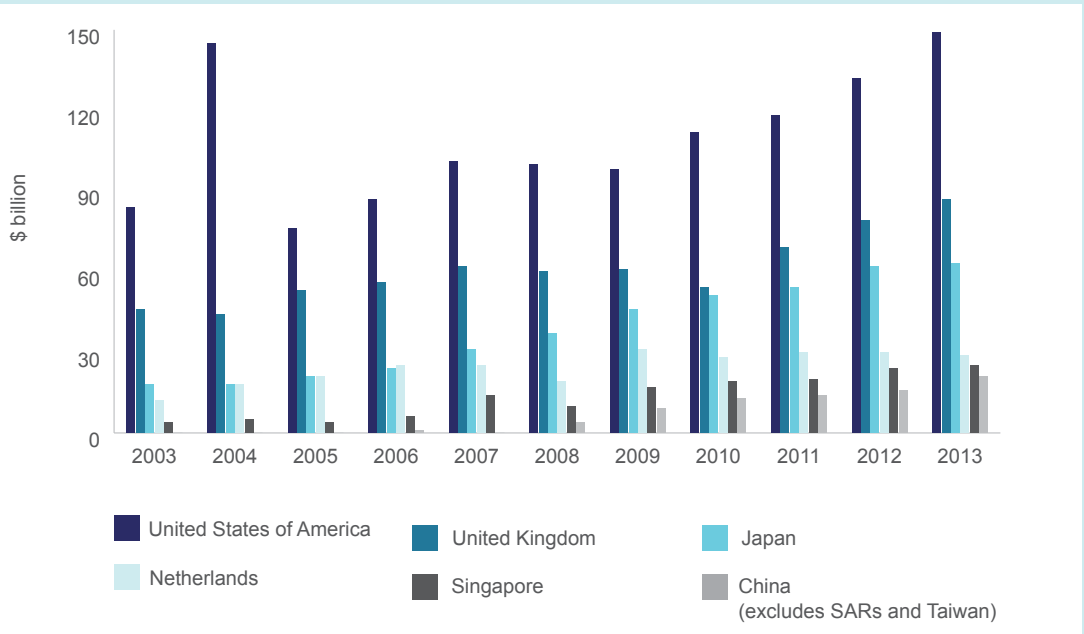
While media headlines are dominated by China's demand for Australia's minerals, it is by no means the only story. There is evidence of opportunities in other sectors as well.

Prior to 2010, the United States was Australia's largest services export market, but Australia's exports of services to the United States have remained flat over the last five years. By contrast, Australian exports of services to China have grown by an average annual rate of 8.9 per cent over the last five years, with China overtaking the United States as Australia's largest services export destination in 2010. The majority of these services exports to China are education-related travel services (e.g. Chinese students studying in Australia), which comprised 58.7 per cent of services exports to China in 2013, with an additional 24.3 per cent relating to other personal travel.

China's economic transition will increase demand for other goods, many of which will be higher in the value chain than minerals. The IMF notes that consumption of basic food staples in China is already giving way to more proteins, and base metal consumption is shifting away from low-grade metals (copper and iron ore) toward higher grades (aluminium and zinc), while cleaner primary energy fuels are starting to replace coal.[26] Australia will benefit both directly and indirectly from China's rising food demand. China's higher imports from the world market will push up global demand, resulting in higher prices and export opportunities to both China and other parts of the world.[27]

China is becoming an increasingly important source of investment in Australia. Before 2009, China accounted for less than one per cent of FDI in Australia.[28] However, FDI from China has increased rapidly since then. China accounted for 9.3 per cent of inward FDI transactions into Australia in 2013 and was the third largest contributor to inward FDI activity in Australia (behind the United States and the United Kingdom). This growth comes off a low base, however, and as Chart 1.9 shows, China still only accounts for 3.5 per cent of the total FDI stock in Australia.

Chart 1.9: Inward foreign direct investment levels by source country, 2003 to 2013



Source: ABS cat. no. 5352.0.

Note: SARs are Special Administrative Regions (Hong Kong and Macau).

26 IMF (2014), *World Economic Outlook—Recovery Strengthens, Remains Uneven*, Washington D.C., April 2014, p.36.

27 Zhou Z, Tian W, Wang J, Hongbo L & Lijuan C (2012) *Food Consumption Trends in China April 2012*, Department of Agriculture Forestry and Fisheries, www.agriculture.gov.au/SiteCollectionDocuments/agriculture-food/food/publications/food-consumption-trends-in-china/food-consumption-trends-in-china-v2.pdf, p.68.

28 ABS cat. no. 5352.0. Figures quoted for China exclude Special Administrative Regions and Taiwan.

Much of the Chinese investment in Australia has been concentrated in Mining and Gas industries. In 2012, Mining accounted for 56.3 per cent, and Gas for 28.3 per cent of FDI from China.[29] But a transition away from Mining investment from China may already be underway. In 2013, Chinese Mining investment fell by 62.5 per cent and gas investment fell by 32.4 per cent (even this level of gas investment was supported by a single large transaction). These falls were partially offset by the State Grid deal, which resulted in the power transmission industry contributing 40.2 per cent to FDI from China in 2013, and an increased contribution from investment in commercial real estate (14.2 per cent).

Contrary to the anecdotal evidence around Chinese interests in Australian agricultural farming and agribusiness sectors, KPMG (2014) reports that there were only two transactions recorded in these sectors from Chinese investors in 2013 (accounting for 1.0 per cent of total inward FDI from China). Instead, KPMG notes that Chinese investors are 'very interested in the food processing stage of production, rather than owning farming operations and rural land for primary production'.

Despite the fall in Mining investment from China, and large one-off deals in gas and power transmission, KPMG expects to 'see a distribution in transition from the Mining boom to a far more diversified situation'. In particular, they believe there is genuine interest from China's largest engineering and construction companies in getting involved with projects in Australia's road, rail and civil infrastructure sectors.

Australia's increasing linkages with China carries with it the risk of weaker-than-expected economic growth in China into the future. Despite slowing economic growth in China, an economic bubble may develop due to continued risky over-investment and high levels of borrowing. The Chinese financial sector is also vulnerable to a possible correction in the real estate market. The IMF notes that the Chinese Government still has capacity to absorb and respond to these shocks, but that capacity is reducing due to repeated use of credit-financed stimulus to investment. [30]

There are a number of challenges and downside risks to the international economy that may impact on Australia. The IMF[31] points to geopolitical tensions which could, should they worsen, lead to sharply higher oil prices and further economic distress. Financial market risks, triggered by a larger-than-expected increase in US long-term interest rates, would also tighten financial conditions in emerging markets. Deflation is also a possibility in the euro area, and as discussed in Box 1.2, there is a risk of a 'hard landing' in China.

More broadly, possibly the greatest risk to the global economy relates to rising levels of debt in developed economies that has not translated into productive investment. This sentiment is echoed by the Bank for International Settlements in its *2013–14 Annual Report*, which noted that the global economy '… may be set on an unsustainable path'. More recently, the Geneva *Report on the World Economy* diagnosed the same problem, stating that 'global debt ratios are breaking new highs'.[32]

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29 KPMG (2014), *Demystifying Chinese Investment in Australia*, March 2014 Update, www.kpmg.com/au/en/issuesandinsights/articlespublications/china-insights/pages/demystifying-chinese-investment-in-australia-march-2014.aspx, p.6-7.

30 IMF (2014), *World Economic Outlook: Legacies, Clouds, Uncertainties*, October 2014, Washington D.C., p.19.

31 ibid. 30, p.xvi.

32 Buttiglione L, Lane P, Reichlin L & Reinhart V (2014), *Deleveraging? What Deleveraging?*, The 16th Geneva Report on the World Economy, Centre for Economic Policy Research, London, p.107.

The strength of the Australian dollar continues to affect the international competitiveness of Australian industry

Of particular relevance to Australian businesses is the value of the Australian dollar, which remains high compared to historical levels (see Chart 1.10). A high Australian dollar reduces competitiveness for those Australian businesses that compete with overseas producers, as Australian exports become relatively more expensive in overseas markets, while domestically-sold Australian goods become relatively more expensive than imported goods.

In April 2013, the Australian Trade-Weighted Index—a measure of the Australian dollar weighted against the currencies of Australia's major trading partners—was 29.4 per cent higher than its average over the past 30 years. It has fallen recently—in October 2014 it was 13.2 per cent higher than the 30-year average—but it remains stubbornly high. Box 1.3 examines in greater depth which industries are most affected by movements in the Australian dollar, and how they have responded to these fluctuations.

Chart 1.10: Australia's real and nominal trade weighted index of the exchange rate, September quarter 1984 to September quarter 2014 [33]

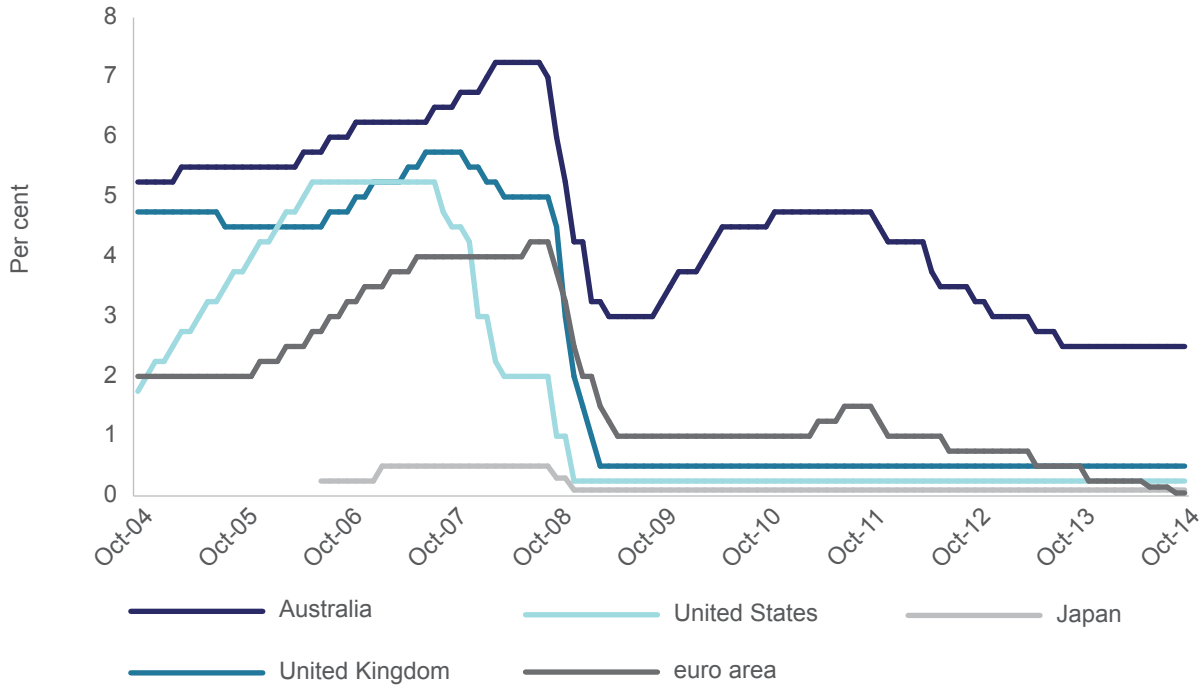
Source: Thomson Reuters DataStream; Reserve Bank of Australia (RBA).

33 The nominal trade-weighted exchange rate is the average value of the Australian dollar in relation to currencies of Australia's trading partners (based on a weighted geometric average). The real trade-weighted exchange rate is the average value of the Australian dollar in relation to currencies of Australia's trading partners adjusted for relative price levels from those countries.

An important driver of Australia's high exchange rate is the interest rate differential between Australia and the rest of the world. Relatively higher interest rates, coupled with a strong economy, has made Australia an attractive investment destination, as returns on Australian bonds, for example, are relatively higher. This increased investment leads to higher demand for Australian dollars.

As shown in Chart 1.11, exceptionally low interest rates persist in much of the developed world, as central banks continue to grapple with the fallout from the GFC. The central banks of the United States, the euro area and the United Kingdom drastically lowered their economy's policy interest rates in 2008, while the Bank of Japan has been using low interest rates to fight deflation and slow growth for many years. Australia's interest rates are at historical lows, but remain higher than other developed economies. This differential, particularly with the United States and the United Kingdom, is now much larger than it was pre-GFC.

Chart 1.11: Key international policy interest rates, October 2004 to October 2014



Source: Thomson Reuters DataStream.

The outlook for the major economies is that interest rates will remain at very low levels for an extended period of time. In its September 2014 monetary policy meeting, the US Federal Reserve (the Fed) indicated that it will end its program of purchasing Treasury bonds and mortgage-backed securities (a process known as quantitative easing, which lowers long-term interest rates) in October.[34] However, the Fed has indicated that they will not be increasing their near-zero benchmark interest rate for a 'considerable time'.

34 Quantitative easing may exert downward pressure on a nation's currency as it reduces long-term interest rates.

The European Central Bank (ECB) lowered its benchmark interest rate to 0.05 per cent in September 2014, its lowest level since the establishment of the ECB in 1998. The ECB has also announced that it will be introducing its own quantitative easing program, which will begin in late 2014 and run for at least two years.

With Australia's interest rates unlikely to fall any further[35], this could mean that the interest rate differential between Australia and major developed countries could remain high for some time to come.

Box 1.3: Trade-exposed industries and their responses to the high Australian dollar

Australia's price competitiveness, as measured by the real exchange rate, has weakened substantially in recent years. The real exchange rate refers to the purchasing power of a currency relative to another at current exchange rates and prices. The real exchange rate is a good measure of price competitiveness because it takes into account both the value of the Australian dollar and Australian consumer prices relative to trading partners.

In the first quarter of 2013, the real exchange rate reached its highest level since 1976. While the real exchange rate has fallen by 7.6 per cent since this recent peak, as of the September quarter 2014 it remained 28.5 per cent higher than ten years ago. This means that Australian produced goods and services are, on average, at a 28.5 per cent price disadvantage compared with 10 years ago. This is due to both an increase in the nominal exchange rate—which grew by 17.7 per cent over the same period, and higher consumer price inflation in Australia, relative to trading partners.

KPMG, in its *Competitive Alternatives* report, ranks Australia's business costs as the third highest among the ten countries surveyed in 2014 (behind Germany and the United States), noting that the result for Australia is highly sensitive to the exchange rate. KPMG's Australia's Business Cost Index (Australia's business costs relative to the United States) fell by 4.4 per cent between 2012 and 2014, as the Australian dollar depreciated.[36]

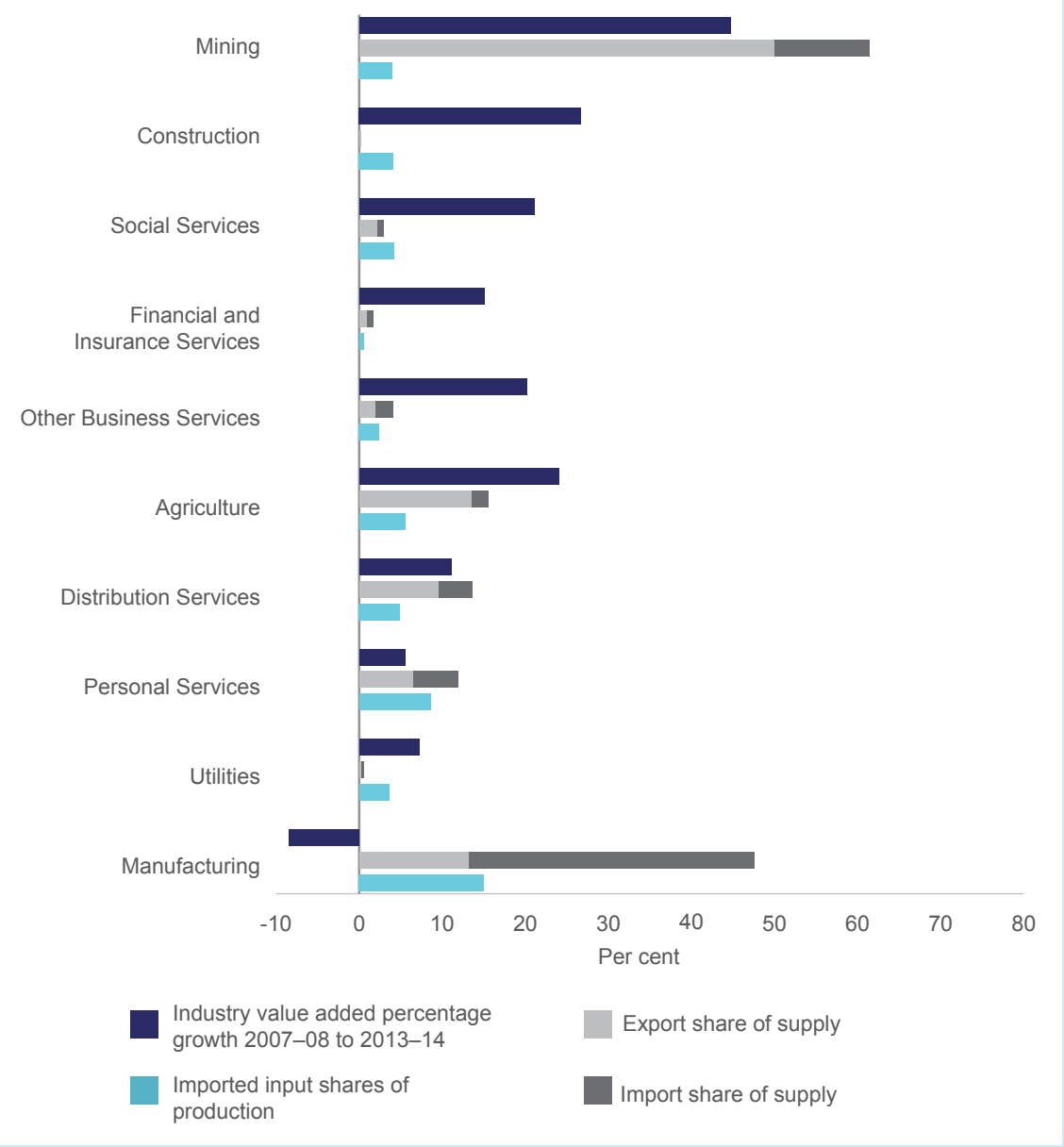
The industries most affected by changes in the real exchange rate are those that are the most trade-exposed. Trade exposure can be proxied by an industry's trade share of supply, i.e. exports plus imports as a share of domestic production plus imports. Chart 1.12 shows estimates of trade exposure against growth in industry value added over the period 2007–08 to 2013–14. Also shown are each industry's imported inputs into production. As the price of imported inputs is expected to fall with an appreciation in the exchange rate, businesses that can import inputs may be able to reduce some of their costs under a higher dollar.

Mining is the most trade-exposed industry in Australia, owing to its high export intensity (i.e. its export share of supply is high). Its strong performance since 2007–08 was largely driven by investment, but a fall in the real exchange rate would make its exports more competitive. Other industries that are highly trade-exposed include Manufacturing, Agriculture and Distribution Services, while Construction, Utilities and Financial & Insurance Services are the least trade-exposed industries.

35 Reserve Bank of Australia (2014), *Minutes of the Monetary Policy Meeting of the Reserve Bank Board October 2014*, www.rba.gov.au/media-releases/2014/mr-14-18.html.

36 KPMG (2014), *Competitive Alternatives: KPMG's Guide to Business Location Costs*, 2014 Edition, p.4. The ten countries surveyed were Australia, Canada, France, Germany, Italy, Japan, Mexico, Netherlands, United Kingdom and the United States.

Chart 1.12: Recent performance and trade exposure of Australian industries, 2009–10



Source: ABS cat. no. 5209.0.55.001, 5204.0 and Department of Industry calculations.

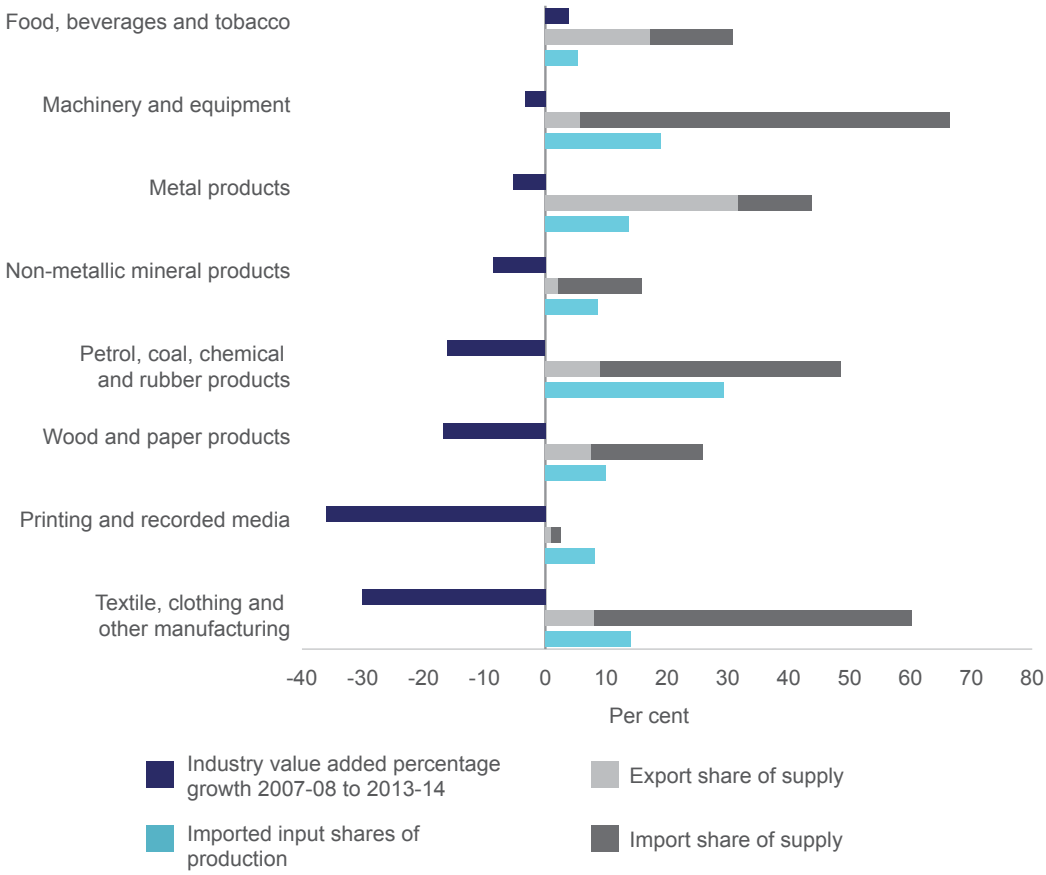
Note: Trade exposure data is for 2009–10. Supply is defined as domestic production plus imports. Industry value added growth rates are chain volume measures and seasonally adjusted. Trade exposure data is current prices and in original terms.

Manufacturing is the second most trade-exposed industry, largely due to import competition. Consistent with this, industry value added in Manufacturing has fallen considerably since 2007–08. Some Manufacturing businesses may have benefited from a rising Australian dollar due to lower input costs, but industry-wide this is outweighed by a particularly high level of import competition. Overall, imported inputs represent 15.0 per cent of the value of Manufacturing production.

As Manufacturing is quite diverse, it is worthwhile examining the various sub-industries of Manufacturing to consider the effects of trade exposure. As can be seen in Chart 1.13, all of the Manufacturing sub-industries (with the exception of Printing & Recorded Media) are highly trade-exposed compared with the non-Manufacturing industries shown in Chart 1.12.

The Machinery & Equipment sub-industry is the most trade exposed (5.6 per cent exports and 60.9 per cent imports), followed by Textiles, Clothing & Footwear and Other Manufacturing (8.0 per cent exports and 52.1 per cent imports). Most Manufacturing sub-industries use a relatively high ratio of imported inputs, particularly the Petrol, Coal, Chemicals & Other Products sub-industry. In terms of industry value added, all of the sub-industries except Food, Beverages & Tobacco, which only grew marginally, contracted between 2007–08 and 2012–13.

Chart 1.13: Recent performance and trade exposure of Australian manufacturing sub-industries, 2009–10



Source: ABS cat. no. 5209.0.55.001, 5204.0 and Department of Industry calculations.

Note: Trade exposure data is for 2009–10. Supply is defined as domestic production plus imports. Industry value added growth rates are chain volume measures and seasonally adjusted. Trade exposure data is current prices and in original terms.

To gain more insight into how the exchange rate is affecting businesses in Australia, the Department of Industry requested the National Australia Bank (NAB) to include a special question on the exchange rate in their *Quarterly Business Survey*. In the September quarter 2014, 34.5 per cent of the businesses that responded said they were adversely affected by the high Australian dollar. Of those that were adversely affected, the most common response to deal with the high dollar was to hedge currency (49.9 per cent), followed by reducing overheads (29.1 per cent), refocusing on or expanding the domestic market (28.3 per cent), importing more business inputs (16.0 per cent) and downsizing (13.1 per cent).

Key points on international economic conditions

The Australian economy is becoming increasingly linked to the global economy. The rise of China is particularly important to Australia's recent economic performance and outlook due to China's demand for commodities. As China continues to develop, opportunities in other sectors, such as Services, will also emerge.

Global economic growth will be moderate in 2014, but the outlook is improving. Despite this, there are risks to the outlook, including stimulus measures which have not yet translated into investment, low price growth or deflation in the euro area, volatility in financial markets and geopolitical tensions.

One way global economic events impact on Australian industries is through the value of the Australian dollar. Those industries that are most trade exposed—Mining and Manufacturing—are most adversely affected by a strong dollar.

Domestic economic and business conditions

This section outlines recent developments in the Australian economy and how they are affecting Australian industries and businesses. This section reports on overall conditions in the labour market and implications for skills shortages, wages and the cost of doing business.

Domestic output growth is below trend, but improving, while income growth remains subdued

A diverging trend is emerging—while Australia's annual GDP growth has been positive since 2009–10, real incomes[37] have been falling for the last two years. GDP per capita[38] grew by 0.8 per cent in 2013–14. This is well below the long-term trend pace of 1.9 per cent. By contrast, the preferred measure of Australian living standards, the Real Net National Disposable Income (RNNDI) per capita,[39] fell by 0.4 per cent in 2013–14, following a 1.7 per cent fall in 2012–13.

While GDP and income growth typically track each other closely, income growth has exceeded GDP growth throughout most of the last ten years. The only exceptions were at the height of the GFC in 2009–10 and in the last two years. Chart 1.14 shows a widening gap between GDP per capita growth and income per capita growth since 2003–04, turning from positive to negative in 2012–13 and 2013–14.

The reason living standards improved faster than GDP per capita in the period leading up to 2011–12 was Australia's booming terms of trade—the price Australia receives for its exports relative to what it pays for its imports—which has been driven by the commodities price boom. The higher terms of trade

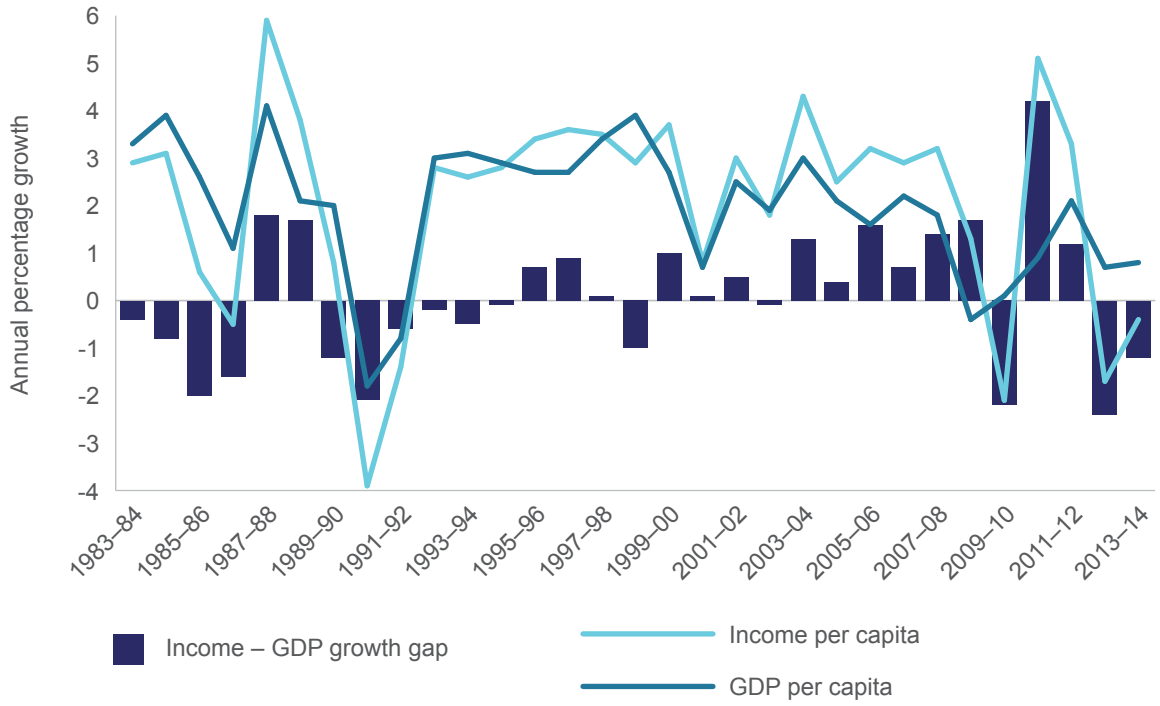
37 Income adjusted for inflation.

38 GDP per capita is GDP divided by the population (per person). Per capita measures are used here to remove the distortion of population growth, since population growth alone does not improve living standards.

39 GDP measures the total volume of goods and services produced in an economy. RNNDI attempts to measure the real purchasing power of income. It is calculated as real GDP plus the trading gain or loss resulting from changes in the terms of trade plus real primary incomes receivable from abroad minus real primary incomes payable abroad plus real current transfers receivable from abroad minus real current transfers payable abroad minus consumption of fixed capital in volume terms.

increases domestic wealth, because Australians receive a relatively higher price for what they sell overseas, and pay a relatively lower price for what they buy from overseas.

Chart 1.14: Annual growth in GDP and income per capita, 1983–84 to 2013–14



Source: ABS cat. no. 5204.0.

Note: Incomes are Real Net National Disposable Income; data is chain volume measures.

The terms of trade have boosted incomes, but it is important to note that the impact of the terms of trade may be exaggerated to some extent. In particular, there is an assumption that the export revenue is captured by Australians and not foreign-owned companies and that the additional wealth is spent and not saved.

The terms of trade peaked in 2011–12, and have been in decline since. This is expected to continue in the near future, putting further downward pressure on national incomes and subsequently overall living standards. The Treasury forecasts the terms of trade to fall to early-2008 levels by the June quarter 2016.[40]

This may provide some relief for trade-exposed industries. The lower terms of trade should translate to a real depreciation in the Australian dollar. This has occurred historically,[41] but exchange rates are notoriously difficult to predict, as there are many other factors that are in play. In particular, growth in domestic prices relative to foreign prices (known as purchasing power parity), interest rate differentials (known as interest rate parity) and relative economic performance (which may drive investment

40 Australian Government (2014), *Budget Strategy and Outlook: Budget Paper No.1*, Budget 2014-15, Statement 2: Economic Outlook, p.5.

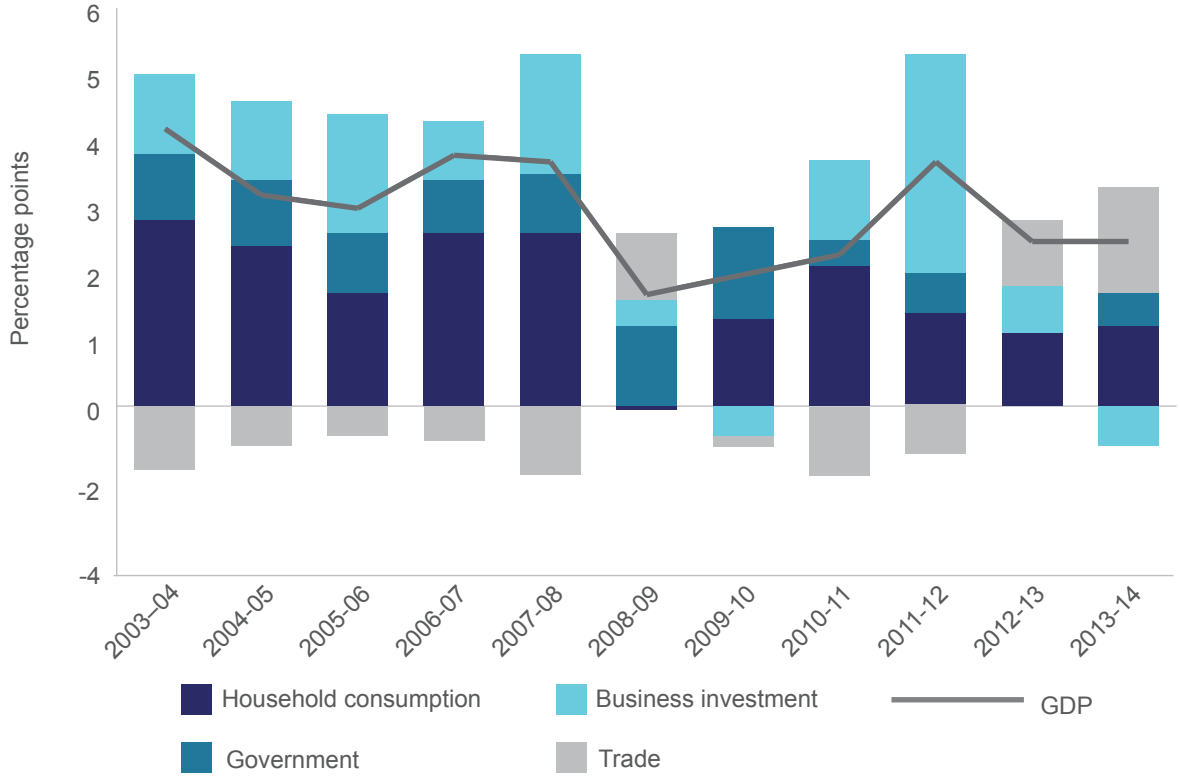
41 Atkin T, Caputo M, Robinson T & Wang H (2014), *Macroeconomic Consequences of Terms of Trade Episodes, Past and Present,* Reserve Bank of Australia, p.11.

and trade) are important factors that may impact on the exchange rate. As previously discussed, interest rate differentials continue to put upward pressure on the Australian dollar.

The boom and subsequent fall in the terms of trade are largely due to the Mining investment boom. In particular, high commodity prices increased the value of Australian exports and encouraged massive investment in Mining capacity. Commodity prices have since peaked, reducing the terms of trade and Mining investment activity.

Mining investment has significantly impacted on the composition of Australia's GDP growth. As can be seen in Chart 1.15, total business investment detracted from growth in 2013–14, which was almost entirely due to falling Mining investment.[42] The fall in business investment follows strong positive contributions to GDP growth throughout most of the previous decade.

Chart 1.15: Contribution to annual growth in GDP, by key components, 2003–04 to 2013–14



Source: ABS cat. no. 5204.0.

Note: Data is in chain volume measures. 'Government' includes government consumption and government gross fixed capital formation.

While Mining investment has begun to slow, it should drop further according to the Australian Bureau of Statistics (ABS) survey of expected private new capital expenditure.[43] Businesses expect nominal private new capital expenditure to decline further by 8.1 per cent in 2014–15 to reach its lowest level since 2010–11. Most of the fall is expected to come from Mining, but nominal private new capital expenditure in Manufacturing and other industries are also expected to fall.

42 ABS cat. no. 5625.0.

43 ABS cat. no. 5625.0.

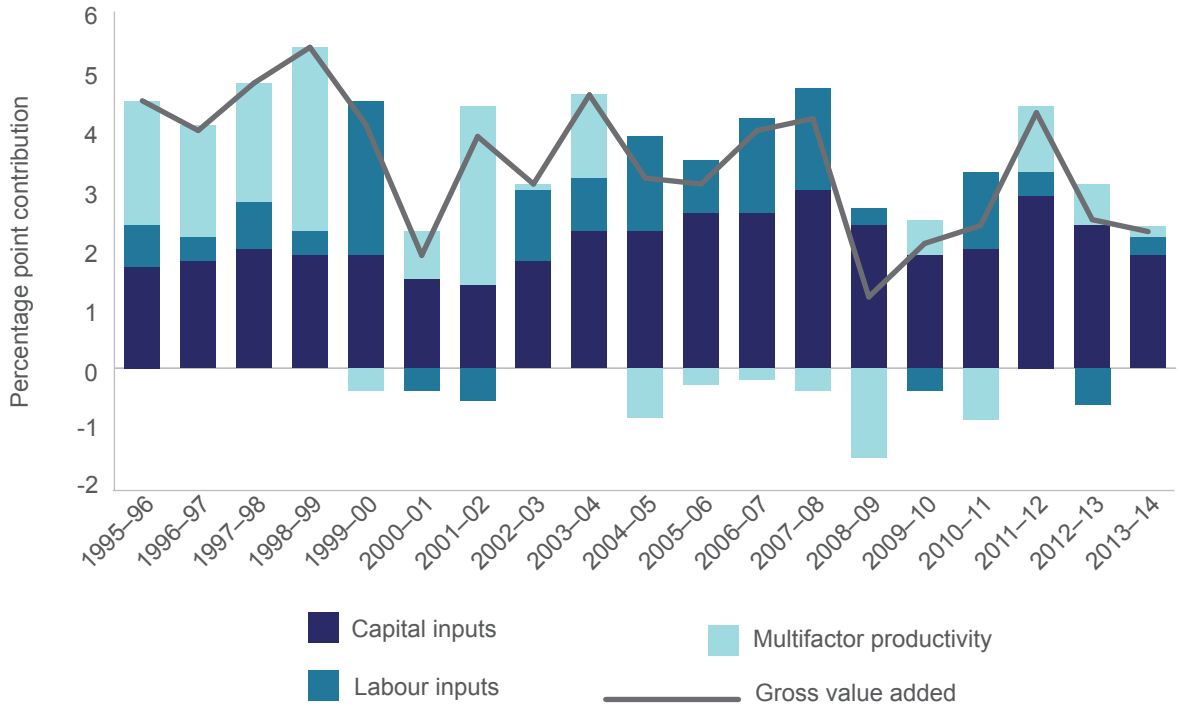
The decrease in investment is not all bad news—the drivers of GDP growth are changing toward trade and more diverse sources of growth. Chart 1.15 shows that in 2012–13, trade accounted for almost 40 per cent of GDP growth, but its share increased to 63.0 per cent in 2013–14. Most of this was due to an increase in exports. By contrast, trade detracted from GDP growth over 10 of the 11 years prior to 2012–13, driven by surging imports, which in turn were driven by imports of intermediate inputs into production.

Bureau of Resource and Energy Economics projections indicate that Australia's export earnings from resources and energy commodities will increase by an average annual rate of 7 per cent from 2013–14 to $274 billion in 2018–19 (current prices).[44] The projected growth is volume driven, with prices expected to continue to decline.

Productivity growth has been falling, but should improve

At the economy-wide level, output growth in the three years to 2013–14 has been slow primarily because of the slow growth in factor inputs (labour and capital), but also due to low productivity growth.[45] As shown in Chart 1.16, the softening demand for factor inputs is entirely due to almost zero growth in labour inputs over the last three years—which means that demand for labour hasn't grown in this period (Chart 1.19 shows that hours worked per head of population has been falling sharply).

Chart 1.16: Contributions to Australian economic growth by key components, 1995–96 to 2013–14



Source: ABS cat. no. 5204.0.

Note: Data is GVA in the market sector. GVA represents 94 per cent of GDP. The market sector comprises all industries excluding social services. Factor inputs are combined labour and capital inputs. Data is chain volume measures.

44 Australian Government (2014), *Resources and Energy Quarterly*, September quarter 2014, Bureau Resource and Energy Economics, Canberra, p.18.

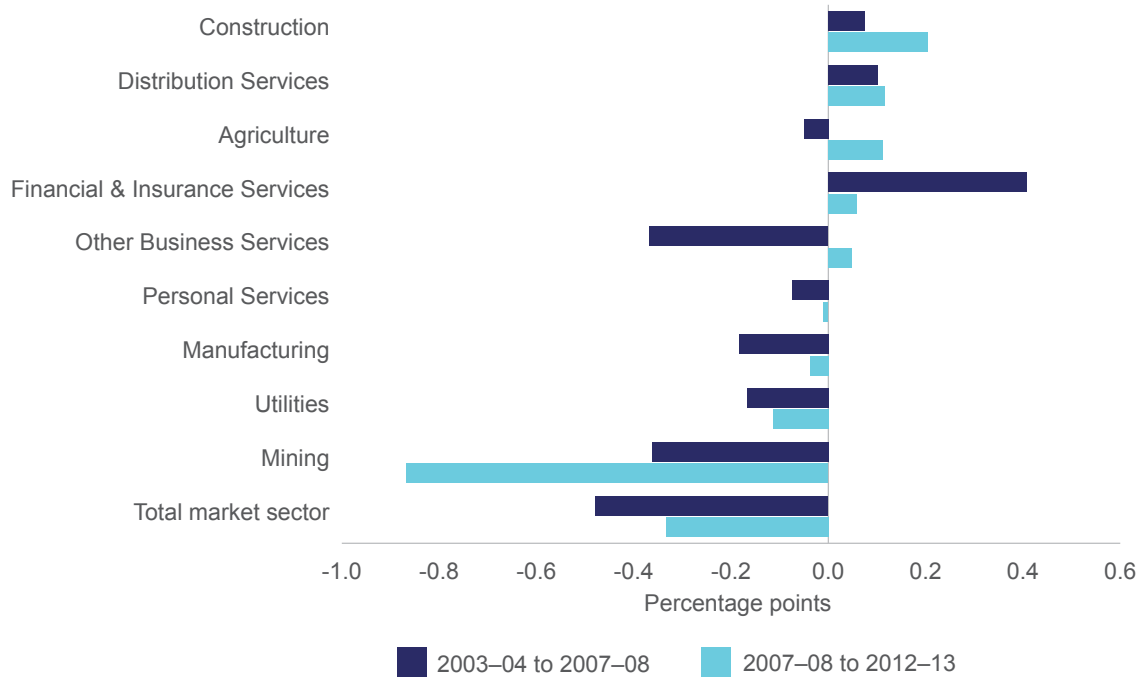
45 Productivity in this report refers to multifactor productivity, unless stated otherwise. GVA equals multifactor productivity plus factor inputs (labour and capital inputs). Multifactor productivity is output per unit of combined inputs (labour and capital).

By contrast, over the period 2003–04 to 2010–11, productivity contributed negatively to GDP growth, while labour and capital inputs were growing strongly. This is consistent with the investment driven growth period shown in Chart 1.15 (because investment requires inputs but not outputs). Growth in capital inputs has remained strong over the last ten years, which is consistent with the Mining investment boom—Mining is a capital intensive industry.

Chart 1.16 shows the contribution of factor inputs and productivity to growth in GVA over the past 19 years of available data. Over the period 2003–04 to 2010–11, productivity fell by 0.5 per cent per year, but in the last three years it has been growing by 0.6 per cent per year. Growth in capital inputs has been reasonably consistent over the two periods at above 5 per cent per year, while growth in labour inputs slowed from 1.7 per cent per year over the period 2003–04 to 2010–11 to just 0.1 per cent per year in the last three years.

The industry drivers of productivity growth, shown in Chart 1.17, indicate that the Mining, Utilities and Manufacturing industries have been the major drivers of falling productivity. Mining was the most significant driver—large and expensive capital projects in new mine construction have only recently come online, and have not yet produced much output. Productivity growth in Mining is expected to improve as Australia moves from the investment phase of the Mining boom to the production phase.

Chart 1.17: Industry contributions to annual growth in market sector multi-factor productivity, by productivity cycle



Source: ABS cat. no. 5260.055.002, 5204.0 and Department of Industry calculations.

Note: Estimates exclude reallocation affects, i.e. movements of labour, capital and output between industries. Data is in chain volume measures and in original terms.

A similar story emerges in Utilities, which has experienced very high input growth and low output growth over the two most recent productivity growth cycles. This is again likely due to significant capital investment (network upgrades and water desalination plants, for example) from which the productivity losses may be temporary. However, as noted by the Productivity Commission (PC)[46], some of this may reflect 'structural' changes—for example, requirements to meet environmental objectives, shifts to non-dam water sources and shifts to underground power lines.

There is no single cause of the fall in Manufacturing productivity. According to the PC[47], the bulk of the decline in the 2003–04 to 2007–08 cycle (where the fall is most prominent) is attributed to the Petroleum, Coal, Chemical & Rubber Products, Food, Beverage & Tobacco Products and Metal Products subsectors. Some of the factors influencing productivity in these subsectors include lags between investment and output, unmeasured increases in quality and lower capacity utilisation. The PC noted that some of those factors reflect temporary responses to changing competitive pressures.

Overall, the outlook for productivity growth is more positive than the recent productivity performance. For example, some of the losses in productivity in Mining and Utilities may be reversed, as investment slows and production picks up as a result of the new productive capacity. To what extent a lower Australian dollar may improve competitiveness and output in trade-exposed sectors, such as Manufacturing, remains to be seen.

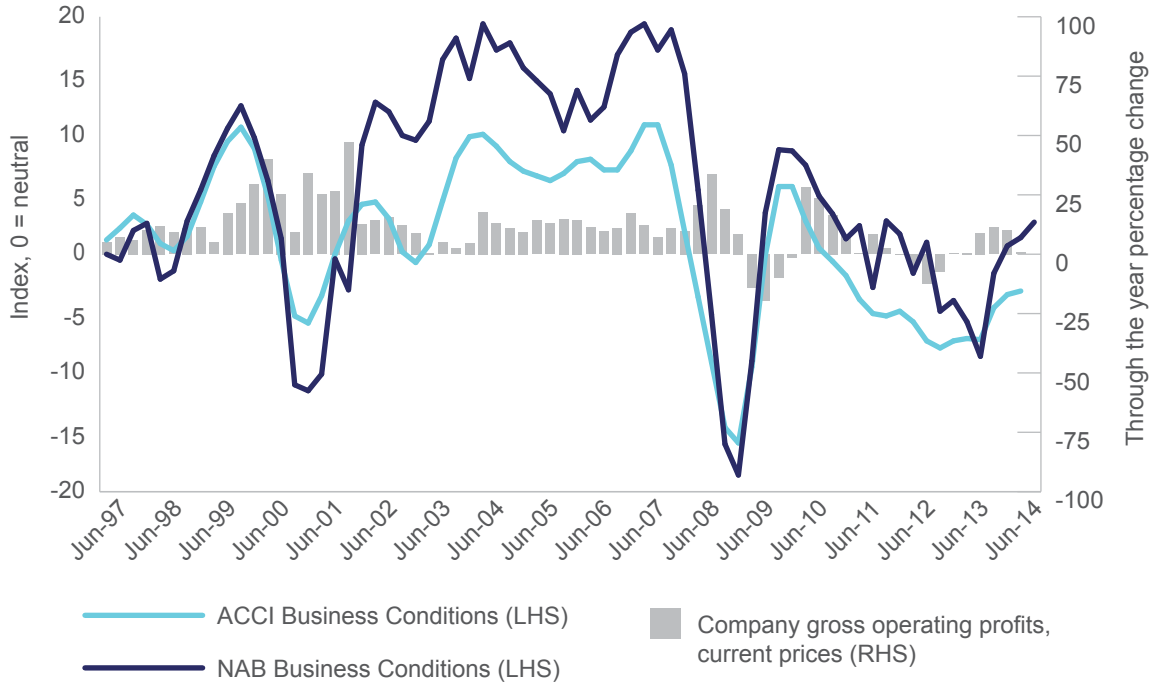
46 Australian Government (2013), *PC Productivity Update*, May 2013, Productivity Commission, Melbourne, p.33.

47 Barnes P, Soames L, Li C, Munoz M (2013), *Productivity in Manufacturing: Measurement and Interpretation*, Productivity Commission Staff Working Paper, Melbourne, p.3.

Indicators of business conditions are tentative and reflect uncertainty

The NAB *Business Survey* and the Australian Chamber of Commerce and Industry (ACCI) *Business Expectations Survey* both point to moderately positive or negative business conditions recently, reflecting uncertainty in the business community. However, both surveys point to some improvement following its recent trough in September 2013 (see Chart 1.18). This is supported by the recent lift in company gross operating profits.[48]

Chart 1.18: NAB and ACCI business conditions, September quarter 1997 to September quarter 2014



Source: NAB, ACCI, ABS cat. no. 5676.0; Thomson Reuters DataStream.

Note: Data are number of firms reporting an improvement in business conditions versus number of firms reporting deterioration. ACCI data have been rebased from neutral = 50 to neutral = 0.

ACCI survey data correlates closely with the recent NAB monthly business survey index. The NAB survey for September 2014 notes that 'the upward trend in the [business conditions] index has stalled, with very little impetus from forward indicators to suggest the trend will resume its upward trajectory in the near-term. The effects of soft national income growth—a function of lower commodity prices, excess capacity and cautious spending behaviour—are being felt across the economy'.

NAB reports that the main constraint on output in September 2014 is sales and orders, with 55.1 per cent of firms identifying this as a significant constraint. Finding suitable labour is the next most important constraint on output growth.[49] However, as highlighted later, this constraint eased in recent years due to softer labour market conditions.

48 Gross operating profit is revenue less cost of goods sold.

49 NAB (2014), *Quarterly Business Survey*, NAB Group Economics, September 2014, p.15.

Soft labour market conditions reflect weak demand, but labour has become more productive

Overall labour market conditions remained soft in 2014. A key measure of overall labour market conditions is labour utilisation[50], which reflects the extent to which people aged 15 years or older are engaged in employment. Labour utilisation has been on a downward trend since late 2011, and as of October 2014 was at 84.0 hours per person per month[51], the lowest level since 1994. As previously mentioned, a slowdown in the growth of labour inputs has contributed to lower GDP growth in recent years (see Chart 1.16). Moreover, the Treasury projects that labour utilisation will not contribute to GDP growth in the decade to come, putting the emphasis on productivity gains to drive economic growth.[52]

Changes in labour utilisation can be explained by one or a combination of changes in the unemployment rate, changes in the participation rate[53], or changes in the number of hours worked per employee. All of these measures have weakened in recent years, reflecting a combination of demand and supply factors. Demand has been weak due to slow growth in economic activity, while supply has been affected by the ageing population.

Another factor affecting labour utilisation is the long-term trend away from full-time and toward part-time employment. In October 2014, full-time employment represented 69.5 per cent of total employment, its lowest level on record. This compares with 76.0 per cent full-time employment 20 years earlier.

The trend unemployment rate was 6.2 per cent in October 2014—the highest level since 2002. But conditions may have stabilised in recent months, with the ANZ Job Advertisements series pointing to an increase in the availability of jobs in the five consecutive months to October.[54]

The trend participation rate was 64.6 per cent in October 2014—its lowest level since early 2006. While improvements in labour demand will encourage some workers back into the labour market, in the longer term, the ageing population will continue to exert downward pressure on the participation rate and on labour utilisation. The RBA recently noted that 'in time it is likely that the availability of workers, not jobs, will be the main concern'.[55] The relationship between labour utilisation and the participation rate is shown in Chart 1.19.

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50 Defined as the number of hours worked per person of 15 years of age and over.

51 ABS cat. no. 6202.0, trend data.

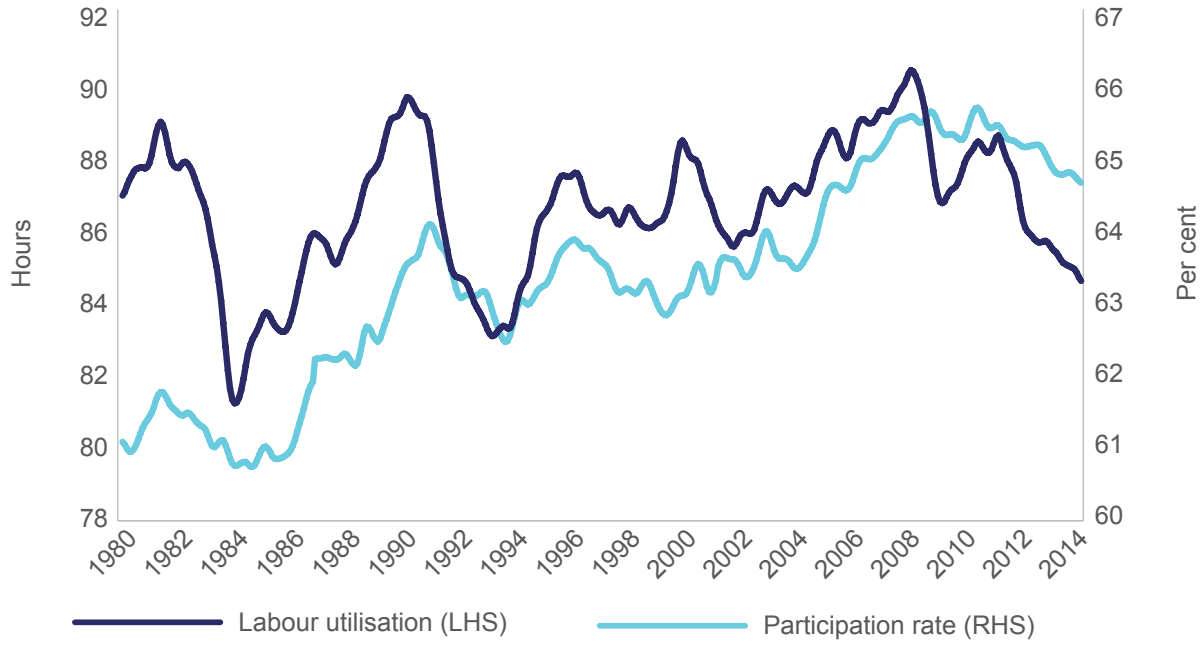
52 Australian Government (2014), *Budget Strategy and Outlook: Budget Paper No.1*, Budget 2014-15, Statement 4: Sustaining growth in living standards, p.6.

53 The participation rate is the share of the labour force (those employed or looking for work) in the population (of 15 years or older).

54 ANZ (2014), Media Release: Job advertising strengthens a little further in October, ANZ Research, 3 October 2014, p.1.

55 Kent C (2014), *Cyclical and Structural Changes in the Labour Market*, Reserve Bank of Australia, www.rba.gov.au/speeches/2014/sp-ag-160614.html.

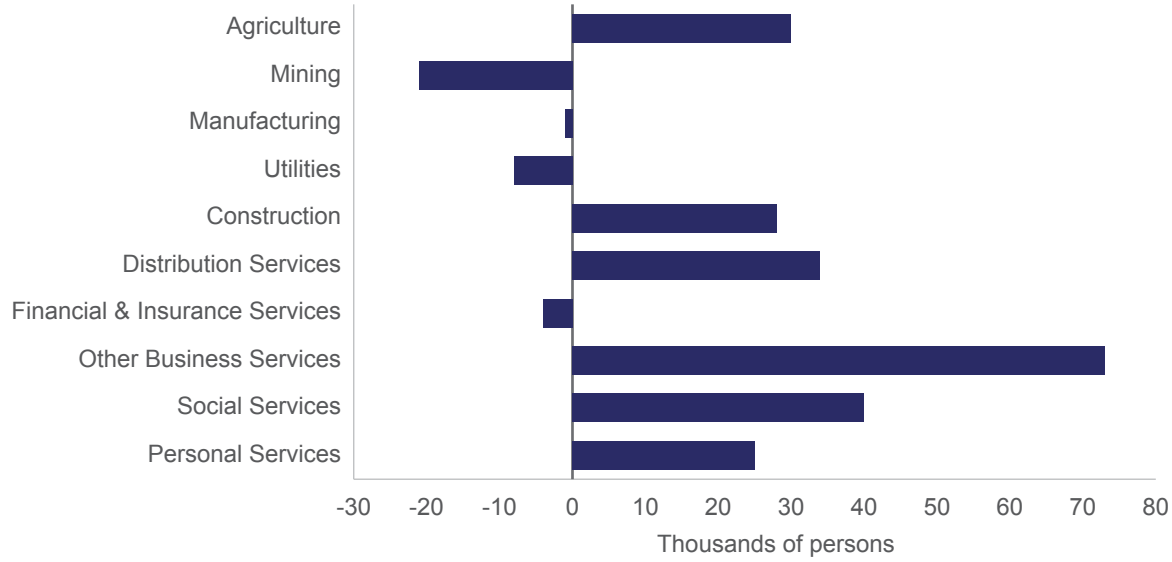
Chart 1.19: Labour utilisation and the participation rate, January 1980 to October 2014



Source: ABS cat. no. 6202.0.
Note: Data is in trend terms.

Employment increased by 115,000 persons in the year to August 2014, of which 59.3 per cent was part-time employment. As shown in Chart 1.20, the largest employment growth came from Other Business Services (+73,000 persons) Social Services (+40,000 persons), and Distribution Services (+34,000 persons). The most dramatic decline in employment occurred in Mining, where employment fell by 21,000 persons over the year to August 2014. Other industries with declining employment were Utilities (–8,000 persons), Financial & Insurance Services (–4,000 persons) and Manufacturing (–1,000 persons).

Chart 1.20: Change in the number of employed persons, August 2013 to August 2014



Source: ABS cat. no. 6291.0.55.003.

Note: Data is in trend terms.

The impact of a soft labour market on GDP growth has not been as significant as it could be, due to recent improvements in labour productivity growth. While overall (multifactor) productivity remains in decline, labour productivity has picked up in the last three years. This is reflected in 'capital deepening', which means that on average each unit of labour has more capital to work with (i.e. production is getting more capital intensive).[56]

Between 2003–04 and 2010–11, labour productivity in the market sector grew slowly, by 0.9 per cent per year, but accelerated to 2.4 per cent a year between 2010–11 to 2013–14. Chart 1.21 shows that the improvement in labour productivity in the last few years is broad based, but primarily driven by Mining, Distribution Services and Construction.

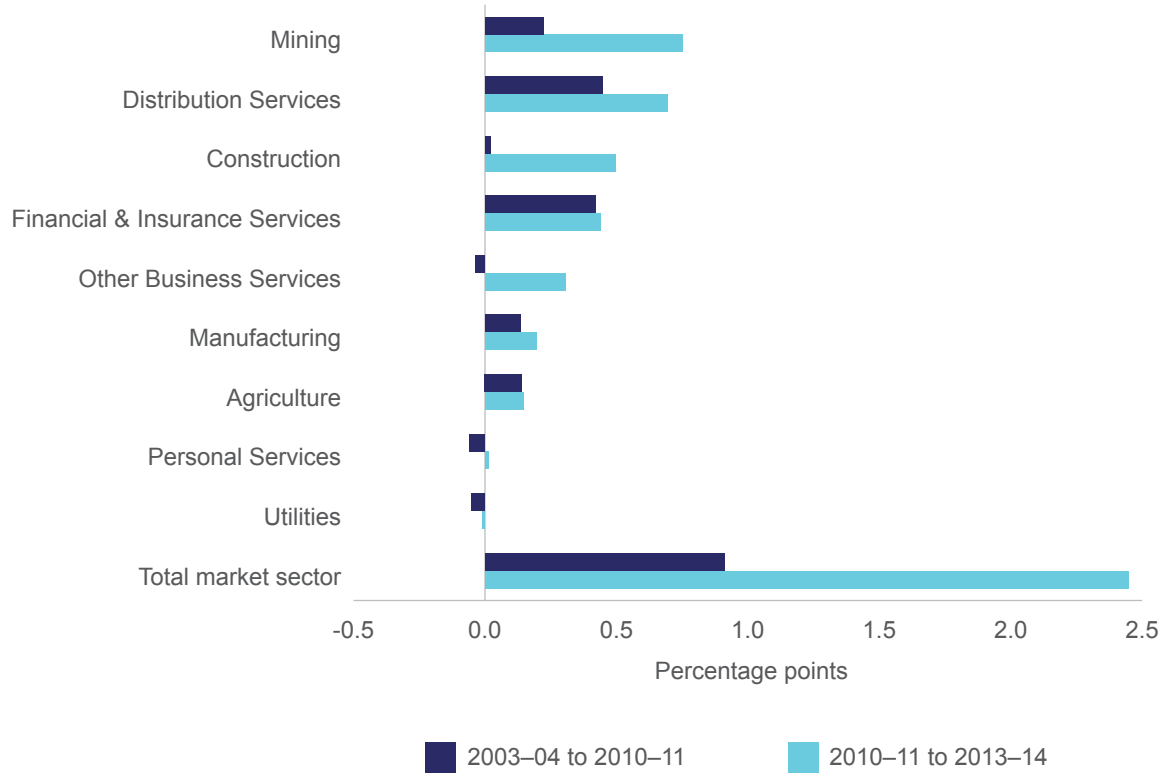
Although the contribution of Mining to aggregate labour productivity shows up as positive in both 2003–04 to 2010–11 and 2010–11 and 2013–14, the level of labour productivity within Mining has actually fallen. The positive contribution is due to a compositional effect. Mining has a high level of labour productivity, and the effect of workers moving into the industry and away from lower productivity industries has more than offset the industry's falling labour productivity.

The RBA notes that 'outside of the Mining sector, the general improvement in [labour] productivity growth may have been in response to a range of competitive pressures coming to bear during a period of weak growth in aggregate demand. The still high level of the exchange rate is one such competitive pressure'.[57]

56 Labour productivity growth equals multifactor productivity growth plus capital deepening.

57 Kent C (2014), *Cyclical and Structural Changes in the Labour Market*, Reserve Bank of Australia, www.rba.gov.au/speeches/2014/sp-ag-160614.html.

Chart 1.21: Contribution of industries to annual growth in market sector labour productivity, selected years



Source: ABS cat. no. 5204.0, 6291.0 and Department of Industry calculations.

Note: Market sector comprises all industries excluding Social Services and ownership of dwellings. Estimates include labour reallocation effect (i.e. effect of labour moving between industries).

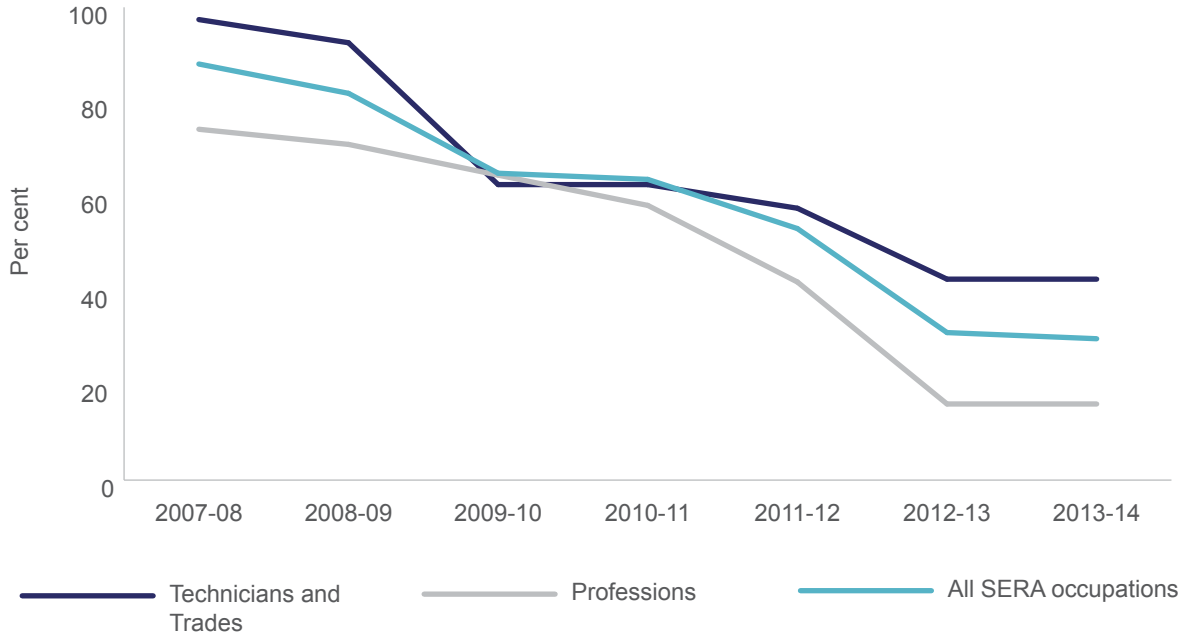
Skills shortages are easing as the demand for higher skills increases

A positive for businesses under weak labour market conditions is that they may face less competition for specialised skills. Results from the Department of Employment's *Survey of Employers who have Recently Advertised* (SERA) indicate that employers continued to recruit skilled workers without a lot of difficulty in 2013–14, with employers filling significantly more vacancies than five years earlier. The Department of Employment reports that only 30 per cent of the occupations continuously assessed in the SERA research program[58] were in shortage in 2013–14, down from 82 per cent in 2008–09.

As evident in Chart 1.22 below, shortages for trades were more pronounced than shortages for professional occupations, with 43 per cent of Technician and Trade occupations in shortage compared with 16 per cent of Professions. In 2013–14, advertised vacancies were hardest to fill in Services sectors relying on food, hairdressing and automotive trades, whereas vacancies for School Teachers, Accountants and ICT Professionals were the easiest to fill. In terms of location, regional New South Wales, regional Queensland and Darwin were the areas where employers found it most difficult to recruit, whereas metropolitan Adelaide, Brisbane, Hobart, regional Western Australia and regional Northern Territory were the locations employers found it easiest to find skilled staff.

58 The SERA research program assesses the labour market for more than 100 skilled occupations, focusing mainly on professions and trades, but also including a small number of management, technicians and other occupations. The Department of Employment determines whether vacancies are filled six weeks after advertising for professions and technicians and four weeks for other occupations.

Chart 1.22: Proportion of occupations in shortage: Professions, Technicians and Trades and all SERA occupations, 2007–08 to 2013–14



Source: Department of Employment.

Note: Based on the set of more than 70 occupations which have been assessed annually as part of the department's skill shortage research programme between 2008–09 and 2013–14.

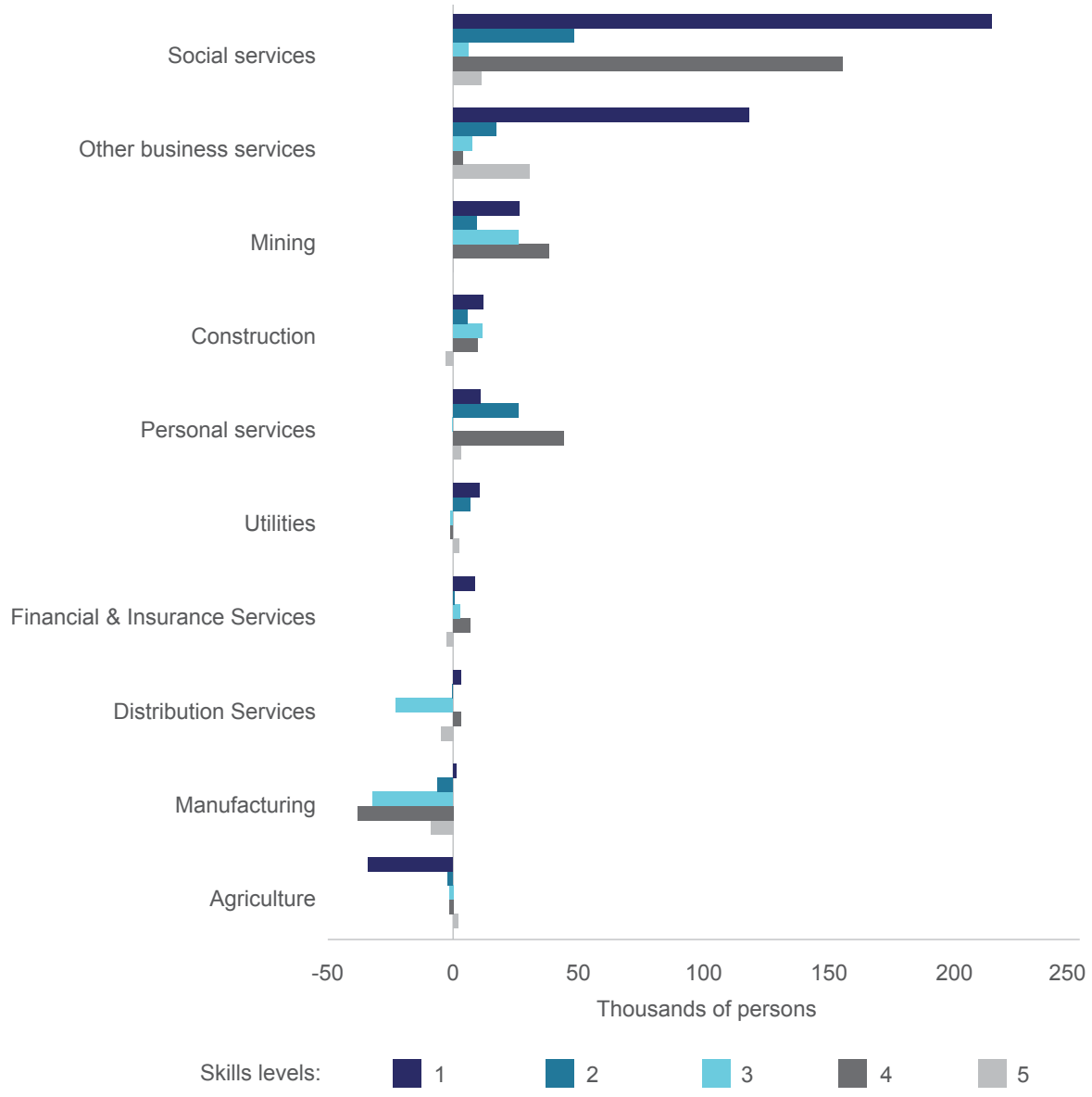
In addition to the trend towards easing skills shortages, there is a trend towards demand for higher skilled occupations across most industries. In particular, the total share of employees with bachelor degrees or above (skill level 1) increased from 29.1 per cent to 30.5 per cent over the last five years. This up-skilling has also been occurring over the longer term, with the share of bachelor degrees being only 24.5 per cent in 1993–94.

As shown in Chart 1.23, most of the growth in demand for occupations that require bachelor degrees or above over the last five years can be attributed to Social Services (214,800 persons, mostly in Health Care & Social Assistance) and Other Business Services (118,200 persons, mostly in Professional, Scientific & Technical Services). Partially offsetting this was a fall in the number of bachelor degree or above occupations in Agriculture (–33,900 persons).

Over the last five years, the share of occupations that require the lowest skills—Australian Qualifications Framework (AQF) Certificate I (skill level 5)—fell from 17.9 per cent to 17.1 per cent, which is consistent with the longer-term trend. While the share of total jobs fell for this category, the overall number of jobs continued to increase. Most of the growth in demand for this skill level came from the Other Business Services (30,300 persons, which was almost entirely comprised of Administrative & Support Services) and Social Services (11,300 persons, mostly in Public Administration & Safety) sectors. This was partially offset by a fall in the number of AQF Certificate I's employed in Manufacturing (9,000 persons). There was a fall in Manufacturing employment across all skill levels, except bachelor degrees or above between 2008-09 and 2013-14.

The share of occupations in the AQF Certificate II or III category (skill level 4) increased slightly from 26.2 to 26.4 per cent, while the share attributable to AQF Certificates III or IV (skill level 3) fell from 15.6 to 14.6 per cent, and the share attributable to AQF Associate Degree, Advanced Diploma or Diploma (skill level 2) increased slightly from 11.1 per cent to 11.3 per cent.

Chart 1.23: Growth in the number of employed persons by ANZSCO skill level, 2008–09 to 2013–2014



Source: ABS unpublished Labour Force Survey data.

Note: Skill levels range from 1 to 5, where 1 represents Bachelor Degree or above and 5 represents Australian Qualifications Framework Certificate 1. See Appendix B for further information.

A key ongoing factor driving trends in the demand for particular occupations is automation, which has driven falling demand for some occupations and increasing demand for others. Box 1.4 discusses the impact of automation on the demand for skills.

Box 1.4: Exploring the nexus between skills and automation

In 1801, a weaver introduced a piece of machinery that would permanently change how we view technology. The Jacquard loom, named after its inventor, revolutionised the textile industry by slashing the number of workers required to produce fabrics. The artisans and weavers protested against its introduction by publicly smashing the devices.

The textile workers were well justified to believe that the arrival of the mechanical loom would cause pain. Many became excess to requirement, as a result of the technological development, causing 'technological unemployment'. Though there is still debate, workers likely had to endure decades of hardships as living conditions and real wages stagnated.[59] Following the introduction of automated looms, however, clothes became cheaper and consumers found they now had higher disposable incomes. The benefits of automation were eventually realised through higher living standards.

Today we have entire factories assembling intricate and specialised devices without human intervention. Foxconn, China's largest private employer, began replacing a million workers with robots in 2013.[60] In the Netherlands, Philips uses 128 robots to produce electric razors, with only nine quality assurance workers at the very end of the production line. Since 2001, Japanese robotics company FANUC has been operating a humanless 'lights out' factory of robots that manufacture other robots.[61]

Technology is increasingly becoming capable of performing the tasks of workers as it is developing exponentially (Gordon Moore accurately predicted that the number of transistors in a circuit will roughly double every two years). There is considerable debate on which workers are most at risk of being displaced by technology. Economists have views ranging from seeing technology as factor-neutral, benefiting all workers equally like a rising tide with ships, to seeing technology as skill-biased, where an occupation's skill level is a significant indicator in determining how susceptible it is to automative technologies.[62]

At first it was considered that low-skilled employment would be more affected by the introduction of machinery. But recent research suggests being low-skilled does not necessarily mean that your job will be replaced by robotics. For example, a study by David Autor and David Dorn of the Massachusetts Institute of Technology, and Spain's Center for Monetary and Financial Studies, identified that many jobs that do not require a university education are not particularly susceptible to technological unemployment.[63] The paper listed ten US occupations for which, although a majority of their workforce was not university educated, the tasks required were unlikely to be performed by robots.[64] Collectively, employment in these occupations in Australia (as shown in Chart 1.24) has grown by an average annual rate of 4.9 per cent from 1993-94 to 2013-14.[65] This is in contrast to jobs with a non-university educated majority, which increased annually by only 3.1 per cent on average.[66]

59 Charles H. Feinstein (1998), *Pessimism Perpetuated: Real Wages and the Standard of Living in Britain during and after the Industrial Revolution*, The Journal of Economic History, 58, p 625-658.

60 Amar Toor (2012), *Foxconn begins replacing workers with robots ahead of US expansion*, The Verge, 11 December 2012, www.theverge.com/2012/12/11/3753856/foxconn-shenzhen-factory-automation-manufacturing-US-expansion.

61 The Economist (2012), *Making the future: how robots and people team up to manufacture things in new ways*, www.economist.com/node/21552897.

62 See, for example, Acemoglu, Daron (2000), *Technical change, inequality, and the labor market*, No. w7800. National Bureau of Economic Research.

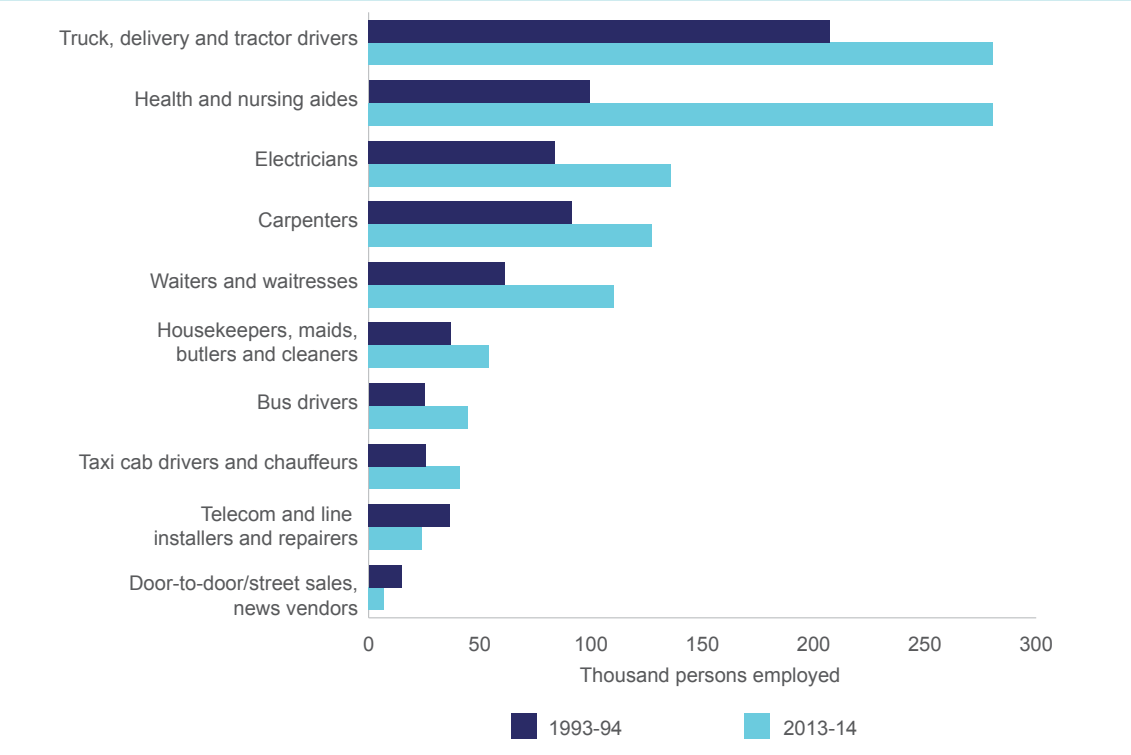
63 Autor, David, and David Dorn (2013), *The growth of low-skill service jobs and the polarization of the US labor market*, The American Economic Review 103.5: 1553-1597.

64 Ibid. 63, Appendix Table 2, p.1593.

65 ABS cat. no. 6291.0.55.003.

66 Ibid. 65

Chart 1.24 Jobs not requiring university education least at risk of being automated, 1993–94 and 2013–14



Source: ABS cat. no. 6291.0.55.003 and Department of Industry calculations.[67]

Jobs identified as having highly automatable tasks, such as secretaries and butchers (as shown in chart 1.25), fell on average by 0.9 per cent per annum between 1993–94 and 2013–14. These jobs were associated with tasks that Dorn and Autor regarded as robotic, i.e. tasks that were not overly manual in nature (robots have trouble with basic skills we find easy, such as climbing stairs); tasks that did not involve abstract thinking (though robots handle complex calculations with ease); and perhaps most importantly, tasks that were highly repetitive and routine (as today's robots are heavily reliant on human programming).

The challenges presented by increasing automation are not limited to low-skilled positions. Indeed, it was the skilled artisan weavers who were replaced in the wake of the Industrial Revolution. One of the at-risk jobs identified in the study are pharmacists: 78.6 per cent of pharmacists in Australia have a bachelor's degree and 15.4 per cent have post graduate qualifications[68], making it one of the most highly educated occupations in the nation. A tertiary education therefore does not guarantee safeguard against automation.

Robots are increasingly replicating the tasks of medium and high-skilled workers. Computers are programmed to diagnose illnesses faster than doctors, machines can analyse volumes of legal text in a fraction of the time that a solicitor can and a robot has even been appointed as director to an investment board.[69] In Australia, high-skilled jobs not at risk of automation, such as surgeons, secondary school teachers and electrical engineers, are projected to grow on average by 4.5 per cent per year—twice the projected growth rate of 2.2 per cent per year of high-skilled jobs in general.[70]

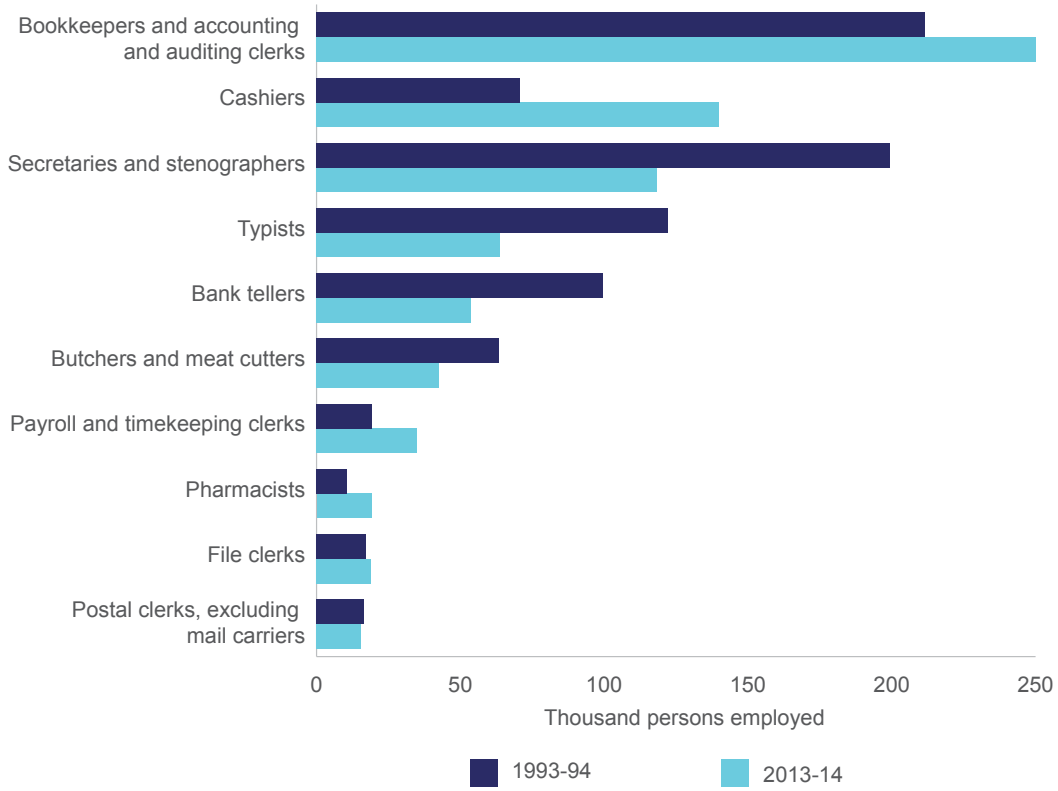
67 The ANZSCO occupation codes for identified jobs are: Truck, delivery and tractor drivers—7331, 7321, 7211 and 7213; Health and nursing aides—6214, 3613, 4116, 4233, 4231; Electricians—3411; Carpenters—3312; Waiters and waitresses—4315; Housekeepers, maids, butlers and cleaners—8113, 8114; Bus drivers—7312; Taxi cab drivers and chauffeurs—7311; Telecom line installers and repairers—3132, 3424; Door-to-door/street sales, news vendors—6217.

68 ABS cat. no. 6291.0.55.003.

69 Zolfagharifard, Ellie (2014), *Would You Take Orders from a Robot? An Artificial Intelligence Becomes the World's First Company Director*, Mail Online, Associated Newspapers, 19 May 2014

70 Department of Employment (2014) *2014 Employment Projections: Occupation projections to November 2018* lmip.gov.au/default.aspx?LMIP/EmploymentProjections, using projections from 2013 to 2018 and defining 'high-skilled' as those jobs with more than 50 per cent college educated.

Chart 1.25: Jobs most at risk of being automated, 1993–94 and 2013–14



Source: ABS cat. no. 6291.0.55.003 and Department of Industry calculations.[71]

Innovation will inevitably lead to some job displacement in the short term, as the price of capital falls relative to the price of labour. But there is a lack of evidence to suggest this displacement is long term. The comparative advantages of being human—the ability to solve problems intuitively, improvise spontaneously and act creatively—allow us to adapt to changing labour markets and occupations. Indeed, in a recent survey of 45 economists, all but one agreed that automation has not historically reduced employment in the United States.[72] The conclusion being that humans have unlimited needs and wants, and therefore there are an unlimited number of potential jobs to fulfil these desires.

Our greatest windfall from automation is that higher productivity will eventually deliver cheaper goods and higher disposable incomes, as it did during the Industrial Revolution. There is potential to benefit from these productivity gains, even if the temporary adjustments may be painful.

71 The ANZSCO occupation codes for identified jobs are: Bookkeepers and accounting and auditing clerks—5511, 5512; File clerks—5613; Pharmacist—2515; Payroll and timekeeping clerks—5513; Butchers and meat cutters—3512, 8312, 8313; Bank tellers—5521; Typists—5321; Secretaries and stenographers—5211, 5212; Cashiers—6311; Postal clerks, excluding mail carriers—5614.

72 Initiative on Global Markets Forum (2014), *Robots*, www.igmchicago.org/igm-economic-experts-panel/poll-results?SurveyID=SV_eKbRnXZWx3jSRBb

Wages growth has slowed considerably, reducing cost pressures on businesses

Wages have responded to the soft labour market conditions. Real wages (wages adjusted for inflation) fell by 0.4 per cent in 2013–14, compared to an average annual increase of 1.4 per cent over the previous four years.[73] As shown in Chart 1.26, wages growth has slowed in nearly all sectors, but particularly in Mining, Other Business Services and Utilities. The fall in Other Business Services was primarily driven by a sharp slowdown in wages growth in Professional, Scientific & Technical Services.

Growth in Mining wages was particularly strong in the four years to 2013–14, driven by the need to attract labour resources from other industries. The transition to the less labour intensive production phase of the Mining boom has led to a substantial dampening of wage growth.

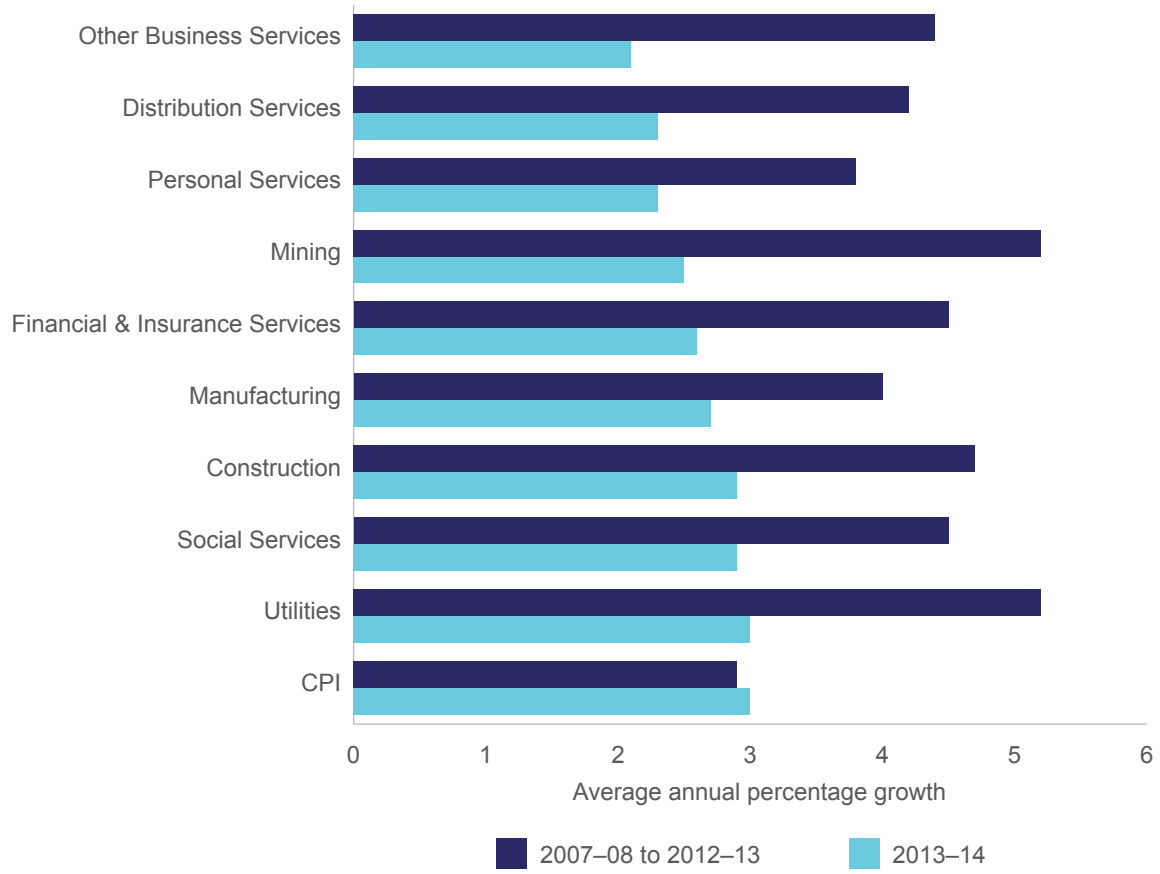
The booming Mining industry may have had some impact on wage growth in other industries, as they had to compete for specialist skills with Mining. The occupations subject to the largest increase in demand by the Mining industry over the four years to 2012–13 were machine and stationary plant operators, automotive and engineering trades workers, design, engineering, science and transport professionals, road and rail drivers and engineering, ICT and science technicians. Overall economy-wide demand for some of these skills has fallen in 2013–14, particularly design, engineering, science and transport professionals (down 3.2 per cent), machinery and plant operators (down 3.0 per cent) and engineering, ICT and science technicians (down 1.5 per cent).

The industries that rely most heavily on these skills (i.e. it makes up 20 per cent or more of their employment) are Transport, Postal & Warehousing (within the Distribution Services sector), Utilities, Other Services (within the Personal Services sector and particularly relates to the automotive electricians and mechanics sub-occupational group), Manufacturing, and Professional, Scientific & Technical Services (within the Other Business Services sector).[74] Therefore, some of the movement in wages in these industries may reflect competition for skills with Mining.

73 Growth in real wages is calculated as growth in the wage price index (total hourly rates of pay excluding bonuses) minus growth in the consumer price index, not seasonally adjusted.

74 ABS unpublished Labour Force Survey data.

Chart 1.26: Wage price index growth by industry, 2007–08 to 2012–13 and 2013–14



Source: Thomson Reuters DataStream, ABS cat. no. 6345.0 and 6401.0.
Note: Data is in original terms and is June quarter over June quarter.

Utilities had the highest wage growth in 2013–14 (3.0 per cent). Utilities also recorded the highest wage growth in the four years to 2012–13, equal with Mining at 5.2 per cent. A likely explanation for high wages growth in this industry is the inflexible wage negotiation processes.[75] Another driver may be competition for skills with the Mining industry, with both industries employing a large number of technicians and trades workers. The feature article explores the impact of the Mining boom on Australia's labour market in greater detail.

Overall, while softening labour utilisation is likely to continue to dampen economic growth going forward, the demonstrated flexibility in wages may assist trade exposed industries, such as Manufacturing, that have faced difficult economic conditions in recent years.

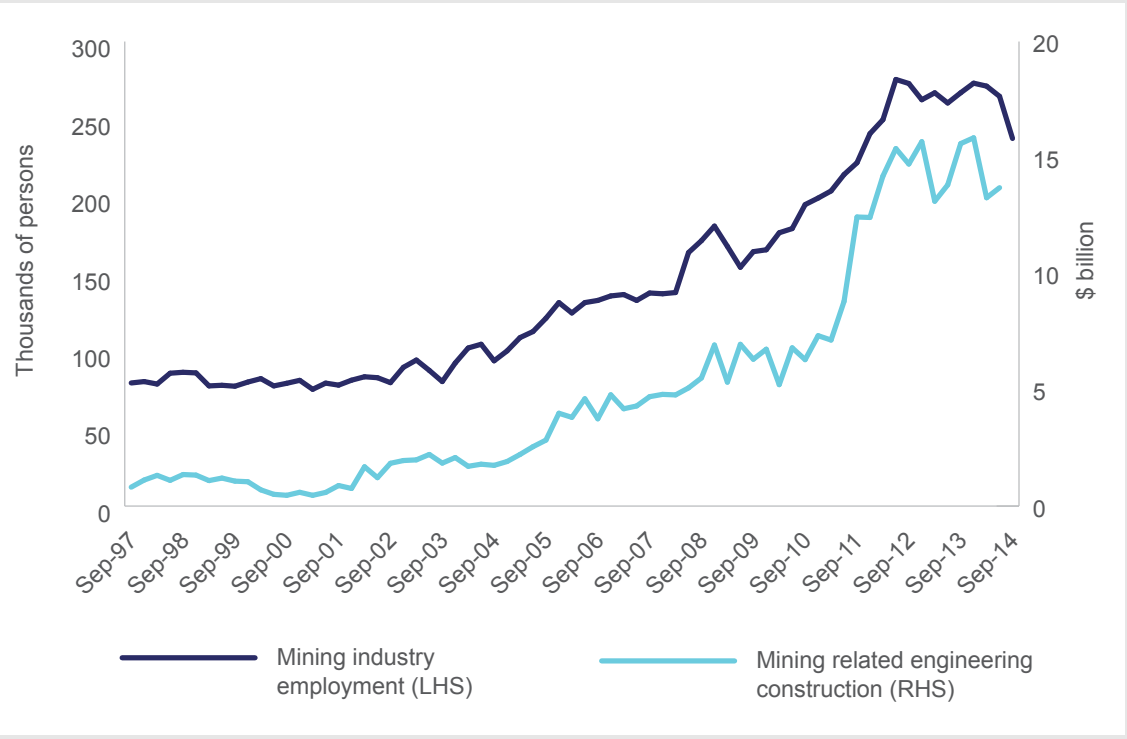
75 Based on verbal advice from the ABS.

Feature article: Mining boom confirms flexibility in Australia's labour market

National Australia Bank

The Mining boom led to a substantial increase in the demand for labour that was concentrated both industrially and geographically—employment in some other industries has actually contracted during this time. The commencement of these divergent trends in the labour market can be traced to the second half of 2003. Between August 2003 and November 2013 (just before it began a sustained decline) Mining industry employment is estimated to have increased by 192,000 people, representing a more than three-fold increase in labour demand in the space of a decade—although the actual share of the labour force directly employed by the Mining sector remains quite low at around 2 per cent. Similarly, job vacancies in the Mining sector began increasing strongly in August 2003 and were sustained at elevated levels for the next ten years (although there is a period of missing official data). Much of this reflects increased construction work within the industry in response to the sharp rise in minerals and energy demand associated with Chinese industrialisation.[76]

Chart 1.27: Demand for labour and capital rose rapidly



Source: ABS cat. no. 8762.0 and NAB calculations.

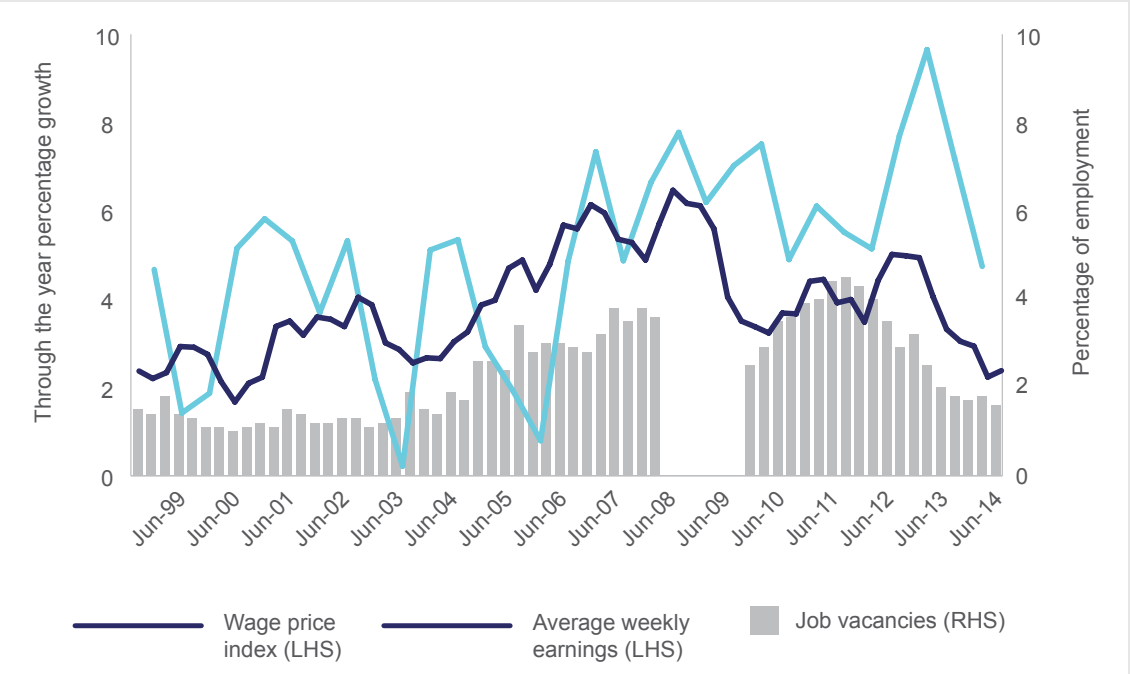
Note: Mining related engineering construction includes engineering construction work done: private sector oil, gas, coal and other minerals.

There has been a reasonably close correlation between the increased demand for labour in the Mining industry and Mining industry wages growth. The ABS wage price index, which represents a standardised hourly pay rate abstracting from fluctuations in overtime and bonus payments, peaked at annual growth

76 Under ABS conventions, investment by an industry on its own account is classified to that industry rather than the construction industry. Employment by industry is collected using the monthly population survey, which classifies industry of employment in the same way. Moreover, in practice, it seems likely that respondents engaged in the construction of mining projects will regard themselves as working in the Mining industry.

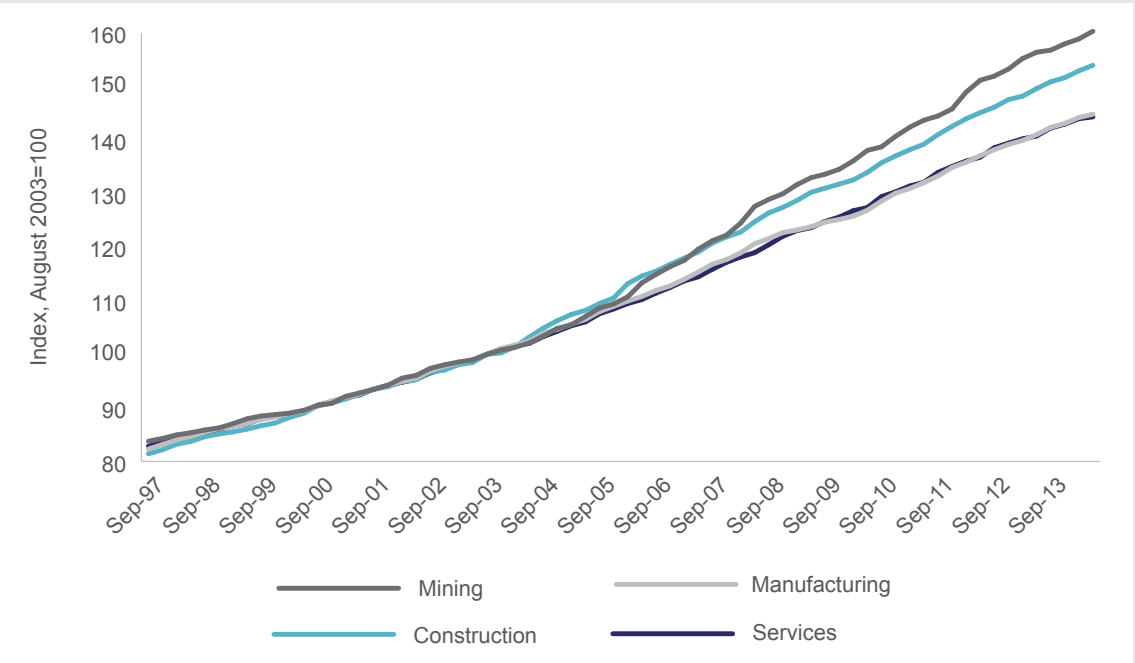
of 6.7 per cent in mid-2008, well above the economy-wide wage inflation rate of 4 ¼ per cent as well as the pre-boom Mining rate of around 3 per cent. Annual growth in average weekly total earnings, a less standardised but more comprehensive measure of wages, averaged less than 3 per cent in the first half of the 2000s, but increased to 6.6 per cent in the second half.

Chart 1.28: Labour market tightened, driving wages



Source: ABS cat. no. 6203.0; 6302.0; 6345.0; 6354.0 and NAB calculations.

Chart 1.29: Mining related wages outperform



Source: ABS cat. no. 6345.0 and NAB calculations.

Note: Services is an employment weighted average of services industries.

Has the Mining boom disproportionately benefited wages in the Mining industry, or is it a case of 'a rising sea lifts all ships?' In a flexi-wage labour market, we would expect to see an initial divergence in wage rates across industries to overcome obstacles to labour mobility but wage relativities would tend to be restored once the adjustment has run its course. If relative wage rates are inflexible, relative industry wages remain unchanged and all wage rates would rise more strongly as demand pressures in mining spread to all industries. The issue is important in understanding how industry wage rates may adjust to the inevitable end of the Mining investment boom.

There is some evidence that the Australian market has followed the flexi-wage paradigm. Beginning in the mid-2000s, the wage price index in Mining surged ahead of Manufacturing and Services, and even Construction, and has stayed there while Mining investment has continued to rise. However, an increase in overall wages growth at the start of the Mining boom could suggest some rigidity in relative wages, although admittedly, some of this may reflect the income effects of the rise in minerals prices. Moreover, the GFC and its aftermath appear to have restored wages growth to pre-boom conditions.

A simple way to measure the divergence in wage rates across industries on a more systematic basis is to calculate an inter-industry coefficient of variation. The coefficient of variation (CV) is a simple statistical measure of dispersion, calculated by dividing the standard deviation of the examined values by their mean; a higher value of the index indicates greater dispersion. In our analysis, we have taken this approach and applied it to average weekly incomes across industries to generate a summary statistic of relative industry wages across the economy.

Naturally, there are limitations to this approach. In our application, a rising CV does not suggest that lower wage industries did not benefit from the Mining boom, just that they have performed worse in relative terms. It also does not take account of some important characteristics such as the number of people employed in each industry, developments in technology/human capital or changes in hours worked over time. Consequently, this is not a measure of wage inequality in Australia *per se* and should not be interpreted as such. It is solely a measure of divergence in average wages across industries. In contrast, a Gini coefficient (the grey line below—indexed to the year 2000) is a better measure of 'national inequality' and would place less weight on Mining (given its smaller share of employment), and in fact shows that national income inequality increased at the outset of the Mining boom but has fallen since the GFC.

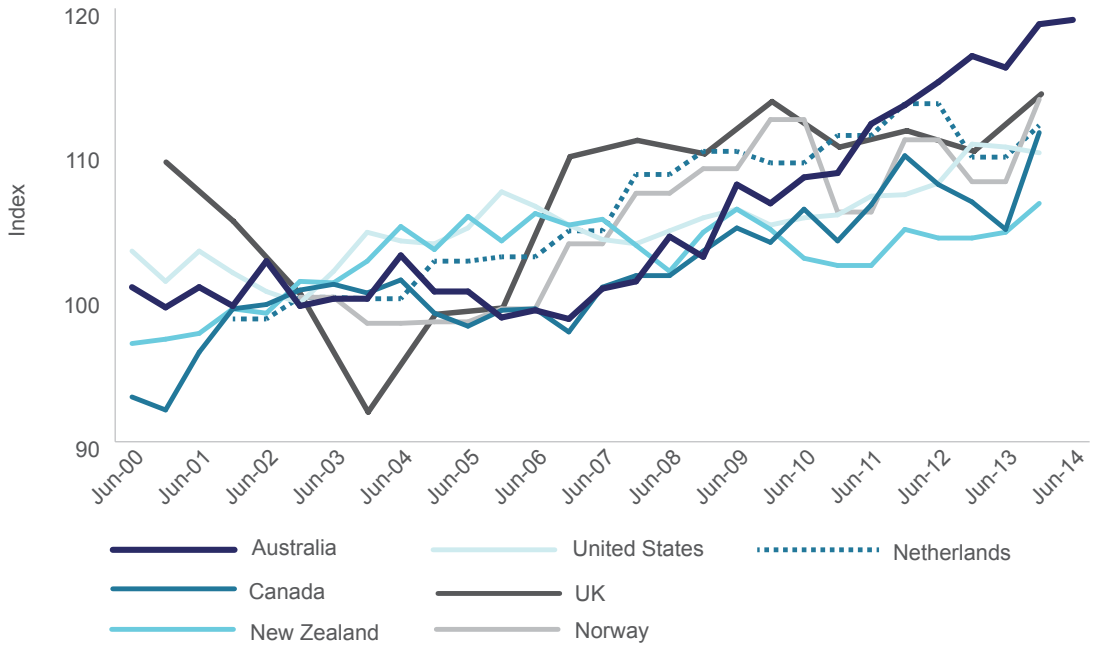
Chart 1.30: Wages were more dispersed following boom

Source: ABS and NAB calculations.

While there are several factors driving relative wages over time, Chart 1.30 seems to demonstrate a clear (positive) relationship between Australia's Mining employment and the inter-industry CV. The elevated Australian dollar (AUD) is likely playing a part in this, but the mix of laggard industries suggests other factors are at work. Certainly, manufacturing has slipped down the wage ranks, but Transport, Postal & Warehousing and Financial Services have also slipped notably, neither of which has a clear and direct negative correlation with the AUD.

Other countries, with a variety of industry structures, have also experienced rising inter-industry CVs—although the pace of wage divergence since 2006 is generally less than in Australia. While the factors driving this divergence in industry wages vary from country to country, a common theme for some has been the relative underperformance of manufacturing wages—a possible result of off-shoring. In contrast, wages in various personal, business and financial services often outperform. In the UK, however, the divergence is less apparent, although wages already varied significantly across industries at the start of the period examined (with average Finance, ICT and Mining wages being the highest). Of the commodity rich countries examined, most showed a persistent divergence in industry wages (rising inter-industry CVs) since the early 2000's. Mining wages growth in Norway has been relatively more subdued since 2009, contributing to the flatter trend in its CV—although miners in Norway are still amongst the highest paid in the industry.

Chart 1.31: Cross-industry Gini rising in various countries

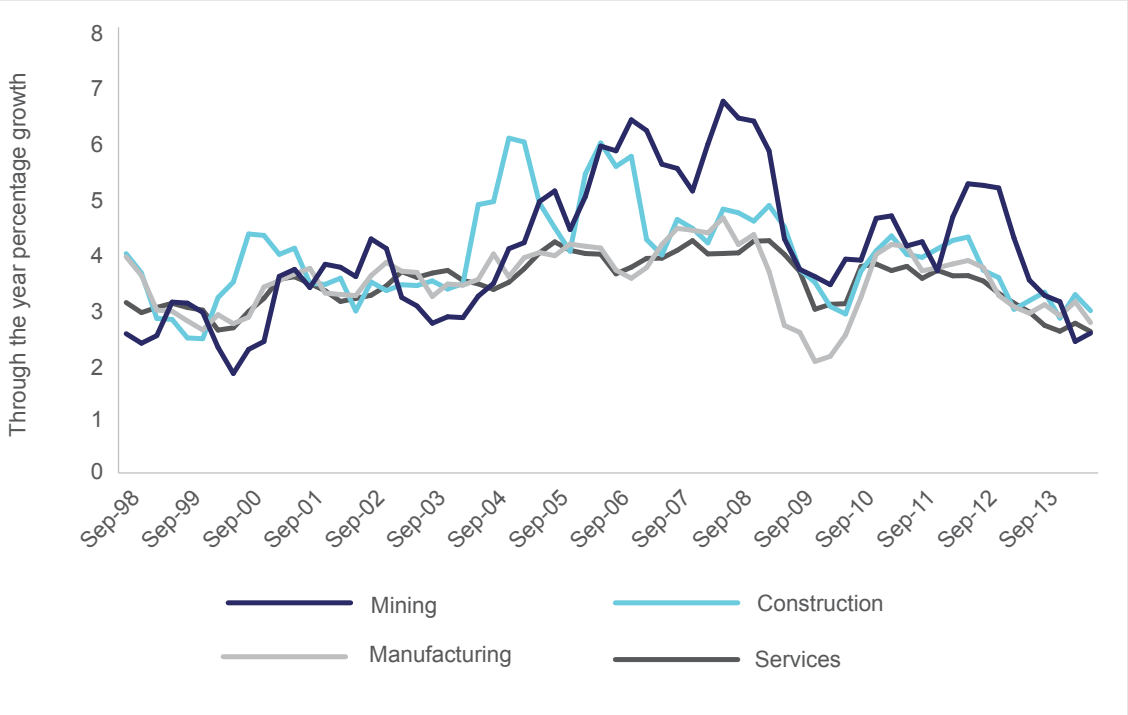


Source: ABS; Thomson Reuters; SSB; CBS; ONS; NAB Economics.

The persistence and strength of wage dispersion indicated by the Australian CV most likely reflects the persistent nature of the Mining investment boom. Outside a brief period during the GFC, Mining investment rose more or less continuously, from around 2 to 8 per cent of GDP so that Mining wages had to remain elevated to continue to attract labour. It is likely that as Mining investment declines to more sustainable levels the dispersion in wages will reverse. We are then more likely to see Mining-related wages ease towards the national average, rather than for non-Mining wages to rise. Indeed, wages data are already

starting to demonstrate this. WPI growth has slowed at the national level to its lowest rate in decades (and negative in real terms), but the slowdown in Mining wages has been particularly pronounced—a trend that is likely to continue. Nevertheless, a simple projection of wages growth suggests that even under a scenario of zero wages growth in the Mining and Construction sectors, it would take two to three years for wages in these industries to return to their pre-Mining boom trend.[77]

Chart 1.32: Recent wages growth slowdown more pronounced in Mining

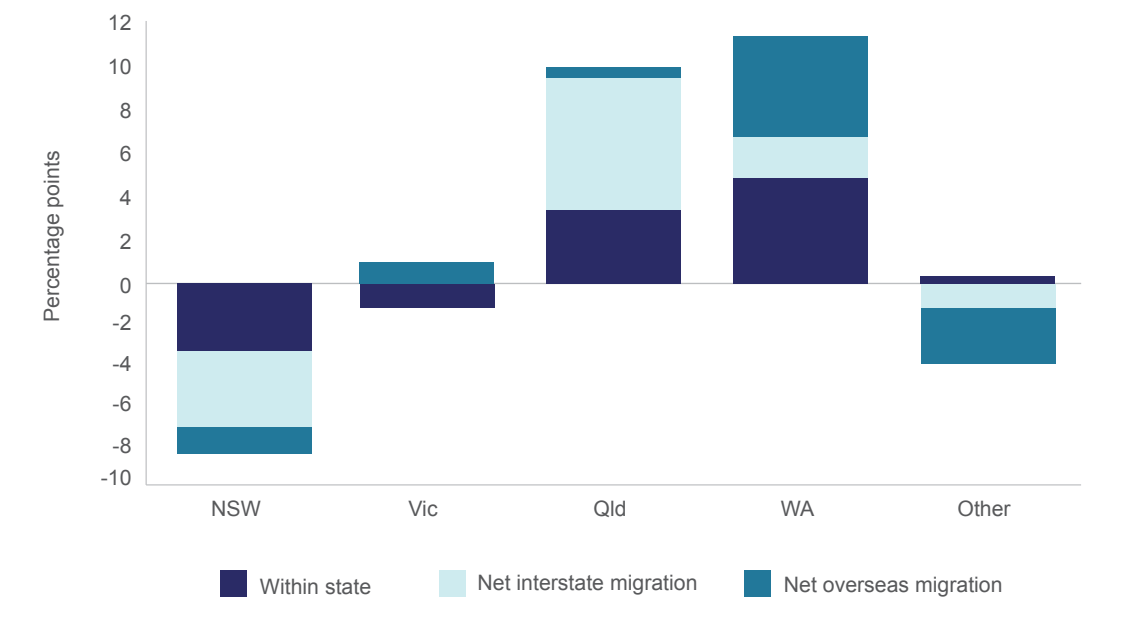


Source: ABS; NAB.

According to some reports, such as the World Economic Forum (Global Competitiveness Report), Australia is one of the lower ranked countries in terms of flexibility of wage determination and hiring and firing practices. However, the Reserve Bank of Australia point out in a research discussion paper released earlier this year that 'the institutional structure of the labour market during the current episode has been the most flexible over any [terms of trade] expansion since Federation' (e.g. 1894–1905, 1922–1925, 1944–1951 and 1968–1974). They point to changing labour market characteristics – such as the amount of cross-industry job shifting and length of employment in current job—to demonstrate improved labour mobility in Australia. Given these characteristics, it appears plausible that the persistent dispersion in wages across industries could be a reflection of skills mismatch and restricted geographic mobility, rather than any limitation from institutional arrangements.

77 Additionally, assuming other sector wages grow at a pace close to the national trend, Mining, Construction and Utility wages would need to remain unchanged for around five years to return the industry Gini back to mid-2008 levels.

Chart 1.33: Geographical factors likely playing a role



Source: ABS; RBA Bulletin December 2012.

Certainly, the RBA emphasises this point in a December 2012 Bulletin article. Chart 1.33 shows that, in the decade leading up to early 2012, employment in WA and Queensland grew by 10 percentage points more than the national average, but grew more slowly than the national average elsewhere. Some of these different employment growth rates arose within each state from above and below-average movements in working-age population, labour force participation and unemployment. Some of them were sourced from above and below-average rates of net overseas migration. The remaining employment growth differences reflected interstate labour mobility, which appears to have had a material role although, interestingly, less so in WA (the state with the largest average wage) than Queensland (Chart 1.33). Another dimension of interstate mobility may be seen from HILDA survey data that shows that 5 per cent of workers who changed jobs within a year relocated interstate to do so.

Overall, these trends tend to suggest that institutional factors that had impeded the flexibility of Australia's labour market during previous terms of trade episodes have been significantly reduced. Relatively low unemployment and inflationary pressures, despite a considerable increase in resource sector wages and a once in a generation boom in the terms of trade, tend to support this (a point argued by the RBA[78]). Nevertheless, we suspect the skills mismatching and geographical constraints contributed to Mining related wages, although alternative sourcing of labour supply (such as from overseas migration) has helped to minimise the impacts. But while Mining related wages have grown significantly, its relatively small share of the labour force has kept the direct impact on the broader economy limited—suggesting this will also be true as the Mining investment boom fades. The impact from second round effects, such as those on employment in industries supplying Mining construction, and from a falling terms of trade, which may make some existing operations uneconomic, are much more difficult to predict. NAB expects that the overall impact will keep the labour market in Australia slack and wage growth subdued for some time yet.

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78 Atkin T, Caputo M, Robinson T & Wang H (2014), *Macroeconomic Consequences of Terms of Trade Episodes, Past and Present*, Reserve Bank of Australia.

Labour costs and competitiveness

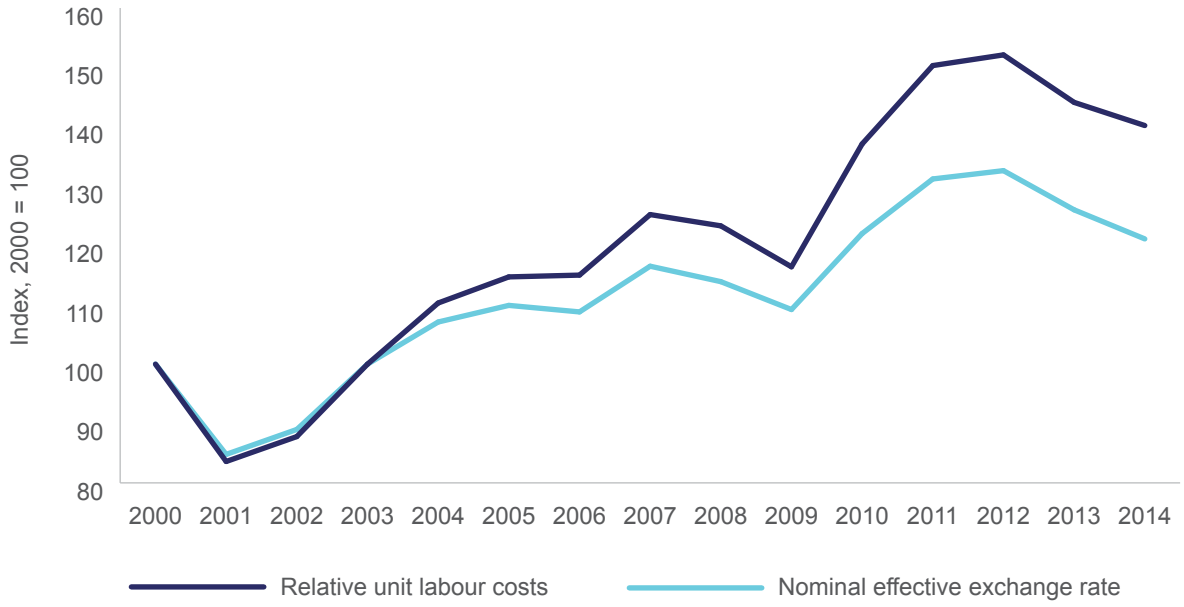
The cost of doing business in Australia has increased in recent years and can be explained by a combination of factors. The most significant reason is the appreciation of the Australian dollar, but a slump in labour productivity and strong wages growth also contributed. Services sectors drove most of the increase in unit labour costs, particularly Social Services and Other Business Services. High wages in Mining were offset by a high level of labour productivity.

Labour costs can be expected to be higher in Australia relative to developing economies. Labour represents a large share of the overall Australian industry cost structure, at 24.9 per cent of the value of production. It is an important input cost in all industries, although the share of labour in total costs varies between industries. Services are the most labour intensive at 28.4 per cent of production, while in Agriculture and Mining, labour only represents 10.3 and 11.6 per cent of production, respectively.[79]

Unit labour costs measure the average cost of labour per unit of output. It is often thought of as an indicator of cost competitiveness, because it takes into account not only the cost of labour (i.e. wages and on-costs), but also the productivity of labour (output per hour worked). Productivity is important, because if an employer pays more for workers, but they are producing proportionately more output, the overall impact on the business bottom line may not have changed.

As shown in Chart 1.34, relative to its trading partners, Australia's cost competitiveness has fallen sharply since 2001. The fall in competitiveness is in large part attributable to an increase in the value of the Australian dollar (also shown in chart), which makes the cost of labour higher in Australia relative to trading partners, regardless of developments in wages.

Chart 1.34: Australia's relative unit labour costs and exchange rate, 2000 to 2014



Source: Thomson Reuters DataStream; OECD; RBA.

Note: Nominal effective exchange rate for 2014 is estimated based on average of January to October 2014. Relative unit labour costs convert unit labour costs to a common currency and divide it by the average labour costs of the country's trading partners. An increase (decrease) in Australia's relative unit labour costs can be attributable to one or a combination of an increase (decrease) in Australia's unit labour costs, a decrease (increase) in the unit labour costs of Australia's trading partners, or an increase (decrease) in Australia's trade weighted exchange rate.

79 Data is for 2009–10, source ABS cat. no. 5209.0.55.001.

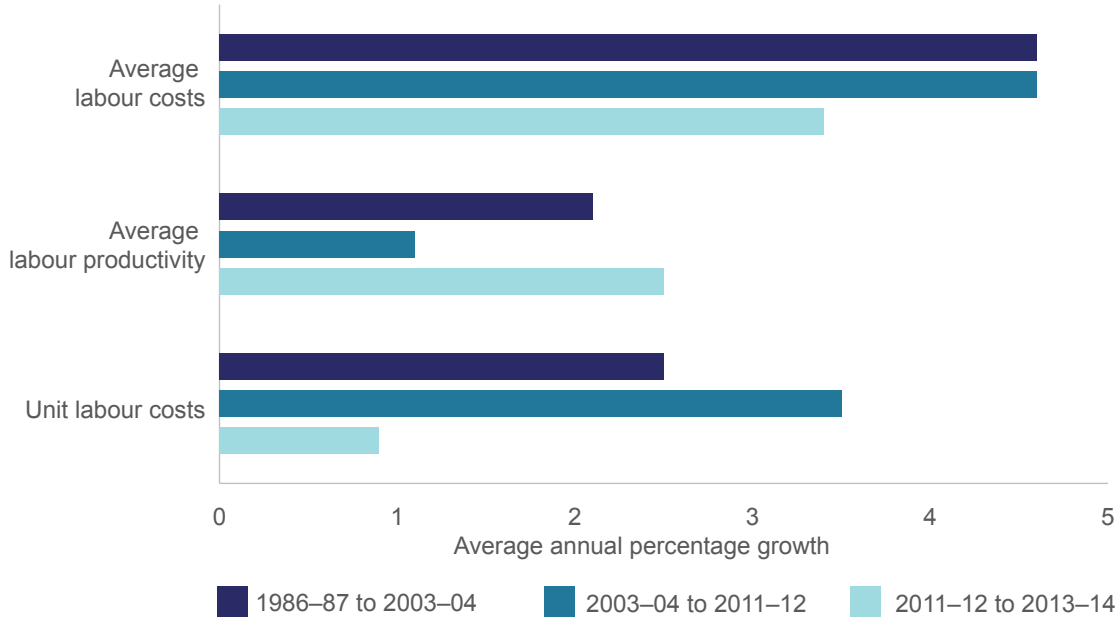
However, even after accounting for the exchange rate, Australia's unit labour costs growth has exceeded that of its trading partners (indicated by the gap between the two lines shown in Chart 1.34). Australia's relative unit labour costs peaked in 2012, and have since fallen slightly, owing to a depreciation of the Australian dollar and slower growth in Australia's domestic unit labour costs. They nonetheless remain high.

Removing the exchange rate effect, Australia's domestic unit labour costs growth was particularly high between 2003–04 and 2011–12 (Chart 1.35). The primary reason for this was low labour productivity growth, with average labour costs (labour costs per hour worked)[80] broadly in line with the historical average. During this period, unit labour costs grew by 3.5 per cent per year, compared with the historical average of 2.8 per cent.

Average labour productivity grew by 1.1 per cent over the period 2003–04 and 2011–12, compared with the historical average of 1.7 per cent. Average labour costs grew by 4.6 per cent over the period 2003–04 and 2011–12, compared with the historical average of 4.4 per cent.

In the last two years, unit labour cost growth has slowed significantly. This is due to both slowing average labour cost growth (3.4 per cent per year) and higher labour productivity growth (2.5 per cent per year).

Chart 1.35: Unit labour costs growth and key components, selected years



Source: ABS cat. no. 5204.0 and Department of Industry calculations.

Note: Average labour costs is labour costs per hour worked. Unit labour costs growth can be approximated by average labour costs growth minus average labour productivity growth. This is because, in level terms, unit labour costs equals average labour costs divided by average labour productivity. Data is in current prices.

80 In this report, average labour costs have been derived from published data on labour productivity and unit labour costs. Average labour costs are defined by the ABS as compensation of employees plus payroll tax minus employment subsidies divided by total hours worked by employees, see ABS (2013) *Australian System of National Accounts: Concepts, Sources and Methods*, cat. no. 5216.0, Canberra, p.453.

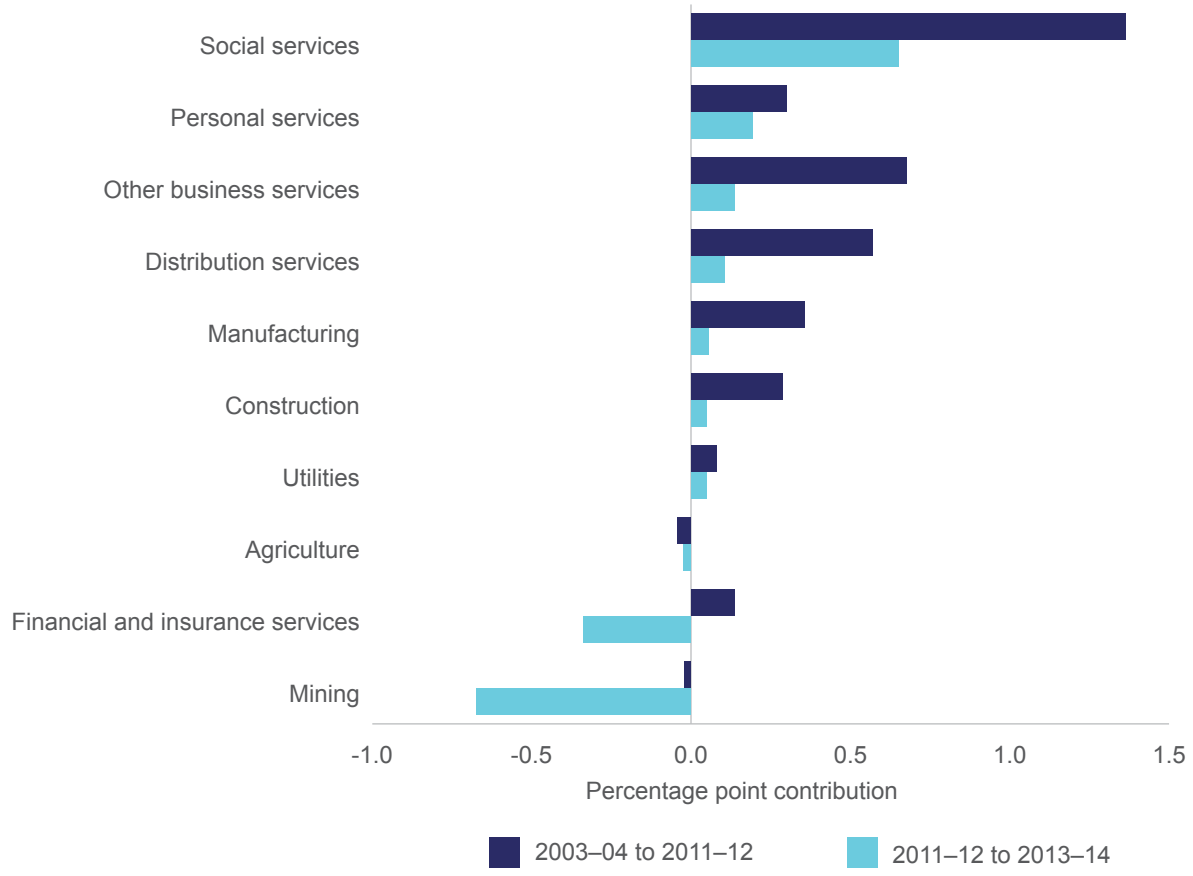
Unit labour costs grew strongly across most industries between 2003–04 and 2011–12, but most significantly in Mining. However, the contribution of Mining to total unit labour cost growth was very small. Mining has a low contribution because it accounts for most of the 'reallocation effect' shown in Chart 1.36. This is because the level of unit labour costs in Mining is relatively low (i.e. the cost of labour is small relative to output), so the Mining boom and the resultant shift in labour resources to Mining offset much of the increase in the industry's actual growth in unit labour costs.

Instead, Australia's high unit labour costs between 2003–04 and 2011–12 were driven by Services industries. The contribution from Health Care & Social Assistance, and Education & Training (industries within the Social Services sector) were the highest over the period, with these two combined accounting for 30 per cent of the increase in unit labour costs.

The high contribution from these industries stems from a combination of increasing labour cost pressures and strong growth in employment in an already high cost sector (i.e. they have both high *growth* and a high *level* of unit labour costs). However, as shown in Chart 1.12 and in Box 1.3, these industries both have low trade exposure—suggesting that the actual impact of high unit labour costs on Australian competitiveness between 2003–04 and 2011–12 may be overstated.

Slower growth or falls in unit labour costs between 2011–12 and 2013–14 occurred across all industries. This is consistent with the slowdown in wages growth shown in Chart 1.26, and improvements in labour productivity shown in Chart 1.21. Chart 1.36 shows that Mining and Financial & Insurance Services had a negative impact on unit labour cost growth in 2011–12 to 2013–14. Social Services continued to be the largest positive contributor to unit labour cost growth, driven mostly by its particularly high *level* of unit labour costs.

Chart 1.36: Estimates of industry contributions to unit labour cost growth, 2003–04 to 2011–12 and 2011–12 to 2013–14



Source: ABS cat. no. 5204.0, Department of Industry calculations.

Note: Estimates of unit labour costs are based on the ratio of compensation of employees to industry value added. An industry's contribution to aggregate unit labour costs growth is affected by its own unit labour cost growth and its level of unit labour costs. See Appendix C for more details on the methodology.

Key points on domestic economic and business conditions

The Australian economy is transitioning away from Mining investment, towards trade-led growth and other more diverse sources of growth. There were strong gains in living standards during the Mining investment boom, but output growth per capita was below trend. Productivity and output growth should be supported by lower levels of investment and higher production in Mining and Utilities during this transition.

Growth in other sectors of the economy may also improve. Adjustments in the economy are being supported by Australia's flexible labour markets—wages growth has slowed considerably, and this has reduced business cost pressures. Labour productivity growth has also been strong in the last two years, and this, together with the slowdown in wages growth, has driven a sharp slowdown in unit labour costs growth.

However, there is some uncertainty about the smoothness of the transition, and this is reflected in surveys of business conditions. In particular, further falls in the exchange rate are needed to improve Australia's international cost competitiveness significantly.

Developments in Australian industry

Business conditions vary from industry to industry. Some have been significantly affected by the Mining boom, either as supplying industries or as trade-exposed industries that are affected by the high Australian dollar. In other industries, factors such as the ageing population or structural change may be more important.

The section below discusses trends and developments in selected industries.

Social Services growth will be supported by the ageing population

The Social Services sector comprises Health Care & Social Assistance (38.9 per cent), Public Administration & Safety (32.4 per cent) and Education & Training (28.6 per cent). The Social Services sector is Australia's largest in terms of output and largest employer (see Chart 1.1 and 1.2). Despite the sector being highly skilled, with 48.5 per cent of employees having a 'bachelor degree or above', labour productivity is very low.

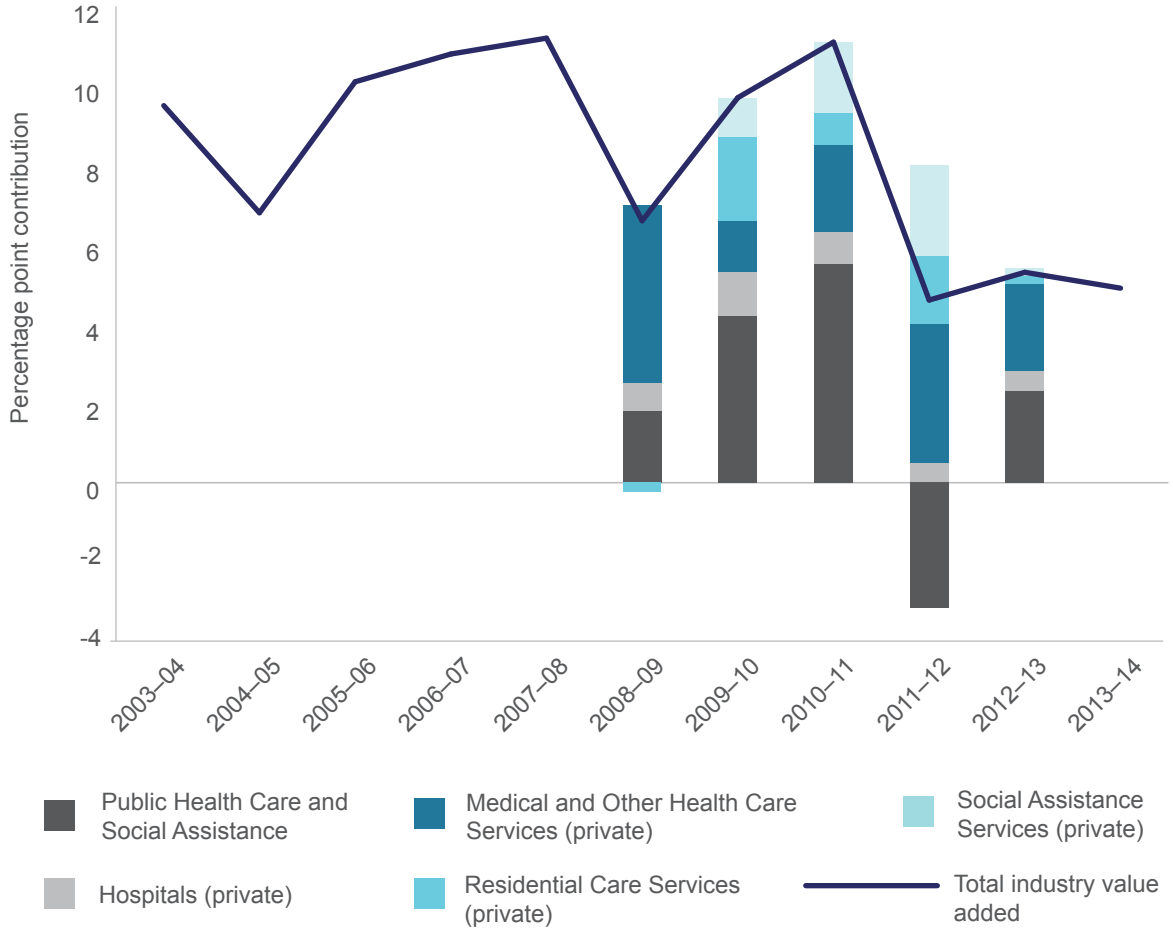
In 2013–14, output produced by the Health Care & Social Assistance industry grew by 4.9 per cent, Public Administration & Safety by 4.6 per cent and Education & Training by 2.3 per cent.

Output growth in the Social Services sector has been primarily driven by growth in Health Care & Social Assistance. The industry has recorded an average annual growth rate of 4.1 per cent over the last five years. Chart 1.37 shows that there was a sharp slowdown in growth in the nominal value of output of Health Care & Social Assistance in 2011–12, which is attributable to a fall in Public Health Care & Social Assistance. However, as there is no market price for public Health Care & Social Assistance, the data is not as accurate as market sector data.

Approximately half of the nominal growth in Private Health Care & Social Assistance in recent years is attributable to Medical & Other Health Care Services. This category includes general practice and specialist medical services, pathology and diagnostic imaging services, allied health services and ambulance services.

By contrast, private hospitals, private residential care services and private social assistance services make up roughly even shares of the remaining 50 per cent growth in Private Health Care & Social Assistance.

Chart 1.37: Health Care & Social Assistance contributions to annual growth, 2003–04 to 2013–14



Source: ABS cat. no. 5204.0 and 8155.0.

Note: Data is in current prices. A breakdown of industry value added in the Health Care & Social Assistance industry is not available prior to 2008–09.

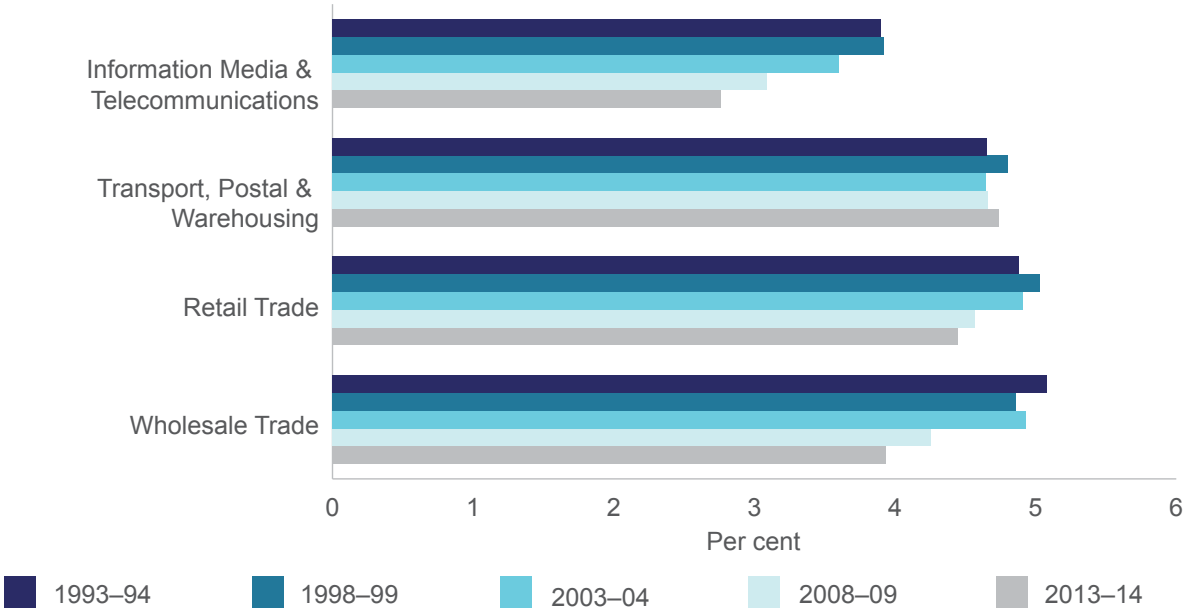
The strong growth in the Health Care & Social Assistance industry reflects Australia's ageing population and increasing demand for health services, aged care and disability support services. The Health Care & Social Assistance industry will likely continue to remain an important driver of Australia's growth.

Distribution Services have maintained a relatively stable share of GDP over time, but faces challenges from technological change

Distribution Services comprises Transport, Postal & Warehousing (29.8 per cent), Retail Trade (28.0 per cent), Wholesale Trade (24.8 per cent), and Information Media & Telecommunications (17.4 per cent). As enabling industries, Distribution Services have maintained a relatively stable share of GDP over time, although their share of GDP has fallen several percentage points since the early 2000s. Since 1990, the Distribution Services sector's share of GDP has ranged between 18.7 per cent (1996–97) and 15.9 per cent (2013–14).

As can be seen in Chart 1.38, the fall in the last ten years is attributable to Wholesale Trade (down 1.0 percentage point) and the Information Media & Telecommunications (down by 0.8 of a percentage point) and Retail Trade (down by 0.5 of a percentage point). Transport, Postal & Warehousing has increased its share of GDP marginally, by 0.1 of a percentage point since 2003–04.

Chart 1.38: Distribution Services industries share of GDP, selected years



Source: ABS cat. no. 5204.0.

Note: Data is current prices.

Recent declines in the Distribution Services sector are likely attributable to structural changes (for example the transition to online media and distribution services), as well as reduced international competitiveness due to a high Australian dollar. See Box 1.5 for a more detailed analysis of the impact of online retailing on the Retail Trade industry.

Box 1.5: Online shopping and transitions in the retail industry

Technological change in recent decades has led to the rise of online retailing. More people are using smartphones and tablets[81] and more households have internet access [82] than ever before. This translates to online retailers having a larger market base and means that consumers can access detailed information and reviews about products online. The rise of online banking, as well as the increased security of online transactions[83] have simplified access to money (and credit) and made online shopping more attractive and convenient for consumers. With the rise of online retailing, the traditional bricks and mortar retail industry has had to adapt and change the way it engages with consumers.

The take-up of online retail trading

Online shopping is now part of the mainstream retail shopping experience of many Australian consumers. Sensis, in its *eBusiness Report*, estimates that 78 per cent of Australians have purchased goods or services online in 2014.[84] NAB estimates that Australians spent $15.9 billion on online retail in the year to September 2014. This is equivalent to around 6.7 per cent of traditional bricks & mortar retail.[85] However, the PC notes that Australians have been slow in taking up online retailing compared to the United States and the United Kingdom.[86]

According to NAB[87], domestic retailers account for the majority of online retail sales (74.6 per cent), with growth in domestic online retail sales currently growing faster than international online retail sales. Strong growth in the domestic segment of online retailing is in contrast to the perceived threat of international retailers to Australia's online shopping industry.[88] However, estimates are still experimental and likely underestimate international online retail sales. The ABS has started including a 'coverage adjustment' in an attempt to take into account goods and services imported under the low value (GST exempt) threshold of $1000. The ABS is also investigating how to measure intangible products consumed online, such as e-books, music and software.

NAB reports that the 35–44 age cohort accounted for the majority of online retail spending in Australia in the year to July 2014 (24.4 per cent), followed by 25–34 year olds (20.6 per cent) and 45–54 year olds (20.2 per cent). Only around 8.3 per cent of online retail spending was accounted for by the over 65 age cohort, however positive growth in this age cohort over the past 11 months (often at higher growth rates than the other age cohorts) suggests that this phenomenon is not limited to young people and that opportunities exist for online retailers in this market segment.[89]

Chart 1.39 shows the composition of Australian online spending in the year to July 2014. Department and variety stores account for the majority of online spending (34 per cent), while electronic games and toys is the smallest category of online spending (2 per cent).

81 Sensis reports that around 56 per cent of Australians own a tablet device and 77 per cent own a smartphone. Source: Sensis (2014) *Sensis e-Business Report 2014: The Online Experience of Small and Medium Enterprises*, Sweeney Research, p.61.

82 According to the ABS, 83 per cent of households had internet access in 2012–13, compared to 64 per cent in 2006–07. Source: ABS cat. no. 8146.0.

83 For example, firms such as PayPal are offering alternative ways of making online transactions, limiting the need for consumers to continually provide their personal information when making purchases online. Source: Bank of Canada, *Briefing on Digital Currencies*, 2 April 2014, accessed at www.bankofcanada.ca/2014/04/briefing-on-digital-currencies/.

84 Sensis (2014) *Sensis e-Business Report 2014: The Online Experience of Small and Medium Enterprises*, Sweeney Research, p.76.

85 NAB Online Retail Sales Index—September 2014.

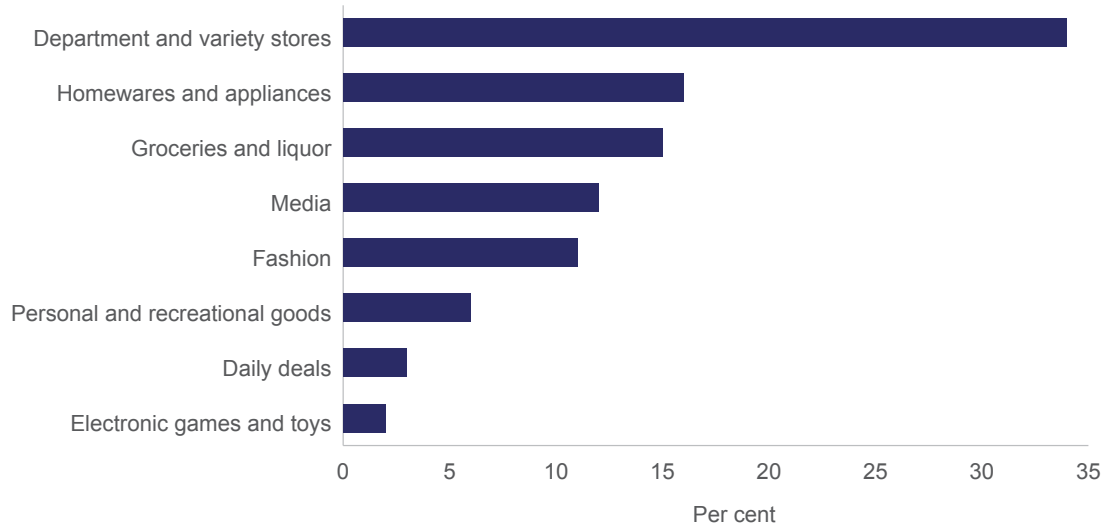
86 PwC (2012) as cited in Productivity Commission (2014), *Relative Costs of Doing Business in Australia: Retail Trade*, Productivity Commission Research Report, September 2014, p.51.

87 NAB Online Retail Sales Index, In-depth Report—July 2014, p.2.

88 IBISWorld Industry Report X0004, Online Shopping in Australia—May 2014.

89 NAB Online Retail Sales Index, In-depth Report—July 2014, p.2.

Chart 1.39: Share of total spending in Australian online retail, 12 months to July 2014



Source: NAB Online Retail Sales Index, In-depth Report—July 2014.

According to Sensis, the top three retail categories that Australians are purchasing online are clothing/ accessories/shoes, airline tickets and books (53 per cent, 52 per cent and 49 per cent of Australians have reported making online transactions in these categories, respectively). This suggests that traditional bricks & mortar retailers in these categories are facing a high level of competition from online retailers. The growth of Amazon and the demise of Borders is an example of this competition at work.

The ABS is now publishing experimental estimates of the value of domestic online retail sales[90], which amounted to around $6.6 billion in the year to August 2014. The ABS estimates that around 36.7 per cent of domestic online retail sales were made by pure-play online retailers over this 12-month period, with the remaining 63.3 per cent from "multi-channel" online retailers. Pure-play online retailers are businesses that solely operate online, while multi-channel retailers have a combination of online and physical stores and/or sell goods and services via catalogues, mail or telephone orders. Since the beginning of the experimental series in March 2013, the value of pure-play and multi-channel online retail sales have grown by similar rates (43.6 per cent and 41.6 per cent, respectively).

Many traditional 'bricks and mortar' retailers have responded to changing consumer preferences by incorporating online options as part of the shopping experience. For example, Woolworths and Coles have responded by incorporating online shopping as part of their business models and also offering delivery or in-store pick-up. Retailers with a physical presence do have some advantages over pure-play online retailers, with research by A.T. Kearney in the United States suggesting that physical stores can in fact help retailers 'drive online sales'. The A.T. Kearney research further suggests that consumers prefer shopping experiences 'that span multiple channels', with 55 per cent of US consumers preferring to use both physical stores and online throughout their shopping experience (from discovery, to trial, purchase, delivery/pickup and return)[91]. For these reasons, many previously pure-play only retailers are testing markets with temporary pop-up shops where consumers can get hands-on with products before making a purchase.[92]

90 ABS cat. no. 8501.0. Notes: estimates only include domestic online retail sales. They do not include non-resident retailers overseas which sell directly to the Australian general public. Online sales by non-employing businesses are also not included.

91 A.T. Kearney (2014), *On Solid Ground: Brick-and-Mortar is the Foundation of Omnichannel Retailing*, accessed at www.atkearney.com/consumer-products-retail/on-solid-ground, p.7.

92 Qantas May 2014 *Special Report, The Retail Revolution*, p.109.

Online retailers can still be successful even if they don't have a physical storefront, or provide some other tangible experience for their customers (and vice-versa for bricks & mortar retailers). Successful business models (whether they are pure-play, multi-channel or bricks & mortar) will depend on businesses reaching consumers and providing the best goods and services creatively and at competitive prices.[93]

Demand for parcel delivery services has soared and continue to rise

One of the key advantages of online retailing is the convenience. So, for retailers to remain competitive, fast and cheap delivery of goods and services is vitally important. Many businesses are absorbing the cost of delivery rather than passing on the cost to consumers. However, this is not a sustainable option for many small businesses.

According to Australia Post, domestic parcel volumes grew by 12.8 per cent in 2013, with this strong growth expected to continue as more businesses sell their products online.[94] With this increased demand, consumers are also after more flexible pick-up and delivery options. Australia Post has been responding to this demand by introducing a range of delivery options, including 24/7 parcel lockers. Extended delivery to six days a week will also be introduced by the end of 2014 (a service that was usually only available during the Christmas peak).[95]

Other companies in the freight and logistics industry have also experienced increased demand for their services and it has also resulted in many smaller businesses entering the parcel delivery industry using existing (e.g. Qantas) freight infrastructure.[96]

Mining has represented a disproportionally large share of GDP growth in recent years

The Mining industry represents only 8.3 per cent of Australia's GDP, but has represented a disproportionally large share of GDP growth in recent years—due to high commodity prices and the resultant Mining investment boom. Mining industry value added increased by 9.5 per cent (in volume terms) in 2013–14, to reach $131.8 billion (in current prices). The primary driver of this growth was Iron Ore mining, which grew by 22.0 per cent in the year. By contrast, Coal Mining grew by 6.5 per cent, Oil & Gas Extraction increased by 1.4 per cent, Other Mining fell by 0.7 per cent and Exploration and Mining Support Services fell by 4.8 per cent.

Mining is currently undergoing a transition away from the 'investment phase', where the main feature was massive investment in equipment, exploration and productive capacity, to the 'production phase', where export volumes are expected to take over as the major driver of growth.

Chart 1.40 shows that Mining investment has already started to come off, falling by 8.2 per cent through the year to the June quarter 2014. The value of Mining exports has picked up significantly in the past few quarters, but falling commodity prices has moderated this somewhat.

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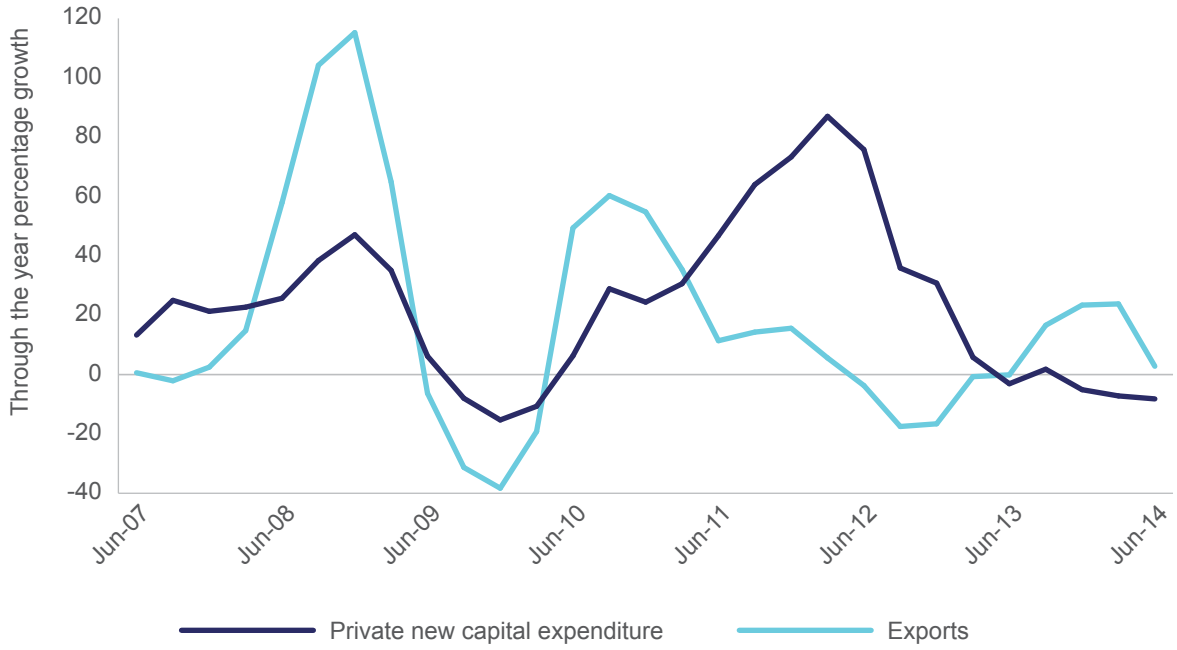
93 Campbell Phillips June 2014 editorial, Online-only Retail is Dead? That's News to Us, accessed www.nora.org.au/NewsDetail/27948/Paul_Greenberg_gives_his_response_to_his_'online_is_dead'_comments.

94 Australia Post (2014), *Annual Report 2014: Your Post is evolving*, accessed at auspost.com.au/annualreport2014/assets/downloads/AusPost_AR14_Full_report.pdf, p.12.

95 Australia Post May 2014 *Australia Post to deliver 6 days a week & launches digital mail offering*, accessed auspost.com.au/about-us/extended-delivery-services.html.

96 Qantas May 2014 *Special Report, The Retail Revolution*, p.106.

Chart 1.40: Mining investment and exports, June quarter 2007 to June quarter 2014



Source: ABS cat. no. 5625.0 and 5368.0; Thomson Reuters DataStream.
Note: Data is current prices and seasonally adjusted

While generating significant revenue, Mining in the production phase is expected to contribute less to GDP growth than it did during the investment phase. The strong result for Mining's contribution to GDP in 2013–14 reflects that the transition has begun, but is not yet complete, with further falls in Mining investment anticipated going forward.

Financial & Insurance Services is growing quickly

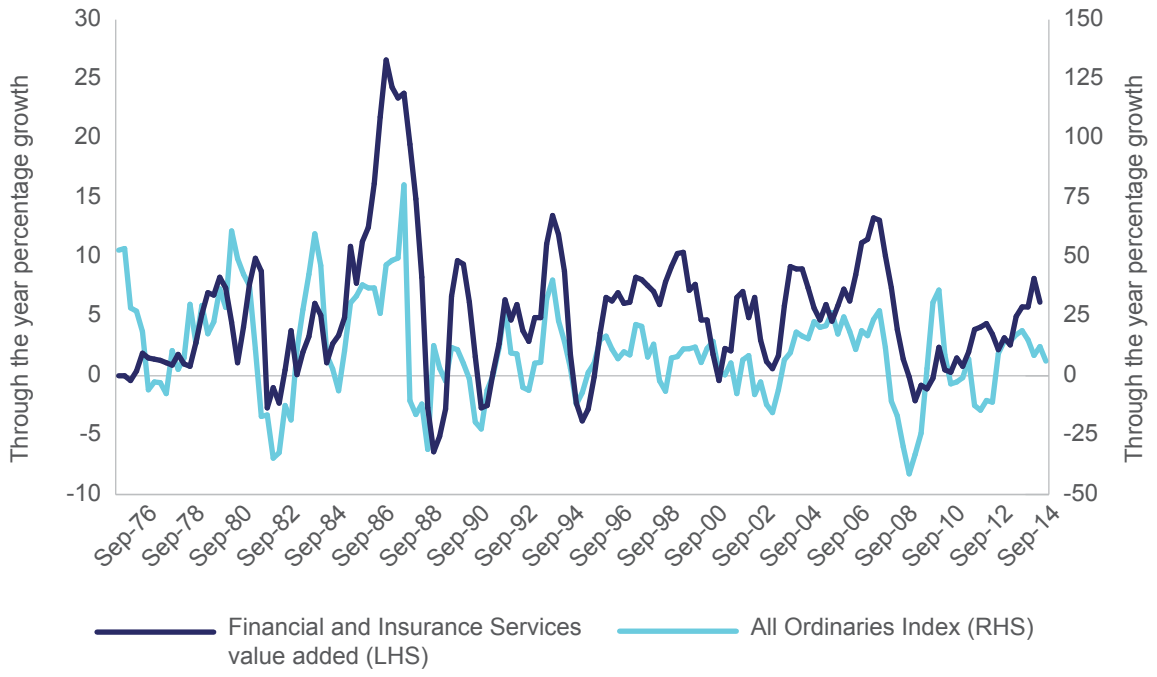
The Financial & Insurance Services industry grew by a solid 5.3 per cent in 2013–14, and has been increasing its share of GDP steadily over time. In 2013–14, it represented 8.4 per cent of the economy, compared with 6.8 per cent 20 years earlier. This structural change, often called 'financialisation' has been observed in many other developed economies.

Despite the strong growth in output attributable to Financial & Insurance Services, employment in the industry has fallen in the last two years, by 1.6 per cent in 2012–13 and by 0.1 per cent in 2013–14. The long-term 'financialisation' trend is also not associated with increasing shares of employment. In fact, the industry's share of total employment has fallen over time, from 4.1 per cent in 1993–94 to 3.6 per cent in 2013–14.

Short-term trends in Financial & Insurance Services output can be explained by using changes in the All Ordinaries Index as a proxy for investor confidence. As shown in Chart 1.41, Financial & Insurance Services output grew by 12.4 per cent in the year to the September quarter 2007 in the lead-up to the GFC (the All Ordinaries Index rose by 27.4 per cent over the same period), and fell by 0.7 per cent in 2009 (following sharp falls in the All Ordinaries Index), at the height of the crisis.

The strong growth in Financial & Insurance Services output in 2013–14 coincides with strong gains the All Ordinaries Index of 12.3 per cent through the year to the June quarter 2014. However, the rate of growth in the All Ordinaries Index slowed to 6.2 per cent through the year to the September quarter 2014.

Chart 1.41: Financial & Insurance Services value added and the All Ordinaries Index, September quarter 1976 to September quarter 2014



Source: ABS cat. no. 5206.0; Thomson Reuters DataStream.

Other Business Services show diverging trends

The Other Business Services sector represents 11.8 per cent of GDP and comprises Professional, Scientific & Technical Services (53.5 per cent), Administrative & Support Services (24.1 per cent) and Rental, Hiring & Real Estate Services (22.4 per cent). Other Business Services primarily provides services to other businesses, with 82.7 per cent of the industry's output going to intermediate usage.[97] This, combined with its relatively low trade exposure (see Chart 1.12), makes the performance of Other Business Services largely dependent on domestic business conditions, research and development and construction activity.

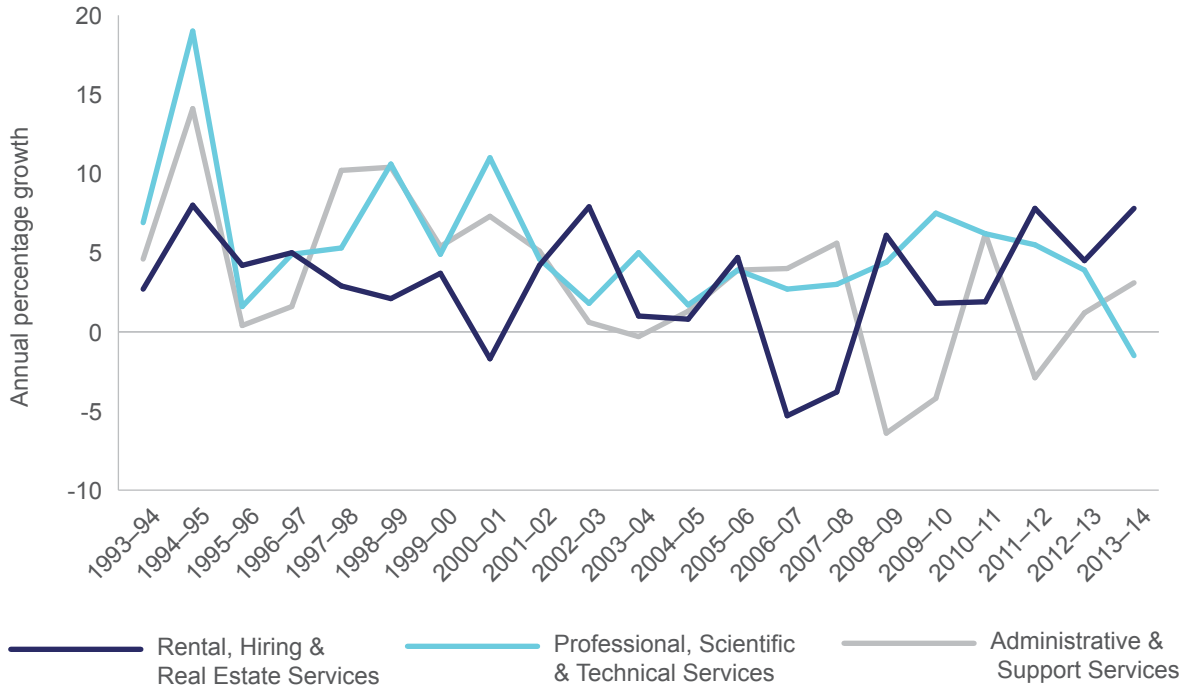
Other Business Services output grew by 1.5 per cent in 2013–14, much slower than the ten-year average of 2.8 per cent. The slowdown has been driven by falling output in the Professional, Scientific & Technical Services sub-industry, which fell by 1.5 per cent in 2013–14. Meanwhile, solid growth of 3.1 per cent was recorded in Administrative & Support Services, and very strong growth (7.8 per cent) in Rental, Hiring & Real Estate Services.

97 ABS cat. no. 5209.0.

As shown in Chart 1.42, output of the Professional, Scientific & Technical Services industry has been very strong in recent years, for example growing by 7.5 per cent in 2009–10, although growth has slowed since then. Data from 2012–13 suggests that this slowdown is attributable to the Professional, Scientific & Technical Services Except Computer System Design & Related Services sub-industry, which grew by 2.3 per cent in 2012–13 in current prices.[98]

By contrast, the Computer System Design & Related Services sub-industry grew strongly, by 11.5 per cent in current prices in 2012–13. One key difference between the two sub-industries is that the former has strong linkages with the Mining and Construction industries (15.6 per cent of its output goes into these industries), whereas the latter has virtually no connection with either of those industries. This suggests that the recent poor performance of Other Business Services is possibly due to the slowdown in Mining investment and engineering construction activity.

Chart 1.42: Other business services sub-industries value added, 1993–94 to 2013–14



Source: ABS cat. no. 5204.0.

Note: Data is chain volume measures.

Construction performance has been mixed recently

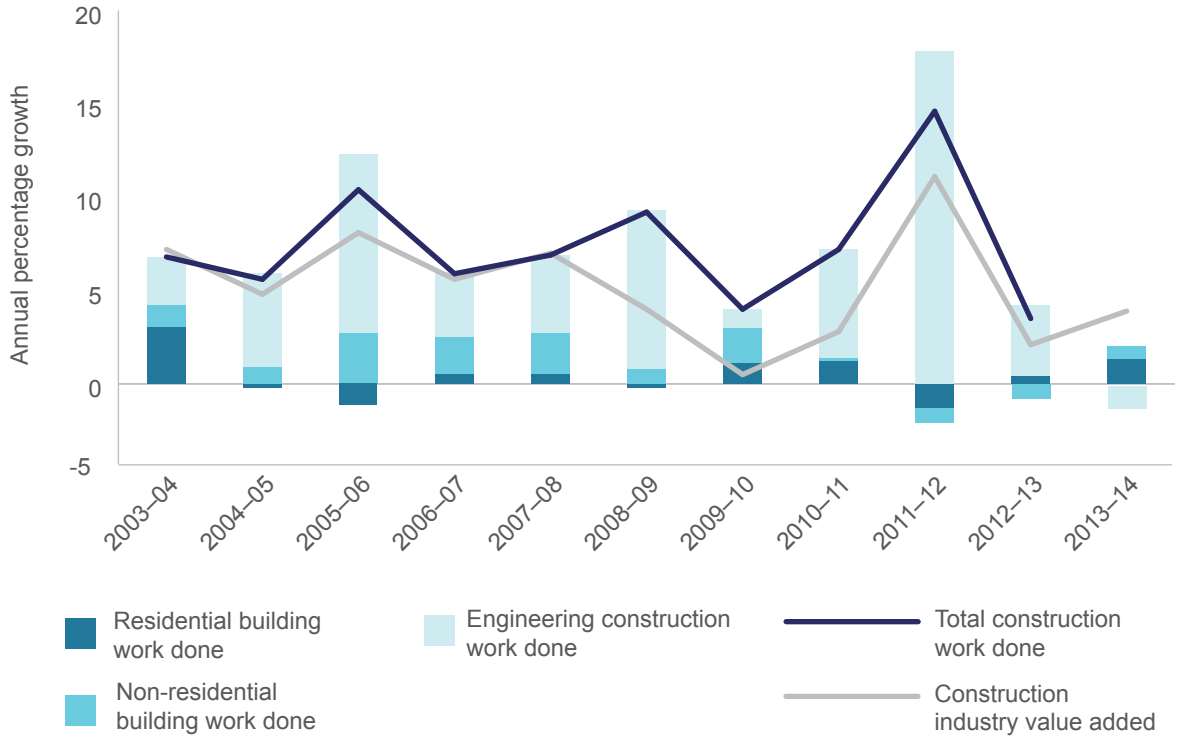
The Construction industry represents 7.9 per cent of GDP. As illustrated in Chart 1.43, Construction output underwent a sharp slowdown in 2009–10 during the height of the GFC. Following a rebound in engineering construction activity, the industry experienced strong growth in 2011–12 (11.1 per cent), but then slowed to 2.1 per cent growth in 2012–13. Growth in Construction industry value added has picked up in 2013–14, growing by 3.9 per cent.

98 ABS cat. no. 8155.0.

A number of factors affect the performance of the Construction industry, including borrowing costs, business and consumer confidence and population growth. As such, Construction is typically a very pro-cyclical industry, performing strongly when economic conditions are good and poorly when they are weak.

A key indicator of growth in Construction industry value added is the value of construction work done. Chart 1.43 shows that the strong growth in construction work done in 2011–12 was entirely driven by an increase in engineering construction activity. Most of this engineering construction activity took place in Mining[99] and all of this growth came from the private sector.

Chart 1.43: Construction industry value added and contributions to construction work done, 2003–04 to 2013–14



Source: ABS cat. no. 5204.0 and 8782.0.65.001.
Note: Data is chain volume measures.

Similarly, the slowdown in output growth in 2012–13 was also correlated with a sharp slowdown in construction work done, which grew by 3.5 per cent in the year. This was due to a contraction in engineering construction activity—driven by the slowdown in Mining investment activity.

Contrary to the historical relationship, the increase in Construction output in 2013–14 did not correspond with an increase in construction work done, which fell by 0.2 per cent in the year. There has been a marked pickup in building construction activity, particularly residential building (up by 5.5 per cent), but this has been more than offset by falling engineering construction.

99 Deloitte Access Economics (2014), *Investment Monitor: Engineering work steady as pipeline thins*, March 2014, p.7.

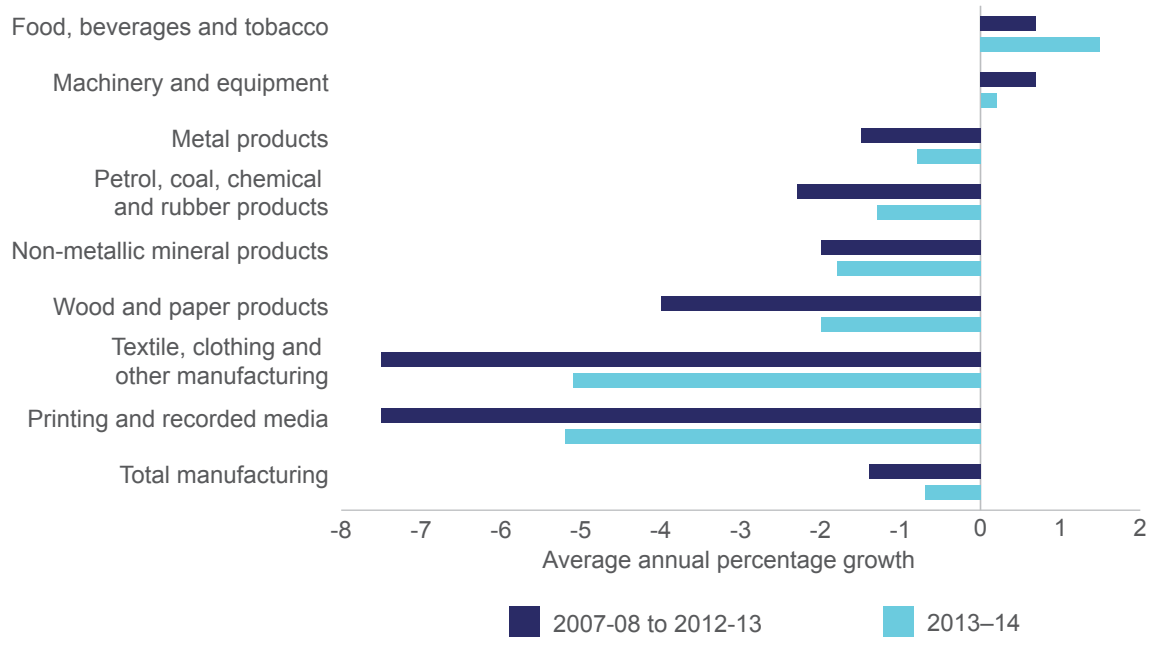
Deloitte Access Economics (DAE) notes that due to population growth, low interest rates, high housing prices, foreign buying and government incentives, there is currently a significant amount of 'momentum' in residential building construction.[100] DAE also notes solid growth in office construction. However, DAE expects the 'construction cliff', brought about by the end of the Mining investment boom, will continue to intensify. Overall, DAE forecasts construction industry value added to slow to 2.8 per cent in 2014–15 and 0.4 per cent in 2015–16. As a result, DAE expect business investment to detract from GDP growth through to 2016–17.

The Manufacturing industry is highly trade-exposed and has faced a challenging environment in recent years

Manufacturing represents 6.4 per cent of the Australian economy, although this share has been declining over time. Manufacturing output fell by 1.8 per cent in 2013–14, driven by falls in Machinery & Equipment (down by 6.5 per cent), Petrol, Coal & Chemical Product Manufacturing (down by 5.9 per cent) and Printing & Recorded Media Manufacturing (down by 5.5 per cent).

As shown in Chart 1.44, total Manufacturing output has been declining since it peaked in 2007–08, falling by an average annual rate of 1.5 per cent between 2007–08 and 2013–14. Over this period, falls have been recorded in the Manufacturing sub-industries, with the exception of Food Beverages & Tobacco, which grew by 0.6 per cent per year.

Chart 1.44: Manufacturing industry value added by sub-industry, 2007–08 to 2012–13 and 2013–14



Source: ABS cat. no. 5204.0.

Note: Data is chain volume measures and seasonally adjusted.

100 Deloitte Access Economics (2014), *Business Outlook: China's tricky transition*, September 2014, p.17.

The recent declines in the Australian Manufacturing sector can be explained by the loss of competitiveness described in this chapter. Manufacturing is highly trade-exposed (see Charts 1.12 and 1.13) and has therefore felt the effects of the high Australian dollar and rising unit labour costs (Chart 1.33) more strongly than other industries. The long-term trend of de-industrialisation (discussed in Chapter 2), may have also played a role.

Other industries

Personal Services (4.8 per cent), Utilities (2.7 per cent) and Agriculture (2.4 per cent), collectively represent 9.9 per cent of the Australian economy. As a group, these sectors grew by 0.4 per cent in 2013–14, driven by Personal Services (1.0 per cent) and Agriculture (2.1 per cent), while Utilities fell by 2.1 per cent through the year.

Key points on developments in Australian industry

The transition away from the Mining investment boom holds important implications for other Australian industries. For example, growth in Construction has slowed considerably, owing to its recently high reliance on mining-related engineering construction activity. On the upside, residential and non-residential construction activity has started to pick up recently. Growth in Other Business Services has been mixed, while the highly trade-exposed Manufacturing industry has faced a challenging environment in recent years.

There are other trends which are also important to particular industries. The ageing population and increased demand for health services, aged care and disability support services has driven strong growth in Social Services. The Financial & Insurance Services industry has also been growing rapidly, due to underlying structural change, although short-term volatility is strongly linked to investor confidence. While Distribution Services has maintained a relatively stable share of the economy in recent years, technological change such as online retailing may present challenges.

Summary

Global economic conditions remained uneven in 2014. India and China continue to grow more rapidly than developed economies, although the pace of growth in these countries is slowing. Following the poor growth performance since the GFC, the United States economy has improved recently, while the euro area continues to undergo a weak economic recovery and economic growth in Japan is expected to remain slow.

In recent years, Australia's economic performance has remained strong, with economic activity largely fuelled by demand from emerging economies for Australian resources. Over the coming decades however, the economy will face a number of challenges.

The Mining boom, combined with other factors, such as the low interest rate environment in most developed economies, has exerted upward pressure on the Australian dollar, which has reduced the international competitiveness of Australia's trade-exposed industries.

High domestic labour costs also continue to constrain business competitiveness. The high growth in unit labour costs between 2004–05 and 2011–12 can be largely attributable to slow growth in labour productivity across the economy. Strong growth in wages in service industries have also contributed to Australia becoming less competitive than a decade ago.

The Mining industry is now entering the production phase. In this phase, Mining is expected to contribute less to GDP growth. More diverse sources of growth will therefore be needed to maintain economic growth. Supporting industries, such as Construction and Professional, Scientific & Technical Services, which have provided inputs into the Mining investment boom, will need to adapt. There is some evidence of this already occurring in Construction—residential and non-residential construction activity has started to pick up.

The sectoral composition of Australia's economy is affected by long-term structural changes and short to medium-term cyclical factors. As the Australian population ages and demand for health care continues to increase, Social Services will maintain a dominant share of Australia's GDP and employment.

Structural changes are occurring in Distribution Services as a result of new technologies that are changing the way goods are transported and the way people shop. The sector is facing a number of cyclical challenges as a result of the high Australian dollar. Manufacturing is strongly affected by these factors, but with a much greater emphasis from the dollar due to its high trade exposure.

More broadly, the development of global value chains in recent decades has demonstrated that events further afield can have considerable impacts on the Australian economy. As technological progress continues to accelerate, it will have an impact on the demand for skills—with increasingly advanced robotics able to compete for jobs at all skill levels.

Australian industries are well placed to adapt to these changing circumstances. The terms of trade are expected to continue to fall, which should exert downward pressure on the Australian dollar, and provide some relief for trade-exposed industries. Productivity should pick up as the economy transitions to the production phase. Labour market conditions are softening, but due to flexibility in the labour market, this has had the upshot (for businesses) of reducing wage costs and skills shortages. Unit labour cost pressures have also been subsiding, and combined with some depreciation in the exchange rate, this has led to Australia's cost competitiveness improving moderately over the past two years.

CHAPTER 2
Structural change and Australian industry

Structural change is a broad concept that encompasses long-term shifts in the sectoral composition of the economy. The Australian economy has experienced significant structural change over recent decades due to a range of factors. These include the rapid industrialisation of China and India and their growing appetite for Australian resources, Australia's ageing population, and the emergence of developing economies as low-cost manufacturing powerhouses.

These factors have induced a relative expansion in the Services and Mining shares of the Australian economy at the expense of Manufacturing and Agriculture. However, while Manufacturing and Agriculture's share of the economy has decreased, their output[101] has grown steadily in recent decades, just less quickly than other parts of the economy.

This chapter analyses the extent and nature of recent structural change in Australia in order to better understand developments and trends in the economy at the industry level. It compares the Australian experience to other developed countries, considers the role of structural change in the development process and analyses the drivers of structural change in order to understand why these changes are taking place.

The chapter also takes a considered look at Manufacturing to analyse the impacts of structural change on this industry.

Finally, the chapter considers the implications and possible future directions of structural change, as well as the role of government in the structural adjustment process.

101 In this chapter, output is nominal output (GVA at current prices) unless otherwise stated. This is because price changes are a key signalling mechanism in the structural change process.

What is structural change and why is it important?

Structural change is typically defined as shifts in the distribution of output, investment and employment across industries or regions. Structural change generally refers to medium to long-term changes, rather than short-term or cyclical phenomena. This concept can be broadened to include changes within industries and within firms[102], but this chapter focuses on shifts between industries to highlight the impact of structural change at industry level.

The drivers of structural change are many and varied. Examples include technological advances, changes in demographics and consumer preferences, domestic policy reform, as well as international developments, such as increased import competition from emerging economies. These, in turn, impact on the relative prices of goods and services in the economy, and inputs, such as land, labour and capital, used to produce these goods and services. When relative prices change, patterns of production and consumption follow suit, and some industries expand or contract in relative terms.

Structural change is a continual process as relative prices are constantly fluctuating and economic resources constantly flow into and out of industries to take advantage of this. To illustrate the economy's constant state of flux, in the 12 months to February 2013, over a million workers changed jobs (9.2 per cent of those working in February 2013). Of these, around 600,000 changed industry and around 457,000 changed occupation, and such magnitudes have been broadly similar since 2008.[103] Similarly, there were 239,000 business entries and 301,000 business exits in 2012-2013.[104] The net effect of this constant flux is what economists call structural change, while the creation of new businesses and the decline of less competitive businesses are key to long-term economic growth.

Structural change reflects the collective responses of individuals and firms to changing relative prices. Without structural adjustments, economies cannot respond to changes in relative prices, and therefore cannot achieve optimal allocation of resources under new conditions. Timely adjustment is therefore crucial for economic prosperity, growth and development. The recent Mining boom, for example, which has buoyed the Australian economy over the last decade[105], would not have been possible without a rapid reallocation of resources towards this industry, and demonstrates a period of structural adjustment which has benefitted the vast majority of Australians.[106]

Resources, however, tend to move more slowly than prices, due to barriers to the adjustment process. Workers take time to respond to changes in relative wages, for example, because it can be difficult to relocate, or because it takes time to re-skill to change occupations. Similar barriers affect the timely adjustment of capital and land. These barriers can lead to unemployment and other inefficiencies such as idle machinery and equipment, which can have costly economic and social consequences. Further, if adjustment occurs on the back of a short-term shock rather than a longer-term trend, the economy can take time to re-adjust and some industries or businesses may not be able to return

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102 Downes P & Stoeckel A (2006), *Drivers of Structural Change in the Australian Economy*, Centre for International Economics, Sydney and Canberra, p.12.

103 ABS cat. no. 6209.0.

104 ABS cat. no. 8165.0. Note: Not all exits were due to insolvency, they may have been sold or due to mergers.

105 Gruen D & Wilcox R (2014), *After the resources investment boom: Seamless transition or dog days?,* Speech to the Australian Conference of Economists, Hobart.

106 It is debateable whether the Mining boom is a structural change or a cyclical phenomenon. As it has been apparent for over a decade, and is likely to continue in the future (albeit in a different form) we treat it as structural.

as quickly or easily as they left.[107] This illustrates that while structural change is typically seen as an efficient response to relative price changes, it can also have detrimental effects. The lower the barriers, the quicker the economy can adjust, which will lessen the economic and social costs of the adjustment process.

Structural change can also have negative consequences for individuals, particularly those who are not readily able to transition between industries, and this could lead to long-term unemployment. On the other hand, opportunities for some individuals may appear in industries where structural change results in increased demand for their skills.

Structural change can be measured using structural change indices (SCIs, see Box 2.1). While SCIs are useful to measure the extent of structural change, they do not provide any information about the nature of that change. For this reason, it is also important to examine the changes in relative shares of industries. However, changes in relative shares may still be misleading, because they provide no information about absolute changes. For example, an industry that is declining in terms of output or employment share but is growing in absolute terms is unlikely to be of as much interest or concern to policy makers as an industry that is declining in absolute terms as well.

Recent structural change in Australia is analysed in this chapter by using a range of measures including SCIs, trends in industry output, employment and skills in both relative in absolute terms, as well the impacts of changes in relative prices across industries.

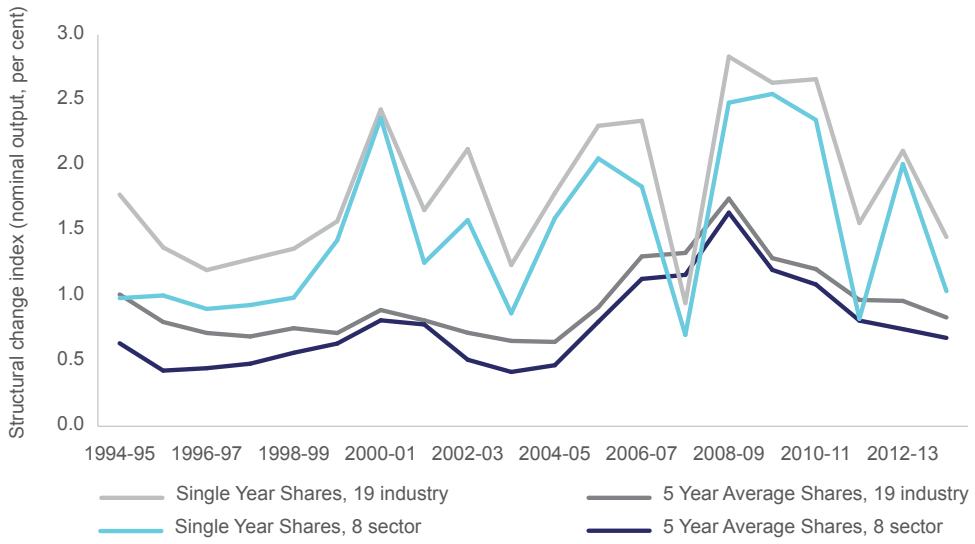
107 OECD (2012), *Australian Manufacturing in the Global Economy*, OECD Publishing, p.43.

Box 2.1: Structural change indices

A common way of measuring structural change is through structural change indices (SCIs).[108] SCIs report the extent of movements of a measure, such as output or employment, between industries or sectors over a given period. This is calculated as the sum of all changes divided by two, as a single movement will be tallied as an increase in one area and a decrease in another. However, the choice of measure, the level of disaggregation, and the time period chosen will have a considerable impact on the value of the SCI. The larger the number of industries or sectors, the greater the reported extent of structural change is likely to be, as this increases the movements that are counted.[109] Calculating the SCI over a longer period of time has the same effect. Another consideration is that calculating sector shares of a measure as single-year statistics may mean that the SCI reflects cyclical change rather than long-term structural change. Therefore, measuring each sector's share as the average share over a number of previous years may be a more appropriate approach.[110]

Chart 2.1 shows structural change indices based on industry or sector shares of total industry GVA, or industry output.[111] The chart illustrates how the construction of the SCI can alter the extent of measured structural change—disaggregating the economy into 19 industries results in slightly higher SCI values compared with 8-sector SCI values. Using single-year shares of total GVA compared to the average of the previous five years has a more pronounced effect, except in 2008 (which highlights the effect cyclical factors such as the GFC can have on the index using this method), and also results in greater volatility of the SCI.

Chart 2.1: Structural change indices for GVA, 1994-95 to 2013-14



Source: ABS cat. no. 5204.0.

Note: GVA is at current prices (nominal output).

108 See Appendix A in Productivity Commission (1998), Aspects of Structural Change in Australia and Appendix B in Productivity Commission (2013), Looking Back on Structural Change in Australia: 2002−2012, for more detailed discussions of SCIs.

109 For example, if the share of output in social services decreases and that in business services increases by the same amount, calculating the SCI with all services aggregated results in this change not being included in calculations; if services are disaggregated then it is included.

110 Connolly E & Lewis C (2010), *Structural change in the Australian economy*, RBA Bulletin September 2010: 1-10; Productivity Commission (2013) Looking Back on Structural Change in Australia: 2002-2012, Appendix B.

111 In this chapter, 'ownership of dwellings' is excluded from the calculation of total industry GVA (output), so total industry GVA is just the sum of the 19 ANZSIC industries' GVA.

Stylised facts of structural change

Structural change is common to all economies. Similar patterns of structural change over the long term have been generalised in the 'stylised facts' of structural change. These 'stylised facts' are as follows:

- Pre-industrial economies are dominated by agriculture.
- Productivity improvements due to technological advances free up resources (particularly labour) that were producing food to work in other industries, as less labour is required to feed the population. This results in the long-term decline of agriculture and the rise of manufacturing.
- As economies further modernise, manufacturing declines and services emerge as the dominant sector.[112] This is typically a result of a more than proportionate change in demand from goods to services as incomes increase—holidays, health care, fine dining, education, etc.

Chart 2.2 illustrates these 'stylised facts'. It plots the output shares of Services, Manufacturing and Agriculture for Australia and a composite trend of major developed countries between 1970 and 2012 against the level of economic development (measured by GDP per capita) at each time point. As the level of development rises, the Services share of output for both Australia and the international trend increases while the Manufacturing and Agriculture shares decrease. This suggests that a growing share of Services output is a natural consequence of the economic development process.

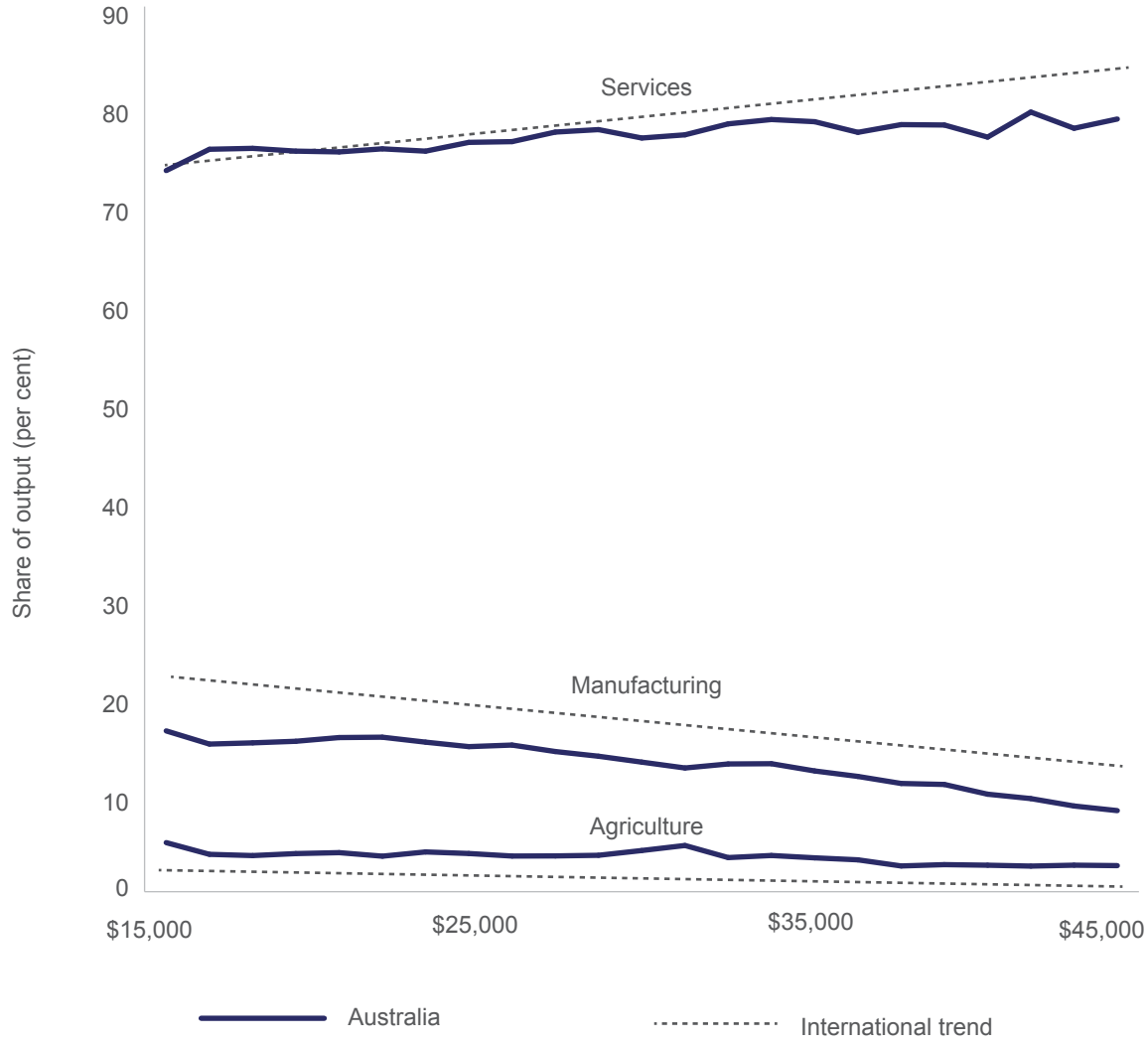
In Australia, the share of output from Agriculture fell from over a third in the 19th Century to just three per cent in the 2000s. Similarly, the share of Manufacturing output and employment fell by more than half between the 1960s and 2000s—output falling from 26 per cent to 12 per cent and employment falling from 26 per cent to 11 per cent.[113] While Services already accounted for about half of output in the 19th century, its share had grown to 59 per cent by the 1960s and to 78 per cent by the 2000s.[114]

112 Ibid. See also Jorgenson D & Timmer M (2011), Structural change in advanced nations: A new set of stylised facts, *Scandinavian Journal of Economics* 113:1-29, who argue that services should not be treated as homogenous, and emphasise the role of distribution services and the use of skilled labour and ICT capital in continued productivity growth.

113 Connolly E & Lewis C (2010), *Structural change in the Australian economy*, RBA Bulletin September 2010, p.1.

114 Ibid.

Chart 2.2: Shares of output of selected industries, 1970-2012



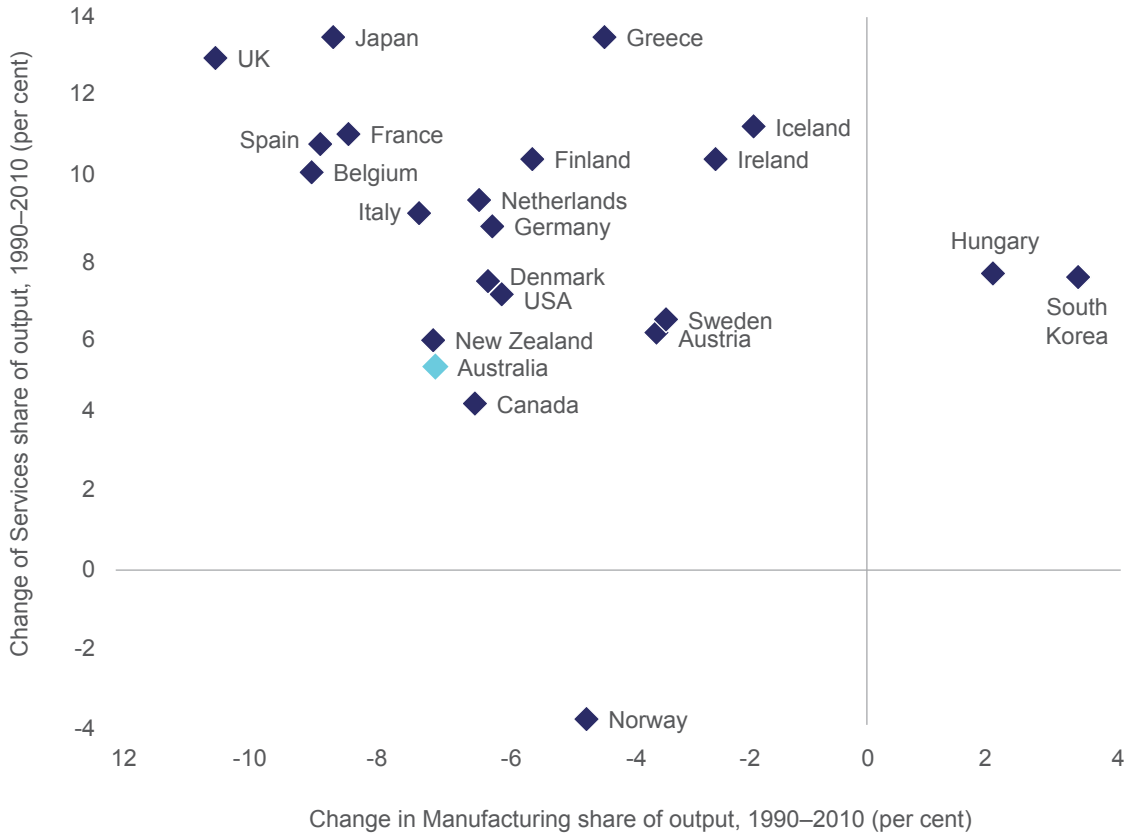
Source: OECD STAN database, EU KLEMS Database, ABS cat. no. 5204.0.

Note: International trend is a linear trend fitted to data for four major developed countries (Germany, Japan, UK and USA). Output is total industry GVA at current prices.

Chart 2.3 focusses on how the output shares of services and manufacturing have changed in 22 developed countries over the last two decades. With the exception of Hungary and South Korea, which are slightly further behind in the development process and still experiencing an increase in the share of manufacturing, all these economies experienced a decline in manufacturing's share of output. Similarly, all these countries, with the exception of Norway,[115] experienced increases in the services share of output.

115 Norway experienced a resources boom much larger in scale than Australia's due to its abundance of oil and gas reserves. The magnitude of this boom induced a relative decline of all other sectors, including Services. Norway is Europe's largest oil producer and the world's third-largest natural gas exporter – see U.S Energy Information Administration - Norway (2014) www.eia.gov/countries/analysisbriefs/Norway/norway.pdf.

Chart 2.3: Change in Services and Manufacturing shares of output, selected OECD countries, 1990-2010



Source: EU KLEMS Database, OECD STAN Database, ABS cat. no. 5204,0, IMF World Economic Outlook, Statistics New Zealand Table SND005AA, Statistics Canada CANSIM Tables 3790023 & 3790029.

Note: Data for Germany and Hungary are for 1991-2010. Data for Greece, Iceland, Ireland, Japan, and Spain are for 1990-2009. Output is total industry GVA at current prices.

The shifts in the Manufacturing and Services shares of output in Australia are similar to that of other commodity exporting countries such as Canada and New Zealand. Australia's decline in Manufacturing's share of output (6.9 per cent) is slightly larger than average (5.2 per cent), while the expansion in the Services sectors' share of output (5.2 per cent) appears to be modest relative to that observed for other developed countries (8.3 per cent, on average). This is likely to be the result of the sharp increase in Mining's share of output in Australia, which crowded out all other sectors to some extent.

The different endowments, policy settings and geographical characteristics of countries mean that the exact nature and extent of structural change will vary between them. Australia's comparative advantages in agriculture and its substantial endowments of mineral resources, for example, has meant that fluctuations in global demand and prices for such goods have played a significant role in shaping it's patterns of structural change.

Drivers of structural change

There are numerous interconnected factors that drive structural change. The main drivers are technology, globalisation, preferences and policy.

While they are addressed separately in the following section, they are so intertwined that this can over-simplify the discussion. For example, technological progress and trade liberalisation have resulted in an increasingly connected world—making Australia's economy more dependent on events in other countries. Rapid development in Asia, particularly in China and India, has led to dramatic growth in demand for Australian mineral exports. Concurrently, the increasing flow of low-cost imported goods from these countries have rendered domestically produced goods less competitive, while populations in many developed countries, including Australia, are growing older and wealthier and are spending an increasing portion of their income on services. The result in Australia has been growth in Mining and Services to meet rising demand, while increasing competition has placed pressure on trade-exposed industries.

Technology

Technological change is a fundamental driver of productivity increases and economic growth. It is inherently linked with globalisation, given major advancements in transport and communication technologies. In turn, globalisation exposes countries to more competition, which has led to a greater number of technological breakthroughs.

Technological change encompasses both the development of new products and improvements to existing products and processes. Closely tied with technological change is the diffusion of knowledge, which determines how quickly and efficiently new technology emerges and can be adapted by industry for various purposes and this can result in changes in the skill requirements of workers. Both the pace at which new technology can be adapted and the degree to which labour can be displaced can alter the competitiveness and performance of firms, which ultimately drives structural changes in the economy.

Technological change has driven structural change across the economy in a number of ways. Improvements to robotics, for example, have increased the range of occupations which can be automated, while improved communications and data transfer technologies have facilitated transactions over great distances. These developments have allowed a greater number and variety of services to be exported without the need for the physical movement of people between countries. This is one of the many factors that have contributed to the recent growth in the relative share of services across developed countries. In addition, computerised stock handling and management systems have allowed large companies to reduce storage costs, while also making delivery of products cheaper and quicker. Box 2.2 illustrates the role of measurement as a driver of technological progress.

Box 2.2: The National Measurement Institute: Facilitating technological progress

The importance of measurement in the economy

The importance of measurement science (metrology) for engineering, construction and manufacturing cannot be overstated. Technical development in these fields is driven by scientific and technological progress. New measuring systems can be powerful drivers of progress and technological changes that lead to transformation of the economy. For example, the invention of the atomic clock was an early step in the series of discoveries that led to laser technology. Atomic clocks and lasers have each spawned new measurement technologies and applications, and atomic clocks are now an essential part of global positioning systems (GPS). Lasers are used for accurately measuring distances and the latest surveying equipment combines laser rangefinders with GPS.

For measurements to be reliable, repeatable and comparable–as is essential for industrial, regulatory and scientific use–they must be traceable to a measurement standard of known accuracy (such as a reference atomic clock). Most nations develop and maintain internationally consistent reference measurement standards in national metrology institutes, enabling measurements to be demonstrably equivalent regardless of where they are made.

Australia's National Measurement Institute

The National Measurement Institute (NMI) is Australia's peak measurement body responsible for biological, chemical, legal, physical and trade measurement. NMI maintains a wide range of measurement standards, including for physical quantities such as time, mass, temperature, force, humidity, acoustics; electrical parameters such as voltage and current; chemical measurements for food, drug, health, industrial and environmental chemistry; and biology. These national measurement standards are the benchmark against which instruments are calibrated for use in industry and by regulators and researchers, underpinning the correct use of the metric system in Australia for a myriad of purposes. Among other things, measurement science applications in the economy can deliver enhanced consumer and business confidence in products and processes, and in trade.

The NMI is a foundation element of publicly funded innovation in Australia, which includes research organisations, research grant providers, and the patent system. Without the NMI's expertise and traceability to international measurement standards, aspects of innovations cannot be verified and checked. The NMI is a public sector innovator in its own right, developing systems, tools, techniques and instruments for measurement. Collaboration between the NMI and instrument developers can promote incremental technology improvement, and bring new technologies into use more rapidly.

Australia's standards and conformance system relies on the NMI's measurement capabilities to support the adoption of overseas-made technologies and processes, which are often drivers of the technological change. The examples below illustrate how the application of scientific measurement can facilitate structural adjustment in the economy through the adoption of new technologies.

Advanced manufacturing—carbon fibre

The manufacture of composite materials, such as carbon fibre, is considered an important part of Australia's transition to a high- technology, high value-add Manufacturing industry. The end of automotive assembly in Australia makes precision component manufacture for global supply chains an option to retain skilled workers and capabilities. Indeed new Australian exporting businesses are being established, for example, Carbon Revolution is a company that produces carbon fibre wheels for high-performance car brands. The ability to manufacture these precision components depends on access to high-level measurement expertise.

Other Australian companies like Marand and Quickstep are supplying composite parts for global civilian and defence aerospace companies, including wing surfaces for commercial airliners and tail assemblies for jet fighters. Aviation components are generally made with a higher precision than automobile parts. Marand has applied measurement science to its operations to facilitate its transition from metal auto components to higher precision composite components for aerospace industries. The company maintains

an in-house metrology laboratory to ensure that its factory floor tools and instruments are correctly calibrated to known tolerances, by calibrating them through commercial calibration laboratories that are in turn traceable to international measurement standards maintained at national institutes like NMI. This consistent approach to measurement enables the company to integrate its precision composite components into overseas global supply chains.

Nanotechnology

The emerging field of nanotechnology also highlights the link between measurement approaches and new industries. The nanotechnology industry harnesses the properties of materials at the nanoscale, which is in the order of a thousandth of the thickness of a human hair. Instruments that visualise and control materials with nanoscale precision are enabling new, high-value products and processes, such as nanoparticles for targeted drug delivery, cancer therapies and improved medical imaging; smart, self-cleaning coatings for energy efficient buildings; lighter and longer lasting batteries; and smaller, faster computer circuitry.

The NMI's nanometrology services enable Australian nanotechnology developers to calibrate their in-house nanoscale measuring instruments, giving them confidence in the accuracy of their measurements and helping to ensure process and quality control. Beyond calibration, the NMI provides researchers and industry with access to unique, highly specialised measurement facilities and expertise, thus supporting the industrial transformation that nanotechnology promises. The NMI has delivered nanometrology services to Australian companies that are leading suppliers of nanomaterials for applications, such as personal care products and therapeutic goods. Accurate measurements of the properties of such materials not only help in maximising the potential benefits arising from their novel properties, they also support industry, consumers and regulators in ensuring the responsible development and use of the technology.

Health – genetic analysis for cancer diagnosis

The most rapid technological change is often associated with computing and communications, however, life sciences technologies, such as methods and instruments for deoxyribonucleic acid (DNA) gene sequencing and analysis have progressed even faster. Genetic testing can now be undertaken for diagnostic, predictive screening or monitoring purposes, and can identify DNA changes typically associated with certain diseases. Genetic testing, including direct-to-consumer testing, is expanding rapidly, with new innovations expected to lead to personalised medicine. Diverse instrument platform technologies are being used, which share the common feature of measuring DNA. Many of these platforms were only suitable for research purposes until recently.

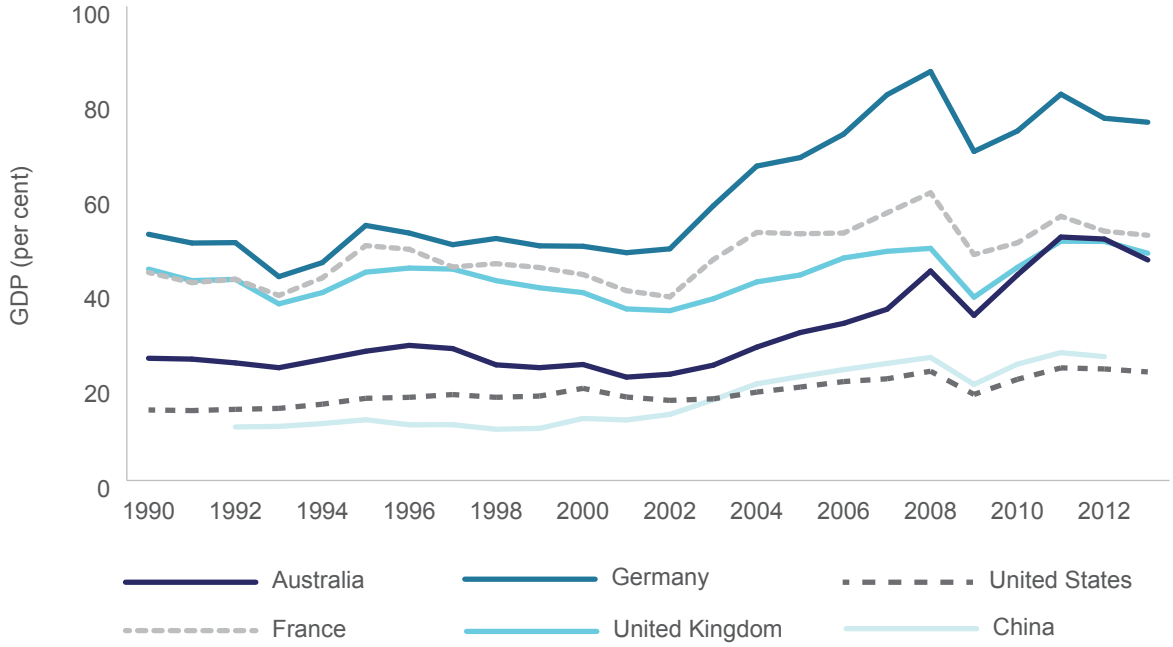
The NMI contributes to the translation of molecular discoveries from experimental laboratories to clinically relevant tests through the development and validation of methods and DNA reference standards for the quality control of gene analysis techniques. For example, DNA reference standards produced by NMI were used by medical researchers to validate biomarkers for the detection of paediatric acute lymphoblastic leukaemia and to characterise diagnostic thresholds. The utilisation of such quality control will contribute to a database of disease data that can be utilised by researchers to identify the most effective genetic tests for disease diagnosis.

Globalisation

Globalisation refers to the increasing interconnectivity of economies and markets. In recent decades this process has been driven by a combination of technological advances, which have reduced transport costs and improved communication and information flows, and policy changes which have reduced barriers to trade, capital flows and labour mobility.

Australia has been no exception to this. Effective protection rates (the added value to a domestically produced good due to protection policies such as tariffs and subsidies) in Manufacturing fell from almost 35 per cent in the late 1960s to less than 5 per cent in 2014. In addition, freight and insurance costs for imports fell from 8 per cent of freight on board (FoB) value to less than 5 per cent since the late 1980s.[116] As Chart 2.4 shows, Australia's international trade increased from approximately 26 per cent of GDP to 47 per cent per cent of GDP over the past two decades, and has doubled in the last decade (2003-2013). This is similar in magnitude to China's expansion of international trade over the last decade, but more pronounced than most OECD economies.

Chart 2.4: Exports and imports as a percentage of GDP, 1990-2013



Source: OECD (MEI Dataset).

Note: GDP in $US, current prices, current PPPs, millions.

116 Productivity Commission (2003), *Trends in Australian Manufacturing*, Commission Research Paper, AusInfo, Canberra, p.152.

Trade within industries (i.e. imports and exports of similar types of goods) as a proportion of total trade increased by almost nine per cent between 1988 and 2013 (if 'crude materials, inedible, except fuels'[117] are excluded, the increase exceeded 21 per cent).[118] This increase in trade has meant that industries producing tradable goods have faced increasing competition from imports, but also increased opportunities to access export markets. The transport and communications technologies that have spurred global economic integration have also presented opportunities for firms to outsource business functions overseas. The growth of imports of services and intermediate goods suggests that this is indeed happening; however the effect on employment in Australia is difficult to establish.[119]

Rising international demand for Australian mineral exports, coupled with relatively high interest rates in Australia, has driven a strong appreciation of the Australian dollar. Meanwhile, the rise of East Asia as a centre of low-cost manufacturing has meant that prices of many manufactured imports have fallen. As a result, Australia's terms of trade have risen dramatically since the early 2000s (see Chart 2.5), reaching an all-time peak in 2011.[120]

The Mining boom, which has resulted from this combination of increasing demand and prices, has also had a subsequent effect on other industries (see Box 2.3). One aspect of this is the increased demand which additional income in the Mining industry has delivered to other industries, with Services industries in particular benefitting. To illustrate, the 'resources sector' can be decomposed into *resource extraction* which is similar to the ANZSIC Mining industry classification but also includes resource specific manufacturing, and resource related activity which covers activities that are directly connected to resource extraction. It is estimated that resource extraction made up about a two thirds of total resources sector output in 2012, while *resource related activity* made up the other third.[121] Breaking down the composition of resource related activity—Business Services is the biggest contributor, making up over a third, followed by Construction, Manufacturing and Transport, Postal & Warehousing. This illustrates that Mining requires a wide variety of professional services (such as accounting, engineering and legal services) as well as construction and transportation services. In total, linkages from the Mining boom are estimated to be up to five times larger for Services than for Manufacturing.[122]

Increasing international linkages also means that the Australian economy is more exposed to international shocks. For example, while Australia's overall recovery from the GFC has been strong, the more trade-exposed industries have suffered from the fall in global demand, which illustrates increasing global interconnectivity.[123]

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117 Standard International Trade Classification (SITC) category 2. This category is dominated by exports of ores, and intra-industry trade in this category has therefore declined significantly due to the Mining boom.

118 Grubel-Lloyd index. Data from ABS cat. no. 5368.0.

119 Productivity Commission (2013), *Looking Back on Structural Change in Australia: 2002-2012*, p.35, see also Henry K (2012), *Presentation to the Ai Group National Forum*, who argues that offshoring may have allowed Australian companies to continue producing in circumstances that they wouldn't otherwise have been able to.

120 Productivity Commission (2012), *Annual Report 2011-12*, Annual Report Series, Productivity Commission, Canberra.

121 Rayner V & Bishop J (2013), *Industry Dimensions of the Resource Boom: An Input-Output Analysis*, Reserve Bank of Australia Research Discussion Paper, p.28.

122 OECD (2012), *Australian Manufacturing in the Global Economy*. OECD publishing, p.44. See also Rayner V & Bishop J (2013), *Industry Dimensions of the Resource Boom: An Input-Output Analysis*, Reserve Bank of Australia Research Discussion Paper, p.28.

123 OECD (2012), *Australian Manufacturing in the Global Economy*, OECD publishing , p.46.

Box 2.3: Dutch disease: Does Australia show symptoms?

Following announcements of large-scale manufacturing plant closures in recent years, the notion that Australia is experiencing 'Dutch disease' has been raised. Dutch disease refers to de-industrialisation that occurs when some industries producing tradable goods become uncompetitive and contract as a result of a rapid commodity price increases and higher demand (known as a 'shock') that accompanies a resources boom.[124] The name comes from the decline of Dutch manufacturing following the discovery and extraction of North Sea natural gas reserves in the 1960s. The key question in the Dutch Disease debate is whether the windfall gains from the boom were enough to offset to negative impacts of the high exchange rate on trade-exposed sectors.

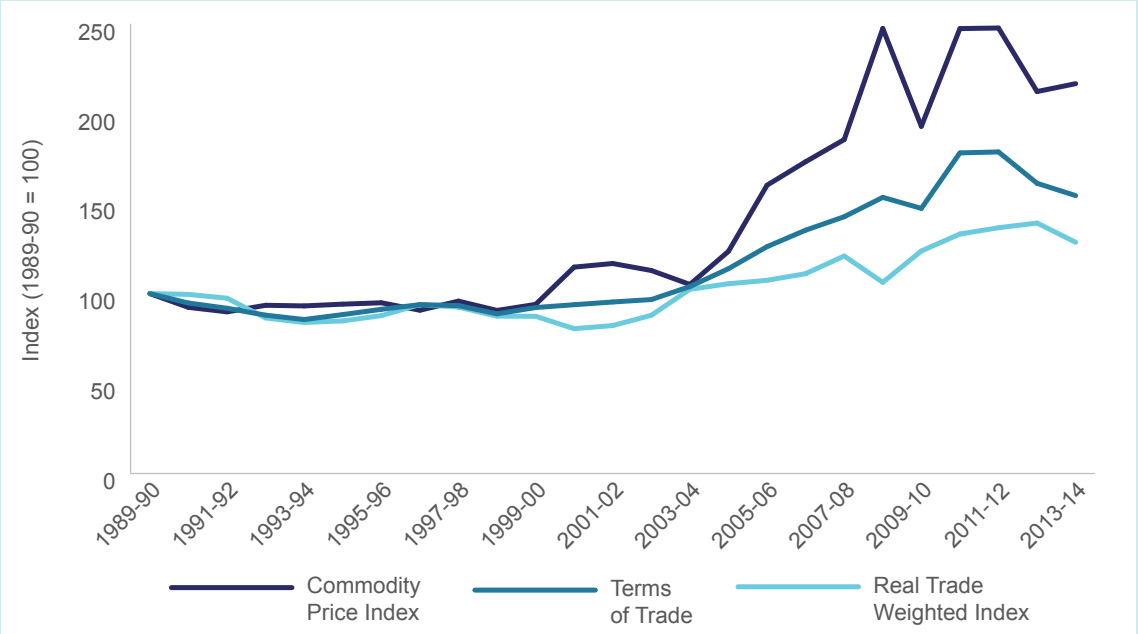
This process occurs through two effects. The 'spending effect' consists of increased demand for goods and services (due to extra income in the booming industries) which, in turn, increases the relative prices of non-tradables. The 'resource movement effect' refers to the booming sector drawing production inputs from other sectors by offering higher prices for those inputs.

The impact can be assessed by dividing the economy into three sectors: (i) The 'booming sector' benefits from the shock and expands, although facing increased input costs as it draws factors of production away from other sectors; (ii) the 'lagging sector' suffers from increased costs without receiving the direct demand benefits of the shock and declines; and (iii) the 'non-tradable sector' faces higher costs, but enjoys the benefit of increased demand and the ability to increase prices (unlike industries producing tradables, which face competition from imports).

So, does Australia display any symptoms of Dutch disease?

Increased demand for mineral products from developing countries, particularly China and India, has significantly increased the ratio of export prices to import prices (known as the terms of trade) since 2004-05. The terms of trade reached an all-time peak in 2011-12 (see Chart 2.5), just higher than the previous peak that occurred in the early 1950s.

Chart 2.5: Terms of trade, real trade-weighted index and commodity price index, 1989-90 to 2013-14

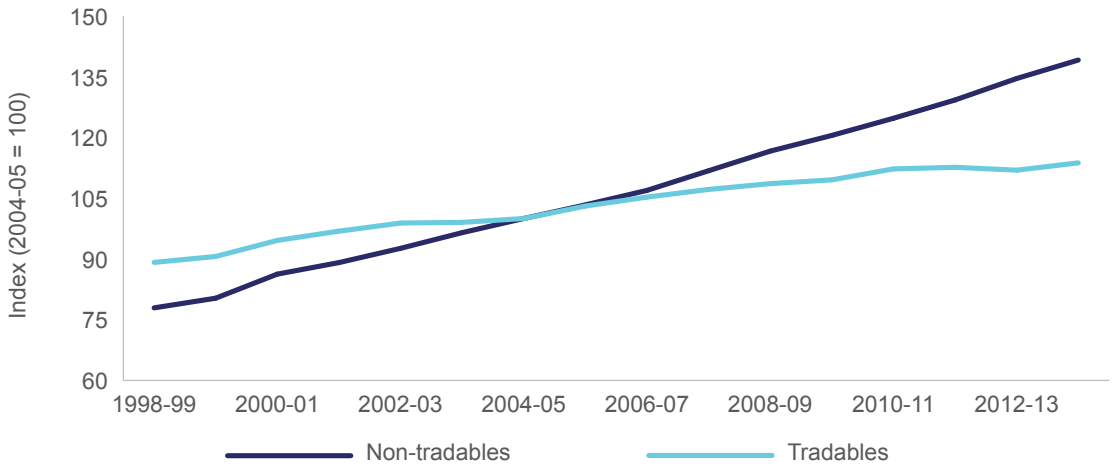


Source: ABS cat. no. 5206.0, RBA F15, RBA I12

124 Corden M (1982), *Booming Sector and Deindustrialization in a Small Open Economy*, www.aae.wisc.edu/coxhead/courses/731/pdf/Corden-Neary-BoomingSector-EJ1982.pdf Accessed [12 August 2014].

The effects of this shock are evident in consumer price and wages growth. Chart 2.6 shows that between 1998-99 and 2004-05 prices of non-tradables increased twice as fast as prices of tradables; and between 2004-05 and 2013-14 prices grew three times as fast (the 'spending effect'). Wages in the total economy grew nearly twice as fast between 2004-05 and 2013-14 than they did between 1998-99 and 2004-05, while Mining wages grew at more than double that rate again (the 'resource movement effect').

Chart 2.6: Tradable and non-tradable consumer price indices, 1998-99 to 2013-14



Source: ABS cat. no. 6401.0.

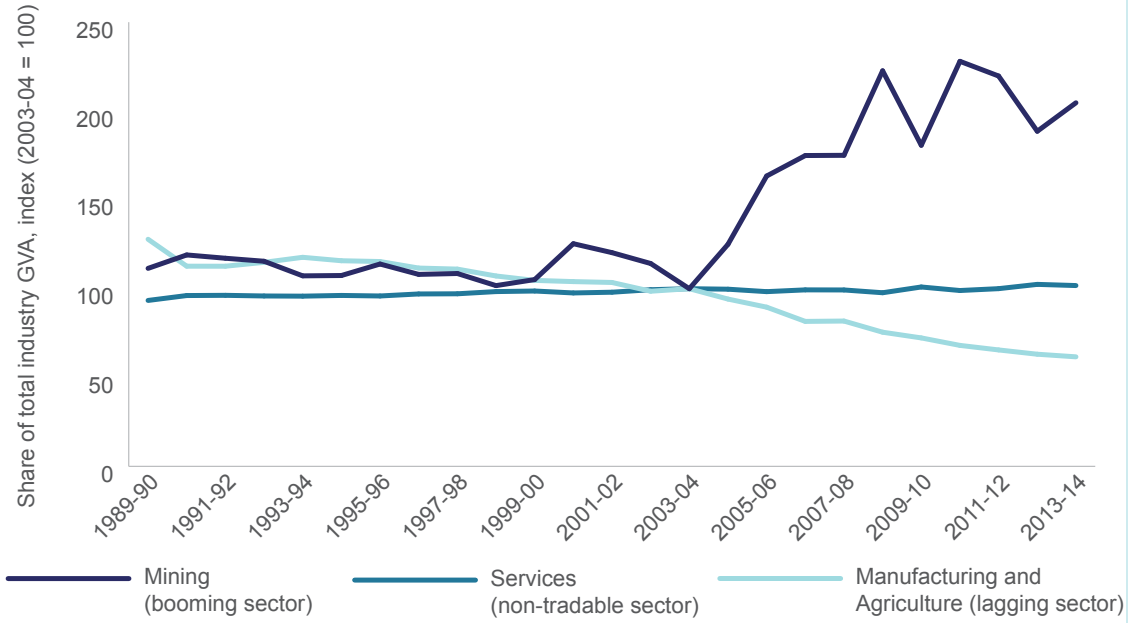
The 'booming sector' is clearly the Mining industry. The Mining sector's share of total industry output doubled between 2003-04 and 2008-09, while its share of employment doubled between 2003-04 and 2011-12. In 2003-04, the Mining industry contributed less than 10 per cent of new capital expenditure in the private sector; in 2011-12 that figure exceeded 40 per cent.

The 'lagging sector' includes Manufacturing and Agriculture, Forestry & Fishing. While these industries have experienced a relative decline for a much longer period, the rate of this decline has accelerated since 2003-04. Manufacturing's share of output declined by more than twice the rate between 2003-04 and 2013-14 than between 1993-04 and 2003-04. Agriculture's share of output grew slightly between 1993-94 and 2003-04 (on average by less than 1 per cent per year), but declined between 2003-04 and 2013-14 (by an average of 2.5 per cent per year).

The 'non-tradable sector' includes all Services. The output share of Services grew by almost the same rate in the years before and after 2003-04.

Chart 2.7 sums up the situation, showing the change in the relative output shares of the sectors over the past two decades. Since 2003-04, Mining has experienced a remarkable boom. Manufacturing and Agriculture, which were already in relative decline prior to 2003-04, have seen an acceleration of this relative decline. Services maintained slow and steady growth of their share of the economy before and after 2003-04, despite the rapid increase of the Mining share.

Chart 2.7: Shares of output by sector, 1989-90 to 2013-14



Source: ABS. cat. no. 5204.0.

Note: Output is total industry GVA at current prices.

Overall, it seems that Australia has displayed some symptoms of Dutch disease. While the term 'disease' is used due to the negative impact of the shock on the lagging sector, it may not be an appropriate description of the effect on the economy as a whole. Given the relatively strong performance of the Australian economy in recent years, it is hard to argue that the benefits of the Mining boom have been completely offset by the adverse effects on other sectors. The RBA found that the Mining boom substantially increased living standards, including raising real household per capita income by 13 per cent, real wages by 6 per cent, while reducing unemployment by 1.25 percentage points, compared to a non-mining boom scenario.[125] The RBA also found that the negative impacts on the lagging sector (the so-called disease) have not been strong, estimating that Manufacturing output is only about five per cent lower than it would have been without the boom. This implies not that the relative decline of the Manufacturing sector has been insignificant, but that the bulk of it would have occurred even without the boom. Moreover, Dutch disease is typically associated with a short-lived resource related shock, while the driving forces behind Australia's resources demand (the rise of Asia), as well as the relative decline of Manufacturing, are likely to be long-term phenomena.

Finally, a common concern regarding Dutch disease is that the lagging sector will not be able to rebound when the terms of trade falls back to pre-boom levels, meaning that the effects of Dutch disease will be irreversible and will impact negatively on economic growth in the long term. However, evidence from other developed countries[126] that have experienced Dutch disease suggests that this has not been the case.[127] Still, there can be no denying that negative effects are being felt in some areas, and may continue to be felt for some time.

125 Downes P, Hanslow, K & Tulip, P (2014), *The Effect of the Mining Boom on the Australian Economy*, Reserve Bank of Australia Research Discussion Paper, p.1.

126 Treasury Budget Paper No. 1, 2011-12, Statement 4: Opportunities and Challenges of an Economy in Transition, p.21.

127 Australian Manufacturing is unlikely to rebound to pre-boom shares of the economy, but it may rebound to something close to what it would have been had there not been a Mining boom.

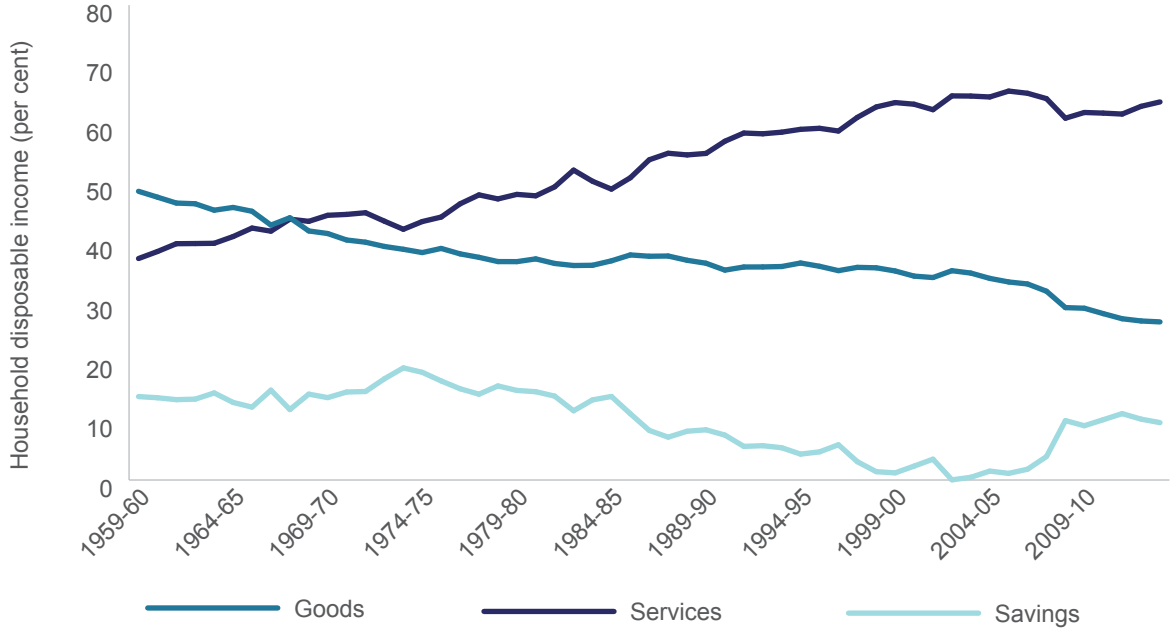
Preferences

Changes in consumer preferences also induce structural changes throughout the economy. Economy-wide increases in consumer income, for example, have led to a more than proportional increase in the demand for services. In addition, the ageing of Australia's population has increased the demand for healthcare services.[128] Charts 2.8 and 2.9 illustrate how these factors have been key contributors to the structural shift of the economy towards Service industries.

Chart 2.8 shows that spending on services as a percentage of household disposable income has increased from 37 per cent in 1959-60 to over 63 per cent in 2013-14, while the proportion spent on goods declined from 49 per cent to 27 per cent. This is ascribed to more than proportionally higher demand for services as disposable income increases.[129] This can be partially explained in that services include luxuries such as leisure activities, travel, high-quality health care, higher education, and fine dining. This also explains why the rise of the services sectors has been pervasive in most developed economies and is a natural part of the development process (see Charts 2.2 and 2.3).

Chart 2.8 also shows that while consumers had been saving less over the two decades up to 2003-04, the savings ratio (savings as a percentage of household income) has recovered to be closer to 1980s levels in response to the GFC.

Chart 2.8: Spending on goods and services and savings as a percentage of household disposable income, 1959-60 to 2013-14



Source: ABS cat. no. 5204.0.

Note: Current prices. Classification of goods and services from Productivity Commission Supplement to the Annual Report 2011-12 (p.42). 'Other goods and services' have been allocated to either goods or services according to the percentage split of expenditure on all goods and services. Consumption of fixed capital was not included in calculation of household disposable income.

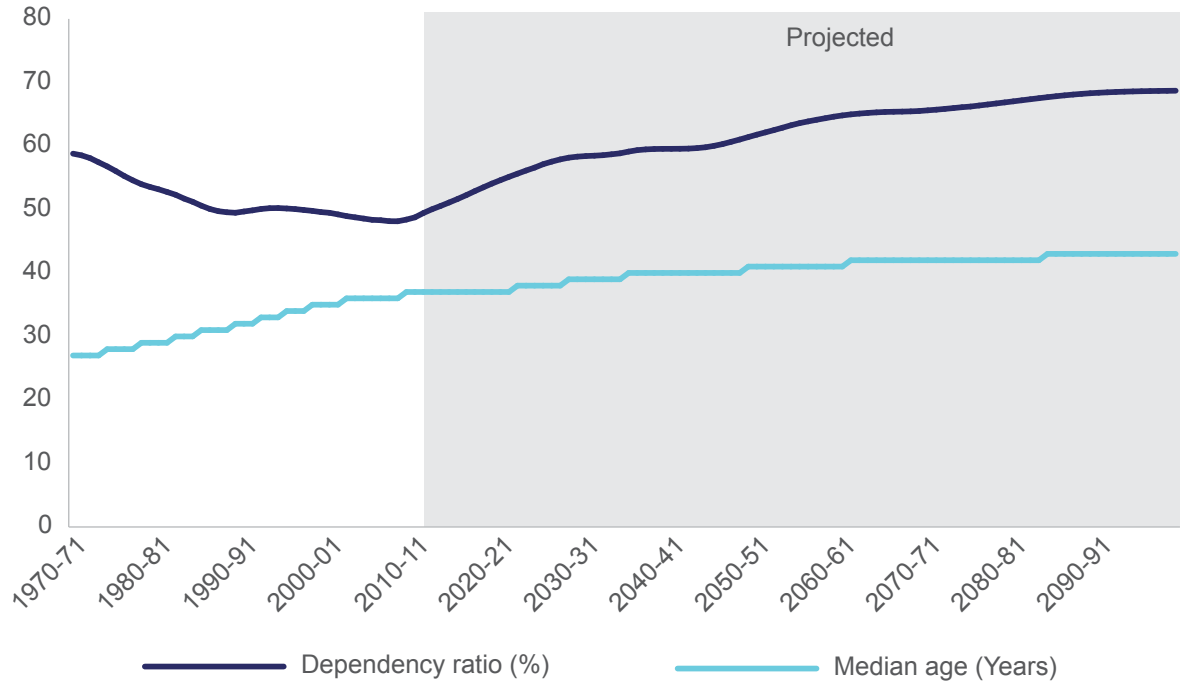
128 Productivity Commission (2013), *Looking Back on Structural Change in Australia: 2002–2012*, Supplement to Annual Report 2011-12, Canberra, p.36.

129 This is known as being income elastic.

Chart 2.9 shows that while Australia's dependency ratio (the ratio of persons below 14 years of age and older than 65 to those aged 15 to 64) has declined over the past four decades, the median age of the population has increased by 10 years (from 27 to 37 years of age). While the median age of Australia's population is forecast to continue to increase, the rate of increase will be slower than in the recent past.[130] The dependency ratio however, is expected to increase rapidly over the next decades, with this trend continuing for many decades to come. Treasury estimates suggest that the ratio of working age people (15-64) to retirement aged people (65+) will fall from 5 to 1 in 2010 to less than 3 to 1 by 2050.[131]

Healthcare spending has increased by an average annual growth rate of 1.8 per cent between 1998 and 2010, or from 8.0 per cent of GDP in 1998 to 9.4 per cent in 2010.[132] Chart 2.8 suggests that the increase in healthcare spending is likely to continue or even accelerate in the future as the median age and dependency ratio increase.

Chart 2.9: Median population age (years) and dependency ratio (%), historical and projected, 1970-71 to 2099-00



Source: ABS cat. no. 3101.0 & 3222.0.

Note: The dependency ratio is the ratio of individuals aged 0-14 and over 65 to those aged 15-64. Data for 1970-71 to 2011-12 are historical; data from 2011-12 onwards are as projected by the ABS in scenario B of Population Projections.

130 ABS cat. no. 3222.0

131 The Treasury (2010), *Australia to 2050: future challenges*, Intergenerational Report, p.viii.

132 ABS cat. no. 4102.0.

Domestic policy

Government policy also has an impact on relative prices and can therefore influence the sectoral composition of the economy. Policy changes can have the effect of either driving structural change, or influencing the way or extent to which it occurs. While the focus of such reform is often on industry policy—policy that is directed at specific industries, all policies and regulations will have unequal effects on industry, or within industries, thereby inducing structural change. Further, policies that are directed at social outcomes can have the unintended effect of creating pricing distortions that drive structural adjustments.

Environmental policy, for example, has driven structural change as industries do not bear the costs of environmental policies evenly. Growing concern over climate change has led to governments around the world implementing various forms of emissions-reduction policies. However, emissions-reduction policies must necessarily alter relative prices if they are to be effective, and as such, can shift resources between industries.[133] To some extent, therefore, structural change can be seen as the purpose of climate change policies.[134]

Policy reform can also have the impact of facilitating structural change, or removing barriers to change. One key example is decentralised wage bargaining—the process through which wages are negotiated at the enterprise level, rather than the industry level—which has allowed relative wages to adjust more efficiently across industries and regions and given workers a stronger price signal in terms of the relative demand for skills. It has also helped to prevent wage inflation that has limited the gains from commodity price booms in the past.[135]

Other policy changes, such as major competition reforms in the 1990s, reforms aimed at increasing the participation rate, such as child care and paid parental leave schemes, trade liberalisation (discussed previously) and changes to education policies, have also shaped the extent and nature of structural change.[136]

Changes in specific industry policies, such as the recent decision to wind down subsidies to the Australian automotive manufacturing sector, also have obvious effects on the structure of the economy. However, this illustrates that domestic policy is just one factor at play, and the government's ability to reverse the structural change process is limited. Automotive manufacturing in Australia has been experiencing declining international competitiveness for a long period and even significant government assistance was unable to arrest this slide.

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133 Productivity Commission (2011), *Carbon Emission Policies in Key Economies*, Research Report, Canberra, p.49.

134 Productivity Commission (2013), *Looking Back on Structural Change in Australia: 2002−2012*, Supplement to Annual Report 2011-12, Canberra, p.25.

135 Lowe P (2012), *The Labour Market, Structural Change and Recent Economic Developments*, Speech to the Financial Services Institute of Australasia (Finsia) Leadership Event, www.rba.gov.au/publications/bulletin/2012/dec/pdf/bu-1212-13.pdf, Accessed [4 March 2014].

136 Productivity Commission (2013), *Looking Back on Structural Change in Australia: 2002−2012*, Supplement to Annual Report 2011-12, Canberra, p.41.

Recently there has been a shift in industry policy away from subsidising uncompetitive industries to focusing on capitalising on Australia's areas of strength.[137] The change in policy direction is an attempt to allow businesses to take better advantage of quickly evolving opportunities, but also an acknowledgement that businesses that are not competitive will not survive in the long term.

The Government intends to create Industry Growth Centres in five sectors, namely Food & Agribusiness, Mining Equipment, Technology & Services, Oil, Gas & Energy Resources, Advanced Manufacturing and Medical Technologies & Pharmaceuticals. These five sectors are analysed in detail in Chapter 3. The centres aim to encourage collaboration between businesses to form commercial research and development partnerships with each other, and with researchers. This shift in policy follows similar policies in the United Sates, the United Kingdom and Canada and has been supported by economic and business commentators such as Deloitte Access Economics and the Business Council of Australia (BCA).[138]

137 Australian Government (2014), *Industry Innovation and Competitiveness Agenda*. p.68.

138 Ibid, see also Deloitte Access Economics (2014), *Positioning for Prosperity? Catching the Next Wave* and Business Council of Australia (2014), *Building Australia's Comparative Advantages*.

Recent structural change in Australia

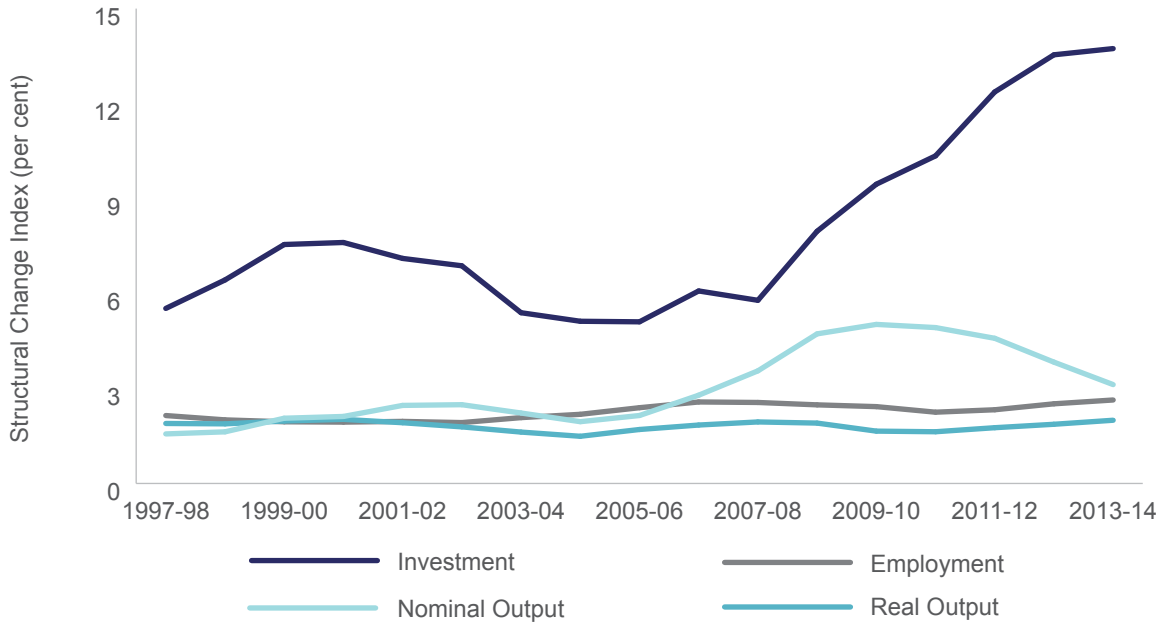
Whether the pace of structural change in Australia has increased in recent years depends on how it is measured.[139] As highlighted in Box 2.1, the extent of structural change is commonly measured using SCIs, which reflects the percentage of resources that have moved between industries or sectors over a given period.

Chart 2.10 shows SCIs for a range of measures over the past 15 years. The rate of structural change as measured by investment has increased sharply since 2007-08, as Mining companies, for example, increased their production capacity to take advantage of the surge in resource prices.

The pace of structural change measured in terms of nominal output began increasing from 2005-06, and peaked in 2009-10. This likely reflects the effect of increased commodity prices and terms of trade (see Chart 2.5), which have considerably altered the relative prices for goods produced by some sectors.

By contrast, the SCI measured by real output has stayed relatively flat, reflecting that production growth in the booming sectors has not kept pace with relative changes in prices. Similarly, the employment SCI has been relatively stable over time meaning that workers do not seem to be switching between sectors much more or less since the late 1990s.

Chart 2.10: Structural change indices, 1997-98 to 2013-14



Source: ABS cat. no. 5204.0 & 6291.0.55.003.

Note: Eight sector model, five-year differences and five-year shares. Nominal Output is GVA in current prices, Investment is fixed capital formation, Real Output is GVA in chain volume measures.

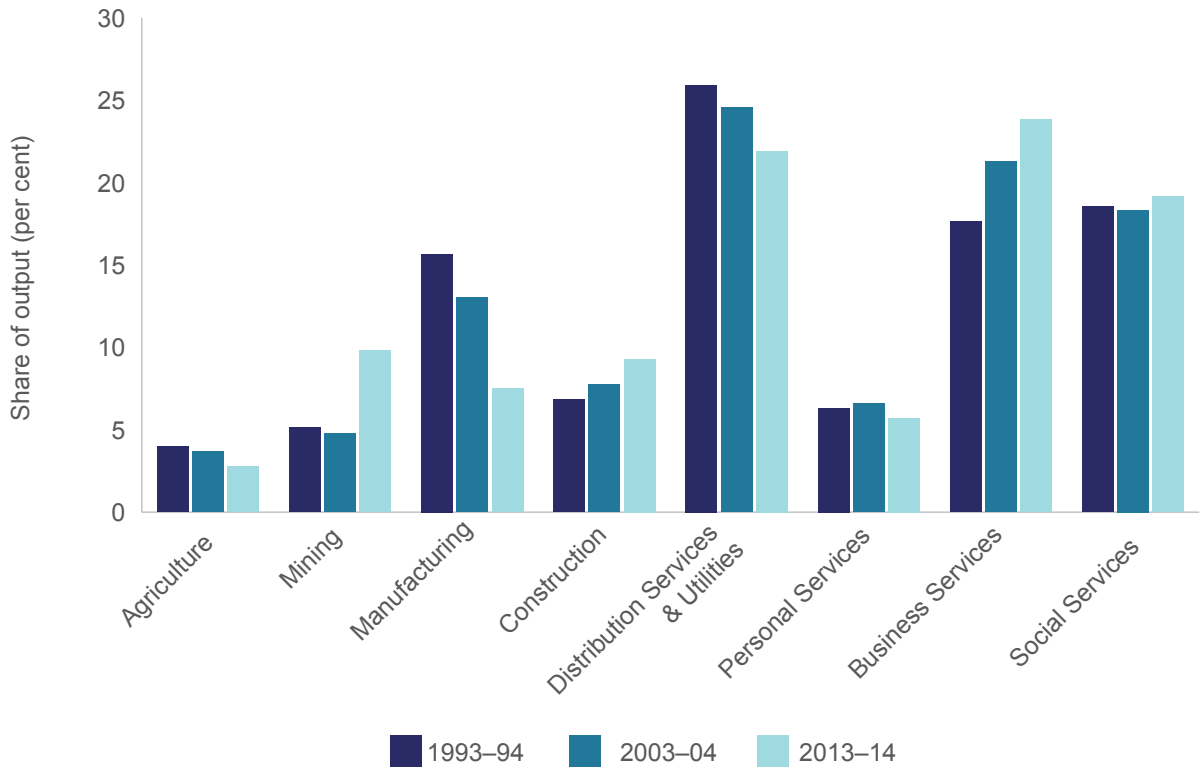
The following sections analyse structural change in terms of nominal and real output, investment and employment in detail to ascertain the nature of recent structural change in these dimensions.

139 Connolly E & Lewis C (2010), *Structural change in the Australian economy*, RBA Bulletin September 2010, p.6.

Structural change in output led by growth in the share of Mining and Business Services

Chart 2.11 demonstrates how the distribution of output across sectors has changed over the past two decades. Mining, Business Services and Construction recorded the highest growth in output share over the period. Business Services' share of output increased from 17.6 per cent to 23.8 per cent, Mining's share of output increased from 5.1 per cent to 9.8 per cent, although this increase occurred exclusively over the most recent decade, and Construction's share increased from 6.8 per cent to 9.3 percent. Manufacturing, Distribution Services & Utilities and Agriculture each experienced declines in output share over the decade. Chart 2.11 corroborates the story from Chart 2.10—the pace of structural change in terms of nominal output has accelerated over the most recent decade. The relative growth of the Mining and Construction shares was larger between 2003-04 and 2013-14 than between 1993-94 and 2003-04, as were the relative declines in Manufacturing, Agriculture and Distribution Services & Utilities.

Chart 2.11: Output share by sector, 1993-94, 2003-04 and 2013-14

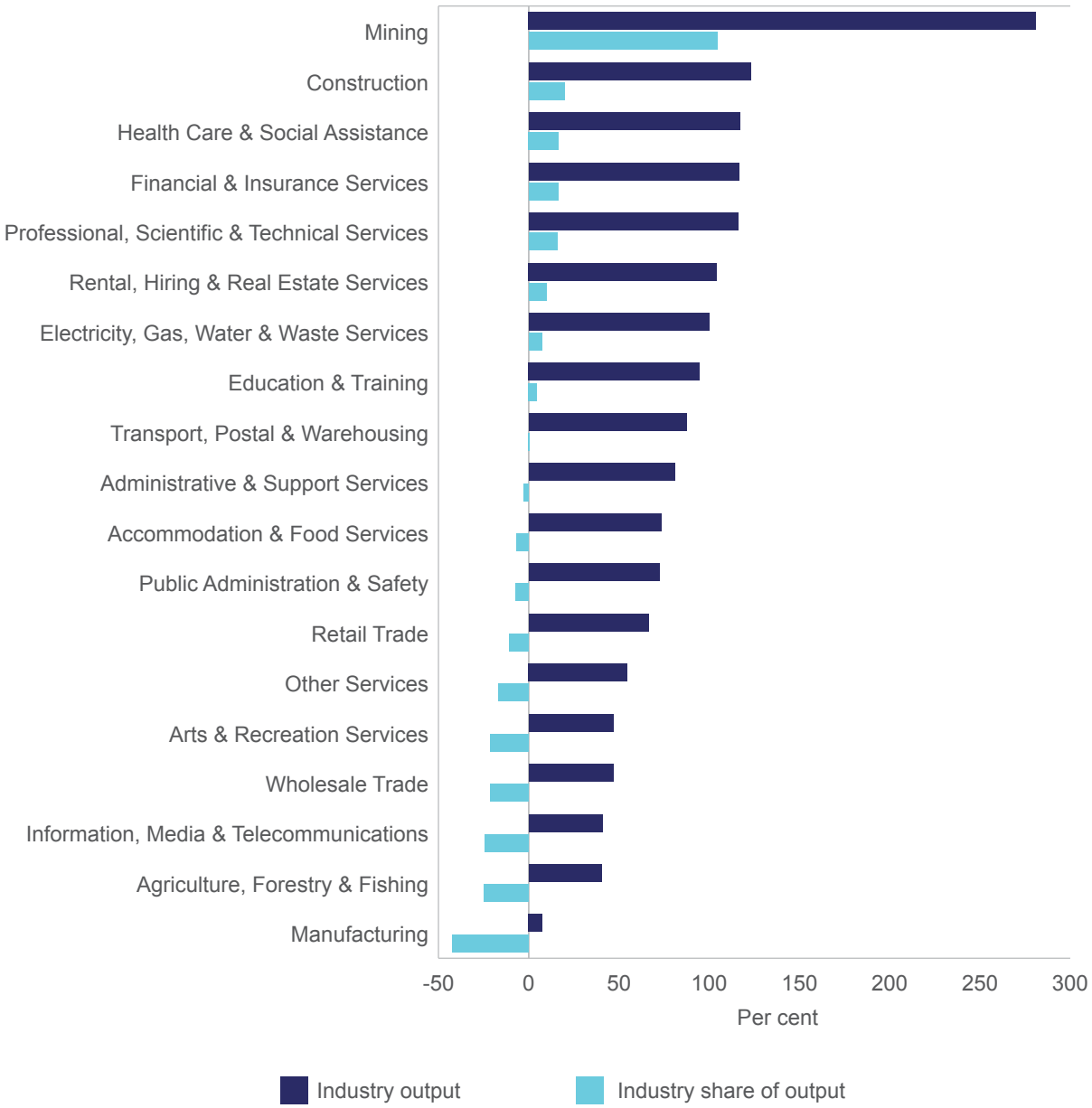


Source: ABS cat. no. 5204.0.

Note: Output is total industry GVA at current prices.

Chart 2.12 disaggregates the changes in share of output over the most recent decade to the 19-sector industry level, which gives a more specific illustration of the nature of structural change over the period.[140]

Chart 2.12: Percentage change in industry output and industry share of output, 2003-04 to 2013-14



Source: ABS cat. no. 5204.0.

Note: Output is GVA at current prices.

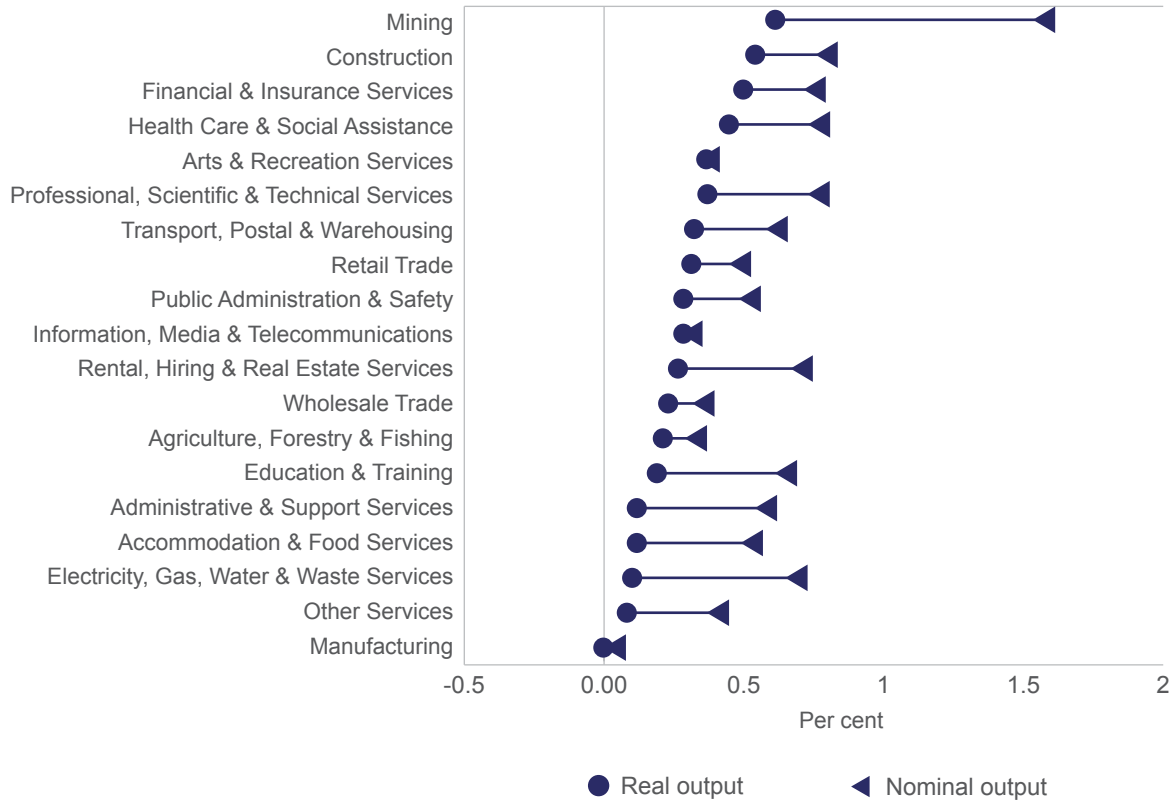
140 See Appendix A for details of industry and sector groupings.

Mining recorded by far the highest percentage increase in nominal output share (105 per cent). Construction and industries in the Business and Social Services sectors experienced relatively strong growth while Electricity, Gas, Water & Waste, and Transport, Postal & Warehousing's output share grew modestly. The output share of the remaining services industries declined in relative terms.

This illustrates that while there has been a general shift towards service industries, this trend has been more nuanced at the industry level. Information Media & Telecommunications, for example, was the third worst performing industry in terms of nominal output growth over this period, which may be partially explained by offshoring of jobs in this industry (employment has declined in absolute terms in this industry—see Chart 2.17).

Chart 2.13 highlights the difference between nominal and real output growth (the difference being changes in prices, or inflation) over the past decade, with the length of the line for each industry indicating the impact of changes in prices. Different industries are of course subject to different rates of inflation. Analysing changes in real output gives an indication of which industries are actually producing more, as opposed to nominal output which gives the value of that production.[141]

Chart 2.13: Average annual nominal and real output growth by industry, 2003-04 to 2013-14



Source: ABS cat. no. 5204.0.

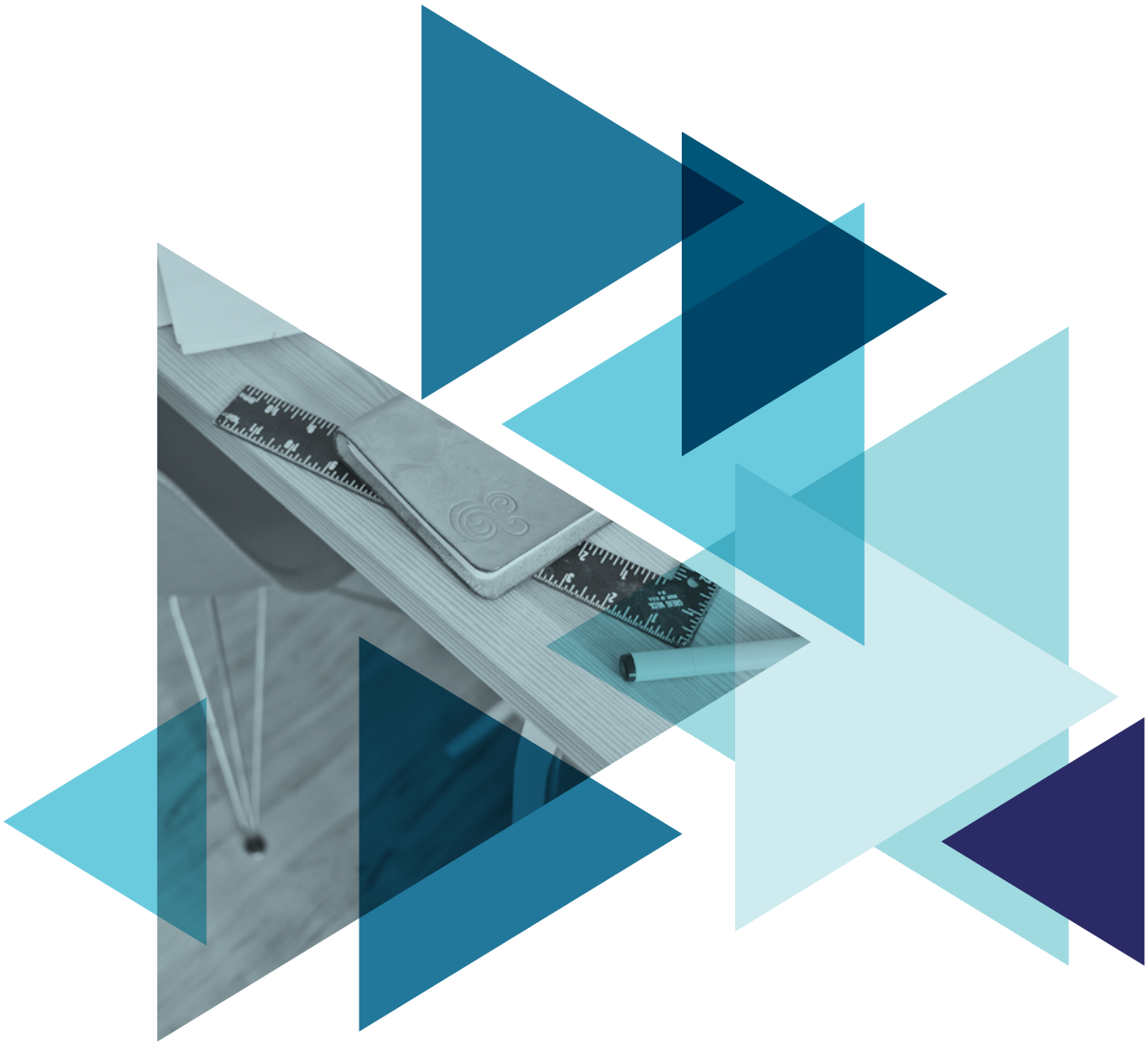
Note: Nominal output is GVA in current prices, real output is GVA in chain volume measures.

141 Nominal output measures the volume of output multiplied by its price.

For example, price increases contributed an annual average of 10.4 percentage points to output growth in Mining, but only 0.8 of a percentage point on average to output growth in Manufacturing over the last decade. In terms of nominal output, the fastest growing industry between 2003-04 and 2013-14 (Mining) grew, on average, 15.4 percentage points faster than the slowest growing industry (Manufacturing). However, in terms of real output, the difference was only 5.8 percentage points per year.

Arts & Recreation Services, Information, Media & Telecommunications, Manufacturing, Agriculture, Forestry & Fishing, and Wholesale Trade experienced the smallest increases in prices over the period. This is likely to be due to a range of factors including increasing productivity coupled with low demand, as well as increasing import competition driving down prices (some of these industries are heavily trade exposed).

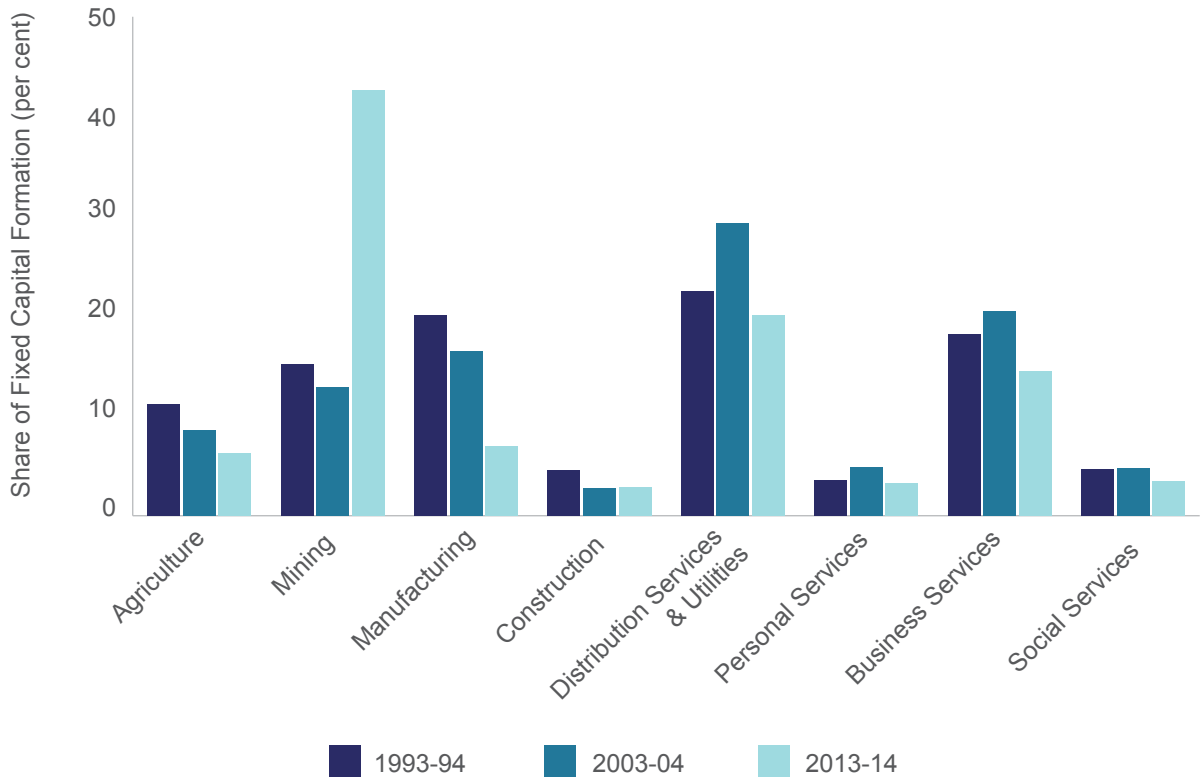
The industries that enjoyed the biggest increases in prices tended to be those that were less trade exposed and therefore subject to less competition from low-cost international competitors (with the exception of Mining), such as those in the Social Services and Business Services sectors, as well as Electricity, Gas, Water & Waste Services.



Structural change in investment reflects the Mining investment boom

Chart 2.14 depicts changes in investment share by sector over the last two decades. The Mining investment boom is apparent here to the extent that the rapid increase in the investment share of Mining, which more than tripled over the last decade, resulted in a decline in the shares of investment of all other sectors between 2003-04 and 2013-14. This explains the increase in the pace of structural change in investment over the most recent decade as shown in Chart 2.10.

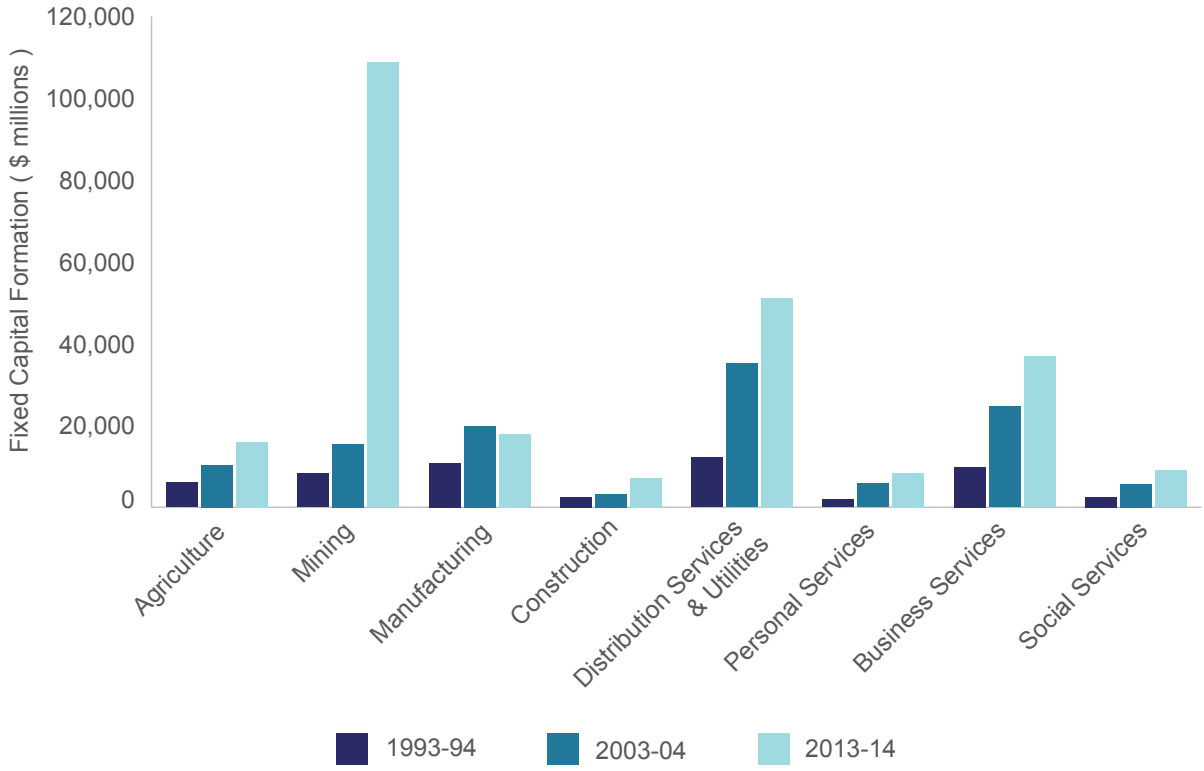
Chart 2.14: Investment share by sector, 1993-94, 2003-04 and 2013-14



Source: ABS cat. no. 5204.0.
Note: Investment is fixed capital formation in current prices.

The impact of Mining in Chart 2.14 may make it appear as though investment declined in other sectors. Chart 2.15, however, shows that in absolute terms, Distribution Services & Utilities, Business Services and Agriculture, Forestry & Fishing had large proportional increases in absolute investment, while Mining investment increased more than ten-fold.

Chart 2.15: Investment by sector, 1993-94, 2003-04 and 2013-14



Source: ABS cat. no. 5204.0.

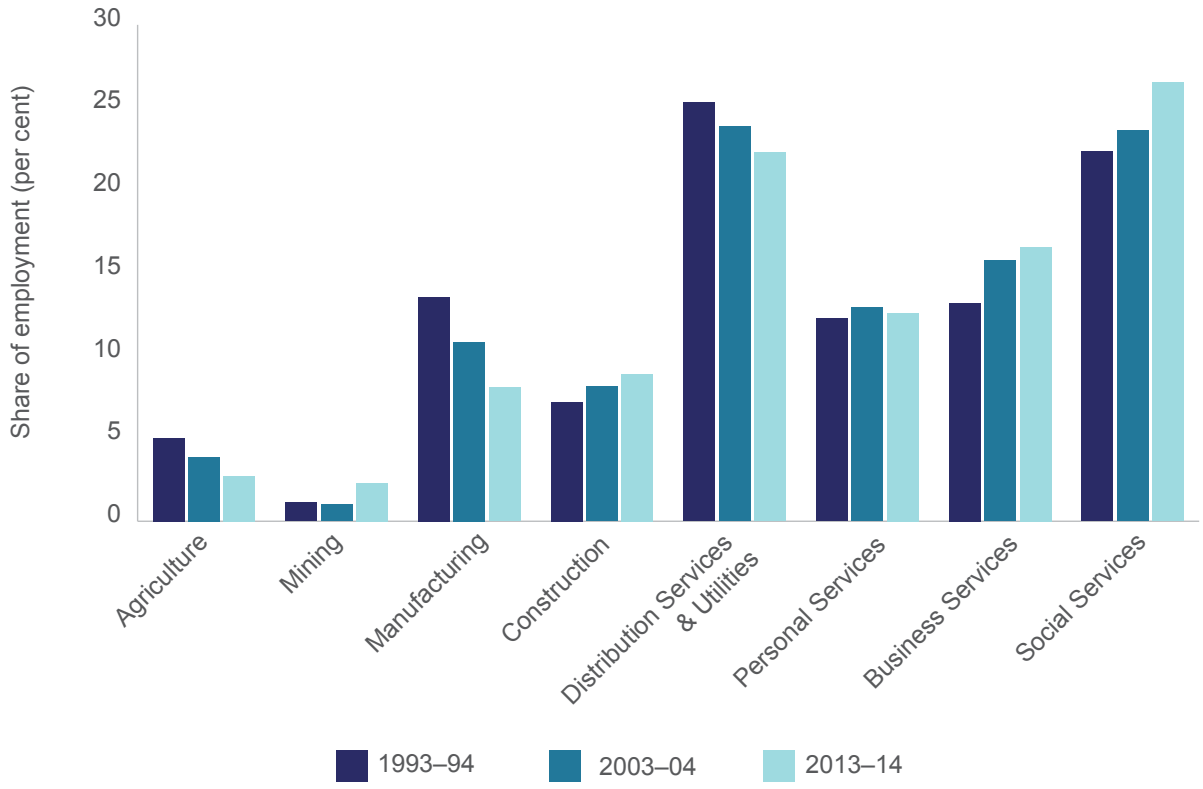
Note: Investment is fixed capital formation in current prices.

Structural change in employment led by growth in the share of Social Services

Chart 2.16 demonstrates the change in the distribution of employment across sectors over the past two decades. Over this period, Mining, Social and Business Services and Construction have recorded the highest growth in terms of employment share. Mining's share of employment more than doubled, from 1.1 per cent in 1993-94 to 2.3 per cent in 2013-14, while Social Services employment share increased from 22.3 to 26.5 per cent, Business Services increased from 13.1 to 16.6 per cent and Construction from 7.2 to 8.9 per cent.

Similar to the trends in output shares, the employment shares of Manufacturing (13.5 to 8.1 per cent), Agriculture, Forestry & Fishing (5.0 to 2.7 per cent) and Distribution Services & Utilities (25.3 to 22.3 per cent) have declined considerably. The declines were larger between 2003-04 and 2013-14 than between 1993-94 and 2003-04, while the growth of Mining and Construction's shares of employment were correspondingly larger in the latter period. Employment growth in Social Services appears to have been considerably stronger than output growth (see Chart 2.11 for output shares). This chart also highlights that while Mining accounted for nearly 10 per cent of output in 2013-14, it still only accounts for just 2.3 per cent of the economy's employment.

Chart 2.16: Employment share by sector, 1993-94, 2003-04 and 2013-14



Source: ABS cat. no. 6291.0.55.003.
Note: Monthly employment data averaged over financial years.

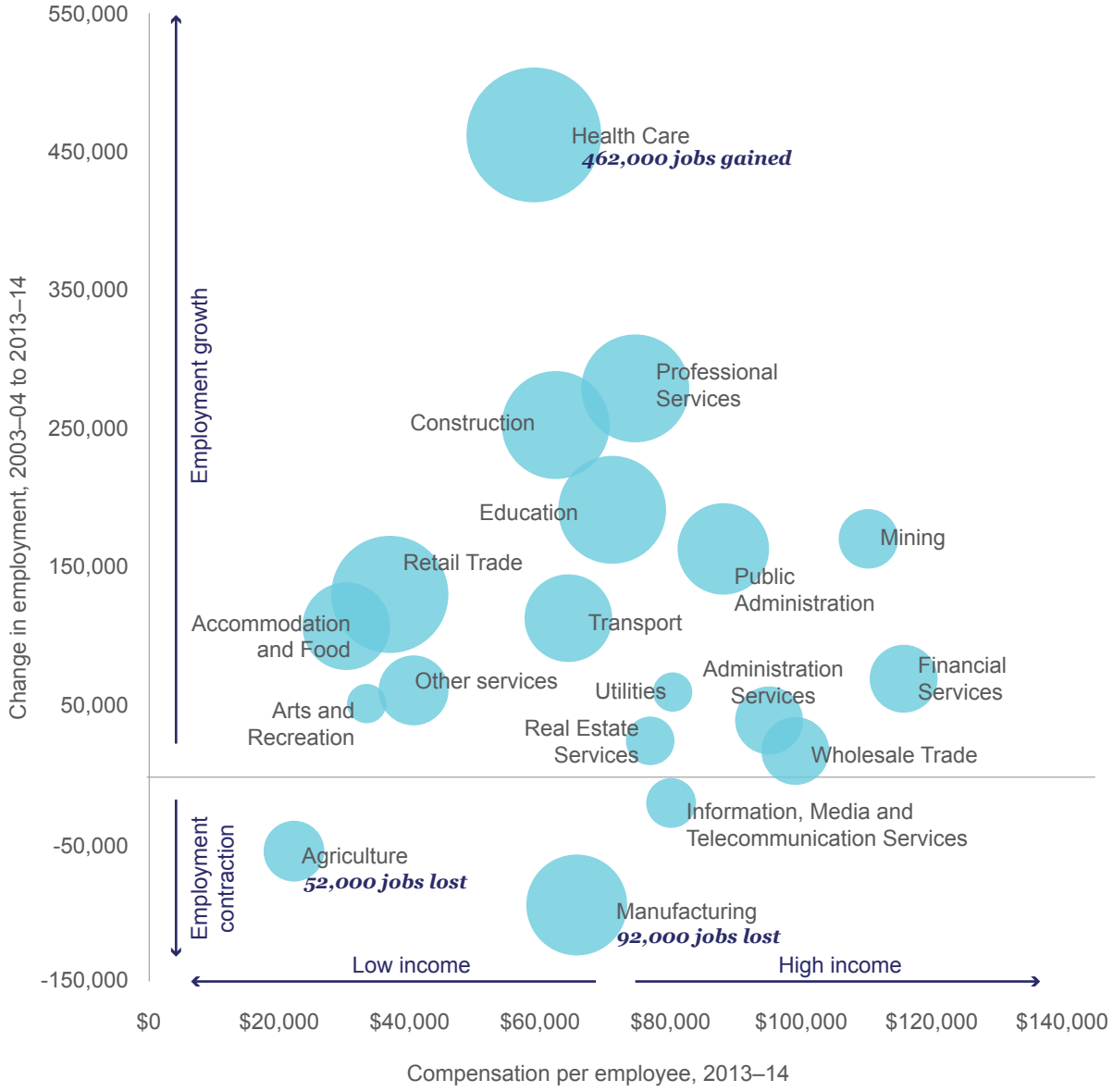
Chart 2.17 shows the change in the number of people employed by industry over the decade from 2003-04 to 2013-14, as well as average compensation per employee and the number of people employed in each industry in 2013-14 (the size of the bubble). Manufacturing and Agriculture, Forestry & Fishing both experienced considerable decreases in employment over this period. Although the absolute employment losses were much smaller in Agriculture, Forestry & Fishing, the decline (14.4 per cent) was proportionally larger than the decline in Manufacturing (9.0 per cent).

The job losses in these industries can be attributed to a range of factors. There has been a shift in demand preferences towards services, as well as increasing competition from low-cost international economies. Concurrently, technological improvements have allowed these industries to produce similar levels of output with fewer workers, further contributing to the fall in labour demand.

In the context of overall industry employment, these job losses were comparatively small. The employment increases in the bottom five increasing industries (Wholesale Trade, Rental, Hiring & Real Estate Services, Administrative & Support Services, Arts & Recreation Services and Electricity, Gas, Water & Waste Services) outweighed the decreases in employment in the three decreasing industries (Information Media & Telecommunications, Agriculture, Forestry & Fishing and Manufacturing). In fact, the increase in Health Care & Social Assistance employment alone compensated more than twice for the total job losses in the three employment-shedding industries. Health Care & Social Assistance is now the biggest employing industry in Australia.

Chart 2.17 also indicates that employment growth was relatively evenly distributed in terms of wages. The bulk of employment growth occurred in the middle-wage industries, such as Health Care & Social Assistance, Professional, Scientific & Technical Services, Construction and Education & Training, while employment growth in high wage industries such as Mining, Financial & Insurance Services and Wholesale trade only marginally outstripped employment growth in low wage industries such as Accommodation & Food Services, Retail Trade and Arts & Recreation Services.

Chart 2.17: Change in employment (2003-04 to 2013-14), employment and compensation per employee (2013-14) by industry



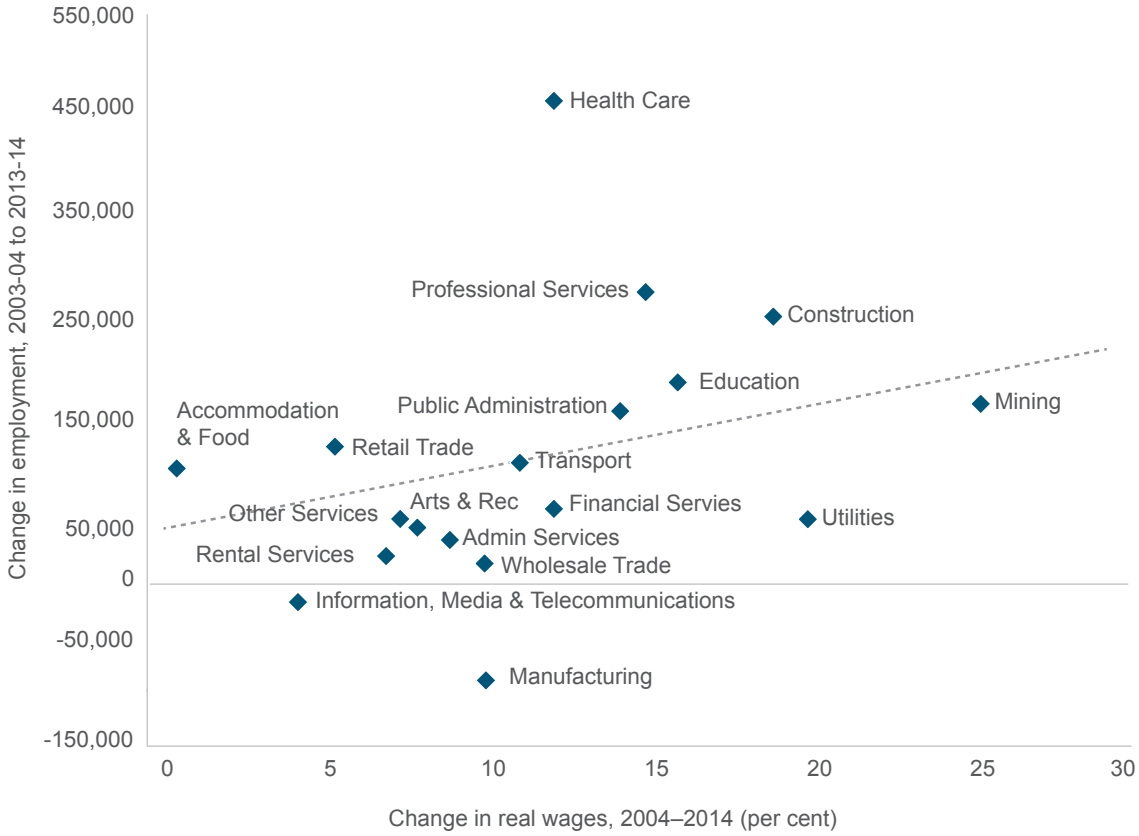
Source: ABS cat. no. 6291.0.55.003 & 5204.0.

Note: Industry names have been abbreviated.

As noted at the beginning of this chapter, resources flow into and out of industries in response to changes in relative prices. In terms of labour, the relative price in question is wages. As wages increase in one industry relative to others, this should draw workers to the industry with higher wages. However, there are obviously many other factors at play here. Workers may not be readily able to transition between industries because they do not have the requisite skills to do so, or they may lack the inclination or ability to move geographically (Mining opportunities in Western Australia, for example).

Chart 2.18 shows the relationship between changes in real wages (wages adjusted for inflation) and changes in employment. There is a clear positive relationship, indicated by the trend line, meaning workers flowed to industries where wages increased over the period.[142]

Chart 2.18: Change in employment and real wages, 2003-04 to 2013-14



Source: ABS cat. no. 6345.0 & 6401.0.

Note: Industry names have been abbreviated. Agriculture, Forestry & Fisheries has been omitted as there is no Wage Price Index (WPI) data for this industry.

Mining experienced the largest increase in real wages over the decade at 25.5 per cent, and increased employment numbers by 172,000. While this was not the highest increase in employment in absolute terms, Mining had by far the highest percentage increase in employment, nearly tripling over the period (from 94,000 in 2003-04 to 267,000 in 2013-14). This rapid increase in employment illustrates that the Mining industry was able to draw labour out of other industries by offering high wages.

142 The R^2 for the trend line on the chart is 0.15. Absolute employment changes are used here rather than percentage changes in employment, so as not to skew the results based on the initial employment size of the industry. However, when using percentage changes an even stronger relationship is apparent (R^2 = 0.46).

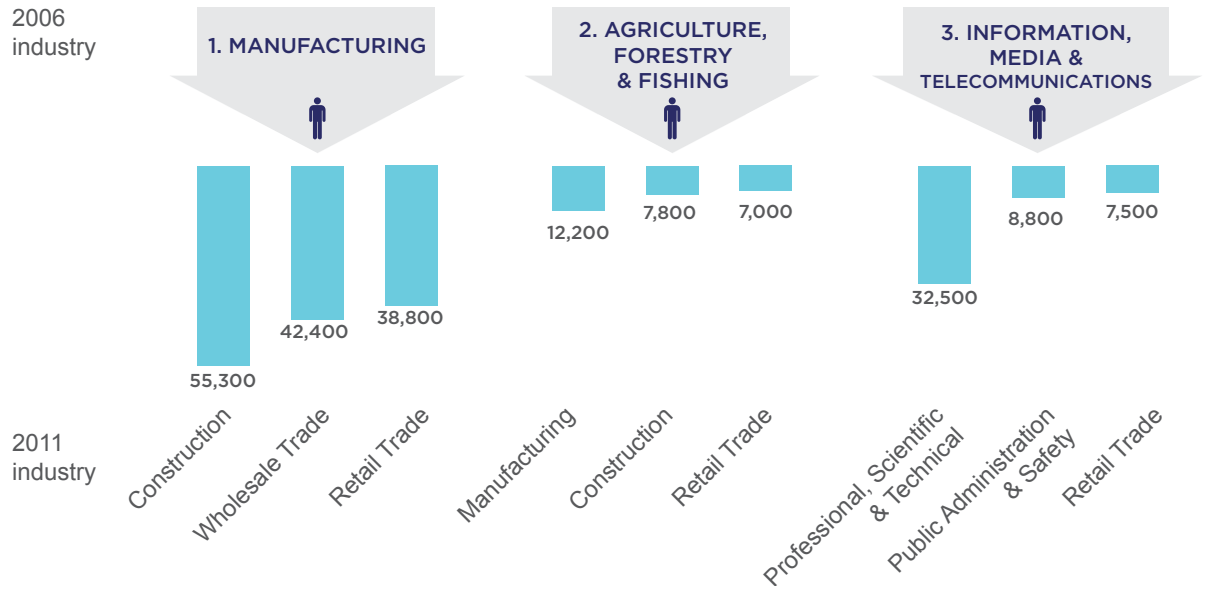
Health Care & Social Assistance and Manufacturing are the biggest outliers in terms of the trend. Health Care & Social Assistance experienced by far the largest increase in absolute employment, while its increase in wages (12.4 per cent) was just above the average (unweighted) increase across all industries (11.8 per cent).

Conversely, employment losses in Manufacturing were accompanied by a moderate increase in wages (10.3 per cent). This indicates that it is possible that lower wage growth may have reduced the number of job losses over the period in this industry. Most of the other industries were close to the trend line in terms of wage and employment growth.

The Australian Census Longitudinal Dataset (ACLD) can be used to track the employment outcomes of workers between industries between 2006 and 2011 through combining 2006 and 2011 Census data.[143] Focusing on movements out of the industries that experienced employment losses during the last decade (Agriculture, Forestry & Fishing, Manufacturing and Information and Media & Telecommunications) and into those that experienced the strongest employment growth, (Health Care & Social Assistance, Professional, Scientific & Technical Services, Construction, Education & Training and Mining), gives an indication of structural change, i.e. how employment has flowed between industries.[144]

Chart 2.19 shows movements of workers out of the industries that experienced a decline in employment over the period.

Chart 2.19: Top three industry destinations for workers moving out of declining industries, 2006-2011



Source: Australian Census Longitudinal Dataset.

143 We can only obtain worker's industries as at 2006 and 2011, so further changes within the period will not be picked up.

144 While the ACLD period (2006-2011) is different to the period analysed in the preceding two charts (2003-2013), as it falls within the timeframe the results remain informative.

Of those who were working in the Manufacturing industry in 2006, but had changed industry by 2011, the most common industry to move into was Construction, followed by Wholesale and Retail Trade.

That the most common destination industry of Agriculture, Forestry & Fisheries workers was Manufacturing might be considered surprising. Although the net result for Manufacturing was a contraction in employment, Manufacturing experienced significant flux during the period with many workers entering the industry, but even more leaving.

Information, Media & Telecommunications workers in 2006 were most likely to move to Professional, Scientific & Technical Services, Public Administration & Safety and Retail Trade, while Agriculture, Forestry & Fisheries workers were most likely to move into Manufacturing, Construction and Retail Trade, respectively.

Interestingly, Health Care & Social Assistance does not appear in the top industry destinations for any of the three declining industries, despite experiencing the highest absolute employment growth between 2003 and 2013. This may indicate that despite opportunities in certain employment areas, workers must have the appropriate skills to be able to transition smoothly, or the ability or inclination to move geographically.

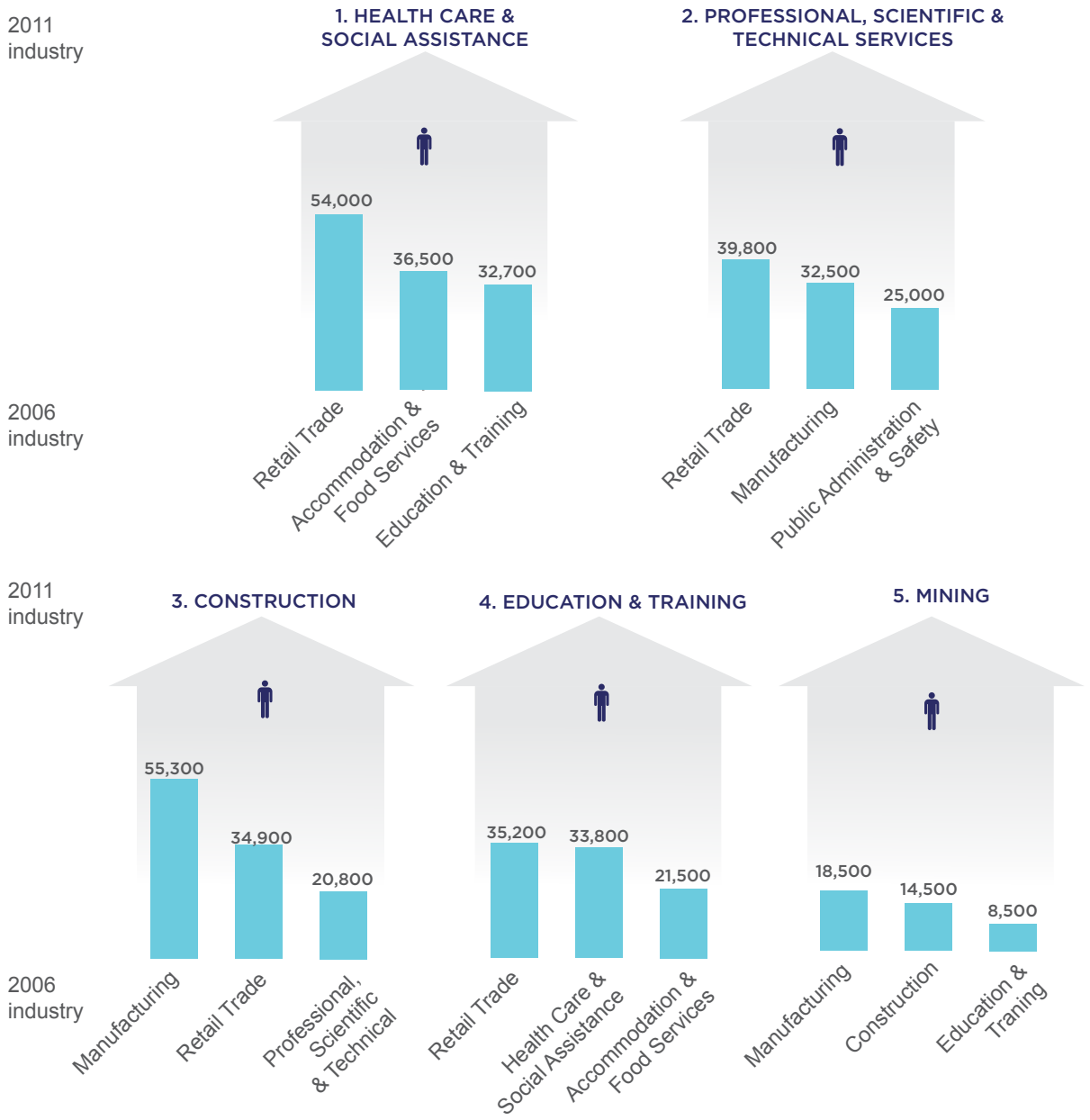
It might be expected that workers in the declining industries in 2006 were the most likely to be unemployed in 2011. However, Manufacturing, Information, Media & Telecommunications and Agriculture, Forestry & Fisheries came in at 5th, 8th and 17th, respectively, in terms of percentage of 2006 workers unemployed (highest to lowest) amongst all 19 ANZSIC industries. This indicates that workers in declining industries were predominantly able to transition smoothly to new employment, as unemployment amongst these workers was not significantly higher than across all industries. Accommodation & Food Services (3.8 per cent), Administrative & Support Services (3.2 per cent) and Construction (3.0 per cent) had the highest percentages of 2006 workers being unemployed in 2011.

Chart 2.20 shows the origins of worker movements into the industries with the strongest employment growth.

Those that moved into Health Care & Social Assistance were most likely to have been working in Retail Trade, Accommodation & Food Services and Education & Training in 2006. 2011 workers in Professional, Scientific & Technical Services were most likely to have come from Retail Trade, Manufacturing and Public Administration & Safety. Those that moved into Construction were most likely to have been working in Manufacturing, Retail Trade and Accommodation & Food Services in 2006.

The largest proportion of workers who moved into Mining came from Manufacturing (approximately 18,500). This indicates that there were substantial direct transitions from industries that experienced reductions in total employment into industries that increased their employment numbers, illustrating the forces of structural change.

Chart 2.20: Top three industry origins of workers moving into the highest growing industries, 2006-2011



Source: Australian Census Longitudinal Dataset.

Retail Trade and Manufacturing feature heavily in Chart 2.20, but likely for very different reasons. Retail Trade is often a starting point for younger workers or students who then move into industries such as Health Care & Social Assistance or Professional, Scientific & Technical Services once they have completed their studies. The transition from Manufacturing into Mining, Construction and Professional, Scientific & Technical Services is more likely to represent structural shifts in the economy as labour moves towards areas where there are more opportunities, or higher wages.

Feature article: The growing role of outsourcing in Australia

Sasan Bakhtiari

The organisation of today's industry is vastly different from what it used to be. In the 1930s, Ford Motor Company owned its ore processing factory, steel mill, power plant, and railroad network. Such level of integration is unthinkable today. Car manufacturers now buy almost everything - tyres, engine components, body parts, electronics, windshields and upholstery - from external suppliers and only task themselves with the assembly of these components for the end user.

This shift was borne out of necessity. In the course of several decades, the dramatic expansion in the size of corporations and in the range of activities undertaken put increasing pressure on management. The globalisation of world markets intensified competition, demanding substantial cost cutting and efficiency gains. It was under such circumstances that outsourcing gained strategic priority. A large company could replace its vast and diverse divisions with suppliers to greatly simplify its business model. This shift diminishes the possibility of managerial mishaps, misunderstandings and coordination issues and reduces the number of managers, lowering staff costs. In addition, suppliers are better placed to specialise in their own niche fields which reduces per unit costs, and contributes to efficiency gains. Furthermore, the advent of the internet made geographical distances almost irrelevant for a range of tasks, allowing businesses to tap into suppliers in low-wage countries to maximise cost savings.

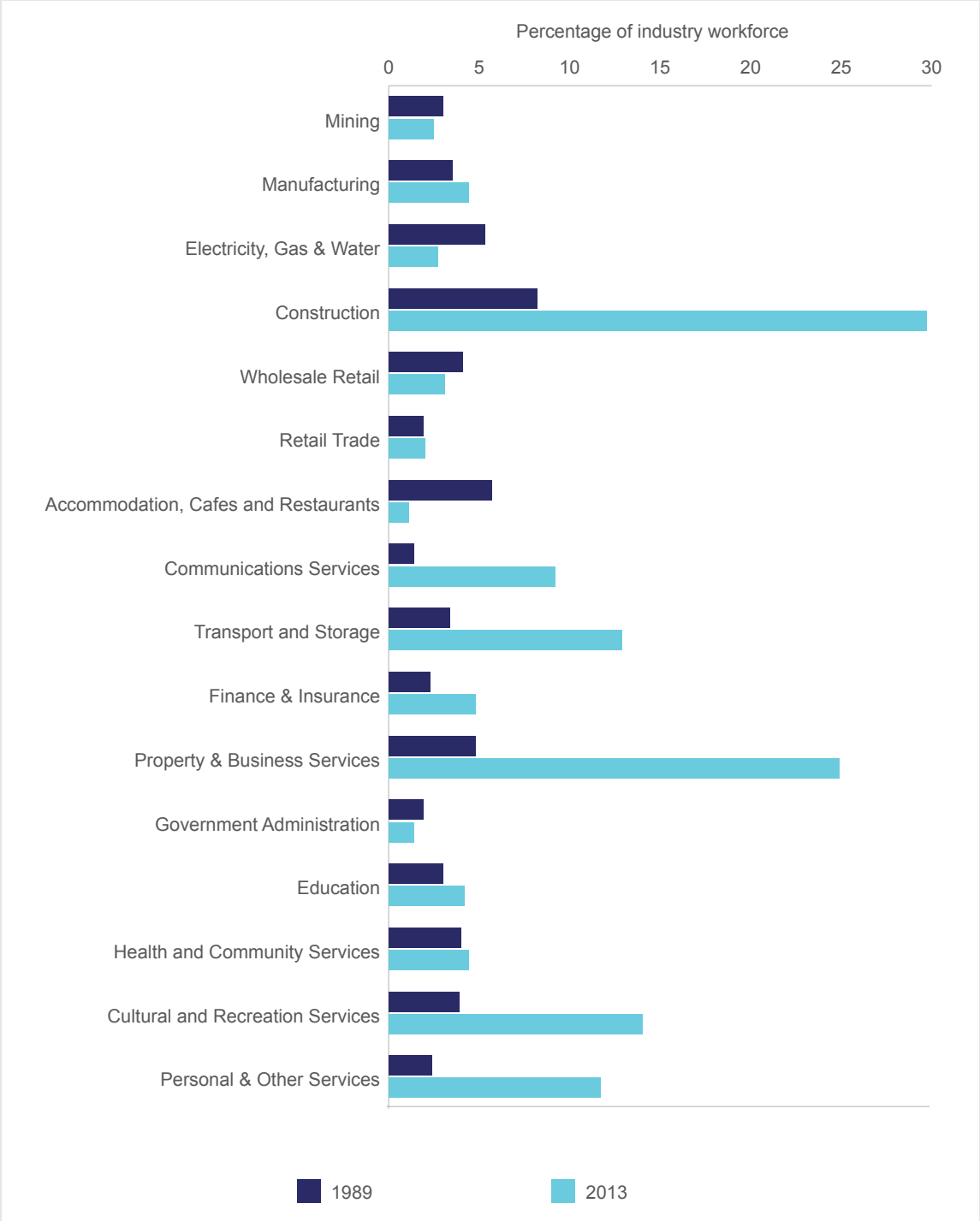
Australia has been no exception to the rule. Data from the Australian Bureau of Statistics (ABS) show that Australian businesses are increasingly outsourcing. The number of independent contractors engaged by other employers grew substantially from 3.5 per cent of the total workforce in 1989 to 8.5 per cent by 2013, although growth has been uneven across industries.[145] The Construction industry - traditionally the largest employer of independent contractors - recorded the highest growth, with the share of independent contractors from the workforce increasing more than threefold from 8.2 per cent in 1989 to 29.7 per cent in 2013 (Chart 2.21). During the same period, the share of independent contractors in the Financial & Insurance Services industry increased from 2.3 per cent in 1989 to 4.8 per cent in 2013. Growth in the share of contractors in Manufacturing has been more modest and increased by 3.5 per cent to 4.4 per cent in 2013, while some industries, such as Mining, experienced a fall in their reliance on independent contractors over the period. Offshoring is not picked up in the ABS data used for this analysis (independent contractors are only those working in Australia), so we cannot quantify it here. However, as offshoring is a subset of outsourcing, the figures presented likely under report the extent of total outsourcing in the economy.

These trends are neither a cause for celebration, nor a reason for concern. Outsourcing can improve business operation and performance, but it can also expose businesses to increased risk. An example of outsourcing going awry is Boeing's 787 Dreamliner, where production was delayed several times due to problems with suppliers.[146] In choosing outsourcing over internalisation, the decision maker must take into account that suppliers act in self-interest, which can present risks to the company's deadlines and objectives. The decision of whether or not to outsource a function often rests in the trade-off between the benefits and the perceived risks from doing so.

145 ABS cat. no. 6359.0 (2013 data) AWIRS main workplace survey (1989 data).

146 *The Telegraph* (2013), Boeing 787 Dreamliner: a timeline of problems, July 28, www.telegraph.co.uk/travel/travelnews/10207415/Boeing-787-Dreamliner-a-timeline-of-problems.html Accessed [4 March 2014].

Chart 2.21: Independent contractors as a percentage of total workforce by industry, 1989 and 2013



Source: Wooden (1999) and ABS cat. no. 6359.0.

Note: Agriculture, Forestry & Fishing and Administrative & Support Services were excluded from the analysis. As 1989 and 2013 data are classified using different industry classifications (ANZSIC 1993 and ANZSIC 2006, respectively) a simple concordance was implemented by adding Rental Hiring & Real estate Services to Professional, Scientific & Technical Services in the 2013 data to approximate Property & Business Services in the 1989 data, with all other industries being matched one for one. We note that there are many other smaller differences between the classification structures, so this chart should be interpreted with caution.

If managers are fully informed and outsource for the right reasons, outsourcing can be a key driver of productivity growth. However, managers can be myopic and partial and vie for fast results. Cost-oriented outsourcing then becomes the strategy of choice. In this scenario, managers choose the cheapest outsourcing option without doing a proper risk assessment. Despite lowering costs in the short term, the strategy can backfire in the long run by leaving the business at the mercy of suppliers and without creative control over production.

In a well-informed environment, on the other hand, the best business strategy is innovation-oriented outsourcing. This approach puts greater importance on the future performance of the business, even at the expense of short-term profits. The business outsources peripheral tasks and invests all its managerial and financial resources on its core competencies in order to optimise the internal innovation process.

Breunig & Bakhtiari (2013) show that this strategy has been a vehicle for continued innovation among Australian manufacturing companies during the 1994–1998 period.[147] If functions are outsourced overseas (i.e. offshoring), there is the added benefit of the firm also getting access to the foreign pool of knowledge through its links and interactions with the supplier. However, one should bear in mind that there is more risk in using foreign suppliers and less control, for example, there may be language or other cultural barriers to deal with, and a foreign supplier may have more incentive to cheat or mislead due to the difficulty in prosecuting across international boundaries. For these reasons, choosing the right foreign supplier is a more delicate job than choosing the right domestic supplier. ABS data also suggest an ongoing role for innovation-oriented outsourcing in Australia. In 2012, about 11 per cent of businesses identified by the ABS as innovative increased outsourcing activities, while 6.4 per cent reduced outsourcing.[148] There has been a consistent trend between 2006 and 2012, with a growing number of innovative firms embracing outsourcing as a business strategy. On the other hand, for businesses identified as non-innovative, the number of businesses increasing and decreasing outsourcing activities almost offset each other in every year over the period. The evidence suggests that the bulk of growth in outsourcing activities in Australia over the last decade has been instigated by innovative firms – which could be an encouraging trend.

Given the discussion so far, Government policies that encourage outsourcing could be complimentary to current government initiatives such as research and development (R&D) and innovation incentives and could help to boost innovation and productivity growth. However, the benefits will only be realised if outsourcing is implemented for the right reasons, as highlighted above, and any policies must be developed with this in mind.

Policies supporting outsourcing must also consider social aspects. Dube & Kaplan (2010) show that cleaners and security guards in the US tend to earn 5 per cent to 20 per cent less if their jobs are outsourced.[149] The implication is that even if every job destroyed in the outsourcing business is simultaneously created by a supplier, the social impact is still not fully offset. With 65 per cent of independent contractors in Australia operating as replacement for low-skilled jobs – such as administration, machine operation, and labouring – low-skilled workers will be the most impacted by an increase in outsourcing.[150]

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147 Breunig R & Bakhtiari S (2013), Outsourcing and Innovation: An Empirical Exploration of the Dynamic Relationship, *B.E. Journal of Economic Analysis and Policy*, 14(1), p.395–418.

148 ABS cat. no. 8167.0.

149 Dube A & Kaplan E (2010), Does Outsourcing Reduce Wages in the Low wage Service Occupations? Evidence from Janitors and Guards, *Industrial and Labor Relations Review*, 63(2), 287–306.

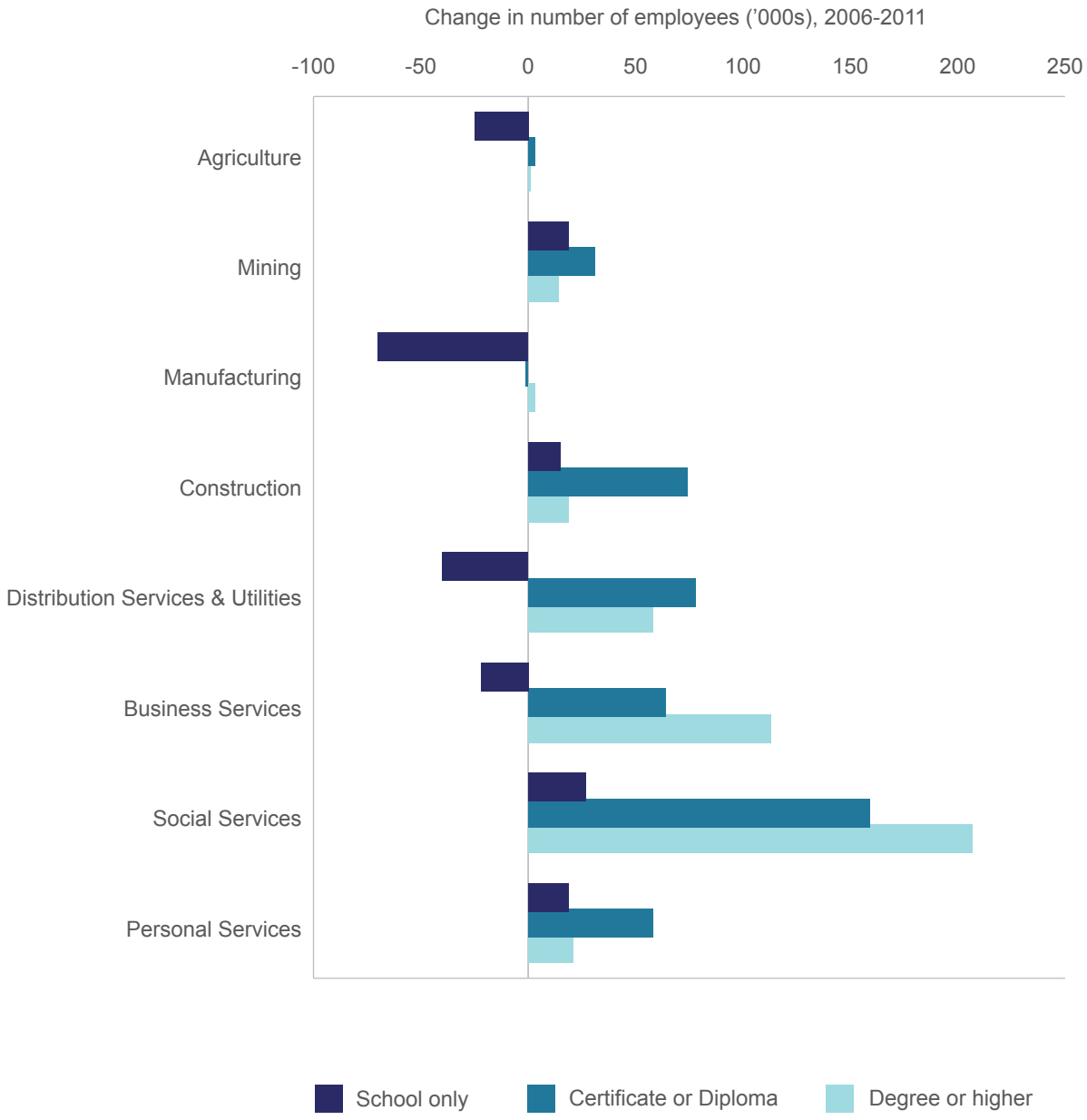
150 ABS. cat. no. 6359.0.

Structural shifts towards Services have necessitated an increasingly skilled workforce

The section below focuses on the changes in skill and education levels of employees in the wake of recent structural change. Chart 2.22 shows that employment growth was dominated by tertiary qualified workers while employment losses were concentrated among those without post-school qualifications.

The sizable job losses in Agriculture, Forestry & Fishing and Manufacturing shown in Chart 2.17 were predominantly workers without post-school qualifications. Over this period, the total number of employees with bachelor or higher degrees grew by 21.8 per cent, the number with certificate or diploma qualifications increased by 18.7 per cent, while the number without any post-school qualifications declined by 2.0 per cent.

Chart 2.22: Change in number of employees by industry and qualifications, 2006-2011



Source: Australian Census Longitudinal Dataset.

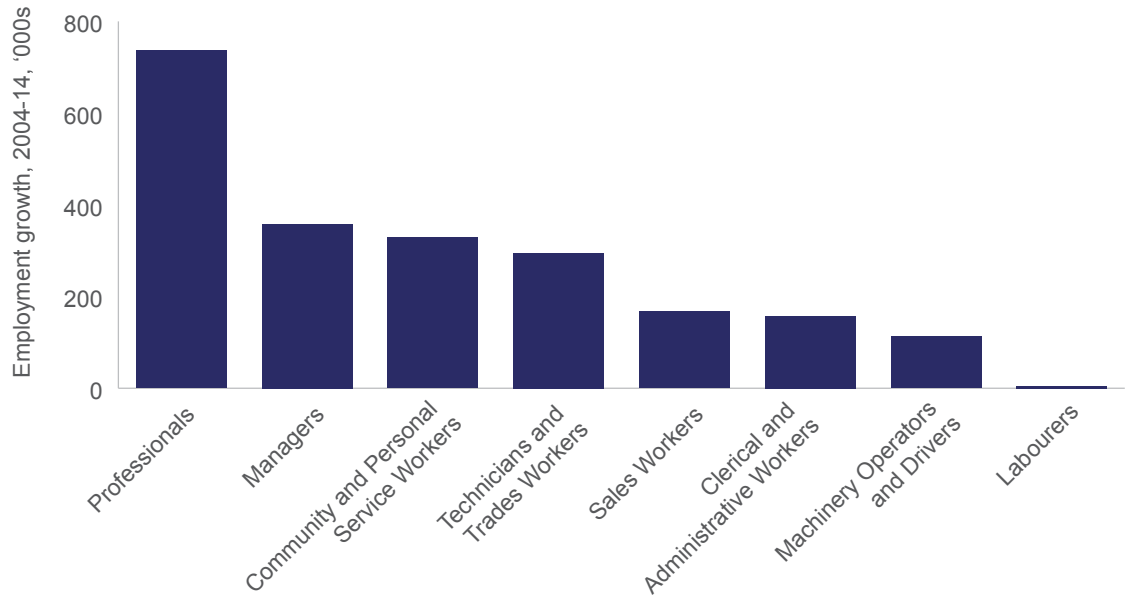
Chart 2.23 shows that the long-term structural shift towards Services industries has resulted in a vast increase in employment in highly skilled occupations, such as professionals (accountants, lawyers, engineers, etc.), and managers. This suggests that the structural shift towards services has necessitated a transition to an increasingly highly-skilled workforce. The resultant increase in demand for highly skilled workers can also be traced back to technological change. The rise of computer technology, for example, has led to an increase in demand for workers with the skills to use and maintain them. This phenomenon is known as skill-biased technical change.

Low skilled occupations have seen much lower growth apart from Community and Personal Service workers – which have increased mostly due to Australia's ageing population.

Lydon, Dyer and Bradley (2014) argue that Professionals, Managers and Community Service workers make up 'interaction jobs' which are characterised by higher levels of reasoning, judgement and the ability to manage non-routine tasks.[151] People in these occupations, it is argued, must be collaborative, creative and have strong problem solving skills. It is also likely that these jobs need an element of face-to-face contact or human interaction—hence the name. Chart 2.19 clearly shows that the vast majority of job growth in Australia over the last decade has been amongst 'interaction jobs'. These types of jobs cannot easily be outsourced or replaced by machines, which means that growth in these types of jobs is likely to continue as Australia moves further along the path towards a knowledge-based service economy.

Charts 2.22 and 2.23 also underscore the importance of Education & Training as an enabling industry. Structural change towards more highly skilled service industries and hence occupations is only possible if workers can re-train and up-skill.

Chart 2.23: Employment growth by occupation ('000s), 2004-2014



Source: ABS cat. no. 6291.0.55.003.

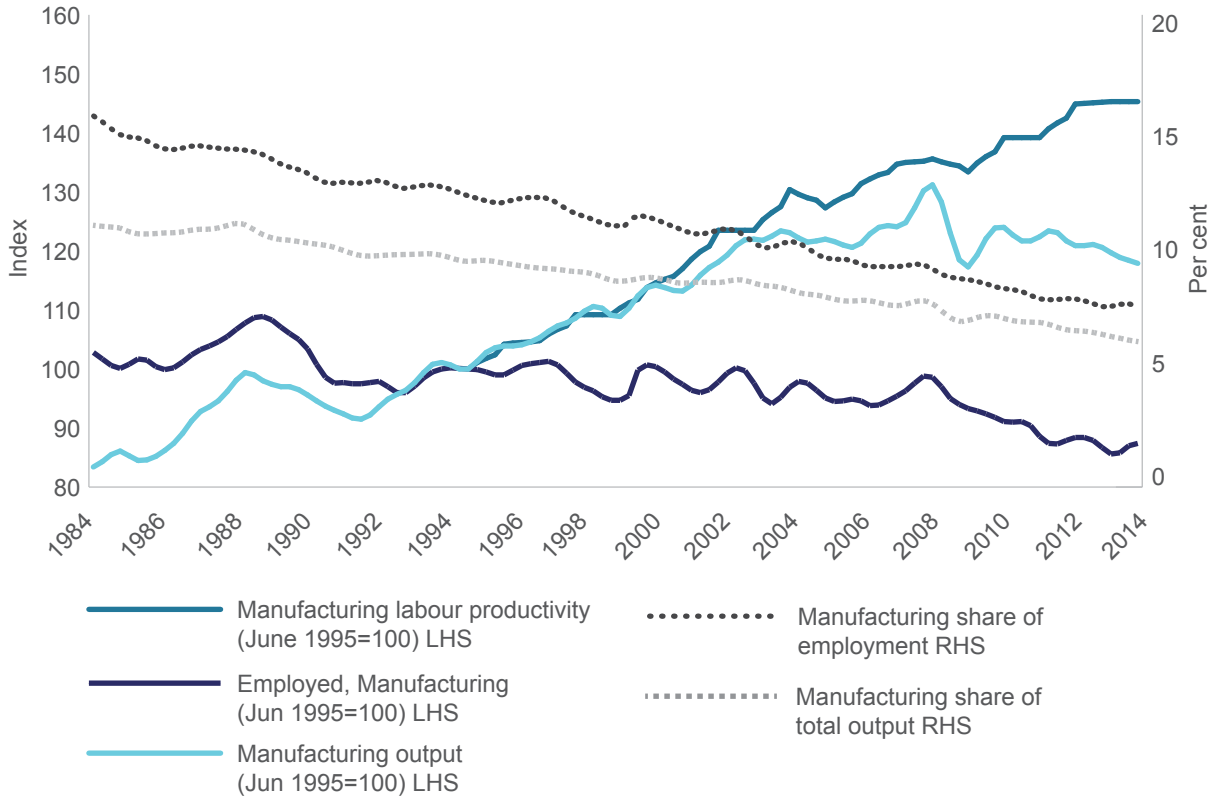
151 Lydon J, Dyer D & Bradley C (2014), *Compete to prosper: Improving Australia's global competitiveness*, McKinsey Australia, p.24.

A closer look at structural change in the Manufacturing industry

Manufacturing remains an important part of the Australian economy. It produces around $100 billion of output each year[152], which ranks it sixth among ANZSIC industries, and accounts for over 930,000 jobs, making it the fourth largest employing industry.[153]

The Manufacturing industry, however, has been at the centre of significant structural change in Australia over the past three decades, as it has been in most developed economies. As recently as 2008, Manufacturing was Australia's largest employing industry and the biggest producer of output. While the industry has enjoyed continued growth in output (at least up until the GFC), the industry's share of output has declined at a gradual but sustained pace, indicating that output has grown less quickly than in the rest of the economy (see Chart 2.24).

Chart 2.24: Australian Manufacturing real output and employment, 1984 to 2014[154]



Source: ABS cat. no. 6291.0 & 5204.0.

Note: Output is GVA in chain volume measures (real output) and in trend terms.

152 ABS cat. no. 5204.0.

153 ABS cat. no. 6291.0.55.003.

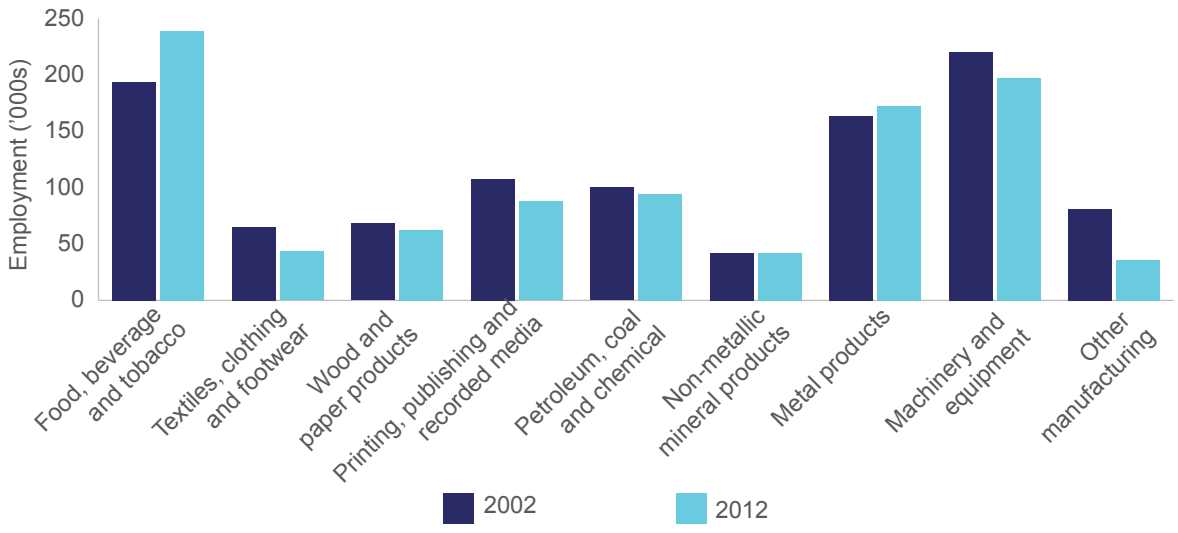
154 The starting point of each series represents the earliest record for each measure in their respective data sources. Labour productivity is measured here as GVA per hour worked.

Manufacturing employment has declined in both relative and absolute terms over the past several decades. That employment declined while output grew indicates that labour productivity increased, as indicated in Chart 2.24. In 1984, the Manufacturing industry represented 16.8 per cent of the Australian workforce. By June 2014, the industry represented 8.1 per cent of the workforce; less than half the proportion 30 years ago. In absolute terms, Manufacturing employment was relatively steady between 1990 and 2008. The beginning of a sharp contraction in Manufacturing employment coincided with the GFC and, in the 6 years to June 2014, Manufacturing employment in Australia fell by 12.0 per cent, or by 127,000 jobs.[155]

The relative decline of the industry is due to a range of factors, including increasing labour and other production costs[156], increased competition from low-cost countries such as China and India, a shift in domestic consumer preferences towards services, and the persistently high Australian dollar. The trend towards outsourcing non-core functions may have also contributed to Manufacturing losing share to other industries.[157] For example, functions previously carried out within a Manufacturing firm and therefore classified as Manufacturing activities that have since been outsourced may now be classified as Services.

Aggregate trends, however, hide the difference in performance among Manufacturing subsectors. For example, employment in the Food, Beverage & Tobacco subsector increased by nearly 50,000 jobs over the decade, and this subsector is now the largest employer within Manufacturing, employing nearly a quarter of a million people. On the other hand, job losses have been severe in the Textile, Clothing, Footwear & Leather and Machinery & Equipment Manufacturing subsectors (see Chart 2.25).

Chart 2.25: Manufacturing subsector employment ('000s), 2002 and 2012[158]



Source: ABS cat. no. 8221.0, 8159.0 & 8155.0 and Department of Industry calculations.

155 Ibid.

156 The Boston Consulting Group ranks Australia last out of the 25 countries in its Global Manufacturing Cost-Competitiveness Index. See - https://www.bcgperspectives.com/content/articles/lean_manufacturing_globalization_australia_manufacturing_cost_competitiveness/ accessed [4 October 2014].

157 See Feature article: The growing role of outsourcing in Australia.

158 As in ANZSIC 1993, Manufacturing subdivisions are: Food, beverage and tobacco (FBT); Textile, clothing, footwear and leather (TCF); Wood and paper products (WPP); Printing, publishing and recorded media (PPR); Petroleum, coal, chemical and associated products (PCC); Non-metallic mineral products (NMP); Metal products (MPM); Machinery and equipment (M&E); Other (OTH).

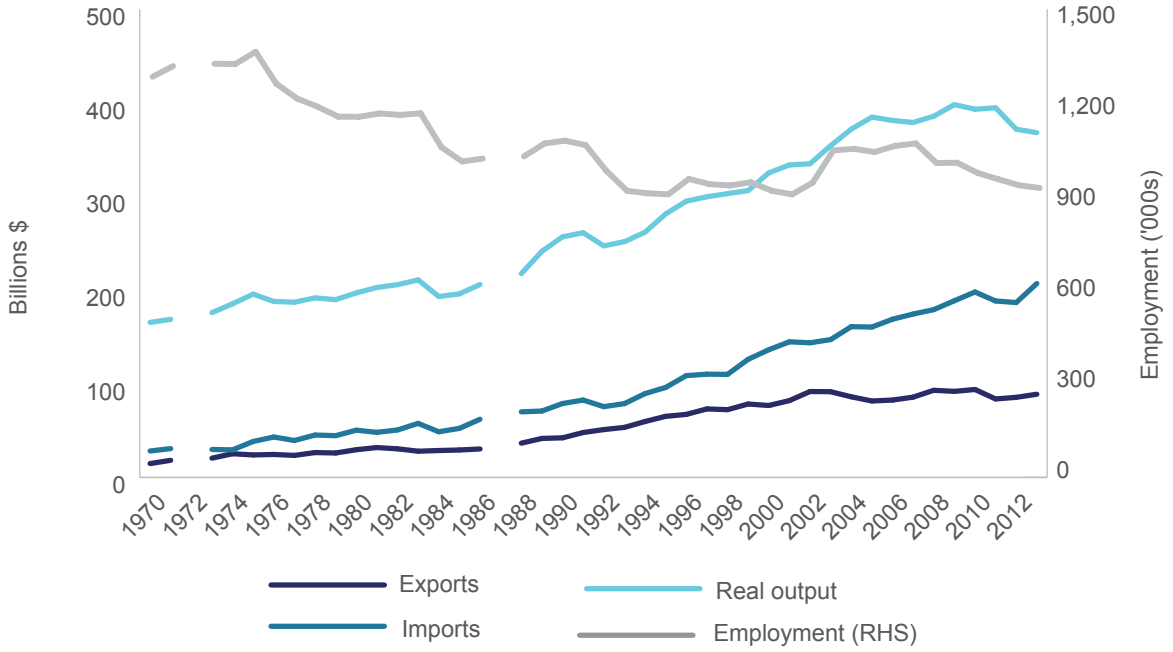
This aspect of structural change has generated much media and public debate, especially in the context of large-scale manufacturing plant closures in recent years. The following sections look at some key considerations with respect to Manufacturing, including the role of import competition, the incidence of product-service bundling, the regional impacts of the relative decline of this industry, as well as employment outcomes for former automotive manufacturing workers, to inform some of the aforementioned debate.

Increased import competition has contributed to job losses in Manufacturing

One of the issues facing Australian Manufacturing in recent times has been the increase in import competition from lower cost countries, particularly India and China. The following section analyses the extent to which increased import competition has hampered Australian Manufacturing.

Chart 2.26 reveals trends in Australia's Manufacturing output, employment and trade flows since the late 1960s. Import growth has been steady and generally faster than export growth during this period. Moreover, exports appear to have stagnated since 2001. As such, the Manufacturing trade deficit (the gap between Manufacturing imports and exports) has been widening. This trend raises concerns that Australian manufacturers have been unable to increase their global presence over the past decade while chronically losing domestic market share to international competitors. These developments go some way to explaining the long-run decline in Manufacturing employment.

Chart 2.26: Australia's Manufacturing output, employment and trade flows, 1969–2012



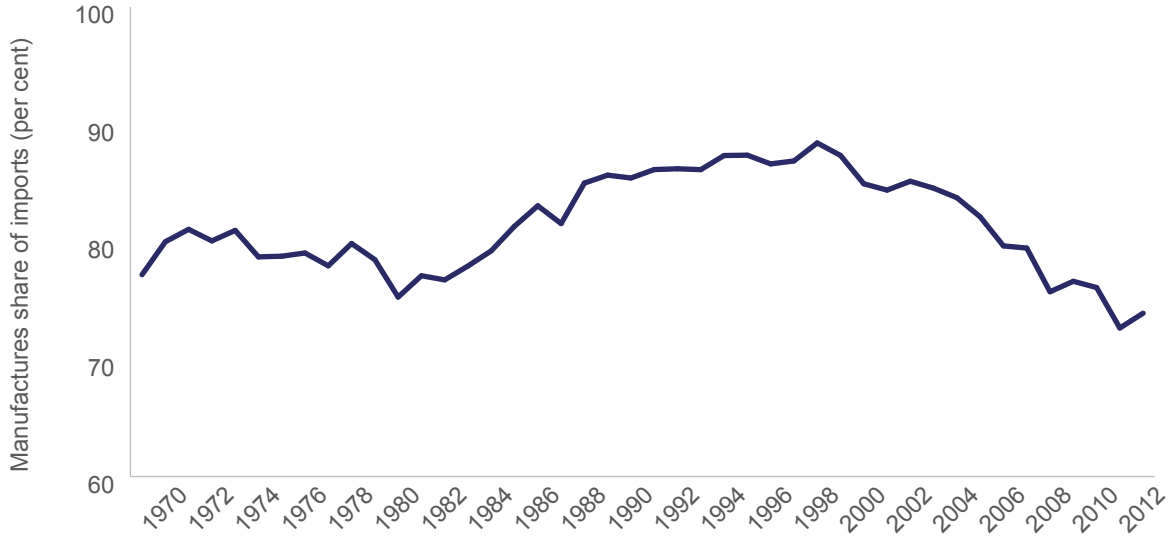
Source: Industry Commission (former name of Productivity Commission) *Australian Manufacturing Industry and International Trade* (1995) and ABS Cat. No. 8221.0, 8159.0 & 8155.0

Note: Output and trade data are in real terms (chain volume measures). Breaks in 1971 and 1986 are due to the Manufacturing census not being carried out in those years.

Manufactured goods dominate Australia's imports. Chart 2.27 shows that the share of the import value of manufactured goods of Australia's total import value has remained above 70 per cent over the past four decades, with the period average over 81 per cent. Australia's imports of manufactured goods as a share of its total imports have remained not only high, but also relatively stable for a long period.

The fall in the value of manufactured imports from over 85 per cent of total import value in the late 1990s to less than 75 per cent in 2012 can be mostly attributed to the increase in commodity prices during this period (see Chart 2.5). As the ratio measured in Chart 2.27 is a value measure, the relative increase in commodity prices has increased the share of commodity import values at the expense of manufactured import values.

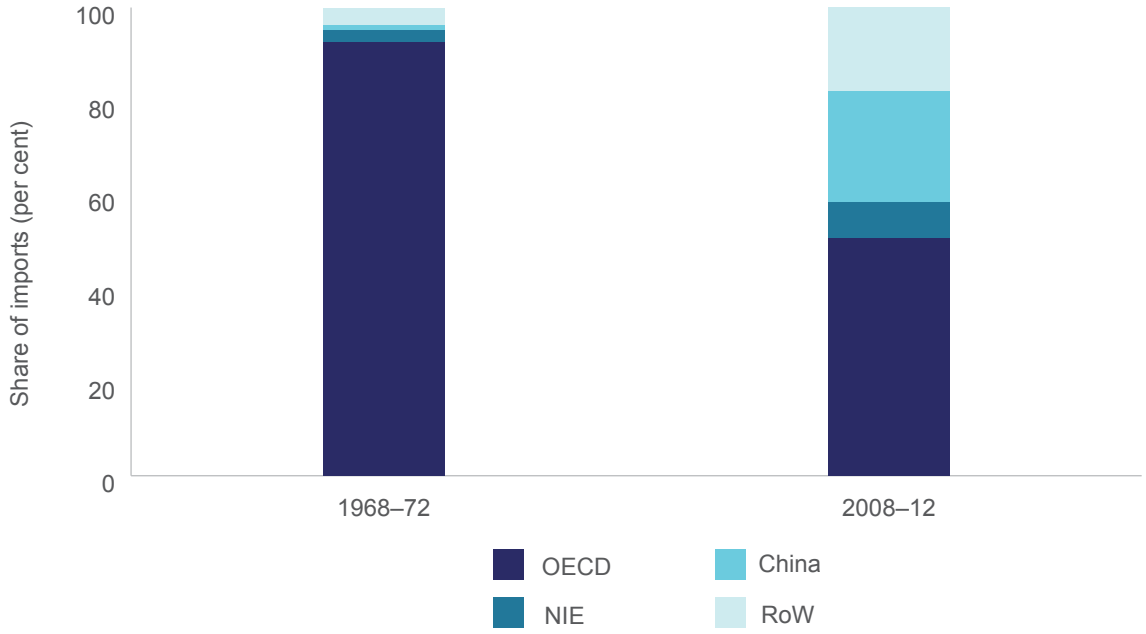
Chart 2.27: Ratio of manufactures to total import values of Australia, 1969–2012



Source: Department of Industry calculations based on nominal data from UN Comtrade database.

The sources of Australia's imports of manufactured goods, however, have changed noticeably. Chart 2.28 illustrates that in 1969, OECD countries accounted for over 90 per cent of Australia's total imports of manufactures, the four newly industrialising economies (NIEs) of Hong Kong, Singapore, South Korea and Taiwan supplied about 3 per cent, while China and the rest of the world (RoW) combined accounted for less than 5 per cent. By contrast, in 2012, the OECD accounted for around 50 per cent of Australia's manufactures imports, while the NIE share was 8 per cent. China has increased their share from 1 per cent to 24 per cent while the rest of the world increased their share from 4 per cent to 18 per cent of Australia's imported manufactures.

Chart 2.28: Average shares of major sources of Australia's manufactured imports, 1968–72 and 2008–12[159]



Source: Department of Industry calculations based on nominal data from UN Comtrade database.

It is a widely held view among Australian businesses and workers in the Manufacturing industry that import competition, especially from low-wage countries, has significantly contributed to the difficulties of the industry. Similar sentiments are prevalent in both policy circles and the popular media. Economic literature on this issue suggests that trade between labour-abundant, low-wage countries (e.g. China) and labour-scarce, high-wage countries (e.g. Australia) would lead to a contraction of labour-intensive industries in the latter. Even if such trade promotes expansion of capital-intensive industries in high-wage countries, job losses in labour-intensive industries will almost certainly outweigh job gains in capital-intensive industries. It therefore follows that aggregate Manufacturing employment is likely to fall.

The link between import competition and domestic employment may appear straightforward. To the extent that imports are substitutes for domestically produced goods, employment in the industry in question can be adversely affected if imports displace domestic production. However, the precise effect of import competition on industry-specific employment adjustments remains unclear for a number of reasons. First, non-competing imports cannot plausibly have an adverse effect on employment. Second, a shift in consumer preferences away from manufactured goods can lead to lower demand for Manufacturing workers. Finally, other factors, such as an appreciation of the exchange rate, can lead to the erosion of Manufacturing competitiveness, as locally produced goods become relatively more expensive than imported goods and less competitive internationally. An analysis of trade-related employment adjustments should therefore take these factors into account.

159 Four-year averages are taken for each period to avoid end point bias, e.g. any shocks that were specific to a particular year.

Empirical analysis into the impact of increased imports on Manufacturing employment suggests that increased imports had a statistically significant negative impact on Manufacturing employment, whereas exports had the opposite effect between 1969 and 2012.[160] These results prevail when the analysis is restricted to the pre-mining-boom or pre-GFC years as well as when Textiles, Clothing & Footwear and Machinery & Equipment subsectors are excluded from the analysis. The results also show that, over time, trade's role in employment determination has waned, and the responsiveness of labour demand to changes in relative wages has increased. This suggests that the Manufacturing industry has become less labour-intensive, and that the Manufacturing labour market has become more flexible.

The impact of higher imports on employment differs between Manufacturing subsectors. For example, imports were found to have no statistically significant effect on employment in Food, Beverage & Tobacco as well as in the Printing, Publishing and Recorded Media and Non-metallic Mineral Products subsectors. In addition, exports have a significant positive effect on employment in all sub-industries except in the latter two. Moreover, relative wage changes have a significantly negative relationship with employment in all subsectors, except Printing, Publishing & Recorded media and Non-metallic Mineral Products.

These findings indicate that foreign competition will impact on labour markets that are significantly trade-exposed.

The distinction between Manufacturing and Services is blurring

It is critical to view Manufacturing, not as an isolated industry, but closely linked to and a critical input to other industries. Manufacturing firms add value to the outputs of other firms by transforming raw products into more complex goods. Manufacturing also provides valuable inputs to wider production processes and services, including through R&D spill-overs, productivity improvements and as a driver of demand for knowledge-intensive services.

Another change reportedly influencing the structure of Manufacturing is 'servitisation'—the trend whereby manufacturing firms in developed economies are apparently incorporating more service-like activities, blurring the distinction between manufacturing and service delivery. Some data indicate that revenue from service provision in Manufacturing has grown rapidly in recent years, with 30 to 55 per cent of manufacturing jobs in advanced economies now classified as involving the delivery of services, and service inputs make up 20 to 25 per cent of manufacturing output.[161]

The bundling of goods and services occurs in many industries, from retailers bundling installation services with their products to restaurants providing home delivery of meals. In the literature, however, much of the focus on the growth of servitisation relates to Manufacturing, where firms provide services bundled with their products, often at a wholesale level. Servitisation, it has been argued, has the potential to provide greater value to customers and increase business competitiveness.

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160 Tuhin R (2014), *Impact of international trade on employment: Evidence from Australian manufacturing industries*.

161 McKinsey Global Institute (2012), *Manufacturing the future: The next era of global growth and innovation*.

The apparent growth in servitisation in developed economies has been attributed to deregulation, technology, globalisation and fierce competitive pressure from emerging economies.[162] Servitisation may occur through increased levels of support for product owners over the life-cycle, provision of expert knowledge of product features and capabilities, and the growth of self-service, through new technologies such as the ability to track parcels online offered by couriers.

The picture of servitisation remains relatively unclear, however, with several distinct challenges to measuring servitisation[163], as well as some evidence that the trend towards servitisation is not as strong as widely believed.

Classification issues are foremost among challenges in measurement. For example, if a Manufacturing facility designs and then produces a product, design activities generally count as Manufacturing and the workers engaged will be counted as Manufacturing employees. If the design is done within the Manufacturing firm, but at a location where no physical production occurs, it could be counted as a Services sector product. If the manufacturer purchases the design from a specialist design firm, the design process will be attributed to the Services sector, and the workers involved will be considered Services sector employees. In all three cases, total employment and total value added are identical. The only difference is the sector or industry to which the employment and value added are attributed in the data.[164]

Assuming that data accurately reflect product-service systems, the empirical support for the trend towards servitisation is mixed. One study that used data from over 10,000 manufacturing firms globally found that the proportion of manufacturing firms that offer services in addition to their manufactured goods, increased by less than 1 percentage point, from 29.5 in 2007 to 30.1 in 2011.[165] The United States, which has the highest level of servitisation, observed a marked reduction in the proportion of firms classified as being servitised in 2011, from 58 per cent in 2007 to 55 per cent. In contrast, China recorded growth in the proportion of Manufacturing firms offering services bundled with their products, from less than 1 per cent in 2007 to 19.3 per cent in 2011. A number of other countries also recorded sharp increases in servitisation, including Japan, France, Sweden, Norway and the United Kingdom. The McKinsey study suggests that the proportion of Australian firms that are servitised increased from 22 per cent in 2007 to 28 per cent in 2011.

Another way to quantify the servitisation of Manufacturing is to examine the proportion of Manufacturing workers in services-related occupations. The proportion of workers in Manufacturing that were in service-related occupations rose marginally from 38.6 per cent in 2006 to 40.5 per cent in 2011.[166] This reflects a small but notable shift towards greater services offering in the Australian Manufacturing industry.

Research into whether servitisation has the potential to improve firms' profitability has yielded conflicting results. Some studies argue that the data compellingly reflects the benefits of servitisation,

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162 Vandermerwe S & Rada J (1988), Servitisation of Business: Adding Value by Adding Services, *European Management Journal*, 6, pp. 314-324.

163 Levinson M (2013), *U.S. Manufacturing in International Perspective*, Cornell University ILR School, Federal Publications.

164 Ibid

165 Neely A, Benedettini O & Visnjic I (2011), *The servitization of manufacturing: Further evidence*, Cambridge Service Alliance, University of Cambridge.

166 Department of Industry calculations using Census data.

while others are more reserved in their conclusions.[167] Overall, while it appears that successful growth can be achieved by firms choosing to servitise, servitisation is not necessarily a path to success in itself, with many firms choosing not to increase service offerings competing well.

The decline in Manufacturing employment has had regional impacts, but regions have adjusted

Regional perspectives on labour market outcomes are important to fully understand the economic and social aspects of structural adjustment. Census data was used in a recent study to examine the regional impacts of the accelerated decline of employment in the Manufacturing industry between 2006 and 2011.[168] Additional factors (including skill levels, the ability or inclination of workers to move between labour markets and the impacts of changes in wages between regions) that may offset the negative labour market impacts of the decline in the Manufacturing industry were also examined.

The results show that the decline in Manufacturing employment between 2006 and 2011 did have a statistically significant impact, lowering full-time employment levels and increasing unemployment rates, on average, across regions in Australia over the period. However, when analysed in the context of the GFC and the rapid structural change that occurred during this period, regions showed remarkable resilience. Approximately one third of regions experienced a reduction in their unemployment rate over the period, while approximately two thirds recorded an increase in their employment-to-working age population ratios.

As the Manufacturing industry is predominantly a 'full-time' industry, the decline was found to have little effect on part-time employment levels. In fact, there appears to be some evidence that the decline in Manufacturing actually boosted part-time employment, as previously full-time workers settled for part-time jobs, or as those previously not participating in the labour force found part-time jobs in order to supplement family income.

Regions with greater increases in the proportion of their populations with post-secondary qualifications were more likely to have increased their participation rates. However, the specific effects of different types of tertiary education were somewhat unexpected. Those areas that displayed increases in the proportion of the population with vocational education and training (Certificate III or IV qualifications) were more likely to experience falling unemployment rates than those regions that experienced increases in the proportion of their population with university level qualifications.

This may reflect a number of underlying causes. For example, Certificate III and IV qualifications may be more commonly obtained by workers who maintain full-time employment while studying, through apprenticeship programs. As such, graduates of vocational education may be less likely than their higher education counterparts to experience a period of unemployment (or underemployment) immediately following graduation. Another explanation could be that local economies require a balance of workers with certificate level qualifications and university qualified workers. For example, economies require trades people, construction workers and transport workers, as well as lawyers

167 Ibid.

168 Georgeson C & Harrison AW (2014), *Regional Impacts of the Accelerated Decline of the Manufacturing Sector in Australia*.

and accountants. This may imply that regional labour markets struggle to absorb large cohorts of university graduates.

Evidence corroborated previous research indicating relatively low levels of geographic labour mobility among Manufacturing workers. Manufacturing workers are generally less likely to relocate from one region to another than non-Manufacturing workers. This may inhibit structural change and, to some extent, explain why the decline in Manufacturing has had a negative impact on regional labour markets.

The rate of structural change was also found to be an important factor in terms of the impact of an industry contraction on employment and unemployment rates. Gradual change allows greater absorption of displaced workers, while rapid contraction creates high levels of competition due to the similar skill sets of workers in the pool of job seekers. Modelling indicates that unemployment rates at the regional level were affected more substantially during the 2006 to 2011 period than in the preceding 5 years, as contraction in Manufacturing employment accelerated during the GFC. This suggests that as economic conditions improve and the rate of contraction of Manufacturing employment slows, the impact on regional employment and unemployment will diminish.

As Manufacturing employment continues to feature heavily in the structural adjustment process, identifying the characteristics that make some regions more resilient to structural change than others, as well as the particular characteristics of Manufacturing workers themselves, will be crucial in minimising the economic and social costs of this adjustment process.

Manufacturing continues to be a key part of Australia's economy. The future of Manufacturing in Australia may, however, be in niche pockets of advanced manufacturing—the manufacture of high complexity, high specificity and high value goods from the concept, R&D and design states all the way through to post sales services. These forms of manufacturing take advantage of Australia's highly skilled workforce and are difficult to replicate in low-cost economies. Further, advanced manufacturing has outperformed more traditional forms of manufacturing in recent years. More detailed analysis of advanced manufacturing and other key sectors is undertaken in Chapter 3.

Box 2.4: Outcomes for Automotive Manufacturing workers

The announcements of the closures of the Ford, Holden and Toyota plants are a continuation of the long-term decline in employment in the Australian automotive manufacturing sector. To illustrate, the automotive employment contracted by a quarter over the 2006 to 2011 period, from over 63,000 employees to less than 48,000.

The Australian Census Longitudinal Dataset (ACLD) can be used to track the employment outcomes of automotive workers over time by combining the 2006 and 2011 Censuses. Using this past information may lead to a better understanding of the likely outcomes for displaced automotive workers in the future. That said, future circumstances may be different and the announced closures will likely accelerate the employment decline in this sector.

A third of workers in the automotive sector in 2006 remained in automotive manufacturing in 2011, another third changed industries altogether, 14 per cent switched to another manufacturing subsector, while only 3 per cent of 2006 automotive manufacturing workers were unemployed in 2011. This indicates that most workers exiting the sector managed to successfully transition to other industries or sectors. Focussing on those who left the sector (either voluntarily or otherwise), 83 per cent found alternative employment, 5 per cent were unemployed and the rest had left the labour force (to study or raise a family, for instance, or because they have given up looking for work).

While the story is largely positive, employment outcomes for some groups were less favourable than for others. For instance, female 2006 automotive workers were more likely to be unemployed in 2011 than men, and were three times more likely to be working part-time in 2011 than their male counterparts.

Other groups that may be more vulnerable to adverse employment outcomes are young and older workers, two groups that were overrepresented among the unemployed. This may reflect a reluctance of firms to employ young workers (who just entered the workforce and often lack experience) and older workers (who may be close to retirement). The evidence also suggests that some older automotive manufacturing workers may have been forced to retire earlier than they otherwise would have.

The ‘destination’ industries of former manufacturing workers varied between men and women. The top three destination industries for men leaving automotive manufacturing were Construction, Wholesale Trade and Transport and Other Services. In comparison, women were more likely to move into Retail Trade, Wholesale Trade, Health Care & Social Assistance or Professional, Scientific & Technical Services. The different destination industries for men and women leaving automotive manufacturing can be explained, in part, by the occupations within the automotive sector in 2006. A much larger proportion of men were working in technicians & trades jobs in 2006, while a larger proportion of women were working in clerical & administrative jobs in 2006.

Workers that remained in automotive manufacturing in full-time positions in 2011 earned a higher median wage than those who took up full-time work in another industry or sector. However, not all wage outcomes were unfavourable. Those that moved into full-time positions in Wholesale Trade, Professional Scientific & Technical services and Mining earned higher wages than those who stayed in automotive employment. The wage outcomes for automotive manufacturing workers moving to Health Care & Social Assistance, Transport, Postal & Warehousing, Retail Trade and Other Services were less favourable, earning considerably lower median wages than those that remained in automotive.

This analysis shows that despite the magnitude of the structural change, the employment outcomes for 2006 automotive workers were mostly positive, especially in the light of the adverse economic conditions during this period.

Future structural change directions and implications

Structural change is driven by a number of complex interconnected factors. As such, the nature of future structural change is difficult to predict. However, some trends are evident and will continue to present opportunities and pose challenges for the Australian economy.

First, the rapid industrialisation of China and India is likely to continue, albeit at a slighter slower pace than in recent history (see Chapter 1). The size of these countries and their proximity to Australia means that these transitions will have numerous implications and opportunities for Australian industry. Industrialisation in East Asia will coincide with urbanisation and a burgeoning middle class and will necessitate a more highly-skilled workforce, presenting opportunities for Australia's international education sector, which is already Australia's largest service export.[169] China and India's growing middle class are also likely to demand an increasing proportion of luxury goods as incomes increase. Examples include holidays, high quality health and aged care and high quality proteins including beef and lamb. Australia is well known as a tourist destination and for producing quality fresh produce and meats, indicating opportunities for Australia in tourism and agriculture.[170]

Second, Australia's population will continue to age (see Chart 2.8), meaning that the Health Care & Social Assistance industry will likely continue to increase its employment share of the economy. This is more likely to present a challenge for policy makers than an opportunity as the industry is heavily government subsidised. However, populations in emerging economies are also ageing - China, for example, is projected to age faster than Australia, with the percentage of the population aged 60 and over projected to increase from 13.9 in 2013 to 32.8 by 2050, compared to Australia's projected increase from 19.8 per cent in 2013 to 27.6 by 2050.[171] The combination of Australia's aesthetics and amenities could present desirable retirement and nursing home options for foreigners.

Third, Australia's compulsory superannuation laws have led to an increasingly large wealth management sector, with Australia's funds under management the fourth largest in the world.[172] Demand for such financial services is likely to continue to grow as domestic superannuation savings grow, and as emerging countries grow wealthier and begin to save more. In general, financial and professional services are likely to increase their relative shares of output and employment as the transition towards a knowledge-based service economy continues. Technological improvements are also likely to continue to increase trade in Services, as web designers, architects, artists, engineers, consultants, and many other service professionals are increasingly able to work remotely through digital means. However, while this will provide opportunities for Australian professional service providers, it will also expose them to increasing foreign competition.

Fourth, while the Mining industry is likely to see lower prices going forward, production will continue to increase in the medium term and the demand for Australian resources is unlikely to abate any time soon. However, investment in the Mining industry has already fallen from its 2013 peak and is likely

169 Lydon, J, Dyer, D, Bradley, C (2014) *Compete to prosper: Improving Australia's global competitiveness*, McKinsey Australia, p.32.

170 Deloitte Access Economics (2014), *Positioning for Prosperity? Catching the Next Wave*, p.25.

171 UN, Department of Economic and Social Affairs, *World Population prospects*, 2012 revision, June 2013.

172 Ibid.

to continue in this vein. Historically low interest rates, which are likely to persist (at least in the short term) may allow the Construction industry to pick up some of this investment slack and transition from mining construction to residential and commercial construction.

Finally, Australia has abundant reserves of both conventional and unconventional gas. It is estimated that up to an additional $200 billion in infrastructure in the gas sector will come online by 2017. Demand for gas is likely to grow as emerging countries such as China and India are increasingly concerned about air quality and climate change, as gas is cleaner than other energy sources such as coal and oil.[173]

To a degree, these future structural change forces were reflected in scenario modelling of future employment trends undertaken by Deloitte Access Economics in 2012. The modelling was based around four potential scenarios in the Australian economy, which aim to describe plausible futures up to 2025.[174] Chart 2.29 shows the range (the length of the line for each industry) and average (the grey marker) of projected employment growth by industry across these four scenarios.[175]

Employment is projected to grow fastest in the social services—Education & Training and Health Care & Social Assistance, followed by business services—Professional, Scientific & Technical Services and Financial & Insurance Services, followed by Mining (although Mining industry employment growth depends heavily on which scenario is likely to transpire).

Projected employment growth in the Agriculture, Forestry & Fishing, Electricity, Gas, Water & Waste Services and Construction industries does not reflect the prior analysis, however it is likely that any opportunities in these industries will be realised through productivity and output gains (via technological improvements and innovations) more so than employment growth.

However, while structural change presents Australia with a number of opportunities, there has been some concern from policy makers in the past regarding the shift from manufacturing-based activities to service-based activities. It is often claimed that the nature of services activities provide less scope for productivity growth than manufacturing activities, because 'making things' more naturally leads to R&D and innovation, which are major drivers of productivity gains; whilst productivity in some services industries is difficult to improve (doctors can, for example, only see a limited number of patients per hour). It is therefore argued that structural change could hamper future economic growth.[176]

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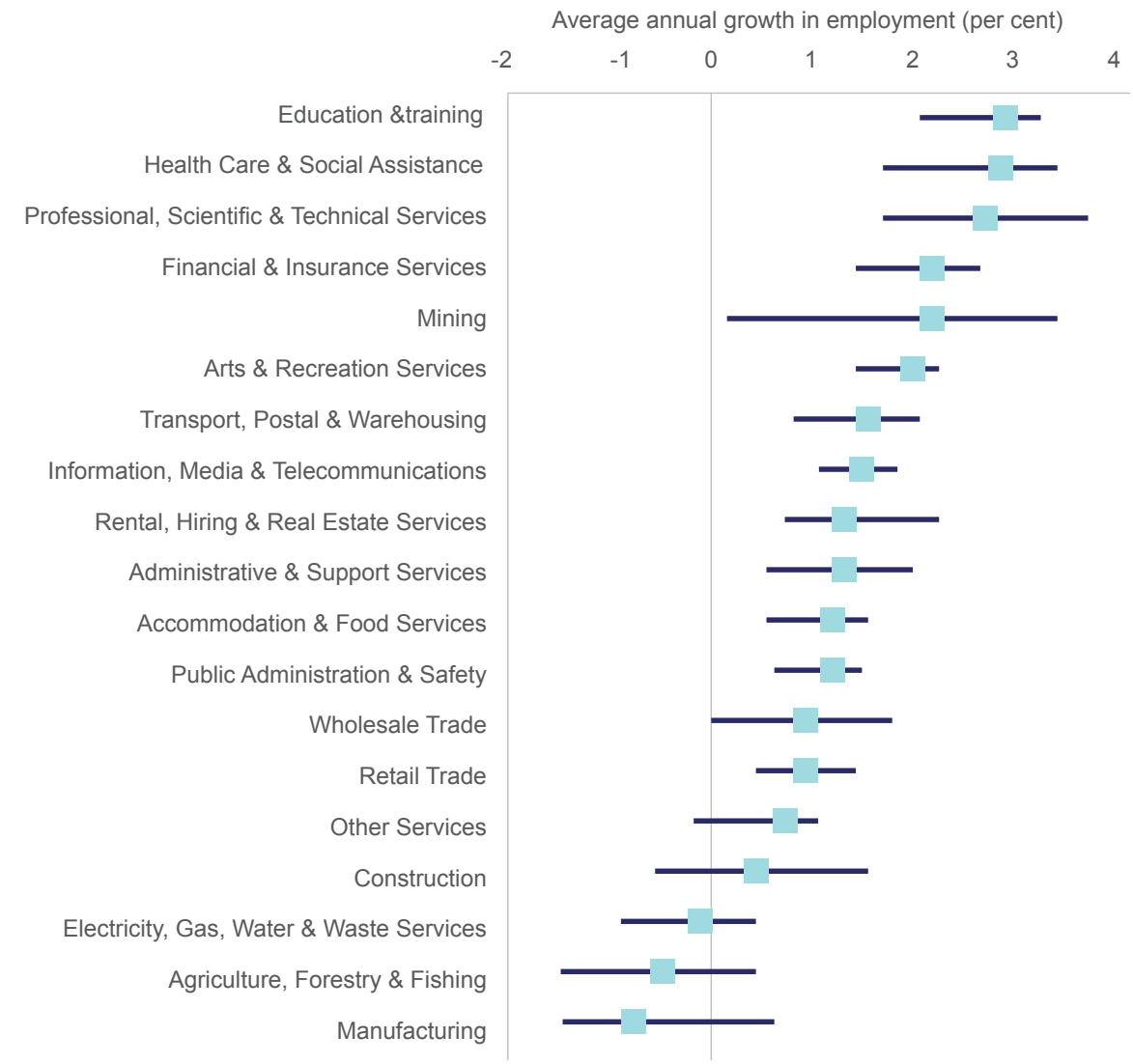
173 Deloitte Access Economics (2014), *Positioning for Prosperity? Catching the Next Wave*, p.28.

174 See AWPA (2012), *Scenarios for Australia to 2025*, available at www.awpa.gov.au/our-work/Workforce%20development/national-workforce-development-strategy/2013-workforce-development-strategy/documents/scenarios-for-australia-to-2025.pdf, accessed [6 May 2014].

175 The four scenarios are as follows:
Long Boom: Quick recovery by the world economy from the uncertainty of 2011-12. Australia prospers through strong demand for resources, agricultural products and services to Asia, firms adopt productivity-enhancing strategies to remain competitive.
Smart Recovery: Instability in global financial markets continues until 2014-15. Economic growth accelerates after governments in the United States and Europe constrain the growth of government debt to a sustainable path. Australia's growth accelerates due to technology and the adoption of knowledge work as a critical factor in productivity gains and new job creation.
Terms of Trade Shock: New global sources of mineral and energy resources lead to oversupply and strong downward pressure on prices. Australia's terms of trade fall, returning to historical levels, and the dollar loses value. However, technology and innovation drive industry restructure and competitiveness, and the other non-mining industries do better.
Ring of Fire: Ongoing uncertainty and volatility characterised by sovereign debt, bankrupt governments and a string of political crises involving many small shocks. Australia becomes more conservative and protectionist, leading to lower productivity growth and lower economic growth.

176 This is known as 'cost disease' See Wolfl, A. (2005) The Service Economy in OECD Countries in OECD (2005) *Enhancing the Performance of the Service Sector*.

Chart 2.29: Projected employment growth by industry, 2011-2025



Source: Deloitte Access Economics, 'Economic modelling of skills demand and supply', commissioned by AWPA, available at: www.awpa.gov.au/publications/Documents/DAE-Economicmodellingofskillsdemandandsupply.pdf

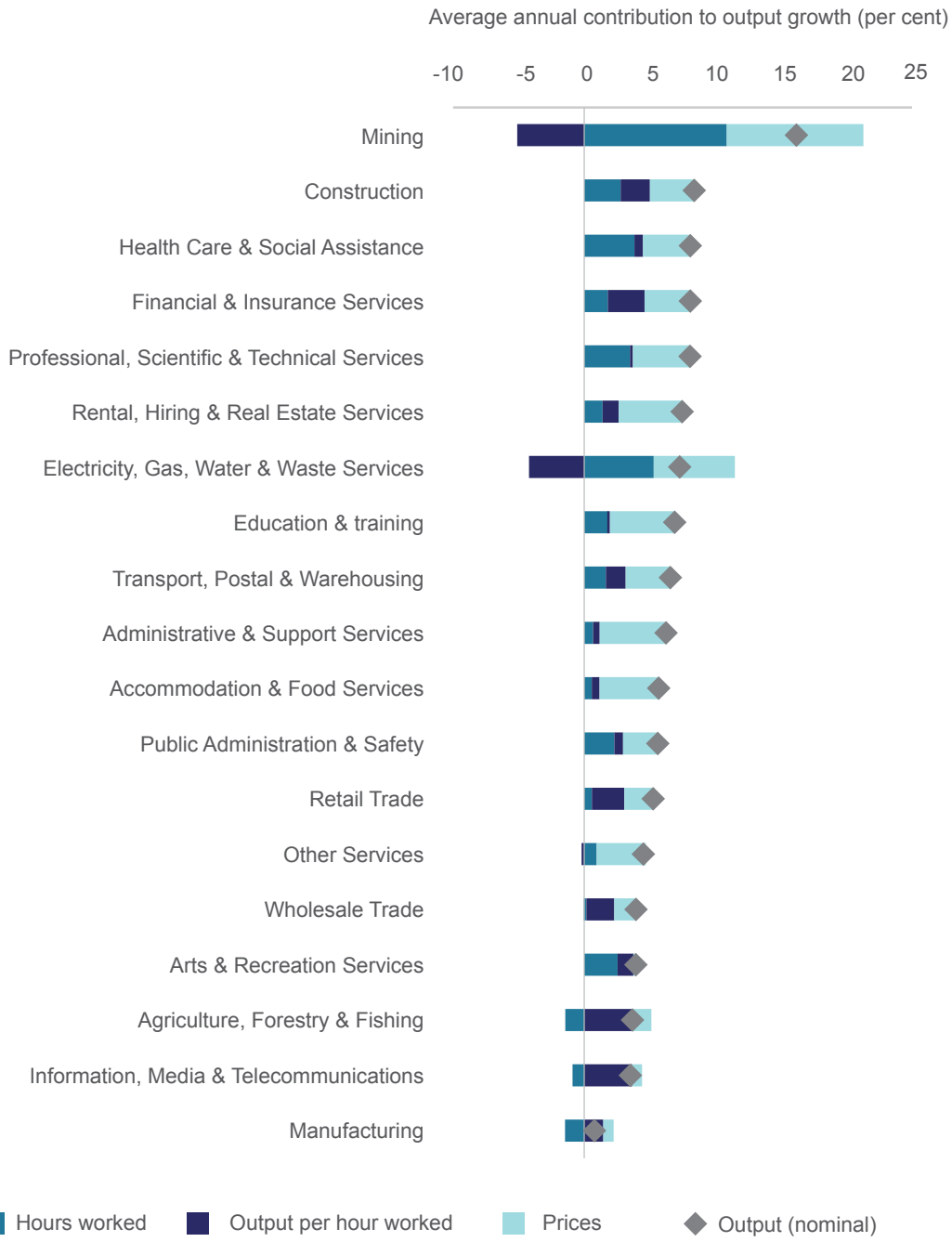
This argument does not take into account the emergence of 'modern services'[177] which are information and communications technology 'heavy' services that can be digitally stored and traded (and are therefore similar in some ways to manufactured products). Examples include financial services and other business services such as engineering, architecture and consulting. These services are likely to experience high productivity growth in the future thanks mainly to technological advances. *The Economist*, for example, recently predicted that a wave of technological innovations will continue to transform the financial industry in the future, which will drive further productivity gains.[178]

177 Mishra et. al. (2012), Service Export Sophistication and Economic Growth, *VoxEU*, 8 April 2012.

178 The Economist Intelligence Unit (2014), *Industries in 2014*.

Chart 2.30 breaks down the average annual growth of nominal output in each industry into changes in prices, changes in hours worked, and the change in output (GVA) per hour worked. The change in output per hour worked measures changes in labour productivity.[179] Labour productivity is the ratio of outputs to labour inputs, and increases in labour productivity indicate that employees produce more outputs for every hour worked. Chart 2.30 shows that some 'modern services', such as Financial & Insurance Services, experienced higher labour productivity gains (2.8 per cent annually on average) than Manufacturing (1.4 per cent annually on average) over the last decade.

Chart 2.30: Average annual change in industry output - contributions of changes in prices, hours worked, and output per hour worked, 2003-04 to 2013-14



Source: ABS cat. no. 5204.0.

Note: Output is GVA in current prices

179 Technically this also accounts for changes in capital intensity and labour quality.

If future structural change involves a movement of workers from industries such as Manufacturing and Agriculture into 'modern services', fears regarding a resulting productivity slump may be unfounded. However, it is likely that non-market sector industries such as Health Care & Social Assistance and Education & Training will be among the largest and fastest growing industries of the future and as such, productivity gains in the non-market sector will also be crucial in lifting Australia's growth potential.[180]

The future is uncertain, however, and disruptive technologies, changes in domestic and international policies as well as changes in consumer preferences will continue to dramatically change the landscape by presenting a host of unforeseen opportunities and challenges. Despite this, the broad trends we have identified throughout this chapter, such as the shift from Manufacturing and Agriculture to Social and Business services, are likely to continue into the future, at least for the next few decades.

The previous discussion demonstrates that there are powerful domestic and international forces at play that shape the structural change process. Indeed the shift towards services is a natural part of economic development and in an increasingly connected world, the government's ability to reverse this process is limited. As noted at the beginning of this chapter, the economy benefits from smooth structural change where the periods of unemployment for those in transition are shortened, and the economy is flexible enough to quickly take advantage of opportunities.

However, while structural change can play a positive role in the process of economic growth and raising living standards, it can impose costs and cause difficulties for some groups. The government can play a role in helping to remove or reduce some of the barriers to the adjustment process, such as the costs of re-training, unnecessary regulation, the costs of moving geographically and skills mismatches, for example. The Government would work with affected individuals, firms and regions to ensure that they have genuine options and support to adjust. Policies that support smooth structural change will better position the Australian economy to be more competitive and capitalise on growth opportunities while lowering the costs of adjustment.

The Government can also play a role in facilitating the economy's ability to exploit its areas of comparative advantage, to enable Australian businesses to turn structural change to their benefit. Developing business capabilities, harnessing the potential of science and research and encouraging collaboration between researchers and industry, forging new trade alliances and trade agreements, facilitating the commercialisation of ideas and building workforce skills are just some examples of such initiatives. Facilitating, rather than resisting structural change, is likely to pay economic dividends in the long-run.

180 Gruen D (2012), *The Importance of Productivity*, Productivity Commission-Australian Bureau of Statistics Productivity Perspectives Conference. www.treasury.gov.au/~/media/Treasury/Publications%20and%20Media/Speeches/2012/Importance%20of%20productivity/Downloads/PDF/Gruen_The_Importance_of_Productivity.ashx, accessed [4 October 2014].

Summary

Structural change is the result of the economy shifting resources to where they are most valued, and is therefore necessary for continued growth and prosperity, and crucial for the economy's ability to capitalise on opportunities. Structural change describes relative changes in the composition of the economy. These changes are a natural consequence of the economic development process and are a feature of most economies. Indeed, Australia's experience is very similar to that of other commodity producing countries, and broadly similar to that of most developed countries.

While there has been a long-term shift of resources from Manufacturing activities to Services, the extent of structural change in Australia appears to have accelerated in recent years in terms of some measures. Recent global developments, such as the rise of low-cost manufacturing in developing countries, particularly in East Asia, and increased demand for Australian resource exports, have combined with longer-term domestic trends such as the ageing population and increasing incomes to speed up the relative decline of Manufacturing and Agriculture's shares of the economy. On the other hand, the shares of Mining and Construction along with Business and Social Services have increased substantially in recent years. Overall, the Australian economy has grown relatively strongly over the past decade. Employment growth in the Health Care & Social Assistance industry alone more than accounted for employment losses in all the declining industries—which highlights the opportunities that structural change presents.

Changes in the sectoral composition of the economy can impose costs on some workers and regions. Barriers to labour mobility, for example, mean that the impact of structural change can be severe for certain groups, and these negative impacts tend to dominate the public discourse around structural change. Given that Manufacturing employees in particular seem to be less geographically mobile than in other industries, declining employment in Manufacturing poses some challenges. Empirical results, however, show that while the recent accelerated decline of the Manufacturing industry did have an impact on regional employment and unemployment rates in Australia, regions have demonstrated considerable capacity to adjust. Employment outcomes for automotive workers in recent years in the face of major structural change have also been reasonably positive. Increases in skill levels and education play an important role in minimising the economic and social costs of structural adjustment.

Recent employment growth has been stronger in higher skilled occupations, and for individuals with higher levels of education. These trends, along with other recent trends in employment growth, are largely expected to carry on as the transition towards a knowledge-based economy continues. Concerns that the shift towards services may stifle productivity and output growth tend to over-simplify the issue, as some Services industries have produced strong labour productivity growth in recent years. However, there is no doubt that the ever increasing employment shares of the traditionally low-productivity social service industries does pose some challenges to Australia's future growth potential.

Structural change is a continual process, and the strength of the Australian economy will depend on its ability to adjust to that change. While the exact nature of structural change in the future is unknown, some inferences can be made as to the broader future trends. It is clear that education, labour mobility, economy-wide productivity growth and the business environment are the key factors that will continue to determine how well Australia copes with future patterns of structural change. Government can play a role in facilitating the adjustment process, removing barriers, helping those affected by structural change to transition and ensuring that businesses are in a position to exploit Australia's areas of comparative advantage.

CHAPTER 3
Selected industry sectors in focus

Chapters 1 and 2 of this report highlighted a range of factors that impact on Australian industries. Among others, these include rapid technological change, an ageing population, changes in consumer preferences, the high exchange rate and increasing global competition. Against the backdrop of these factors, and the challenges and opportunities that they present, Australian businesses are under constant pressure to remain competitive. Investment in innovation, R&D, machinery and equipment, training and management capability will be key to achieving ongoing productivity gains.

This chapter of the *Australian Industry Report* provides analysis of selected sectors of Australia's diverse economy to provide insight in key areas of interest. In this inaugural report, the chapter provides information and analysis that will help to inform the Government's sectoral policy and the establishment of the initial Industry Growth Centres by focusing on the five key sectors that are highlighted in the *Industry Innovation and Competitiveness Agenda*.[181]

Through the *Industry Innovation and Competitiveness Agenda* the Australian Government is refocusing industry policy to drive innovation and entrepreneurship. Industry polices will be re-targeted to capitalise on Australia's strengths and the growth prospects of Australia's high-potential small and medium-sized businesses and most promising sectors. Australia's strengths and the trends in global demand and supply provide a window to where some of the jobs and industries in the future may lie.

The *Industry Innovation and Competitiveness Agenda* details the government's proposal to establish five initial Industry Growth Centres, which will be rolled out from early 2015. The Industry Growth Centres will aim to encourage businesses to collaborate with each other and research organisations to unlock their potential. The five initial centres will be these identified growth sectors i) Food & Agribusiness, ii) Mining Equipment, Technology & Services, iii) Oil, Gas & Energy Resources, iv) Advanced Manufacturing, and v) Medical Technologies & Pharmaceuticals. These sectors have

181 The *Industry Innovation and Competitiveness Agenda* was released on 14 October 2014. See: www.dpmc.gov.au/publications/Industry_Innovation_and_Competitiveness_Agenda/index.cfm.

recently been identified in a number of independent reports for having promising future growth prospects.[182]

It is important to note that the methodology adopted in this chapter for characterising the sectors was developed for analytical purposes only. It has no bearing on eligibility for the Industry Growth Centres initiative or other complementary initiatives including the Entrepreneurs' Infrastructure Programme; and Industry Skills Fund.[183]

The findings in this chapter are based on experimental and preliminary data and represent a first step in analysing the five key sectors. As part of a broader research agenda around these sectors, the department has many related projects with the purpose to explore data, identify associated data gaps and to provide insight into the intrinsic features and issues that these sectors face. These projects will inform stakeholders and provide input into future policy direction as well as programme evaluation.

An analysis of five key sectors that have been identified as having distinct strengths

This chapter provides a preliminary analysis of the five key sectors listed in the introduction. It provides an overview of the contribution and key features of these sectors, as well as an analysis of their characteristics and performance. It also describes the challenges researchers and policymakers face in defining these sectors (given the diversity of the sectors in terms of their economic activity) as well as the associated limitations for analysis (see Appendix D).

The analysis of the five key sectors draws on a variety of information sources, including customised ABS data. For the purpose of this analysis, the sectors have been defined based on the framework of ANZSIC (see Appendix A and Appendix E). The ABS is the primary and official source of data in Australia and ANZSIC provides a means for a standardised analysis of data at the industry level.

The ANZSIC-based definitions allowed the ABS to produce key financial information on these sectors, extracted from the Business Activity Statements (BAS) of firms. Once defined according to ANZSIC, the department also derived measures for GVA, employment and labour productivity to track sector performance. This was done via a proportional approach as explained in Appendix D. While the current definitions and methodologies used in this chapter are not without limitations, the chosen framework provided a solid basis for the analysis of these sectors across a wide spectrum of indicators as well as over time.

An overview of the composition, profile and dynamics of the five sectors

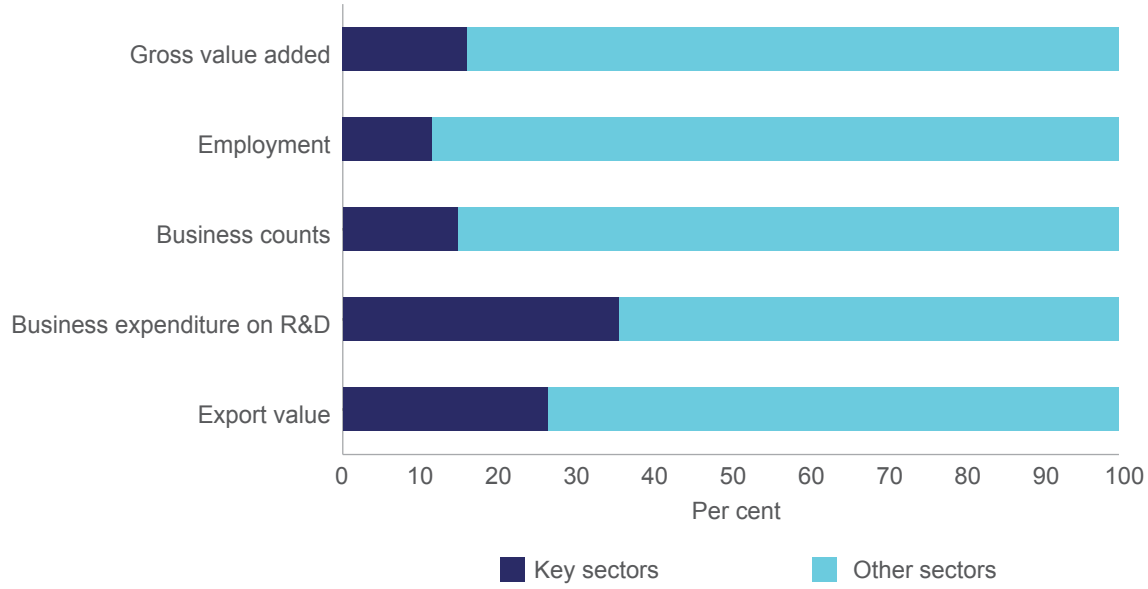
The five sectors differ in scale, business size composition, and performance benchmarks that will be highlighted in this section. Their current contributions to economic activity are reported in Chart 3.1 below. These sectors have the potential to expand their share of the economy over time. It should

182 Table 1 of the Government's *Industry Innovation and Competitiveness Agenda* on page 9 for example lists some future growth sectors that have been identified by Deloitte, PwC, IBIS World, Outlook Economics and McKinsey.

183 For information about eligibility criteria, please consult the department's website: www.industry.gov.au.

be stressed that the data used in this chapter is experimental and the figures given are therefore preliminary estimates.

Chart 3.1: Share of the five key sectors by various characteristics, latest available data



Source: ABS cat. no. 5206.0, 6291.0.55.003, 8104.0 and 5368.0, and Department of Industry calculations.

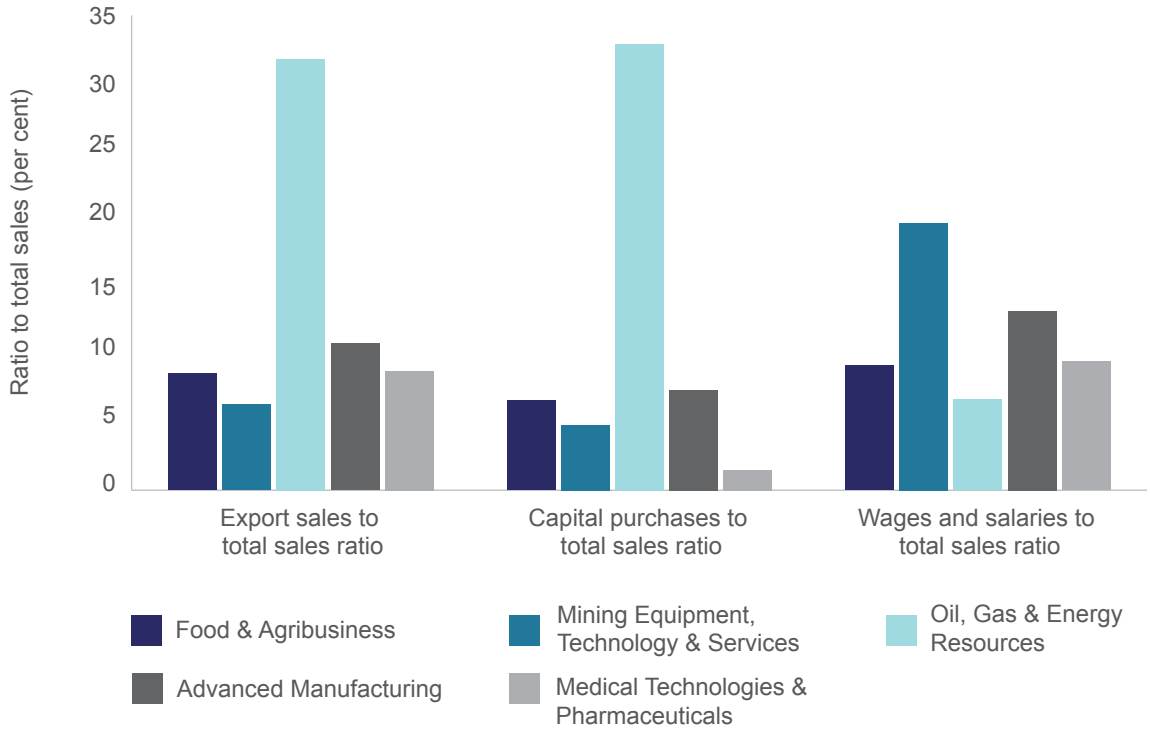
Notes: Value added (2013-14), Employment (2013-14), Business counts (June 2013), Business expenditure on R&D (2011-12), Export value (2012-13).

As at June 2013, based on the ANZSIC Classes presented in Appendix E, the five key sectors comprised around 309,000 actively trading businesses (around 14.9 per cent of the total business population in Australia). The majority of these firms (around 60 per cent) are non-employing firms. The key sectors' combined share of overall industry GVA and employment in 2013-14 was around 16.0 per cent and 11.6 per cent, respectively. The share of GVA attributed to the five sectors increased by 1 percentage point between 2008-09 and 2013-14, while the share of total employment remained unchanged. In 2011-12 (the latest available data), the five sectors accounted for around 35.7 per cent of business expenditure on R&D[184], while their share of the value in exports was around 26.5 per cent.

Chart 3.2 illustrates some industry benchmarks based on preliminary financial data that have been extracted by the ABS from the Business Activity Statements (BAS) of firms. It shows that Oil, Gas & Energy Resources has relatively high export intensity (export sales to total sales ratio) of 32 per cent and is also relatively capital intensive, as reflected in the capital purchases to total sales ratio of 33 per cent. Mining Equipment, Technology & Services has a relatively high wages and salaries to total sales ratio of around 20 per cent, which may reflect its highly skilled workforce and recent growth due to the mining boom that necessitated high wages in order to draw workers from other sectors.

184 Data for some industry Classes in ABS cat. no. 8104.0 are not available for publication, but are included in totals where applicable. Where the five key sector definitions include all Classes within Groups, Group totals were used to overcome this problem. However, this could not be applied in all cases. The estimates for business expenditure on research and development for the five key sectors should therefore be regarded as an underestimate.

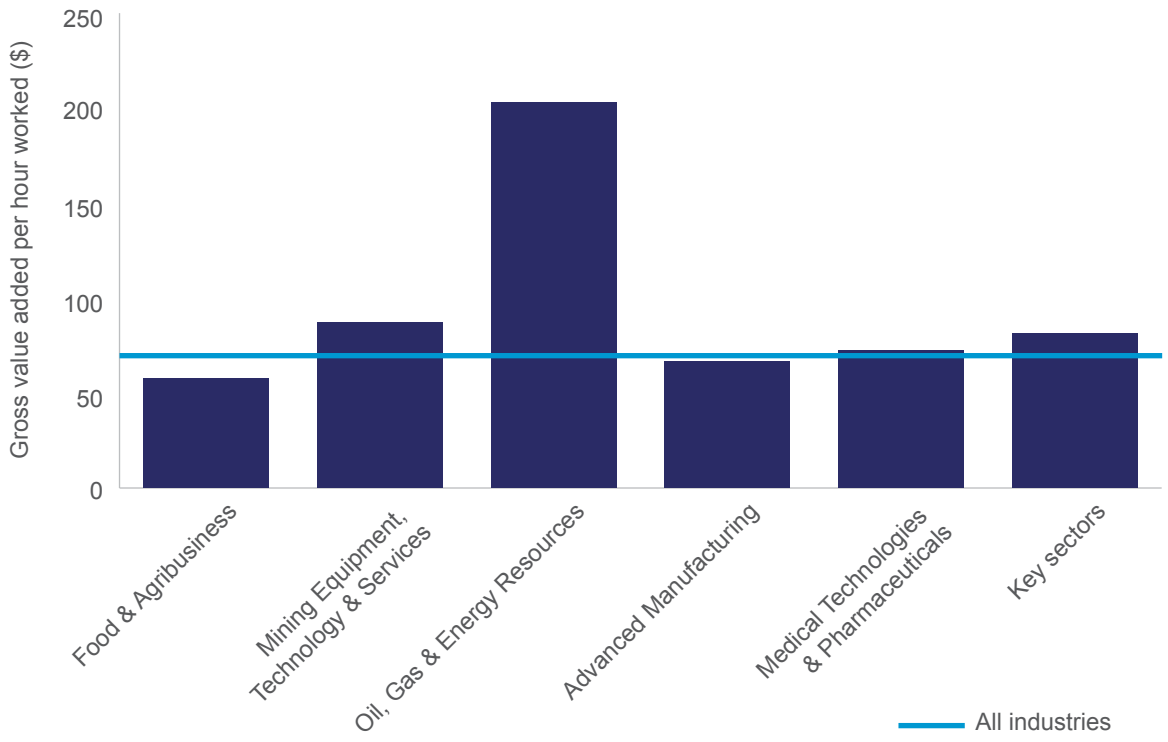
Chart 3.2: Key sector benchmarks, 2012-13



Source: ABS customised data and Department of Industry calculations.

Preliminary estimates (see Chart 3.3) show that, in aggregate, labour productivity (or the amount of goods and services produced by one hour of labour as measured by GVA per hour worked) for the five key sectors ($81.30 per hour) in 2013-14 was much higher than that of overall industry ($69.20 per hour). Labour productivity was highest for Oil, Gas & Energy Resources ($203.20 per hour), Mining Equipment, Technology & Services ($87.30 per hour) and Medical Technologies & Pharmaceuticals ($72.20 per hour). Over the period 2008-09 to 2013-14, Food & Agribusiness and Advanced Manufacturing recorded the strongest average annual growth in labour productivity of 2.9 per cent and 2.2 per cent, respectively.

Chart 3.3: Labour productivity, 2013-14



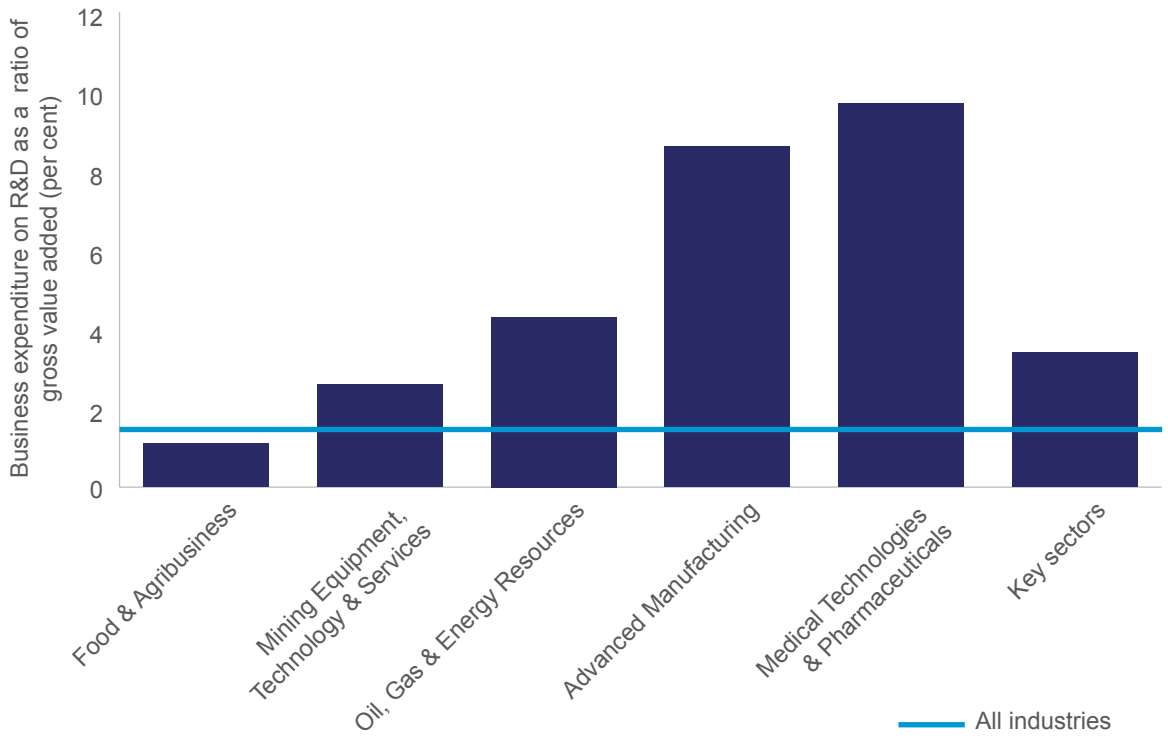
Source: ABS cat. no. 6291.0.55.003, 5204.0, 5206.0 and Department of Industry calculations.

R&D intensity (the ratio of expenditures by a firm on R&D to the amount of goods and services produced as proxied by business expenditure on R&D as a ratio of GVA) for each of the key sectors (except for Food & Agribusiness) in 2011-12 was well-above the all-industry average (see Chart 3.4). Medical Technologies & Pharmaceuticals recorded the highest R&D intensity (9.7 per cent), followed by Advanced Manufacturing (8.6 per cent) and Oil, Gas & Energy Resources (4.3 per cent). Over the period 2006-07 to 2011-12, Mining Equipment, Technology & Services and Food & Agribusiness recorded the strongest average annual growth in business expenditure on R&D of 14.2 per cent and 9.2 per cent, respectively.

R&D can be performed by a sector for its own purposes or as a service to other sectors. For example, much of Mining Equipment, Technology & Services R&D is provided as a service for the broader Mining sector. In this context, the broader sectors' industry value add should be taken into account when making sense of R&D intensities.

The Food & Agribusiness is a sector of strong contrasts in terms of investment in innovation related activities. Agriculture has below-average R&D intensity, whereas Food product manufacturing has above-average R&D intensity. This might be explained by differences in the firm size distribution of firms.

Chart 3.4: R&D intensity, 2011-12



Source: ABS cat. no. 8104.0, 5204.0, 5206.0 and Department of Industry calculations.

The Food & Agribusiness sector has a high proportion of non-employing firms (that is, sole proprietorships and partnerships without employees), many of which are likely to be farms. This explains its large firm count (around 182,000, as at June 2013) of the total 309,000 firms in the five key sectors (57.9 per cent).

Mining Equipment, Technology & Services follows with around 104,000 firms (33.2 per cent of the combined total of the five sectors). Relatively fewer firms were operating in Advanced Manufacturing (around 19,000 or 6.1 per cent of the combined key sector firms), Medical Technologies & Pharmaceuticals (around 7,000 or 2.1 per cent) and Oil, Gas & Energy Resources (around 2,000 or 0.7 per cent). Small employing firms (with between 1 and 19 employees) account for the bulk of firms in the Advanced Manufacturing and Medical Technologies & Pharmaceuticals sectors.[185]

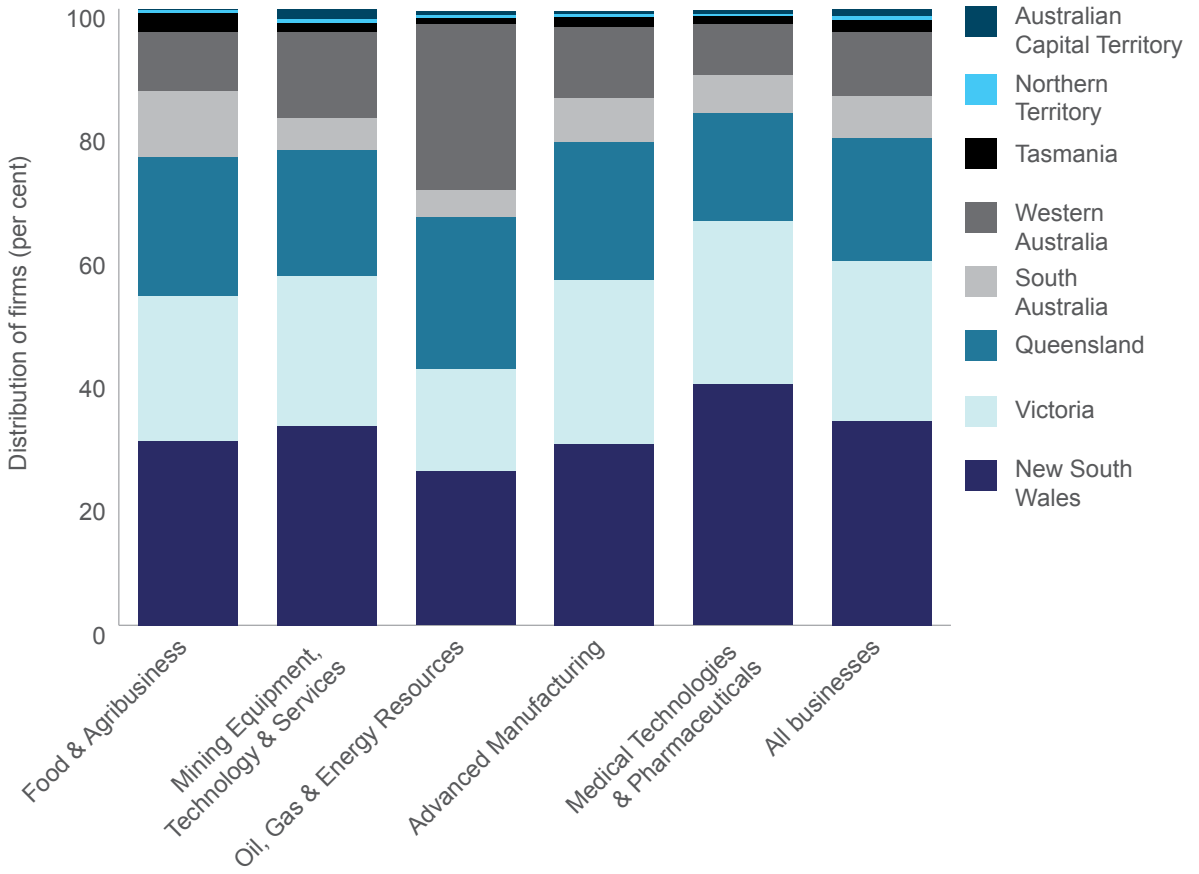
In line with the overall business population, medium and large firms represent only a relatively small proportion of the total firm count of the five key sectors. The share of large firms is slightly higher for Oil, Gas & Energy Resources, with 3.4 per cent of firms in this size class. This may reflect the fact that industries within this sector are comparatively capital intensive as illustrated in Chart 3.2.

Chart 3.5 demonstrates the location of firms associated with the five key sectors. While larger jurisdictional economies represent a larger share of the five key sector firm count, there are some

185 ABS cat. no. 8165.0 and Department of Industry calculations.

prominent exceptions to this pattern. Notably (and to be expected) a disproportionately large number of firms in Mining Equipment, Technology & Services are located in Western Australia.

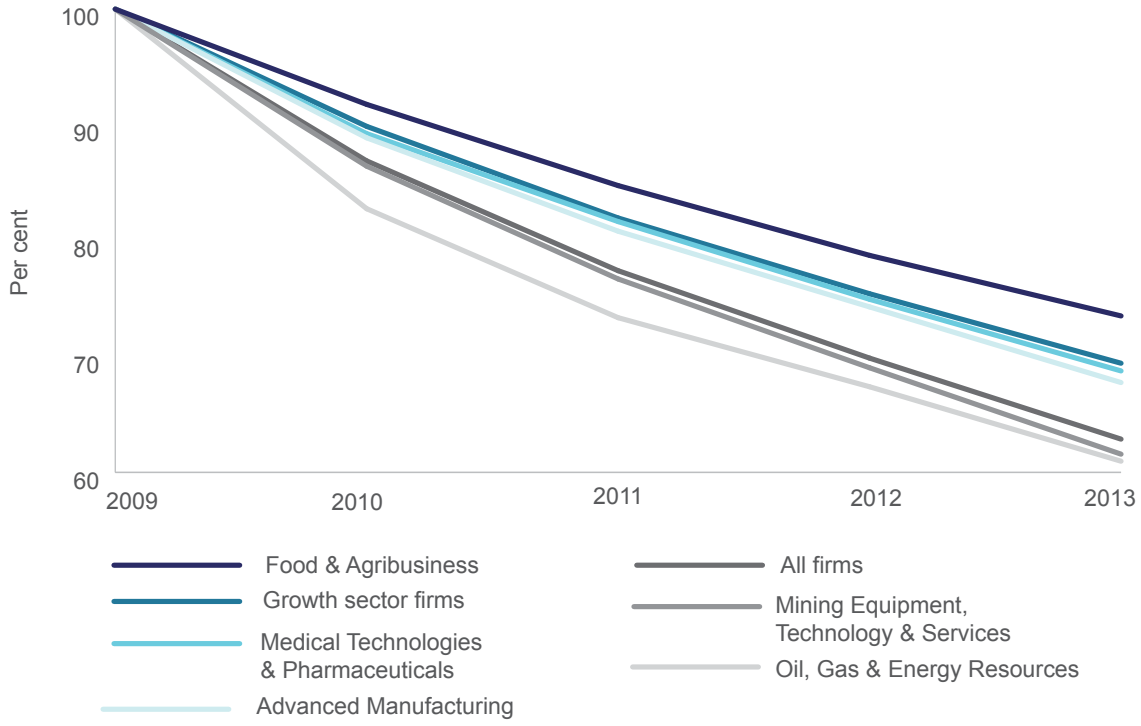
Chart 3.5: Proportion of key sector firms by jurisdiction, June 2013



Source: ABS cat. no. 8165.0 and Department of Industry calculations.

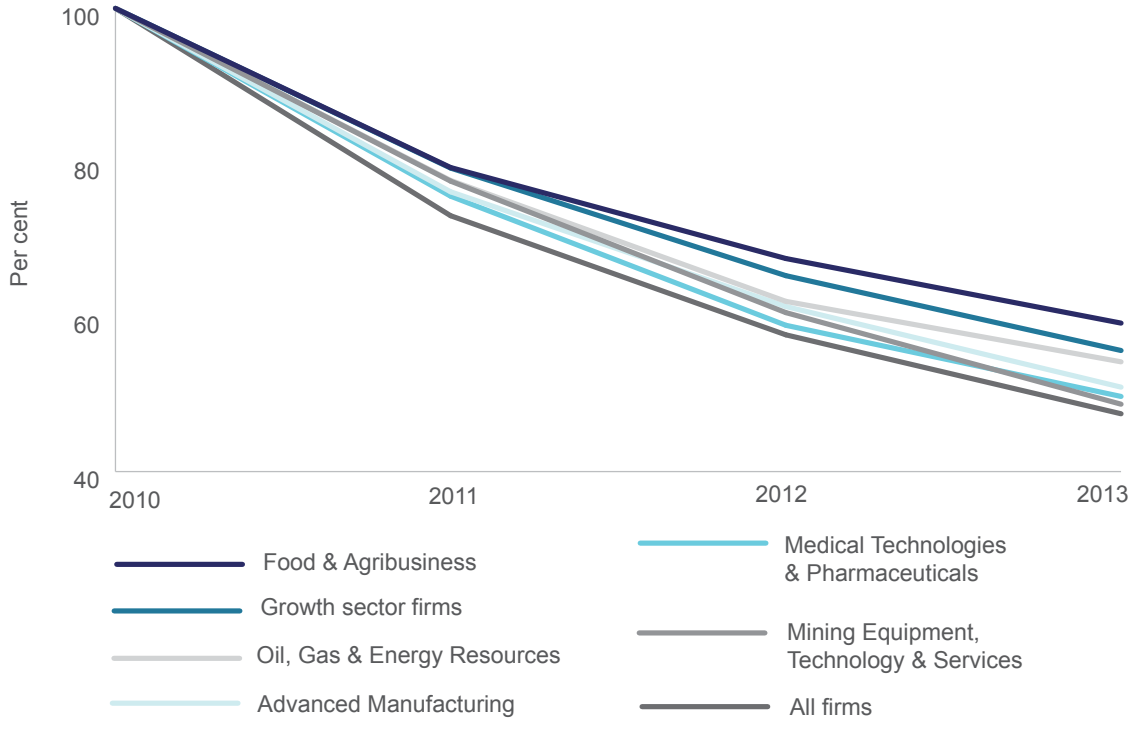
Rates of firm survival are higher among those operating in the five sectors compared to the all-industry average. For example, 69.4 per cent of firms in the five key sectors operating in June 2009 were still operating in June 2013, compared with the corresponding ratio of 62.9 per cent for total Australian firms operating in June 2009 (see Chart 3.6). Similarly, 55.7 per cent of five key sector firm entries (see Chart 3.7) during the 2009-10 financial year were still operating in June 2013, while only 47.5 per cent of corresponding entries across all Australian sectors were still operating in June 2013. This may suggest that firms entering key sector industries on average are more resilient and flexible in identifying market opportunities to capitalise on growth than those outside these sectors.

Chart 3.6: Survival rates of incumbent firms, June 2009



Source: ABS customised data.

Chart 3.7: Survival rates of firm entries, 2009-10



Source: ABS customised data.

The remainder of this chapter provides analysis of each sector individually.

Food & Agribusiness

The Food & Agribusiness sector includes food-related agricultural production, food processing and the major inputs into these sectors (such as veterinary services and the production of pesticides and food packaging), but not the wholesale or retail sale of these goods. It can be divided into two subsectors: i) Food products including all food processing and beverage manufacturing, as well as key inputs into this sector; and ii) Agribusiness including all agriculture that relates directly to food production as well as key inputs into this sector. Employment in the sector is spread across many occupations from highly-skilled engineers and managers to lower-skilled labourers.

In revenue terms, farm inputs & associated support represents the largest segment of the sector. This is followed by the meat, livestock & fish segment, which comprises several major operators including Australian Agricultural Company, Lake Woods and Heytesbury, and the grains and cereals segment, which includes GrainCorp and Olam Investments. Other major segments include dairy, wine, poultry, and fruit and vegetables.[186]

Snapshot of performance benchmarks and sector dynamics

The Food & Agribusiness sector had around 182,000 actively trading businesses as at June 2013.[187] This is the highest among the five sectors and can be ascribed to the relatively high proportion of non-employing firms. According to preliminary estimates (see Table 3.1), the sector employed around 527,000 persons and generated around $58.3 billion in output in 2013–14. Export revenue of the sector was around $13.2 billion in 2012–13.

Over the period 2008-09 to 2013–14, employment in the Food & Agribusiness sector contracted by an average annual rate of 1.4 per cent, while GVA growth was subdued at 0.9 per cent. Labour productivity (GVA per hour worked) increased by 2.9 per cent per year over this period, well above the all-industry average of 1.9 per cent.

Declining employment is consistent with the long-run trend of falling employment in the Agriculture, Forestry & Fishing industry. This is the result of increasing capital intensity as family-owned businesses consolidate and/or corporatize, as well as the increasing use of contractors who may be classified as working in other industries.[188]

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186 IBISWorld Industry Company and Business Research Reports.

187 Business counts for each key sector are based on ABS cat. no. 8165.0 and Department of Industry calculations. See Appendix D for more detail on sector definitions and methodology.

188 AWPA (2013), *Food and Beverage Workforce Study*.

Table 3.1: Food & Agribusiness performance indicators

	2013-14	Average growth (5 years)	Deviation from national average growth (ppts)
Gross Value Added ($ billion)	58.3	0.9%	–1.8
Employment (‘000)	526.6	–1.4%	–2.7
Labour Productivity ($/hr worked)	57.5	2.9%	1.0

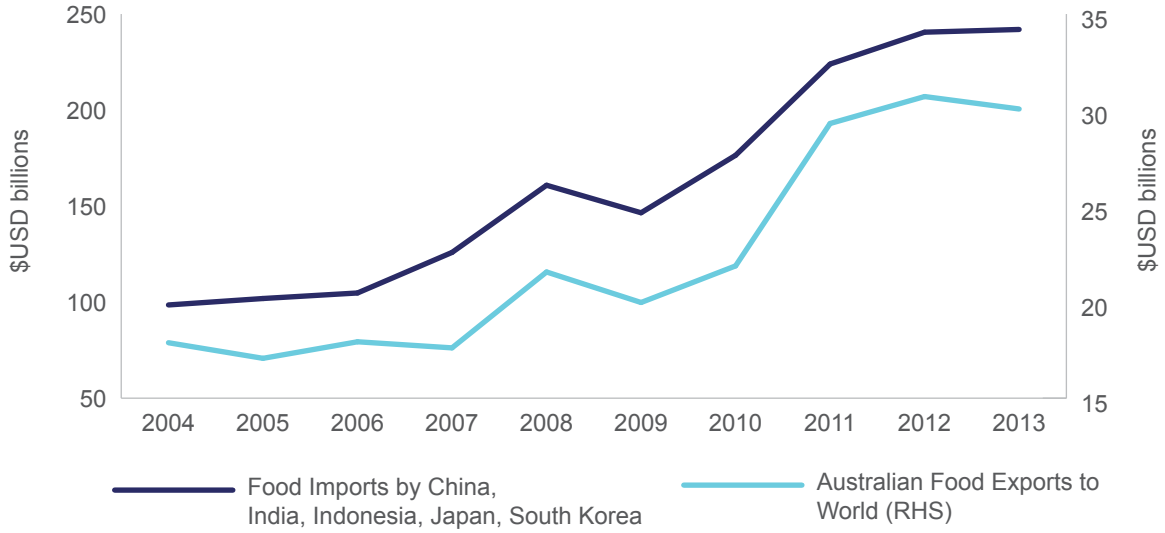
Source: ABS cat. no. 5204.0, 5206.0, 6202.0, 6291.0 (customised request) and Department of Industry calculations.

By far the largest numbers of firms are classed as non-employing (67 per cent of firms in this sector as at June 2013). Owner-operated businesses, particularly at the farm level, represent a large but declining proportion of the sector.

Measured in value-added terms, meat processing, tea, coffee and other food manufacturing, wine manufacturing, poultry processing and fruit and vegetable processing are the largest processing sub-sectors. Meat processing is also the largest exporting sub-sector by a significant margin.[189]

World Trade Organization data illustrate that over the past decade, total food imports for China, India, Indonesia, Japan and South Korea (from all markets including Australia) grew from $100 billion to more than $240 billion at an average annual growth rate of more than 10 per cent (see Chart 3.8). Over the same 10-year period, Australia’s food[190] exports grew from just over $20 billion in 2004 to more than $30 billion in 2013 at an average annual rate of 6 per cent. This suggests that Australia is losing market share in these rapidly growing markets. Some explanations for this might be market access or that Australia has not been a major exporter of products where much of the growth in Asian demand has been.

Chart 3.8: Australia’s food exports compared to major Asian economies’ food imports, 2004 to 2013



Source: WTO Time Series Trade Data (www.stat.wto.org)

189 Food Processing Industry Strategy Group (2012), *Final Report for Non-Government Members*. DIIRTE.

190 Includes food and live animals, beverages and tobacco, animal and vegetable oils, fats and waxes, oilseeds and oleaginous fruit (Standard International Trade Classification sections 0, 1, 4 and division 22).

Box 3.1: Norco supplies fresh Australian milk to China

In May 2014, Norco (a NSW-based dairy processor cooperative), Dairy Connect and Peloris Global Sourcing Pty Ltd (PSG) jointly announced the first successful air freight shipment of fresh milk to China. Under the agreement, each year Norco will supply millions of litres of fresh milk to the Chinese market, where it will sell for $7-$9 a litre.

The successful shipment is a culmination of more than a year of trials and negotiations with Chinese officials, and resulted in an unprecedented quarantine clearance agreement with Chinese customs to bring the delivery time well within the shelf life of fresh Australian pasteurised milk. The cold chain pipeline solution incorporates stringent quality assurance controls that ensure the fresh milk meets or exceeds China's food health and safety standards. The product is maintained at its optimal temperature at all times during transit, and incorporates an innovative product security system that identifies and tracks the location of individual units.

Prior to the breakthrough, exports of fresh milk to China were hampered by lengthy testing and quarantine processes before shipment from Australia, and again upon arrival in China. Export lead times for fresh milk subsequently ranged from 14 to 21 days, which was beyond the normal shelf life for fresh milk.

Outlook and key challenges for the Food & Agribusiness sector

The opportunities for Australia are great, but remain unrealised. While Australia's total processed food exports to most Asian countries continue to grow steadily, Australia is losing market share in nearly all Asian countries. To maximise the benefits of regional growth, Australian producers must not just maintain market share in more established food products, but grow by moving to higher valueadd production through food processing, the development of niche products, utilising scale and by identifying and accessing new and emerging markets, including supply chains.

Australia has a reputation for a safe, reliable, clean food supply and high levels of food security, with quality standards and safety regulations imposed along the food supply chain.[191] This reputation, coupled with Australia's natural advantages in agricultural production; Australia has the most arable land per capita of any country[192], and close geographical proximity to Asia, mean it is able to manufacture and deliver premium food products to Asian markets.

Asia's rapid growth in incomes and population, along with urban migration, is driving increased demand for food in terms of quantity, quality and product integrity. Asia's increasingly affluent consumers will demand more premium food products, animal proteins and dairy products, as well as a greater variety of fruit and vegetables and foods processed for convenience, functionality and other value add. Global demand for food products is expected to rise 35 per cent by 2025 from 2007 levels, with most of this demand coming from Australia's major export markets in the Asia region.[193]

The Department of Employment projects employment to remain stable in the sector over the five years to November 2018, growing by just 0.3 per cent per annum or by 8,200 workers over the period.[194]

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191 Food Processing Industry Strategy Group (2012), *Final Report for Non-Government Members*, DIIRTE.

192 Lydon, J, Dyer, D, Bradley, C (2014), *Compete to prosper: Improving Australia's global competitiveness*, McKinsey Australia.

193 Australian Government (2012), *Australia in the Asian Century White Paper*.

194 Department of Employment (2014), *Employment Projections*, www.lmip.gov.au/default.aspx?LMIP/EmploymentProjections accessed [10 October, 2014].

Within the sector, this modest increase is primarily driven by Meat and Meat Product Manufacturing and Bakery Product Manufacturing which together are projected to grow by around 8,900 workers. On the other hand, Dairy Cattle Farming and Fruit and Tree Nut Growing are expected to experience the greatest falls in employment, with around 6,600 workers projected to leave these sectors without being replaced over the five-year period. At present, the highest employing occupation in the sector is Livestock Farmers, at around 67,000 workers. Other leading occupations include Crop Farmers, Food and Drink Factory Workers, Mixed Crop and Livestock Farmers, Packers and Livestock Farm Workers. In their latest round of skill shortage research, the Department of Employment found recruitment difficulties for Livestock Farmers, Crop Farmers and Mixed Crop and Livestock Farmers. At the same time Bakers and Pastrycooks were found to be in shortage.[195] Skills shortages in this sector could be a major challenge in the future as the number of agricultural students has nearly halved over the past decade, whilst farmers are the oldest workers in the economy, with the average age of Australian farmers (52) being 12 years above the national occupation average.[196]

Mining Equipment, Technology & Services

Mining Equipment, Technology & Services firms are those that provide specialised support and solutions to the mining and minerals processing industry. These businesses are highly diverse, both in size and activities, but are linked by a common market in supplying mining and minerals processing companies.

Given this diversity and the focus on the actual end users in defining Mining Equipment, Technology & Services, rather than on business activity or output, the task of drawing meaningful boundaries around the sector is fraught with complexity.

This section rests predominantly on two sources of information: (1) survey results published by Austmine, the peak industry association for Mining Equipment, Technology & Services firms, and (2) Department of Industry estimates derived primarily by means of the methodology explained in Appendix D.[197] While these two sources are not compatible, each provides a different perspective on Mining Equipment, Technology & Services and related industries. It is hoped that the use of multiple sources of information and different perspectives will lead to a more detailed understanding of the sector. The quantitative estimates in this section are supplemented by IBISWorld market research and other relevant qualitative information.

Box 3.2 below presents some of the key findings from the Austmine survey to provide a general indication of the activities and characteristics of Mining Equipment, Technology & Services.

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195 Department of Employment (2014), *Skills shortages*, https://employment.gov.au/skill-shortages, accessed [10 October, 2014].

196 Deloitte Access Economics (2014), *Positioning for Prosperity? Catching the Next Wave*.

197 Department of Industry estimates, as explained earlier, are based on ABS cat. no. 6291.0.55.003, 8155.0, Census of Population and Housing 2011; & unpublished ABS data.

Box 3.2: Austmine Survey 2013

In July 2013, Austmine published a report entitled *METS – Australia's New Driver for Growth*, based on its in-depth survey of some 860 firms. Austmine estimates that 1,200 – 1,500 firms in Australia could be described as Mining Equipment, Technology & Services.[198]

In 2012-13, the firms identified in the survey generated some $90 billion in gross revenue and employed around 386,000 persons. The survey found that the sector is dominated by small and medium sized enterprises (SMEs), with 60 per cent of Mining Equipment, Technology & Services firms turning over less than $30 million. Some 84 per cent of these businesses are Australian owned with offices not concentrated in one capital city, but spread across Australia with metropolitan, regional and remote locations benefiting from the sector's revenue, jobs and exports. For the remaining 16 per cent of foreign owned entities, around one third are owned by a United States parent, and a further 15 per cent by a United Kingdom parent entity.

In addition, many firms appear to be globally focused. Some 55 per cent reported being involved in exporting, generating around $15 billion of revenue. Their key export destinations include New Zealand, Indonesia and Papua New Guinea. Of the exporting companies, 41 per cent had offices or operations offshore, one-third of them in the United States. Other commonly cited locations were China, Canada and Chile.

The survey estimates that in 2012-13, businesses in Mining Equipment, Technology & Services collectively spent in excess of $1.6 billion on R&D. More than half of these firms reported growth in employment and revenue in the 12 months prior to the survey, citing expansion in their customer base, opening up of new markets and increased marketing activities as the primary drivers of business growth.

Within Mining Equipment, Technology & Services, businesses work across all phases of the mining lifecycle, but most of their business comes from mining operations (78 per cent), followed by design & construction (59 per cent). The emphasis on operations may become an important source of competitive advantage as the domestic focus shifts away from design and construction and more towards operating efficiency and productivity gains.

The full Austmine survey report is available here: www.austmine.com.au/Industry-Insights.

As noted above, Mining Equipment, Technology & Services is identified by its customer base, meaning that Mining Equipment, Technology & Services firms do not neatly fit into the ABS industry classification system where business entities are assigned to respective industries based on their predominant activities.[199] The 1,200 or so Mining Equipment, Technology & Services firms identified in the Austmine survey straddle a long list of industry classes for which official statistics are available.

This chapter looked at nine industry classes that would reasonably be expected to capture part of Mining Equipment, Technology & Services related industries.[200] Inevitably, however, this method will also capture many entities that might only have tenuous links to Mining, and omit others which could perhaps be included. The estimates presented below do not attempt to adjust for these discrepancies. Bearing in mind the limitations and the exploratory nature of this work, the estimates presented below

198 Austmine (2013), *Austmine Industry Insights*, www.austmine.com.au/Industry-Insights accessed [18 September 2014].

199 ABS cat. no. 1292.0. See Also Appendix D.

200 The nine selected Mining Equipment, Technology & Services related industries include Mineral Exploration; Other Mining Support Services; Lifting and material handling manufacturing; Mining and Construction Machinery Manufacturing; Other heavy and civil engineering construction; Surveying and mapping services; Engineering design and engineering consulting services; Scientific testing and analysis services; and Management advice and related consulting services.

should be interpreted with caution and treated as a first order approximation of some of the key features of the selected Mining Equipment, Technology & Services related industries.

Snapshot of performance benchmarks and sector dynamics

The Mining Equipment, Technology & Services sector accounted for around 104,000 actively trading businesses as at June 2013. According to preliminary estimates, the sector employed around 386,000 persons and generated $65.4 billion in output in 2013–14. Export revenue of the sector was around $11.4 billion in 2012–13.

Over the period 2008-09 to 2013–14, both GVA (6.3 per cent) and employment (4.8 per cent) increased strongly in the sector (see Table 3.2), which benefited from strong investment in the overall Mining sector. Labour productivity grew at an average annual rate of 1.5 per cent over the period 2008-09 to 2013-14, reflecting solid growth in the more recent years.

Table 3.2: Mining Equipment, Technology & Services related industries performance indicators

	2013-14	Average growth (5 years)	Deviation from national average growth (ppts)
Gross Value Added ($ billion)	65.4	6.3%	3.6
Employment (‘000)	385.6	4.8%	3.5
Labour Productivity ($/hr worked)	87.3	1.5%	–0.4

Source: ABS cat. no. 5204.0, 5206.0, 6202.0, 6291.0 (customised request) and Department of Industry calculations.

The Mining Equipment, Technology & Services market can be viewed as consisting of a range of distinct segments but it would not be practical to describe all of them here. The following discussion considers two relevant segments: (i) heavy industry and non-building construction, and (ii) engineering consulting.[201]

Leading players in the heavy industry and non-building construction segment are Leighton Holdings Limited (12.3 per cent market share) and Downer EDI (7.5 per cent estimated market share). Other major players include Lend Lease Group (3.9 per cent estimated market share), UGL Limited (3.7 per cent estimated market share) and Aveng Australia Holdings (3.6 per cent estimated market share).[202]

In the engineering consulting segment of the market, the two leading players are WorleyParsons Limited (5.3 per cent estimated market share) and Bechtel Australia Proprietary Limited (4.0 per cent estimated market share). Other major players include Sinclair Knight Merz Holdings Limited, Aurecon Group Pty Ltd, AECOM Australia Holdings Pty Ltd and GHD Group Pty Ltd. Examples of relevant recent projects include WorleyParsons’ $235 million contract for the Chevron Wheatstone downstream project in the Pilbara region, or Bechtel’s front end engineering design contract for the downstream components of Santos’ and Petronas’ $7.7 billion Gladstone LNG project.

201 Information on the two market segments is sourced from *IBISWorld*.

202 IBISWorld Australia, Accessed [18 September 2014].

Outlook and key challenges for Mining Equipment, Technology & Services

Domestically, Mining Equipment, Technology & Services market opportunities are likely to increasingly stem from a greater emphasis on operations, lifting productivity, cost competitiveness and consolidation in parts of the Mining sector. Significant opportunities also exist in the energy supply sector, particularly in the production and export of natural gas and LNG (see Box 3.4).[203] Internationally, Mining Equipment, Technology & Services and related industries are uniquely positioned to emerge as the legacy of Australia's world-leading Mining industry in terms of international competitiveness.[204] With increasing Asian demand for energy and minerals, there are future growth challenges for Australian Mining Equipment, Technology & Services to remain cost-competitive.

The Department of Employment projects an increase of around 0.2 per cent per annum, or by around 4,500 workers, in Mining Equipment, Technology & Services over the five years to November 2018.[205] Within Mining Equipment, Technology & Services, exploration and construction employment is projected to decline by around 2.2 per cent per annum or by 8,600 workers. On the other hand, employment in management and consulting services and engineering and technical services is projected to grow by around 2.5 per cent per annum or by 11,500 workers over the period. These projections reflect the move from construction to production phases already taking place within Mining Equipment, Technology & Services. The top employing occupations in Mining Equipment, Technology & Services include a number of professional occupations such as Accountants, Solicitors and Civil Engineering Professionals. In terms of trades and technicians, Metal Fitters and Machinists and Architectural, Building and Surveying Technicians make up the top employing occupations. Department of Employment research indicates that shortages currently exist for Architectural, Building and Surveying Technicians.[206]

From the perspective of individual businesses within the sector, three responses tended to dominate the future focus of Mining Equipment, Technology & Services firms: i) expanding into new markets and industries, ii) developing new technologies and products, and iii) international growth. This reflects recognition of the importance of diversification and adaptability, and the commitment by firms to invest in their staff, product offering and technologies to meet their customers' needs.

Collaboration, trust and partnership are essential ingredients to commercial success more generally in sophisticated high value-add industries. The Austmine survey found that 65 per cent of Mining Equipment, Technology & Services respondents said that their relationship with customers is a key source of competitive advantage. Many respondents report that their innovation is often supplier- and customer-focused, rather than internally driven — this is consistent with the literature.[207] The survey also suggests that by far the biggest challenge for firms in Mining Equipment, Technology & Services is finding and retaining skilled staff, a common theme identified in a number of studies across industry more generally. In that survey, Mining Equipment, Technology & Services companies indicated that there is a lack of engineering, technical and management skills, particularly in regional areas. Competition and competitiveness are also among the major challenges cited. The employment outlook

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203 See Chapter 3 section on Oil, Gas & Energy Resources.

204 Austmine (2013), *Australia's New Driver for Growth*.

205 Department of Employment (2014), *Employment Projections,* www.lmip.gov.au/default.aspx?LMIP/EmploymentProjections, accessed [10 October, 2014].

206 Department of Employment (2014), *Skills shortages*, https://employment.gov.au/skill-shortages, accessed [10 October, 2014].

207 See, for example, the Australian Innovation System Report series and OECD work on Innovation.

for Mining Equipment, Technology & Services related industries is favourable particularly for the above occupations and skills sets.

Over the past decade or so, growth of Australia's Mining Equipment, Technology & Services and related industries has clearly been linked to the various phases of the mining boom. However, Mining industry demand is highly cyclical, which means that most Mining Equipment, Technology & Services firms need to be well diversified in their business activities as well as their customer base, and have in place robust strategies to adapt to the changing demand conditions.

Diversification of activities and markets will be important for the sector's future prospects, as output from newly installed mine capacity ramps up and operating efficiency becomes the primary driver of profits of Australian mining operations. A spin off of the spectacular growth of the Mining sector was the development of a unique set of skills and capabilities for servicing the sector, resulting in numerous world leading firms that are in a position to compete internationally. Access to new international markets will be crucial to sustainable growth and development of Mining Equipment, Technology & Services. International success is likely to depend on the ability of Australian-based Mining Equipment, Technology & Services companies to leverage their unique technologies, expertise and experience, to deliver a high-value product and service offering in international markets. Domestic opportunities are likely to emanate from an emphasis on lifting mining productivity and cost competitiveness.

With the appropriate diversification, flexibility and risk management strategies, Australian Mining Equipment, Technology & Services firms are well placed to leverage their unique technologies and expertise to deliver a high-value product and service offering in international markets.

Oil, Gas & Energy Resources

Energy remains a key input into overall economic activity and is a crucial determinant of the competitiveness of many sectors. Australia's natural endowment of energy resources, coupled with increased energy demand from growing Asian economies, provide opportunities across the breadth of energy services—from the exploration and extraction of natural resources to the processing and export of energy products.

The majority of Oil, Gas & Energy Resources firms are involved in exploration and/or extraction activities. These firms are primarily located within Western Australia, New South Wales and Queensland, with these states hosting over 75 per cent of the firms involved in the sector.[208] This sector has the highest proportion of large firms (3.4 per cent) among the identified five key sectors, reflective of large capital costs and the presence of large economies of scale.

Snapshot of performance benchmarks and sector dynamics

Around 2,000 actively trading businesses operated in Oil, Gas & Energy Resources as at June 2013. According to preliminary estimates, the sector employed around 128,000 persons and generated $53.9 billion in output in 2013–14. Export revenue of the sector was around $43.0 billion in 2012–13.

208 ABS cat. no. 8165.0.

As illustrated in Table 3.3, over the period 2008-09 to 2013–14, both average annual employment growth (9.5 per cent) and GVA growth (7.3 per cent) was strong in the sector, consistent with the commencement of new projects to meet increased international demand for energy resources.

GVA per hour worked in Oil, Gas & Energy Resources is very high compared to the other key sectors. Labour productivity, however, contracted at an average annual rate of 1.9 per cent over the period 2008-09 to 2013–14. However, as pre-production investment ends and production begins, labour productivity of the sector is expected to rebound strongly.

Oil, Gas & Energy Resources has high export intensity as reflected by the export sales to total sales ratio of 31.8 per cent (the highest of the five key sectors). It also has relatively high capital intensity (as defined by the capital purchases to total sales ratio) of 32.9 per cent (also the highest of the five key sectors).

Table 3.3: Oil, Gas & Energy Resources performance indicators

	2013-14	Average growth (5 years)	Deviation from national average growth (ppts)
Gross Value Added ($ billion)	53.9	7.3%	4.6
Employment (‘000)	128.3	9.5%	8.2
Labour Productivity ($/hr worked)	203.2	–1.9%	–3.8

Source: ABS cat. no. 5204.0, 5206.0, 6202.0, 6291.0 (customised request) and Department of Industry calculations.

By definition, exports in Oil, Gas & Energy Resources are limited to products relating to extraction, manufacturing and processing activities, with extraction companies being the major drivers of exports. Strong export growth is expected on the back of increased capacity and international demand, particularly gas. Box 3.3 highlights some export opportunities in Liquefied Natural Gas (LNG).

Box 3.3: LNG Export Opportunities

LNG is natural gas cooled to about -160°C, at which temperature it becomes a liquid and fills 1/600 of its gaseous volume. The liquefaction process makes natural gas easier to store, and transport in large volumes over long distances. LNG tends to take the role of a "balancing" energy source that satisfies energy demand not met by other energy types.

Australia first exported LNG in 1989 with the completion of the North West Shelf venture in the Carnarvon Basin offshore Western Australia. With the addition of the Darwin and Pluto LNG projects in 2006 and 2012, respectively, Australia's LNG production capacity is now 24.3 million tonnes per annum (Mtpa). Over the last 25 years, Australia has become an established stable and reliable supplier of LNG to customers in the Asia Pacific region. These exports are underpinned by a large resource base of conventional gas reserves.

The coal seam gas (CSG) fields in the east were discovered and developed more recently, and now supply about one third of the eastern gas market. The opportunity to export LNG using CSG has resulted in this resource being significantly expanded through exploration and development (current proved and probable (2P) reserves are 44,000 PJ (1,165 bcm). In addition, Australia has a potentially huge shale gas resource. The exploration focus for unconventional gas at present is in the Cooper basin where shale gas looks most promising. Other prospective areas include the MacArthur and Georgina basins in the Northern Territory and the Canning Basin in Western Australia.

Australia's gas production is projected to grow significantly between now and 2018–19, at an average of around 16 per cent each year, as Australia's LNG sector begins production from its current phase of new investment. Increased gas demand in Asia over recent years has seen seven of the twelve LNG projects currently under construction globally located in Australia. These projects require investment of almost $200 billion in gas facilities, and consist of three world leading CSG to LNG projects in Queensland (Queensland Curtis LNG, Gladstone LNG and Australia Pacific LNG), three land-based conventional offshore gas projects (Gorgon LNG, Wheatstone LNG and Ichthys LNG), and the world's largest floating LNG project (Prelude Floating LNG). The seven projects will provide almost 62 mtpa of additional LNG capacity – an increase of more than 250 per cent – to reach a total capacity of 86.1 mtpa by 2017-18. As a result, Australia is set to become the largest LNG exporter in the world towards the end of this decade, overtaking Qatar and Malaysia.

The major destination for Australian LNG exports is the Asia Pacific region – predominantly Japan – and this is unlikely to change in the medium term. In 2012, Australia became the largest LNG exporter to Japan, supplying 15.9 million tonnes, which accounted for 18 per cent of total imports. Australia's share of LNG imports to Japan grew to just under 20 per cent in 2013. Japanese companies hold equity interests in seven of the ten LNG projects either in operation or under construction in Australia, and have supply agreements with nine projects.

In the Asia Pacific region LNG imports are expected to remain an important and growing source of gas, particularly to satisfy energy demand in Japan, China, South Korea, and India. Given that, the LNG import and gas supply policies adopted by these four countries will play an important role in the development of the LNG export sector in Australia and elsewhere over the next few decades.

There is scope for Australia's LNG exports to expand further through the expansion of existing fields, and discoveries of conventional gas in offshore basins as well as unconventional gas resources. Although Australia's tight and shale gas resources still require further appraisal work, they have the potential to contribute to Australia's LNG exports, particularly where resources are close to existing infrastructure.

Despite the fact that LNG demand in the Asia Pacific region is expected to remain strong in the medium-term, there are concerns about the Australian LNG sector's ability to undergo another wave of growth. A challenge facing the sector over the medium-term is the downward pressure on the region's prices at a time when the cost of projects is increasing. Over the medium term, as additional gas supply becomes

available to the region from Australian LNG and other exporters including from imported pipeline gas, LNG prices in the Asia Pacific market may soften. The downward pressure on prices is mostly due to factors such as greater supply-side competition from gas rich countries such as the United States, Canada, East Africa, Qatar, Papua New Guinea and Russia, more interconnected LNG markets and the adoption of more flexible contract arrangements.

While the Australian LNG sector acknowledges the threat from increased international competition, it regards the main challenge for new investment in LNG projects as spiralling project development costs, with related issues of regulatory 'red tape' and unsatisfactory productivity. Although increasing LNG project costs are a global phenomenon, Australia is regarded as a relatively high cost location for LNG projects due to their complexity, remote locations and exposure to some of the highest construction costs in the world. Recent escalations in project costs have resulted in cancellations, delays and major concept revisions.

In response to high LNG project costs, proponents and government are considering and implementing a variety of measures that include:

- engineering/technology solutions, such as Floating Liquefied Natural Gas (FLNG) facilities, which allows proponents to mitigate the risk of potential labour productivity issues and to avoid costly infrastructure such as pipelines, harbour facilities and roads;
- more efficient and effective environmental and workplace safety regulations; and
- improvements to productivity through the industrial relations framework, improvements to project planning, design, scheduling and procurement processes, and skills training initiatives and arrangements that facilitate the access to skilled foreign and domestic workers.

Notwithstanding the success of measures such as these, further investment in Australian LNG projects is also likely to depend on proponents acquiring and maintaining a social licence to operate. This requires that communities trust the approval, development and monitoring processes of government regulators as well as the actions of LNG development proponents.

The major players in petroleum and coal exploration and extraction include BHP Billiton Ltd, Rio Tinto Ltd and Woodside Petroleum Ltd. Exploration is more diverse, with a significant number of explorers looking to prove the existence of energy resources and then either look to others or seek joint ventures to develop them. It is worth noting that extraction companies are also often involved in some exploration activities.[209]

The market concentration for processing of energy and manufacturing of energy associated products is relatively high and this is reflective of the withdrawal of many of Australia's smaller processors and manufacturers. This has left major players like BP Australia Investments Pty Ltd, Viva Energy Australia Group Ltd, Caltex Australia Limited and ExxonMobil Australia Pty Ltd to control more than 70 per cent of the energy processing and associated manufacturing market.[210]

The major players in domestic gas supply include producers BHP Billiton, Santos, ExxonMobil, Origin Energy, Apache and Woodside[211], pipeline and distribution network operators APA Group, Jemena, Dampier Bunbury Pipeline and Envestra[212], and gas retailers AGL Energy Ltd, Energy Australia Holdings Limited and Origin Energy Limited[213].

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209 IBISWorld, Selected Australian Industry Reports, Accessed [September 2014]

210 IBISWorld, Selected Australian Industry Reports, Accessed [September 2014]

211 EnergyQuest, EnergyQuarterly August 2014, page 86.

212 Australian Energy Regulatory (2013), *State of the Energy Market 2013*, pp. 108, 110.

213 Australian Energy Regulatory (2013), *State of the Energy Market 2013*, p. 122.

Outlook and key challenges for the Oil, Gas & Energy Resources sector

Oil, Gas & Energy Resources is expected to be a major source of future output growth for the Australian economy, driven by developments in the Australian LNG sector (see Box 3.3). However, Oil, Gas & Energy Resources employment is projected to decline by around 0.6 per cent per annum based on Department of Employment estimates or by 3,800 workers over the five years to November 2018.[214] The Exploration workforce is projected to decline by around 3.2 per cent per year. The Department of Employment also projects falling employment in both Coal Mining and Pipeline and Other Transport of 1.7 per cent per year. Australian coal producers have been reducing the size of its workforce as part of cost-cutting exercises to remain profitable. Across the sector, only Gas Supply is projected to increase in size, growing by around 1 per cent per annum or by 1,000 persons over the period. The top employing occupation is Drillers, Miners and Shot Firers, with employment of around 22,500 persons. The other major employing occupations include trade occupations such as Metal Fitters and Machinists and Electricians.

Domestic and international climate policies are one of the key factors influencing demand for energy resources. These policies impact upon the incentives to develop and use different types of energy resources. Any international action to reduce carbon dioxide emissions is likely to affect the demand for energy produced by the sector.

The capital intensity and large capital exposure in the majority of the sub-industries in the sector makes them vulnerable to interest rate changes. These industries typically have high capital costs that require debt financing and this exposes them to refinancing risks capable of reducing profits. Additionally, Australian producers have gradually moved towards the higher end of international cost curves which presents a challenge to the competitiveness of the sector. There has been a renewed focus by the sector on improving productivity to remain competitive. The anticipated fall in the Australian dollar should also help regain some of this competitive ground.

Beyond these cross-cutting issues, each of the industry groupings presents unique outlooks. The demand for exploration services is closely aligned with international energy prices, as the rewards of energy extraction are more apparent when prices are high. Increased energy demand in emerging economies as they fuel their economic development will provide opportunities for the sector in the long term. In the short term, the sector will face some challenges, particularly in coal, where high levels of investment in recent years has contributed to lower prices and reduced profitability.

While increased demand from emerging markets will create opportunities for the processing and export of energy and energy-related products, Australian producers operate in highly competitive international markets. Australian refining and processing firms have to compete with technologically advanced countries with highly skilled workforces and Australian companies will need to adapt to technological change and generate economies of scale to succeed.

In the domestic gas market, demand is expected to decline in the short to medium term with a significant decline in the eastern gas market[215] and only incremental growth in Western Australia.[216]

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214 Department of Employment (2014), *Employment Projections*, www.lmip.gov.au/default.aspx?LMIP/EmploymentProjections, accessed [10 October, 2014].

215 Australian Energy Market Operator (2014), *Gas Statement of Opportunities*.

216 Independent Market Operator (2014), Gas Statement of Opportunities, p. 7.

This decline is due to a demand response to rising gas prices and the improved energy efficiency of buildings. In the eastern gas market, exposure to international markets through impending LNG exports, rising production costs and a tight market have seen substantial increases in contract wholesale gas prices in the last few years.[217]

In the industrial sector, which accounts for almost half of domestic gas use,[218] sectors where gas is a significant input are expected to reduce gas use, switch to cheaper fuels where practical and replace indigenous production with imports.

In electricity generation, which accounts for more than a third of domestic demand,[219] rising gas prices and the removal of carbon pricing are expected to see significant gas powered generation capacity displaced by cheaper coal generation for base load electricity generation.[220]

For the residential and commercial sectors, which account for approximately 15 per cent of gas demand, wholesale gas costs contribute around half of the retail price of gas, depending on the location. Rising costs may encourage switching to already cheaper electric heat pump/reverse cycle technology for space and water heating, with a resulting plateau in demand growth.[221]

There are significant opportunities within the sector to meet the rising energy demand from growing Asian economies providing the sector remains competitive. While the sector has and is projected to experience strong export growth as current projects under construction enter production, there is strong competition from oil and gas suppliers in other countries. The ability of Australian firms to make the most of these opportunities will depend on them being able to respond efficiently to market signals when making their investment and production decisions.

Advanced Manufacturing

Most advanced economies have experienced a decline in their traditional manufacturing industries in recent decades due to the rise of low-cost manufacturing in emerging economies. As discussed in Chapters 1 and 2, Australian manufacturers faced similar challenges.

In spite of these challenges, advanced economies still have the potential to compete in advanced manufacturing fields where production requires higher workforce skill levels. Some Australian businesses are already succeeding in niche pockets of advanced manufacturing, even in industries that are facing substantial challenges overall.

The definition of advanced manufacturing is broader than just the manufacture of high complexity, high specificity and high value goods. It also includes activities from the concept, R&D and design states all the way through to post sales services, with the aim of adding value to the production line and securing a place in the Global Value Chain.[222] Box 3.4 provides examples of advanced manufacturing companies in Australia.

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217 Department of Industry and BREE (2014), *Eastern Australian Domestic Gas Market Study*.

218 Energy Supply Association of Australia (2014), *Electricity Gas Australia*, p. 63.

219 BREE (2014), *Australian Energy Statistics*.

220 Australian Energy Market Operator (2014), *Gas Statement of Opportunities*.

221 Jemena Gas Networks (2014), *2015-20 Access Arrangement Information*, p. 38-39.

222 Committee for Economic Development of Australia (2014), *Advanced Manufacturing. Beyond the Production Line*.

Box 3.4: Advanced Manufacturing companies in Australia

Advanced manufacturing companies are defined by their ability to draw together the skills of a multi-disciplinary team, using technologies to capture customers' needs and transform them into products and related services. The market niches in which they may compete typically have low volumes, and require quick response, cost-and value competitiveness and after-sales support. Sustainable success requires commitment to understanding the nuances of the markets in which they operate and converting this into a globally competitive value proposition to customers.

Advanced manufacturing has many successful Australian and Australian-based companies that are globally competitive and well established in global value and supply chains. These companies generally:

- compete on value rather than price alone;
- have high-quality leadership, management and entrepreneurial skills;
- have high-performing workplaces;
- attract and retain a highly-skilled workforce;
- have excellent working relationships with their suppliers, customers and research agencies, and are able to source market-relevant ideas, techniques and technologies to improve their performance; and
- have access to the finance they need to sustain and develop their firms.

The firms' competitive advantage stems from using the knowledge embedded in these firms to create value.

Precise Manufacturing Engineering Group

Precise is an Adelaide-based supplier of moulds, dies, and automation solutions as well as offering precision machining used to make components for automotive, defence, medical and other applications. The company is strongly committed to innovate, improve and access new markets.

The company's activities over the past few years provide an example of what action can be taken to transition a company through the challenges of changing markets, including a changing global marketplace. Its diversification has reduced its exposure to any single market because of its expanded product range.

Precise comprises a group of companies that offers customers a full range of services from product design, development to manufacture and after-sales service of customised solutions. The company's continuous diversification underpins the sustainability of its operations in South Australia. It has entered the Malaysian market and expanded its product line to include quality packages of moulds and stamping tools at highly competitive prices and delivery times.

In response to the Asian Financial Crisis, Precise expanded to the United States car market. Now around 25 per cent of the Precise Group's sales are in the car industry and more than 90 per cent of those are exports to the United States.

In 2004, the Precise Group diversified further by expanding into defence markets but then took this further by finding applications for a rapid response clamp to repair damaged pipes in the defence sector in other areas, like oil and gas, resources and food.

Precise continues to adapt to changing market conditions by exploiting new market opportunities, changing its product range, business models and internal organisation.

Plantic Technologies Limited

Altona, Melbourne-based private company Plantic Technologies Limited manufactures a range of plastic products made from corn starch. This plastic is food-safe, biodegradable, and offers high quality food packaging.

Plantic bioplastic is used to make plastic for use in the food industry and they are able to supply in sheet form and premade trays. Plantic is at the forefront of innovation in the food industry with constant new release of products that have unmatched characteristics. This includes Ecoplastic R the only fully recyclable high barrier material currently available on the world market. Plantic is used by some of the largest retailers and manufacturers in the world.

Plantic's technology is based on research by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the University of Queensland and the Swinburne University of Technology. The company was created by the Australian Cooperative Research Centre for International Food Manufacture & Packaging Science to commercialise the technology. Although Plantic's head office and principal manufacturing and R&D facility are located in Altona, it also has an application, development and sales centre in Germany with sales offices in the United States and the United Kingdom. The company employs about 75 people worldwide.

Seeley International

Seeley International is Australia's largest air conditioning manufacturer and a global leader in developing ingenious, energy-efficient cooling and heating products.

Mr Frank Seeley AM founded Seeley International Pty Ltd in 1972 in Adelaide where the company's head office has remained. In early 2010, Seeley International launched Climate Wizard, a world first in innovative technology that delivers superior cooling at a fraction of the cost of traditional methods.

The company has more than 350 staff around the world and exports to more than 120 countries. In 2013, the company generated total revenue of $112 million.

Advanced manufacturing cannot be isolated to a particular industry or group of industries. All manufacturing industries are capable of manufacturing advanced products for specific markets. This means that using official data can be problematic because the data is reported on the basis of the type of product that is manufactured and only a relatively small subset of these products will involve advanced manufacturing.

Given these conceptual difficulties, a proxy for advanced manufacturing has been developed by identifying the main manufacturing classes that exhibit characteristics consistent with advanced manufacturing, such as the relative investment in developing new knowledge and processes as revealed through measures R&D intensity, and the relative use of highly skilled (professional or university educated) workers. However, this almost certainly results in a definition which is broader than most would consider as 'advanced manufacturing' in the way the current debate is framed. Inevitably, trying to capture firms that exhibit characteristics consistent with this definition of advanced manufacturing, leads to capturing some firms that may not be. For example, this methodology includes automotive manufacturing, which has been in decline in Australia for a long period and is generally not what comes to mind in discussions of areas where Australia holds a competitive advantage. However, there are many businesses within automotive manufacturing, such as Precise, mentioned in Box 3.2, that have found competitive niches, so leaving out automotive manufacturing would result in a number of diverse and internationally competitive advanced manufacturing firms being excluded.

The analysis of R&D investment revealed that product groups within just three manufacturing statistical subdivisions (Chemicals; Transport; and Machinery & Other Equipment Manufacturing) were responsible for the majority of R&D.[223] These three manufacturing industries were also found to be represented in the top half of manufacturing industries when proportion of staff working in each subdivision with a university education, a post-bachelor degree, or who consider themselves "professionals" were taken into consideration. While this result was not as striking as the R&D intensity measure, the relatively high proportion of skilled workers across these subdivisions supports the association of these subdivisions with advanced manufacturing. Given these results, this discussion examines the Advanced Manufacturing sector in the following industries: Chemical Product Manufacturing, Transport Equipment Manufacturing and Machinery & Equipment Manufacturing.

Snapshot of performance benchmarks and sector dynamics

The Advanced Manufacturing sector comprised around 19,000 actively trading businesses as at June 2013. According to preliminary estimates, the sector employed around 250,000 persons and generated $30.6 billion in output in 2013–14. Export revenue of the sector was around $11.2 billion in 2012–13.

As illustrated in Table 3.4, negative average annual growth in employment (–0.4 per cent per annum) was apparent in this sector over the period 2008-09 to 2013–14. The fall in employment occurred at the backdrop of the challenges that the Manufacturing sector as a whole faced over this period. Advanced Manufacturing outperformed the rest of the Manufacturing sector in general in recent years in terms of employment, GVA and labour productivity growth.

Labour productivity in the sector grew by an average annual growth rate of 2.2 per cent over the period 2008–09 to 2013–14, compared to 1.9 per cent for the all-industry average.

Table 3.4 Advanced Manufacturing performance indicators

	2013-14	Average growth (5 years)	Deviation from national average growth (ppts)	Deviation from rest of Manufacturing growth (ppts)
Gross Value Added ($ billion)	30.6	1.1%	–1.6	2.5
Employment ('000)	250.2	–0.4%	–1.7	1.6
Labour Productivity ($/hr worked)	66.5	2.2%	0.3	0.2

Source: ABS cat. no. 5204.0, 5206.0, 6202.0, 6291.0 (customised request) and Department of Industry calculations

Chemical Product Manufacturing

This sector is generally defined by mature markets with high degrees of foreign ownership and import substitution in commodity goods. However, several parts of this subsector stand out in terms of their

223 The inputoutput tables provide data on own-use research and development activities, which refers to R&D activities undertaken by an industry for their own use, and research and development services, which refers to R&D activities undertaken by a service provider for input into production of another product. These were aggregated by product group to provide an overall measure.

performance. Manufacturing in this industry involves rapidly changing technology that uses digital technologies to improve the yield from each kilogram of explosive. The industry is also applying resources to the tactical use of explosive products to meet new mine and developer requirements, corresponding to the downturn in mineral exploration and the maturity of the resources sector.

Chemical product manufacturing also includes pharmaceutical manufacturing, which is discussed in the medical technologies section.

Transport Equipment Manufacturing

Many parts of this subsector are affected by the decline of Australian automotive manufacturing. However, within these industries, there are several Australian companies that resist mass production, and focusing on low volumes with success.

Australian R&D institutions and companies undertake world-class research and innovation in aluminium, magnesium, and titanium alloys.[224] This expertise allows the production of lightweight and strong metal housings for various forms of transport, particularly the use of aluminium alloys, which are cheaper and more stable than the other types.

In the automotive industry, Mett uses advanced aluminium die casting processes and supplies parts to General Motors in the United States. ARB provides niche parts to 4WD markets and ROH Automotive is a worldwide wheel exporter in alloy and steel wheels.[225] In trailers, Australian companies Jayco and Fleetwood Corporation produce lightweight mobile accommodation utilising aluminium alloys.[226]

Australian shipbuilders also use aluminium alloys to produce lightweight commercial boats that can travel faster than those made from traditional materials.[227] In particular, Australia makes and exports lightweight high-speed commercial catamarans globally. Most of the shipbuilding industry in Australia supplies the Royal Australian Navy.

Australian expertise is also reflected in aircraft manufacturing. Boeing's second largest R&D centre (after the US) is in Australia, and it has established an Advanced Manufacturing Research Centre (AusAMRC) in collaboration with Swinburne University in Melbourne.[228] Composite materials, structures and robotics technologies developed in Australia are being used in Boeing's new 787 Dreamliner, one of the world's most advanced commercial aircraft. In its Port Melbourne plant, Boeing manufactures composite moveable trailing edge wing surfaces in a long-term contract valued at about $4 billion over 20 years.[229]

Machinery & Equipment Manufacturing

Australian manufacturers of machinery and equipment have faced strong international competition from low cost manufacturers, particularly in electronics and whitegoods. Some subsectors have also

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224 Bremer and Co (2013), *Australian Capabilities in Materials Science and Technology: Intelligence Report*. Prepared for Austrade.

225 IBIS World (2014), *C2319 Motor Vehicle Parts and Accessories Manufacturing in Australia*.

226 IBIS World (2014), *C2312 Motor Vehicle Body and Trailer Manufacturing in Australia*.

227 IBIS World (2014), *C2391 Shipbuilding and Repair Services in Australia*.

228 www.swinburne.edu.au/engineering/ausamrc/

229 Austrade (2013), *Investor Update: Boeing opens largest R&D lab outside US in Australia*. Available at www.austrade.gov.au/Invest/Investor-Updates/2013/0508-Boeing-opens-largest-R-D-lab-outside-US-in-Australia.

been changed by disruptive technologies, particularly digital technologies and within these subsectors Australian firms are carving out niches with innovative products.

The photographic film industry has shrunk dramatically in response to digital technologies. Nevertheless, Australian company Redflex has established itself as the world leader in digital speed camera and traffic management systems.[230]

While most measurement and scientific equipment in Australia is imported, there are Australian companies exploiting niche markets. An example is Australian Scientific Instruments that manufactures specialist machines to study rock deformation and spectrometers that can date copper, uranium, gold and silver.[231]

The communication equipment manufacturing industry developing niche products as it finds itself unable to compete with cheap, high-tech imports. One of these niches is in high frequency and digital radio markets where Australian firms have specialist skills in deploying technology to rural and remote areas (especially high frequency radio).[232]

Within the motors and generators industry, Australian firms have developed niche capabilities in the production of next generation batteries and the manufacture of transformers.[233] Wilson Transformer Company exports generators, autotransformers and other products to more than 12 countries, while a collaboration between Pinnacle VRB and the University of New South Wales has produced a vanadium redox battery that is easier to manufacture and safer than traditional batteries. CSIRO is also involved in a commercial partnership to develop a low emission battery for hybrid cars.[234]

Many other sectors follow the same pattern. Pump and compressor manufacturers have focussed on the development of niche markets in water management and mining. Domestic Agricultural machinery manufacturers remains successful and competitive in producing tillage and sowing equipment, while Air conditioning manufacturers provide large commercial units that meet Australian standards which imports have difficulty satisfying.

Outlook and key challenges for the Advanced Manufacturing sector

The Advanced Manufacturing sector, in line with the broader Manufacturing industry, has faced considerable challenges in recent years, as illustrated by falling employment since 2008-09. However, employment fell proportionally more in the rest of the Manufacturing sector. Compared to most of the other key sectors, this sector also has relatively high export and capital intensities.

Australia, like other advanced economies, is well-placed to compete in advanced manufacturing due to its highly skilled workforce. Australia's competitive advantages are likely to be in niche areas of

230 IBIS World (2014), *C2411 Photographic and Optical Goods Manufacturing in Australia*.

231 IBIS World (2014), *C2419 Measurement and other scientific equipment manufacturing in Australia*.

232 IBIS World (2014), *C2422 Communication Equipment Manufacturing in Australia*.

233 IBIS World (2014), *C2439 Motors, Generators and other Electrical Equipment*.

234 Ibid.

advanced manufacturing characterised by unique technologies, skills and supply chains that cannot easily be replicated by lower cost countries.[235]

The sector has the potential to play an important role in driving R&D, with associated spill-overs for technology development and adoption. It is also well positioned to contribute to Australia's economic transformation, raise productivity growth and competitiveness and generate high skilled jobs, as evidenced by its high export and capital intensities. Some Australian firms are already succeeding in niche pockets of advanced manufacturing such as alloy development, traffic management, cosmetics and explosives, capitalising on unique skills, experience and resources to develop advanced manufactures that do not face the same pressures as traditional products.

Most economic commentators are predicting a fall in Australia's exchange rate over the short to medium term. A lower exchange rate will increase the international competitiveness of Australian firms producing and exporting advanced manufactures.

That said, modelling[236] from the Department of Employment points to a fall in the Advanced Manufacturing workforce of around 2.9 per cent per annum, or by 36,200 persons over the five years to November 2018.[237] This fall is primarily driven by a projected reduction in the Transport Equipment Manufacturing workforce, projected to fall by 7.9 per cent per annum or by 27,600 persons over the period. These projections may reflect a period of structural adjustment in Advanced Manufacturing as the workforce moves to a higher skills base. Currently, the top employing occupations in Advanced Manufacturing are made up of mostly tradespersons, along with a smaller number of Industrial, Mechanical and Production Engineers and managerial occupations.

Medical Technologies & Pharmaceuticals

Australia has world-class researchers developing medical technologies, devices and pharmaceutical goods. Medical Technologies & Pharmaceuticals includes the research and development, production and wholesale of these products.

The majority of firms in this sector are located in the eastern states, with firms in New South Wales and Victoria accounting for 65.8 per cent of total firms in this sector.

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235 Lydon, J, Dyer, D, Bradley, C (2014), *Compete to prosper: Improving Australia's global competitiveness*, McKinsey Australia.

236 Employment projections for the five key sectors have been derived by applying the Census-based proportions described in Appendix A to projections published by the Department of Employment (except in the case of Advanced Manufacturing, which is fully defined at the ANZSIC 2-digit level and therefore directly derived from the department's projections). The Department of Employment states that their projections "are derived from best practice time series models that summarise the information that is in a time series and convert it into a forecast. The projections are made by combining forecasts from autoregressive integrated moving average (ARIMA) and exponential smoothing with damped trend (ESWDT) models, with some adjustments made to take account of research undertaken by the Department of Employment and likely future industry, occupational and regional developments. The projection for total employment growth is consistent with the Government's forecasts and projections for total employment growth, as published in the latest Mid-Year Economic and Fiscal Outlook (MYEFO)."

237 Department of Employment (2014), *Employment Projections*, www.lmip.gov.au/default.aspx?LMIP/EmploymentProjections, accessed [10 October, 2014].

Snapshot of performance benchmarks and sector dynamics

Around 7,000 trading businesses were active in this sector as at June 2013. According to preliminary estimates, the sector employed around 71,000 persons and generated $9.3 billion in output in 2013–14. Export revenue in the sector was around $4.4 billion in 2012–13.[238]

Over the period 2008-09 to 2013–14, growth in employment (0.4 per cent) and GVA (2.0 per cent) in Medical Technologies & Pharmaceuticals was below the all-industry average (see Table 3.5). Labour productivity in this sector remained at record levels and increased at an average annual rate of 2.0 per cent over the period 2008-09 to 2013-14.

Table 3.5: Medical Technologies & Pharmaceuticals performance indicators

	2013-14	Average growth (5 years)	Deviation from national average growth (ppts)
Gross Value Added ($ billion)	9.3	2.0%	–0.7
Employment ('000)	71.1	0.4%	–0.9
Labour Productivity ($/hr worked)	72.2	2.0%	0.1

Source: ABS cat. no. 5204.0, 5206.0, 6202.0, 6291.0 (customised request) and Department of Industry calculations.

The sector can be split into two sub-sectors: i) Pharmaceutical manufacturing and wholesale; and ii). Medical technology manufacturing. Pharmaceutical manufacturing and wholesale comprise the Human Pharmaceutical and Medicinal Product Manufacturing (1841), Veterinary Pharmaceutical and Medicinal Product Manufacturing (1842) and Pharmaceutical and Toiletry Goods Wholesaling (3720) ANZSIC Classes, while Medical technology manufacturing is made up of Photographic, Optical and Ophthalmic Equipment Manufacturing (2411) and Medical and Surgical Equipment Manufacturing (2412). These sub-sectors are explored in detail in the following feature article and box, respectively.

The remaining ANZSIC Class in the Medical Technologies & Pharmaceuticals sector, Professional and Scientific Goods Wholesaling (3491), cannot easily be attributed to either of these sub-sectors. While much of its activity would be in either the pharmaceuticals sector or the medical technology manufacturing sector, it would comprise substantial activities that are not attributable to either of these. As such, it is not included in the following feature article and box.

238 These experimental estimates for exports were obtained via a customised ABS data request as part of a broader range of financial indicators for each key sector based on ANZSIC Class. This export total differs from the total that can be derived from the exports of pharmaceutical and medicinal products as well as medical devices in the associated feature article and box that are based on Standard International Trade Classification (SITC) classifications obtained from ABS cat. no. 5368.0.

Feature article: The pharmaceutical manufacturing and wholesale sector

The pharmaceutical manufacturing and wholesale sector includes originator and generic medicines companies, service related segments including wholesaling and distribution as well as some parts of biotechnology. It is one of the leaders in business R&D, investing over $500 million annually over the last four years. In 2013-14, medicinal and pharmaceutical products were Australia's largest export of elaborately transformed manufactures, with $3.4 billion shipped abroad.[239]

The pharmaceuticals sector is knowledge-intensive, characterised by high levels of innovation and skill. Such attributes form the basis of higher value added and technologically advanced production. For this reason, the industry is expected to become increasingly important for the Australian economy, particularly in the context of an ageing population.

As at June 2013, the sector had 309 human pharmaceutical and medicinal product manufacturing businesses and 52 veterinary pharmaceutical and medicinal product manufacturing businesses. Some of these are originators (or 'branded' companies) and some are generics[240], although many companies engage in both activities. There were also 2,491 pharmaceutical and toiletry goods wholesaling businesses.

The industry is dominated by foreign-owned multinational enterprises (MNEs), which are strongly linked to global supply chains. There are several Australian pharmaceutical companies such as IDT and CSL that have performed relatively well globally in recent years.

Total sales for the sector were just over $36 billion in 2012-13. Pharmaceutical and medicinal product manufacturing made up approximately $11 billion of this, while pharmaceutical and toiletry goods wholesaling made up the other $25 billion. Changes to the Pharmaceutical Benefits Scheme (PBS), the expiration of patent protection for some of the blockbuster drugs[241], as well as rising costs and increasing penetration of generic brands are some of the factors that impacted on sales over the past year. With announcement of PBS pricing changes in 2013, further price deductions will continue to affect revenue streams associated with the PBS. This, along with the lack of new blockbuster drugs, is expected to restrain industry growth in the future.

Nevertheless, moderate economic conditions, an ageing population, a greater emphasis on a healthy lifestyle and higher healthcare standards, innovation and technology advancements towards new products such as biologic medicines (any medicinal product manufactured in or extracted from biological sources) and more specialty drugs with higher prices, will all drive industry growth. The strong consumption trends towards the use of complementary medicines and switching products to generic and over-the-counter (OTC) drugs also help to fuel industry expansion. The industry is expected to improve revenue modestly in the coming years due to these factors.[242]

Pharmaceutical product manufacturing

The pharmaceutical product manufacturing sector plays a minor role in the manufacture of active pharmaceutical ingredients (API), a primary manufacturing activity. Companies involved in API largely focus on the synthesis of alkaloids such as morphine and codeine that can be produced from poppies grown in Tasmania. There are an increasing number of companies in the sector involved in the later stages

239 ABS cat. no. 5368.0.

240 Originators are primarily involved in developing new drugs and rely on patent protection for costs and profits. Generics specialise in developing equivalent drugs at cheaper prices to compete with medicines whose patents have expired.

241 A blockbuster medicine is one that generates annual sales of at least USD 1 billion for the company that creates it.

242 IBISWorld industry reports (biotechnology in Australia, pharmaceuticals product manufacturing in Australia and pharmaceuticals wholesaling in Australia), Evaluate Pharma (2014), World preview 2014, Outlook to 2020, and IMS Health (2013), Pharmaceuticals executive, pharma 50.

of the manufacturing process, such as formulation, dispensing and packaging, which can be thought of as secondary manufacturing activity. The majority of pharmaceutical product manufacturing companies in Australia are engaging in secondary manufacturing activity. These companies include Pfizer, AstraZeneca, Sanofi-Aventis and GlaxoSmithKline (GSK).

Pharmaceutical wholesaling

The pharmaceutical wholesaling sector engages in the wholesale of products (prescription drugs, OTC medicines and complementary medicines), obtained from domestic or international manufacturers, and distribution to hospitals and various retail outlets including pharmacies and supermarkets. The changes to the PBS have had fundamental adverse impacts on the sector as about 80 per cent of all prescription drugs sold by the sector are listed on the PBS. Other factors such as the 'patent cliff' (an abrupt drop in sales that follows the expiration date of a patent for products capturing a high percentage of a market), and changes by some pharmaceutical firms to cut wholesalers out of the supply chain have also contributed to the difficulties of the sector.

Biotechnology

Biotechnology is the application of science and technology to living organisms to alter living or non-living materials for the production of knowledge and biotechnology products and services. Within the Australian context, this industry covers biotechnology research and development, biotechnology licensing, biotechnology product manufacturing and biotechnology product wholesaling.[243] While biotechnology is not explicitly accounted for in ANZSIC, IBISWorld estimates that 62 per cent of the products produced in the biotechnology sector are human therapeutics and diagnostics, and that biotechnology research is a key player in the pharmaceutical manufacturing supply chain.

Biotechnology companies have performed well following the downturn during the GFC, generating approximately $6 billion average annual revenue with a compound annual growth rate of 2.9 per cent between 2009-10 and 2012-13.[244]

The majority of biotechnology firms are spin-offs of publicly funded research organisations and universities, although the private sector is increasing its share. These firms are highly R&D intensive, with the most successful able to commercialise their technologies to larger companies. Market sales in the sector are expected to grow strongly moving towards greater profitability, as many companies reach a stage of commercial readiness and demand for products commercialised from biotechnology research continues to grow strongly.

In 2014, the Australian biotechnology industry moved up to 4th place in the world rankings, behind the US, Singapore and Denmark, up from 10th place in 2012.[245] The rankings are based on scores in categories of productivity, intellectual property protection, intensity, enterprise support, education/workforce, foundations, policy and stability. Moreover, the combined worth of Australia's publicly listed biomedical companies was actually higher on a per capita basis compared to such companies in the US in 2012.[246] Recent indicators suggest that the 88 ASX-listed biotechnology companies are valued at more than $51 billion.[247]

Pharmaceuticals industry business expenditure on R&D

The strength of the Australian pharmaceuticals industry lies, in large part, in the international recognition of the quality of Australia's science and medical research, and a reputation for carrying out high quality clinical trials. The Australian pharmaceuticals industry has recorded around $500 million of business expenditure on R&D annually since 2007-08. Following the peak of R&D in 2008-09, business expenditure on R&D in human manufacturing pharmaceuticals products softened slightly, (see Chart 3.9).

243 IBISWorld (2014), *Biotechnology in Australia*, Industry Report.

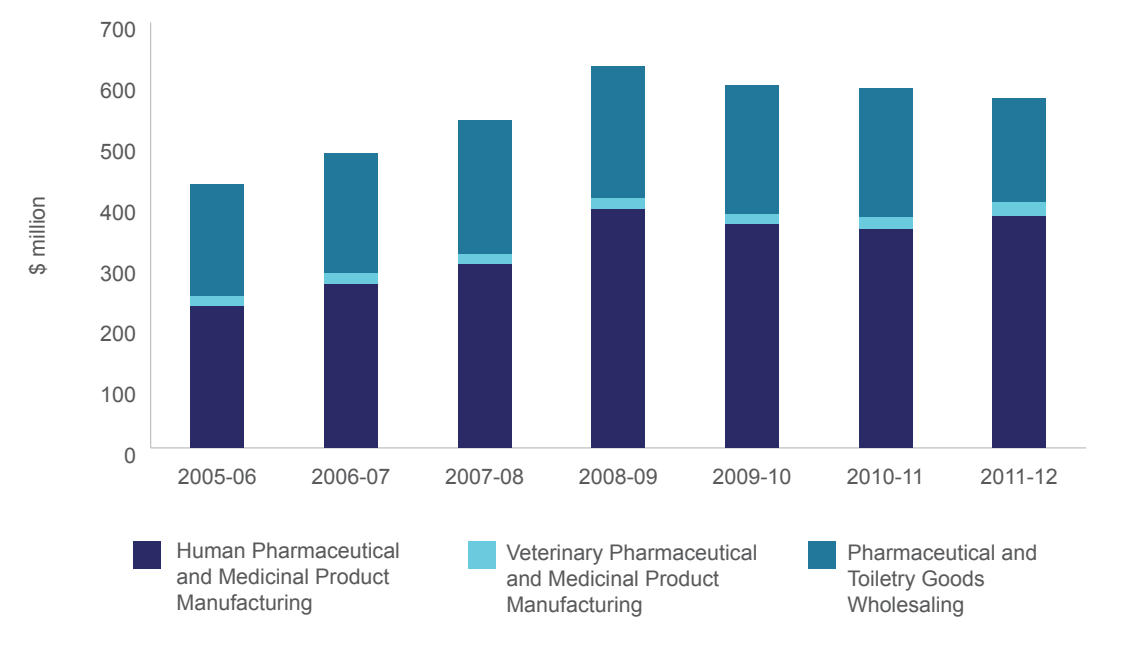
244 Ibid.

245 The Scientific American (2014), *Worldview Scorecard 2013*.

246 Phebra (2013), *Australian Pharmaceutical Report*, February 2013.

247 BioForum, April 2014; Focus reports (2013), Australia pharma report and the Scientific American (2014), *Worldview Scorecard 2013*.

Chart 3.9: Australian pharmaceuticals industry business expenditure on R&D, 2005-06 to 2011-12



Source: ABS cat. no. 8104.0

Clinical trials in Australia have attracted strong R&D investment from overseas, worth $450 million annually and contributing around $1 billion to the Australian economy each year.[248] This has been mainly due to the quality of Australian medical research, a strong reputation for carrying out high quality clinical trials, a relatively efficient regulatory framework and the low cost of operating trials. The number of clinical trials peaked at 865 in 2007, and has since declined steadily to 602 in 2012.[249] This trend is likely to continue, resulting largely from fierce international competition for clinical trial investment and the increasing cost[250] of running trials in Australia.

Exports and Imports

Following record exports of $4.1 billion in 2009-10, exports of pharmaceutical and medicinal products softened to $3.4 billion in 2013-14 (Chart 3.10).

The rapid urbanisation and rising income and living standards in Asia increased the demand for Australian pharmaceuticals. Asia has emerged as Australia's largest overseas market in recent years. China, Hong Kong, Taiwan and South Korea consumed almost half of Australia's total exported medical and pharmaceutical products over the last few years.[251] Asia has demonstrated a growing appetite for healthy lifestyles and this provides great opportunities for the Australian pharmaceutical industry. However, the opening of new world-class pharmaceuticals facilities across the Asia-Pacific region, the closure of a number of manufacturing plants across Australia and the Australian dollar's persistent strength have posed challenges more recently.

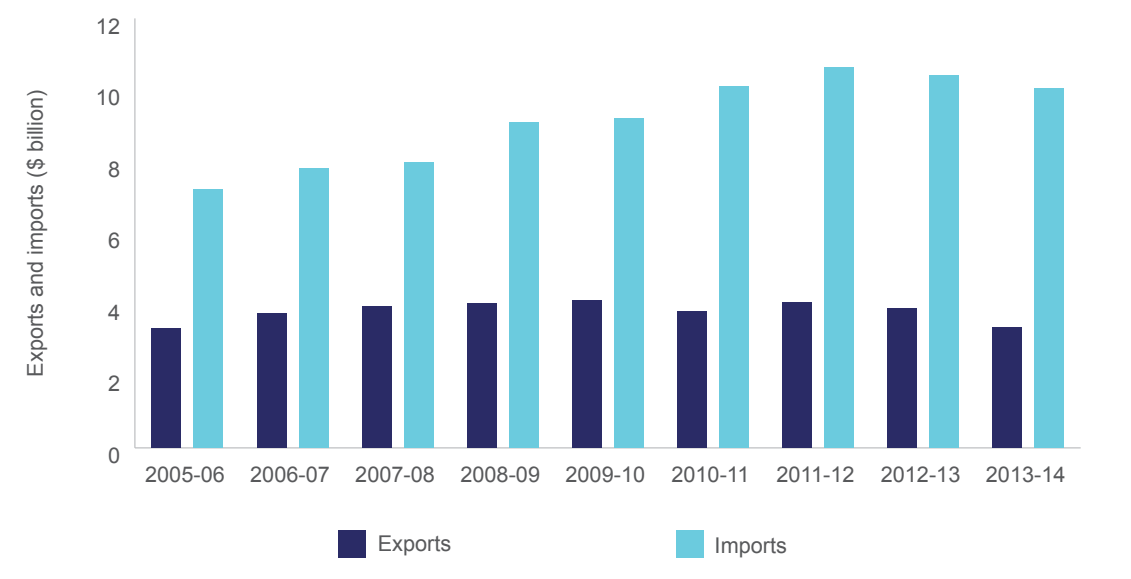
248 Australian Government (2011), *Clinical Trials Action Group report – clinically competitive: boosting the business of clinical trials in Australia*.

249 Therapeutic Goods Administration (TGA) (2014), *Half-yearly performance reports July to December 2013*, May 2014 and TGA (2013), *Inaccuracies in clinical trial statistics reporting for the period 2009-2012*.

250 This may be attributable to the strong Australian dollar, which has had an adverse impact on the industry, pushing the costs of operating clinical trials up.

251 Estimated from unpublished ABS data, Pharma in focus (2013), Industry trends 2013 and ISBS World (2014), Pharmaceuticals product manufacturing in Australia March 2014.

Chart 3.10: Australia's exports and imports of pharmaceutical and medicinal products, 2005-06 to 2013-14



Source: ABS cat. no. 5368.0.

Australia is a net importer of medical and pharmaceutical products and the gap between exports and imports is widening. This reflects the nation's dependence on imported products and highlights Australia as a regional hub for secondary manufacturing processes such as formulation and packaging. The US, the UK, Germany, Switzerland and France are Australia's major source countries of imports, reflecting the country of origin of multinational enterprises that dominate the Australian pharmaceuticals industry.

Employment

The pharmaceuticals industry is a large source of employment in Australia, employing more than 41,000 persons in 2012-13.[252] Employment in the pharmaceuticals industry was at its peak at 45,800 persons in 2009-10, but declined by more than 13 per cent over the period from 2009-10 to 2011-12 as firms cut costs and relocated facilities to emerging economies in the face of falling revenues.

Employment in the pharmaceutical industry grew by 4.3 per cent in 2012-13. Most of the jobs created during the period were in the biotechnology sector including in small-to-medium sized companies.[253] However, larger pharmaceutical companies including Pfizer, GSK, Eli Lilly and Novartis have announced job cuts in their manufacturing operations.

Employment in pharmaceutical manufacturing made up more than 50 per cent of the industry's total workforce in 2009-10, but this had declined to 42 per cent in 2012-13.[254] As pharmaceutical companies change their business models, shifting in-house functions towards partnerships and alliances with universities and other research institutes, the number of R&D staff in the industry has also significantly fallen. In contrast, generics companies recorded an increase in the numbers of sales personnel as demand for cheaper alternatives grow and the government's PBS reforms continue.

252 All figures in this feature article are obtained from ABS (2014), unpublished labour force data, otherwise as noted.

253 Pharma in Focus (2013), *Industry trends 2013* (a survey report).

254 ABS unpublished data.

Box 3.5: Key facts and figures on the medical technology manufacturing sector

The medical technology 'ecosystem' is a broader value chain that includes researchers, medical practitioners, hospitals and clinics, wholesalers, retailers and regulators who all contribute to Australia's economic growth and standing in the global economy.

A medical device or technology is any article, including software, intended to be used by humans for the diagnosis, prevention, monitoring or treatment of a disease, injury or physiological process. This includes products such as complex capital equipment (including operating theatre equipment and diagnostic imaging equipment such as x-ray machines and magnetic resonance imaging (MRI) scanners), high-tech advanced devices (such as ear implants, artificial hearts and other implantable devices); simple, low-risk devices (such as bandages and walking sticks); and diagnostic devices such as in vitro diagnostic test kits.

Unlike the giants of other manufacturing sectors, the great majority of Australian medical technology manufacturing firms are small to medium sized businesses. At the end of the financial year 2010-11, only 13 of these 1,840 businesses had more than 200 employees and only 56 had turnover of $2 million or more. The majority of businesses are located in New South Wales, Victoria and Queensland with the highest concentration being in New South Wales.[255]

At a glance, the contribution of the medical technology manufacturing sector to the Australian economy in 2012-13 was:

- Total sales of $2.7 billion;
- Capital purchases of $0.08 billion;
- Non-capital purchases of $1.7 billion; and
- Wages, salaries and other payments of $0.5 billion.[256]

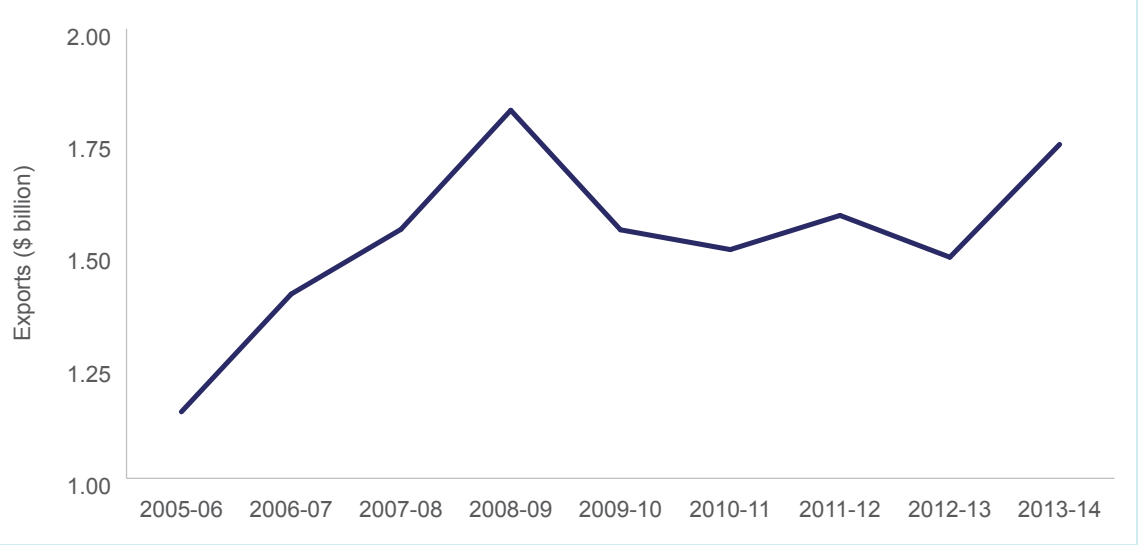
In 2011-12, business expenditure on R&D amounted to around $248 million, compared with $227 million in 2010-11. In 201314, businesses in Australia in the medical devices sector (that includes manufacturing and wholesale) exported around $1.7 billion worth of medical devices to 167 different countries around the world (see Chart 3.11). The top 10 destinations for Australian medical devices exports were the United States of America; New Zealand; the United Kingdom; Germany; the Netherlands; Japan; China; Singapore; Denmark; and the Republic of Korea.[257]

255 ABS, cat. no. 8165.0 Counts of Australian Businesses, including Entries and Exits.

256 ABS customised data.

257 ABS (2014), *International Trade: Customised Report for the Department of Industry*.

Chart 3.11: Australia's exports of medical devices, 2005-06 to 2013-14, FOB



Source: ABS (2014) International Trade: Customised Report for the Department of Industry.

The top five medical technology exports were therapeutic respiration apparatus; appliances which are worn, carried, or implanted in the body to compensate for a defect or disability; instruments and appliances used in medical, surgical, dental or veterinary sciences; artificial parts of the body; and hearing aids.

IP Australia's Patent Analytic Report indicates that Australia ranks 13th in medical device patents globally, comparable to China and the Netherlands. The share of medical device patents filed by Australian inventors (2,706 medical device inventions between 2001 and 2012) is more than the overall proportion of medical device patents filed worldwide. Therefore, Australia is seen to exhibit a positive technological specialisation in the medical devices industry. Australia is one of a few countries with a positive technological specialisation and ranks 8th in technological specialisation globally, comparable to Switzerland and New Zealand.

The Medical technology manufacturing sector has the potential to grow further in the future by increasing market share and establishing new markets. Australia has positive technological specialisation in medical devices and a revealed comparative advantage in terms of trade.

There are a number of drivers for change in the medical technology sector. As being at the cutting edge of the industry is vital for success, Australian Medical technology manufacturing businesses invest in R&D, protect their intellectual property and collaborate to innovate. As they are largely SMEs, they tend to experience major challenges in funding the development of new devices. Despite this, they actively invest in new machinery, equipment or technology, new management and business practices and innovative marketing activities.

Like many sectors, it is important for SMEs to be able to engage with major firms in supply chains, as this is the most typical path of entry for small firms into Global Value Chains. SME participation has the potential to yield benefits such as spill-overs of production and technology and managerial know-how, while their participation can also provide greater flexibilities to larger firms which they might not have otherwise enjoyed.[258]

258 OECD, WTO and World Bank Group. (2014), *Global value chains: Challenges, opportunities, and implications for policy*. Report prepared for submission to the G20 Trade Ministers Meeting Sydney, Australia, 19 July.

Outlook and key challenges for the Medical Technologies and Pharmaceuticals sector

Based on Department of Employment medium-term estimates, Medical Technologies & Pharmaceuticals employment is projected to increase by around 5,600 workers to be 76,700 in November 2018.[259] This sector has the highest projected growth rate of the five key sectors with employment projected to increase by 1.5 per cent per annum over the period. All of the manufacturing and wholesaling sectors within this sector are projected to increase in size, with Pharmaceutical and Toiletry Goods Wholesaling projected to experience the strongest annual growth (3.0 per cent per), or 3,000 workers over the five-year period. Currently, the top employing occupations in the sector include sales occupations such as Advertising, Public Relations and Sales Managers, Sales Representatives and Technical Sales Representatives, along with warehousing occupations such as Storepersons; Importers, Exporters and Wholesalers; and Purchasing and Supply Logistics Clerks. The highest employing trade occupation is Metal Fitters and Machinists with around 1,800 employed in the sector. The Department of Employment's latest round of skill shortage research did not find any of these occupations in shortage.

The Australian pharmaceuticals industry is knowledge-intensive, demonstrating high levels of innovation and skill. Such attributes form the basis of higher value added and technologically advanced production. Moderate economic conditions, an ageing population, a greater emphasis on a healthy lifestyle and higher healthcare standards, innovation and technology advancements towards new products such as biologic medicines (any medicinal product manufactured in or extracted from biological sources) and more specialty drugs with higher prices will all drive industry growth.

The Australian medical devices manufacturing sector is characterised by high investment in R&D; the protection of intellectual property and collaboration to innovate. The industry has an important role to play in the face of various challenges such as an ageing population, new and chronic diseases, escalating pressure on the health system and increasing lifestyle expectations. As they are largely SMEs, the most typical path of entry for businesses in this industry, like many other sectors, into Global Value Chains is via larger firms. SMEs in the sector tend to experience major challenges in funding the development of new devices. Despite this, they actively invest in new machinery, equipment or technology; new management and business practices; and innovative marketing activities.

Australia has world-class researchers developing medical technologies, devices and pharmaceutical goods. As the population continues to age this sector is expected to show significant growth over the coming decades.

259 Department of Employment estimates.

Summary

A number of subsectors across the Australian economy have been identified by various economic commentators as holding a comparative advantage for Australia. These include the following five sectors, which the government has also identified as immediate priority areas: Food & Agribusiness; Mining Equipment, Technology & Services; Oil, Gas & Energy Resources; Advanced Manufacturing; and Medical Technologies & Pharmaceuticals.[260] These sectors are well positioned to take advantage of emerging opportunities and have strong prospects for future growth. This is particularly important in the current context where the resources investment boom has peaked and Australia needs new sources of growth. Long-run prosperity depends on domestic industries that remain globally competitive and productive in the light of intensified global competition.

This chapter made use of a variety of information sources to analyse the profile, performance and dynamics of these five key sectors (as defined in Appendix E). It also outlined the opportunities they present for future growth. The findings are based on preliminary and experimental data. As part of a broader research agenda around these sectors, the department continues to explore data and is conducting broader analysis and research with the aim to provide insight into the intrinsic features and issues that these sectors face.

The preliminary results show that, collectively, the five sectors comprised around 14.9 per cent of total businesses in Australia. Their combined share of overall industry GVA and employment in 2013-14 was around 16.0 per cent and 11.6 per cent, respectively and in 2011-12, accounted for at least 35.7 per cent of business expenditure on R&D, while their share of the value in exports was around 26.5 per cent. Labour productivity and R&D intensity for most of the five key sectors are well above the all-industry average.

Advanced Manufacturing outperformed the rest of the Manufacturing sector in general in recent years in terms of employment, output and labour productivity growth. It is characterised by a relatively high capital intensity, export intensity as well as R&D intensity. However, Advanced Manufacturing experienced negative average annual employment growth over the last five years. This is not unexpected as not all areas of advanced manufacturing are expected to perform well, and Manufacturing in general has suffered from the high Australian dollar and sluggish global demand since the GFC. It is niche areas of advanced manufacturing where Australia can use its highly skilled workforce to research, develop and design unique products that cannot be easily replicated in lower cost labour abundant economies, which are likely to present opportunities for growth.

Mining Equipment, Technology & Services has enjoyed strong average annual employment and output growth of 4.8 per cent and 6.3 per cent, respectively, over the past five years thanks to the investment boom in the overall Mining sector. Labour productivity growth was sluggish over the five years to 2013-14, but has picked up in recent times. In the wake of the transition from the investment phase of the Mining boom to the production phase, diversification of activities and access to international markets will be important for the sector's future prospects, as output from newly installed mine capacity ramps up and operating efficiency becomes the primary driver of profits.

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260 Australian Government (2014), *Industry Innovation and Competitiveness Agenda,* p.70.

Average annual employment growth (9.5 per cent) and GVA growth (7.3 per cent) was strong in the Oil, Gas & Energy Resources sector, consistent with the commencement of new projects to meet increased international demand for energy resources. Oil, Gas & Energy Resources is expected to be a major source of future growth for the Australian economy, driven by developments in the Australian LNG sector. Australia is set to become the largest LNG supplier in the world towards the end of this decade, and it is estimated that if all LNG projects currently proposed are realised, they will contribute an additional $320 billion in GDP, 150,000 new jobs and $5 billion per year in additional taxes and royalties over the life of the projects.[261]

Employment in the Food & Agribusiness sector contracted by an average annual rate of 1.4 per cent over the past five years, while output growth was subdued at 0.9 per cent. However, Australia's reputation for high quality food coupled with its natural advantages in agricultural production and close geographical proximity to Asia mean it is able to manufacture and deliver premium food products to Asian markets at globally competitive prices. Asia's rapid growth in incomes and population will lead to an increasingly large and wealthy middle class, which will demand higher quality food from dependable sources in greater volumes. Significant potential for future growth exists if Australia is able to harness these natural advantages.

In Medical Technologies & Pharmaceuticals, growth in employment (0.4 per cent) and gross value added (2.0 per cent) was below the all-industry average over the last five years. However, this sector has the highest projected employment growth rate of the five sectors with employment projected to increase by 1.5 per cent per annum to 2018. Moreover, Medical Technologies & Pharmaceuticals has the highest R&D intensity of the five key sectors that is significantly above the all-industry average. Australia has world-class researchers developing medical technologies, devices and pharmaceutical goods. As populations in Australia and around the world continue to age this sector is expected to show significant growth over the coming decades.

261 Lydon, J, Dyer, D, Bradley, C (2014) *Compete to prosper: Improving Australia's global competitiveness*, McKinsey Australia.

CHAPTER 4
Administrative data and evidence-based analysis

One of the aims of the Australian Industry Report is to showcase recent empirical research conducted by the department using its administrative data holdings. This chapter, as part of the inaugural report, summarises the initiatives taken by the department regarding its administrative databases. It also discusses the key considerations, challenges and limitations when using administrative data for research and analysis purposes as well as providing some examples of research conducted using such data.

Government departments collect a variety of qualitative and quantitative information to fulfil their administrative, reporting, policy, advisory and accountability functions. This administrative data is collected in accordance with regulatory requirements for the delivery and maintenance of departmental programmes. Examples include applications and ongoing reporting for business programmes.

The department administers several programmes across its portfolio areas. These include skills and training, industry, business capability and innovation, renewable energy, energy efficiency and science and research programmes. Administering these programmes provides the department with a substantial amount of data which can be used to realise its key policy objective—enabling growth and productivity for globally competitive industries.

The Productivity Commission has stressed the importance of systematic, evidence-based policy development and highlighted that administrative data held by government departments provide a largely untapped resource that could be used to strengthen the evidence base of policies and programmes.[262] Using administrative data to its full potential will not only allow the department to better evaluate the effectiveness and efficiency of its programmes, but also acquire knowledge to inform new policy decisions and facilitate better programme design, management and accountability.

262 Productivity Commission, Annual Report 2009-10 and 2012-13 and *Strengthening Evidence-based policy in the Australian Federation*, 2009.

The need for evidence-based policy

Government policies shape the way scarce resources are allocated by businesses and households. Evidence-based policy is concerned with improving economic and social outcomes through applying reliable knowledge to the policy making process, which in turn depends on rigorous analysis of accurate and detailed data sources. Evidence-based policy aims to incorporate research evidence in public policy debates to improve the reliability of advice on the efficiency and effectiveness of policy settings.[263]

The Productivity Commission states that the crucial factors that underpin evidence-based policy are:

- High-quality databases on relevant topic areas; and
- Professionals with skills in data analysis and policy evaluation.

To this end, the department is primarily concerned with: developing high quality databases with relevant information; and ensuring that staff with the appropriate skills are able to interrogate and analyse the data to provide informed policy advice and evaluation.

This highlights the issue that even if high-quality databases with relevant data are developed by the department, if those with the appropriate skills are not able to access it, analysis cannot occur.

The role of evaluation

Evaluations, reviews and performance monitoring are integral to assess the value for money and support evidence-based policy. The evidence found from evaluations also supports the decision making of governments as Australia is called to adapt to changing economic and policy environments. Evaluation can help determine what works, what does not and why, in order to build knowledge on the design and implementation of effective interventions.

The new regulatory framework that came into effect on 1 July 2014 through the *Public Governance, Performance and Accountability Act 2013* (PGPA Act) establishes a core set of obligations that apply to all Commonwealth entities, including a framework for measuring and assessing performance, monitoring and evaluation.

The PGPA Act places greater emphasis on performance monitoring, evaluation and reporting and links the key elements of resource management to establish a clear cycle of planning, measuring, evaluating and reporting of results to the Parliament, ministers and the public.

The Department of Industry has a unit, known as the Evaluation Unit, that manages its evaluation plan and aims to promote and build evaluation capability within the department. The Unit plays a role in ensuring compliance with the new evaluation framework. It operates at arm's-length from the policy owners and programme administrators and aims to harness and leverage analysis, data and experimental work to expand the evidence base related to policy evaluation and analysis. The Evaluation Unit is discussed in more detail in the following box.

263 Productivity Commission (2009), *Strengthening Evidence-based policy in the Australian Federation*.

Box 4.1: The Department's Evaluation Unit

The department's Evaluation Unit engages with its portfolio areas to develop a robust and consistent approach to evaluations by providing advice and ensuring that line areas have the information, tools and support they need to design, implement and effectively manage evaluations.

The department has a rolling two-year evaluation plan covering a broad spectrum of programmes. Recent and current evaluation activity includes reviews of the Australian Industry Participation policies and programmes, Inspiring Australia Strategy, Buy Australia at Home and Abroad initiative, and the business.gov.au website.

Evaluation is seen as part of the broader policy and programme development cycle and evaluation findings and recommendations are used to:

- inform decisions concerning whether programmes should be continued, improved, expanded or curtailed;
- increase the effectiveness and efficiency of programme management, administration and performance reporting; and
- provide an assessment of programme performance and outcomes, thereby providing lessons for future policy and programme development.

The benefits of evaluation can be seen where programmes are improved following recommendations of an evaluation, or when the development of new policies makes use of the lessons learned in evaluations of previous programmes.

An evaluation of the Commercialisation Australia programme in 2013 led to a number of implemented improvements to the programme. The findings from the evaluation of this programme were used to inform the Accelerating Commercialisation, an element of the Entrepreneurs' Infrastructure Programme[264]. Similarly, the lessons from an evaluation of the Industry Cooperative Innovation Program were considered in the development of other programmes aimed at encouraging collaboration between researchers and business.

Using experimental methods to measure programme impact

A key challenge in evaluation is determining and isolating 'what works' since most programmes are instituted in complex settings where there are many factors that influence their success. Estimating the counterfactual in evaluation—what would have happened in the absence of the policy or programme—can help answer the question of whether programme expenditure is justified. Building on experimental methods developed in science and medical technology fields, evaluators can use a control group to separate the effects of the programme from other confounding influences.

The department is partnering with the Melbourne Institute of Applied Economic and Social Research and Nesta, an independent foundation based in the United Kingdom with a remit of catalysing innovation for economic growth and social transformation, to explore the potential use of Randomised Controlled Trials (RCTs) to test the impact of its programmes. RCTs are seen as one of the most rigorous ways to separate the effect of a programme from these confounding influences (especially selection influences whereby firms self-select into programmes based on their pre-programme characteristics).

The Evaluation Unit is also investigating a number of other experimental methods that will produce a more rigorous assessment of programme impact in order to provide an evidence base for the department's programmes.

264 See www.business.gov.au for a description of the Entrepreneur's Infrastructure Programme.

Harnessing the research potential of administrative data

Administrative data typically comes in the form of firm-level or individual level data (known as unit record data) and often in very large datasets. This provides rich and detailed information for researchers, which is generally not publicly available and would be prohibitively expensive to collect privately. It is worth noting that there are a range of Open Data initiatives—such as the release of Principles on Open Public Sector Information[265] and the Government's platform for open data, known as data.gov.au—that are beginning to change the landscape. Attempting to carry out surveys of similar scale would be prohibitively expensive and time consuming.

Many Australian Commonwealth and State and Territory departments are beginning to understand the potential for utilising their administrative data holdings for analysis and evidence-based policy development and evaluation, and have begun to improve their own data management capabilities.

Australia's governments are well positioned to take advantage of their administrative data holdings because:

- Australian governments hold extensive longitudinal administrative databases containing high quality information about large populations;
- increases in computing power, data storage and data capture and matching technologies mean that analysis of very large databases is increasingly feasible; and
- advances in analytical techniques allow investigation in ways that can isolate policy impacts from other influences.[266]

In addition to using administrative data for research and policy development, this data can also:

- provide the basis for comprehensive macroeconomic analysis;
- be used to improve program and administrative reporting; and
- effectively generate longitudinal databases that can be used to track the efficacy of a programme, or the performance of businesses or regions over time.

However, there are a number of challenges and obstacles in using administrative data for research purposes and some of these are explored in the following section.

265 Office of the Australian Information Commissioner.www.oaic.gov.au/information-policy/information-policy-resources/information-policy-agency-resources/principles-on-open-public-sector-information

266 Productivity Commission (2014), *Annual Report 2012-13*.

Challenges in the use of administrative data for research purposes

Unlocking the research and evaluation potential of administrative data is not an easy task. There are communication and technical challenges, cultural challenges and the need for appropriate protocols to ensure confidentiality where necessary.

In the first instance, analysts must be aware that a particular dataset exists, they must be allowed to access the data (subject to confidentiality requirements) and they must be confident in the quality of the data. This requires secure and efficient systems to link, manage and analyse administrative data, as well as building trust and relationships between data custodians, analysts and other stakeholders. The potential resource implications on data holders to respond to requests for access to their data must also be noted. Moreover, the department needs to ensure that analysts and researchers fully understand the importance and implications of confidentiality and sensitivity of the data to ensure its appropriate use. Other challenges in using administrative data for research purposes are detailed below.

Fit for purpose

As administrative data is not collected with research purposes in mind, researchers cannot control what information is collected or how often. This may limit the research that can be conducted or the appropriateness of the data. It can also present challenges with respect to data quality and the suitability of the data in terms of the research issue at hand.

Data quality

Data quality is crucial to the development of evidence. Without high quality databases researchers cannot be confident in their results or recommendations. As a first step, researchers may need to examine the methodology that was used to collect the data, to determine possible bias. Data may also need to be 'cleaned'—to remove errors or handle non-response—in a way that bias in statistical results is minimised.

Confidentiality requirements

The effective use of administrative data requires sharing across programmes, data custodians and even across administrations. At the same time, data must be managed efficiently, and protected from misuse or accidental release. This requires the establishment of protocols to ensure that data sharing is achieved in accordance with legislation to preserve privacy.

Confidentiality is important to prevent the release of commercially sensitive or personal information that could adversely affect the entity or person involved. Programme data are therefore collected subject to certain confidentiality clauses and conventions, and sometimes under particular legislation.

An overview of the department's administrative data holdings

Over the years, the department has amassed a significant amount of data, having administered a number of innovation, science and research, vocational education and training, energy efficiency and renewable energy programmes.

While individual programmes have programme specific data items, the department has established an agreed set of ten core data items that are required to be collected by all currently operating business programmes[267]. The core data items are:

- Australian Business Number (ABN);
- Name of business;
- Date of registration of ABN;
- Address of business;
- Industry of business;
- Number of employees;
- Revenue for the last financial year;
- Export revenue for the last financial year;
- Taxable income; and
- Expenditure on R&D.

One of the most important ingredients to enable the department to exploit its own data assets is the ability to link it with external data assets, and in particular to be able to consider the entire Australian business sector. For this reason the Australian Business Register (ABR)[268], which stores the ABN registration of every Australian business entity, is the starting point and backbone of any major firm-level analysis.

The ABR is also geo-coded (able to provide detail of a company's location) as well as providing ANZSIC industry classification information. This provides an invaluable backdrop to the department's administrative data and provides the ability for rich analyses to be undertaken.

The department is building an IT platform supported by a range of data tools to allow it to analyse and visualise data in many different ways, increasing its capability to draw out insights and drive future evidence-based policy development. The department is also contributing to data.gov.au and currently exploring other open data initiatives (see Box 4.3).

While the department's data assets are considerable, many are based on its interactions with businesses over its various portfolio responsibilities and, as such, are much more likely to be cross-sectional[269] rather than longitudinal (with the exception of the ABR database). Other portfolios have data assets which cover the entire business sector and Australian community in a longitudinal manner (e.g. the Australian Tax Office and the Department of Health).

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267 A business programme is typically a government initiative whereby a business collaborates with one or more government units in order to achieve an outcome jointly aimed at both by the business and the government.

268 The ABR stores details about businesses and organisations when they register for an ABN. The type of information in the Register includes: entity type, legal name, business location and activity type, ANZSIC name and code, authorised contact details, GST status, etc.

269 Data collected by observing many subjects (such as individuals or firms) at a same point in time, or without regard to differences in time, are known as cross-sectional data. On the other hand, we compile longitudinal datasets by observing the same entities repeatedly over time.

Key initiatives undertaken by the department

In light of administrative data's research potential and to address the challenges noted previously, the department has undertaken a number of initiatives that promote and enable the use of its administrative data holdings. The Data Ginger Group as well as the open data project undertaken by IP Australia that are discussed in Box 4.2 and 4.3 are examples of such initiatives.

To address issues related to data collection and the quality of data, a data standards policy has been introduced to define rules around collection and integration of programme data. The policy has been designed to ensure that data fields compiled for each programme dataset are consistent in order to maximise the ability to integrate and analyse datasets.

As highlighted previously, the department has also identified ten core data items to be collected for each programme, in order to maximise the usefulness and consistency of the department's data holdings.

Finally, several research projects have been undertaken using the department's administrative data, some of which have involved collaboration with other government agencies, as well as academia. The feature article at the end of this chapter on the effectiveness of business advice to small and medium sized firms serves as an example of how the department utilises its administrative data to analyse the impact of its programmes and gain insight into policy considerations.

Box 4.2: The Department's Data Ginger Group

The Data Ginger Group was established in 2013 to improve the capacity of the department to marshal its programme data holdings for the purposes of effective administration, monitoring and evaluation of programmes and to drive evidence-based industry policy development.

This is in line with the National Commission of Audit's (NCOA) recommendation that 'major departments and agencies… develop plans to maximise use of their own-source data',[270] and the Productivity Commission recommendation in its 2012-13 Annual Report that departments improve their use of internally-held administrative data to achieve better policy and programme outcomes.[271]

The Data Ginger Group has been driving progress in the data capability of the department by:

- raising awareness of the department's data assets;
- promoting and enabling sharing of the department's data holdings within the department to make them more accessible, and address confidentiality requirements, and;
- making the department's data assets more useful.

The first step in raising awareness of the department's datasets was to attract researchers to the data by making it clear and easy to identify the types of data that the department holds, the quality of those datasets and where they can be found. For this purpose an internal register was created that detailed the programme the dataset comes from, the number of firms the dataset contains, an estimate of the dataset's accuracy, and the specifics in terms of what data is collected for each firm, for example, ABNs, latitude and longitude of business address, employee count, sales data, export data, research and development expenditure, etc.

Data sharing protocols have been established to facilitate data sharing within the department, while protecting it from misuse or accidental release in line with confidentiality requirements. The protocols include line areas being compelled to work cooperatively and share data, training requirements for data users, definitions and distinctions between commerce data and personal data and additional requirements and restrictions in sharing personal data, access requirements, classification and definition of sensitive data, and managing risk.

In order to make the department's data holdings more useful the department has been progressively migrating key strategic data assets into a new, central data warehouse known as Lighthouse. Through Lighthouse, staff can access, analyse and integrate internal administrative data holdings, and compare it with external datasets. This initiative is vital to ensure that the maximum benefit is derived from departmental programme data resources.

270 National Commission of Audit, *The Report of the National Commission of Audit Phase One – Towards Responsible Government*, February 2014, p73. www.ncoa.gov.au/report/index.html

271 Productivity Commission, *Annual Report 2012-13*, August 2013, p15. www.pc.gov.au/annual-reports/2012-13

Box 4.3: Intellectual Property Government Open Data Project

IP Australia

The Intellectual Property Government Open Data (IPGOD) is an ambitious project to make 100 years of records relating to patents, trademarks, designs and plant breeder's rights publicly and freely available, with the last 20 years of Intellectual Property (IP) rights linked to business numbers. The data is highly detailed, including information on each aspect of the application process from application through to granting of IP rights. All of this is available on www.data.gov.au.

The IPGOD project is part of IP Australia's commitment to make its data more accessible to support evidence-based decision making. Under this paradigm, the IPGOD allows Australian IP information to be freely shared and analysed, thus increasing the transparency of government activities leading to improved policy outcomes.

While much of the data included in the IPGOD is already publicly available, it has not been available in a form which makes it convenient for analysis. The IPGOD seeks to overcome this problem by presenting the data held by IP Australia in a format which is easily read by commonly used data analysis programs such as Excel, Stata, R and SAS.

A key feature of the IPGOD project has been the augmentation of IP Australia's administrative data with a unique set of identifiers which enables IP rights to be matched to individual firms and firm-level characteristics. This is a significant contribution which enables IGPOD to be used to analyse complex questions about the impact of policy changes on specific entities.

When a patent application is filed, bibliographic information is published in the AusPat database and the Australian Official Journal of Patents. AusPat is an online database allowing access to bibliographic information and correspondence associated with Australian applications.

What is in the IPGOD dataset?

IPGOD includes data from the beginning of IP Australia's records up until the end of the latest calendar year. The data that is matched to ABNs runs from 1990 onwards.

To give an example of what is available in the IPGOD, consider a typical entry in the Australian Patent Register (AusPat) as in Chart 4.1. This includes bibliographic information on the patent, the invention, the technology associated with the application ('First IPC Mark') and key milestones associated with the application ('Filing date').

Chart 4.1: AusPat entry for a granted Australian patent application

Source: Australian Patent Register (AusPat)

Similar tables have been produced for all IP rights, leading to the release of 33 data tables with more than 350 million data points. The intention is to update the data annually, and release the data with the annual Australian IP report.[272]

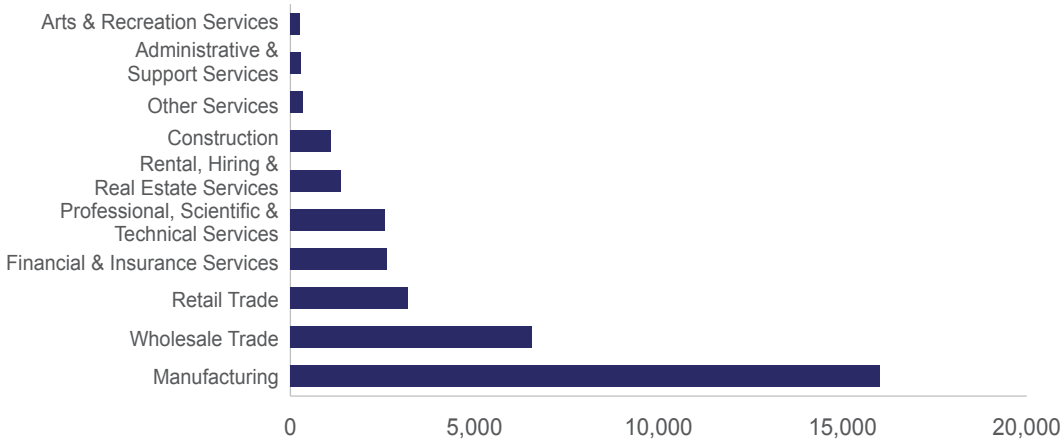
What can be done with the IPGOD dataset?

Because of the wealth of data, the data should help support more research on IP and innovation for policy work, research or decision making more generally. One interesting case study covered in an IP Australia research paper[273] published with the data, looks at Australian entities associated with Wholesale Trade. As it turns out these firms are filing significant volumes of patents in a diverse range of technologies. In fact, it is the third-highest area of focus for Australian applicants. Examining the patents associated with Wholesale Trade, there is a wide spread of technology which includes containers (B65D), fixed construction (E06B), kitchen equipment (A47J) and pharmaceuticals (A61K).

Australian entities are classified in the Wholesale Trade industry if their predominant activity involves the purchasing and on-selling of goods. It is also important to note that Australian entities in Wholesale Trade are distinguished from Australian entities in Manufacturing. They do not own the material inputs, and the production is outsourced or licensed to a third party. Traditionally one might have thought of them as retailers importing products from abroad, but if these Australian entities are filing patents or designs, it suggests that they are innovating in Australia but outsourcing the production.

Beyond patents, one can look at design rights – often used by companies like Apple – which represents a monopoly on the visual features that form the design of an item. Chart 4.2 shows that Australian entities in the Wholesale Trade file more design applications compared to Australian entities in Retail Trade, who predominately sell goods from premises with goods on display.

Chart 4.2: Number of design applications by ANZSIC Division, 1990–2013



Source: IP Australia database

Analysis of the design filings for the ANZSIC divisions suggests that Australian entities in Wholesale Trade are placed high on the global value-adding supply chain. Rather than being involved in the production of goods, these Australian entities prefer to develop new products (protected by patents and designs), outsource or license the production to a third party and then sell the product to consumers, which should imply a higher profit margin. This is consistent with the definition of Wholesale Trade where they do not own the material inputs but own the final outcome.

All this data is now available on-line with the intention of updating and releasing more in the future.

272 www.ipaustralia.gov.au/about-us/reports/2014_ip_report/

273 www.ipaustralia.gov.au/uploaded-files/reports/IP_Government_Open_Data_Paper_-_Final.pdf

Feature Article: Characteristics and performance of business advice recipients[274]

This feature article serves as an example of how the department can use its administrative data to learn how programme participants fare post-programme and gain useful insight into future programme design.

Background

The department has a range of data on the participants of a business advice programme,[275] delivered between 2007–08 and 2013–14. The programme was aimed at Australian small and medium sized businesses in order to assist them to reach their potential through capability building. The services of the programme included a business review, grant assistance to implement recommendations flowing from the review, and a range of tailored innovation services to meet individual business needs.

Some of the best elements of this business advice programme have been incorporated into the Entrepreneurs' Infrastructure Programme (EIP), launched on 1 July 2014. It is the Government's flagship initiative for enhancing competitiveness and productivity of Australian businesses at the firm level. It aims to assist businesses to realise their potential and achieve strong growth.

As highlighted in Box 4.1, the department regards evaluations, reviews and performance monitoring as integral elements of building knowledge on the design of effective and necessary interventions. The remainder of this article reports research results based on administrative data as well as surveys to compare programme participants against non-participants in order to get a better understanding of the nature of participants as well as the impact of the programme. The first part of the article looks at the characteristics of the programme participants (treatment group) compared to all businesses eligible to participate in the programme, while the second part discusses the analysis of the financial performance of participants against a control group (firms that would meet the eligibility criteria for the programme but were not participants).

Differences between business advice recipients and non-recipients

Findings from a survey of business advice recipients and non-recipients

ORIMA Research was commissioned in 2011 to conduct a survey of both business advice recipients (treatment group) and non-recipients (control group).[276] The objectives of these surveys were to:

- assess participant perceptions of the programme's performance in service delivery;
- compare the business practices, business strategy and innovation practices of participant and non-participant firms; and
- analyse the impact of the programme on business performance through comparative analysis against non-participant firms.

In order to assess the outcomes of participating in the programme, the control group was used as a benchmark. This approach was based on the assumption that the capabilities and performance of participant firms would be similar to non-participant firms before their participation in the programme.

Analysis of the survey results indicated that while participants and non-participants were similar in terms of their management capabilities, the participant cohort's financial performance was weaker than the control group prior to their participation in the programme. This suggests underperforming firms self-selected into the programme as they had greater potential for improvement. The relative weakness of participant firms prior to participation in the programme makes it difficult to assess the impact of the programme on the post-programme performance of participants relative to the control group. Moreover, the low response

274 This article uses the words 'recipients', 'participants' and 'clients' interchangeably. As such, 'non-recipients', 'non-participants' and 'non-clients' are also used interchangeably.

275 It was known as the Enterprise Connect programme.

276 *2011 Enterprise Connect Client and Non-Client Survey Report*, ORIMA Research, 31 October 2011.

rate of non-participants on financial performance questions necessitates caution in interpreting the survey results. Hence, to overcome these limitations, the ABS was then tasked to make use of its business register and business performance data to analyse the post-programme financial performance of the participants. This is discussed later in the article.

Drawing on data from the programme records and the ABS, some key characteristics of business advice recipients vis-à-vis eligible business population are discussed next.

State of operation, remoteness and industry classification of business advice recipients in 2012–13[277]

It is important to understand whether there are systematic differences between firms that chose to access the programme's services and the wider population of Australian firms. Estimates of the impact of the programme might be subject to self-selection bias, because firms are not randomly assigned to the programme.

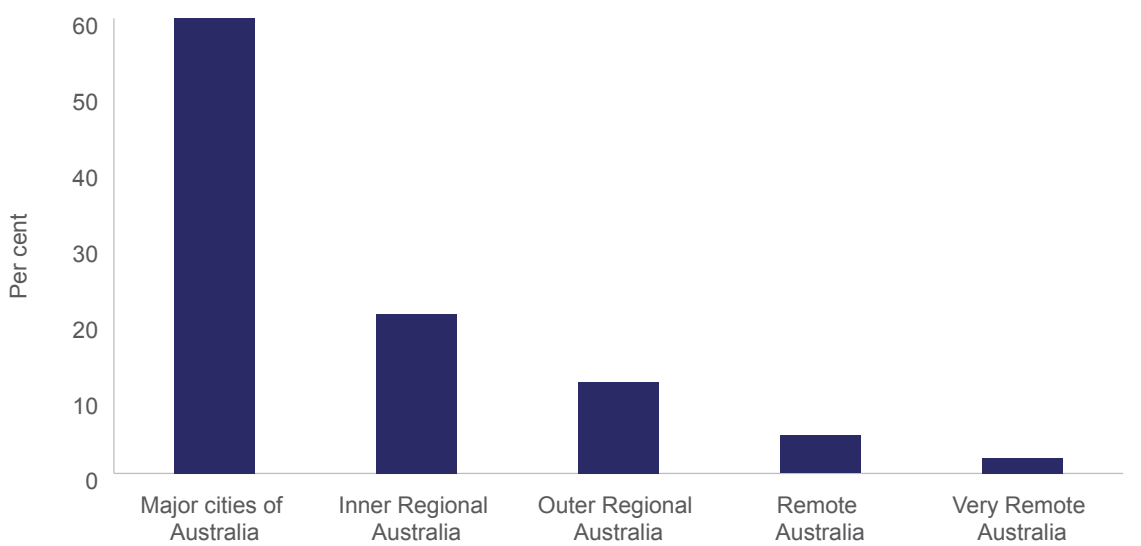
Chart 4.3 shows the distribution of programme participants in 2012–13 by jurisdiction. In line with State population shares, over 70 per cent of programme participants were from the most populous States of New South Wales, Queensland and Victoria, while South Australia and Western Australia accounted for nearly a fifth all participant firms. Main State of operation of all Australian businesses follows a roughly similar distribution. In addition, Chart 4.4 shows that about 60 per cent of programme participants operated in major cities of Australia, while businesses located in either remote or very remote areas accounted for around six per cent of all participants. Notably though, inner and outer regional Australia together were home to a third of programme participants. On the other hand, about 76 per cent of all eligible firms operated in major cities, while about 22 per cent of them were located in regional Australia.

Chart 4.3: Distribution of business advice recipients in 2012–13 by jurisdiction

Source: Programme database, 2012–13.

277 We obtained unpublished, customised business counts data from the ABS regarding the distribution of all firms eligible for participation in the programme as at June 2013. Hence, we compare the distribution of programme participants in 2012–13 with that of all eligible firms in June 2013. This holds for the remainder of this part (Differences between business advice recipients and non-recipients) of the article.

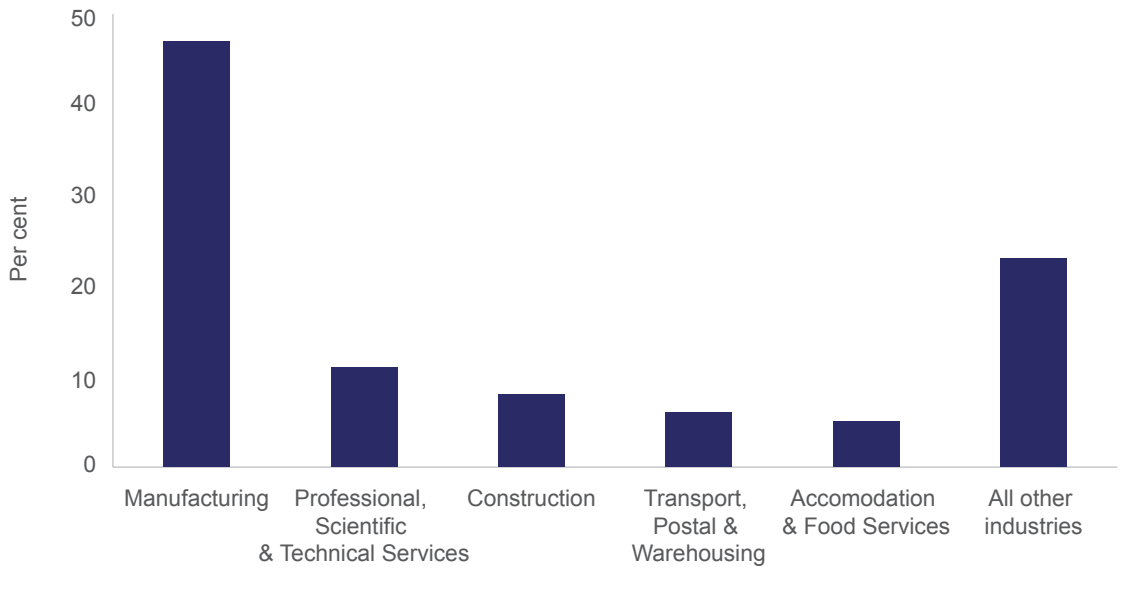
Chart 4.4: Distribution of business advice recipients in 2012–13 by remoteness



Source: Programme database, 2012–13.

As shown in Chart 4.5, the most common programme participants (47 per cent) were Manufacturing businesses. This was a result of explicit targeting; because the share of Manufacturing among all businesses eligible for participating in the programme in 2012–13 was much lower at around 10.5 per cent. Professional, Scientific & Technical Services accounted for the second largest (11 per cent) participant group by industry, in line with this industry's share (11 per cent) in the eligible firm population. Since the large majority of participants were from Manufacturing and Professional, Scientific & Technical Services, it is appropriate to compare participants against similar non-participant from these two industries only.

Chart 4.5: Distribution of business advice recipients in 2012–13 by industry



Source: Programme database, 2012–13.

Size characteristics of 2012–13 business advice recipients of selected industries

Since Manufacturing and Professional, Scientific & Technical Services industries together accounted for about 58 per cent of all programme participants in 2012–13, the article exclusively focuses on the participants of these two industries in this subsection.

Table 4.1 reports that the median programme participant from the Manufacturing industry recorded annual turnover of $3.5 million, while $2.2 million was the annual turnover of the median participant from the Professional, Scientific & Technical Services industry. Participants with missing or zero turnover values were excluded from this analysis.

Table 4.1: Percentile distribution of 2012–13 business advice recipients from Manufacturing and Professional, Scientific & Technical Services by turnover[278]

	10%	25%	50%	75%	90%
Manufacturing (N= 509)	$1.6m	$2.1m	$3.5m	$7.0m	$19m
Professional, Scientific & Technical Services (N = 112)	$1.1m	$1.5m	$2.2m	$4.4m	$9.4m

Source: Programme database, 2012–13.

The ABS data further reveal that the median eligible firm—from both Manufacturing and Professional, Scientific & Technical Services industries—had an annual turnover range of $1m–$10m. Unfortunately, due to strict confidentiality, only a range (as opposed to a point estimate) for turnover of the median eligible firm could be obtained from the ABS. Admittedly, it is rather less informative that the turnover range of the median eligible firm are the same for both industries. Note, however, that the annual turnover of the median programme participant in 2012–13 from both Manufacturing and Professional, Scientific & Technical Services sectors was towards the lower end of the median turnover range of eligible firms in June 2013.

An analysis of the pre- and post-programme financial performance of participants and similar non-participants

In 2013, the department commissioned the ABS to analyse the financial performance of businesses that received a business review and/or a tailored advisory service grant from the former Enterprise Connect programme. The study[279] assessed the post-programme (up to five years) performance of firms that received a business review during the 2007–08 to 2010–11 period.

278 When participants with missing, zero or negative turnover values are excluded from the analysis, the sample size reduced to 509 and 112 firms from Manufacturing and Professional, Scientific & Technical Services industries, respectively.

279 ABS, Financial Characteristics of Participants in the Enterprise Connect Program: Phase II (unpublished).

Data and methodology

The financial indicators analysed were revenue, total wages and proxies for value-added and gross operating profit. The statistical analysis was twofold. The pre-programme performance of participants was firstly analysed against their own post-programme performance. Secondly, participants' performance was compared with that of a set of non-participants with similar characteristics (control group).

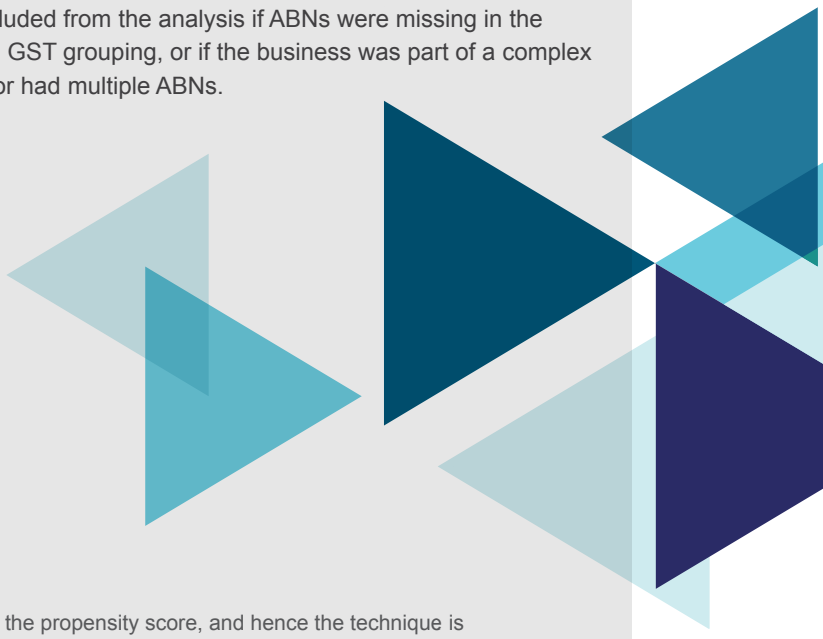
A comparison of the pre- and post-programme performance of the participants alone could generate misleading conclusions due to factors such as overall macroeconomic conditions affecting both participants and non-participants and selection bias of the participants. For example, it is more likely in a period of high economic growth that revenues would increase irrespective of programme participation status. Additionally, a well-managed business may be more likely to seek opportunities for improvement, and hence be more likely to apply for a business review. The technique that was used to abstract from these factors is known as matching.[280]

Matching is required when some businesses are exposed (treated) to a policy and others are not (untreated). The aim is to construct a sample of treated and untreated businesses that are as similar as possible in terms of observable characteristics prior to the policy intervention. The impact of a programme can then be analysed as the mean difference in growth of the treated and untreated firms (the difference in differences). That is, we observe how participants performed, and we estimate how they would have performed (the counterfactual) by using the performance profile of non-participants that were similar to participants in other respects prior to the programme.

Variables used for matching were wages, export status, R&D status, degree of foreign ownership, ANZSIC Subdivision, main State of activity and type of legal organisation. The selection of these variables was guided by economic theory, previous empirical results and programme entry criteria.

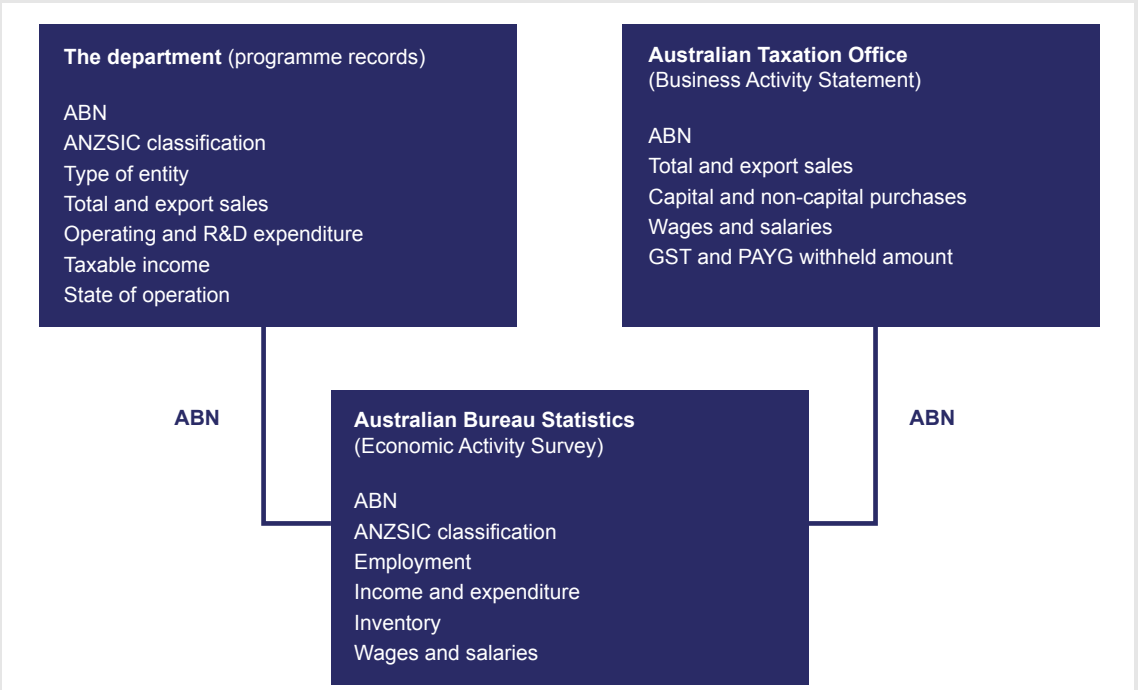
Upon completion of the review, businesses could apply for a small grant to implement recommendations from the review and a number of businesses received this grant. The ABS analysis made a distinction between review-only and review-and-grant businesses since review-and-grant was considered a more intensive 'treatment' than review-only. Two industries (Manufacturing and Professional, Scientific & Technical Services) and two levels of participation (review-only and review-and-grant) generated four groups of cohorts matched separately.

The data used in this analysis were constructed by merging the programme administrative data, ATO data and ABS data. Chart 4.6 shows the data held by each organisation and how they were linked. ATO and ABS data were accorded with the programme's administrative data using Australian Business Numbers (ABNs) as unique identifiers. Businesses were excluded from the analysis if ABNs were missing in the programme database, if the business was part of a GST grouping, or if the business was part of a complex business that operates across multiple industries, or had multiple ABNs.



280 The method applied in this analysis was matching on the propensity score, and hence the technique is commonly referred to as propensity score matching. Propensity scores or probabilities are derived using a statistical modelling technique, such as a logit model which was employed in this case.

Chart 4.6: Linking administrative data to external data sources



Results

On average, businesses that received a review followed by a grant generally realised improvements post-programme and outperformed the control businesses. The evidence supporting this conclusion is stronger for the Manufacturing industry than for the Professional, Scientific & Technical Services industry. On the other hand, results were mixed for the businesses that received only a review. The remainder of this section provides more details about the results of this analysis.

Analysis of the post-programme performance of the participants[281]

In terms of changes in levels of revenue, wages, value-added and gross operating profit, there was weak evidence to suggest that significant changes followed from programme participation for the review-only participants. While statistically significant positive changes in wages were observed in more than half of the cases for both industries, this was not the case for the other variables.

The review-and-grant businesses of the Manufacturing industry demonstrated statistically significant positive changes post-programme in revenue, wages and value-added but not in profit for most cohorts. On the other hand, post-programme performance of the review-and-grant businesses of the Professional, Scientific & Technical Services industry was similar to that of their review-only counterparts.

For percentage changes in revenue and wages, review-only businesses of both industries showed positive and statistically significant changes in wages in half of the cases. In contrast, the expected impact on revenue was observed only in one or two cohorts of these industries. Changes in wages were also positive and statistically significant for the review-and-grant participants of both industries. However, statistically significant positive changes in revenue were observed in most cohorts of the Manufacturing industry only.

281 Since the programme commenced in 2007–08, the post-programme period coincides with the post-GFC period. Hence, when interpreting these results, it should be noted that all firms (i.e. both participants and non-participants) faced more adverse macroeconomic conditions post-GFC.

The analysis also found that the initial size (as defined by total wages prior to programme entry) was not associated with performance post-programme when measured by changes in levels. In terms of the percentage growth in wages, there was an association for Manufacturing, but not for Professional, Scientific & Technical Services.

Comparison of the performances of participants and non-participants

For two-year changes in levels of the financial indicators investigated, there was weak statistical evidence to suggest that the review-only clients outperformed the non-clients. In contrast, the review-and-grant clients achieved higher revenue, wages and, to a lesser extent, value-added after two years.

For example, on average, the review-and-grant businesses of the Manufacturing industry generated $462,000 more in revenue, and paid $91,000 more in wages, than the control group. Average excess increase in revenue and wages of the review-and-grant businesses of the Professional, Scientific & Technical Services industry, on the other hand, were about $263,000 and $124,000 respectively.

These results become markedly weaker when three- to five-year (for Manufacturing) or three- to four-year (for Professional, Scientific & Technical Services) changes are used. Moreover, neither review-only nor review-and-grant participants demonstrated superior profitability when compared against non-participants.

In terms of two-year percentage changes in revenue and wages, both the review-only and the review-and-grant clients on average outperformed the non-clients. For instance, average growth rates realised by the participants were between 10 and 25 per cent higher for revenue and between 8 and 24 per cent higher for wages than those observed by the control group.

For three- to five-year or three- to four-year percentage changes, the results were weaker for the review-only participants. Moreover, the review-and-grant participants of only the Manufacturing industry demonstrated strong evidence of growth in both revenue and wages when three- to five-year percentage changes were used. For example, excess growth realised by these businesses after three years ranged from 70 to 145 per cent for revenue and 51 to 150 per cent for wages. Table 4.2 summarises the results of the comparative analysis of client and non-client performances.

In addition, both types of participants had a higher probability of survival relative to non-participants. However, this result was weaker for the Professional, Scientific & Technical Services industry. While the probability of being an exporter was higher for participants than for non-participants, this result was not statistically significant for either industry.

Table 4.2 Performance of business advice participants relative to non-participants, summary results

	Manufacturing				Professional, Scientific & Technical Services			
	Review-only		Review-and-grant		Review-only		Review-and-grant	
	After:							
Level change in:	2 years	3-5 years	2 years	3-5 years	2 year	3-4 years	2 years	3-4 years
Revenue			✓		✓		✓	
Wages	✓		✓	✓			✓	
Value added			✓		✓		✓	
Profits						✓		
	Review-only		Review-and-grant		Review-only		Review-and-grant	
	After:							
Percentage change in:	2 years	3-5 years	2 years	3-5 years	2 year	3-4 years	2 years	3-4 years
Revenue	✓		✓	✓	✓	✓	✓	
Wages	✓		✓	✓	✓		✓	

Note: ✓ indicates positive and statistically significant differences (between the outcomes of participants and non-participants) for either more than 50 per cent of cohorts or the pooled sample. Blank cells indicate statistically insignificant results for either more than 50 per cent of cohorts or the pooled sample. Statistically significant negative differences (between the outcomes of participants and non-participants) for more than 50 per cent of cohorts or the pooled sample were not found.

Summary

A wealth of information about businesses is held by all levels of government in the form of administrative data. Such data can be utilised for evidence based policy-making and advice. Systematic analysis of administrative data can identify how programme effectiveness may be increased. Alternatively, administrative data may be used to answer other economic research questions that are not necessarily related to the programme from which the data originated. Objective research based on administrative data can assist both the design of policies, and the choice of the most appropriate policy.

The department administers programmes across a wide range of its portfolio areas. Programme databases contain a variety of information on programme clients, which forms the department's administrative data holdings. Research based on administrative data involves its own set of challenges including but not limited to confidentiality, appropriateness, and data quality issues. Such hurdles aside, there is ongoing imperative and endeavour to utilise the department's administrative data holdings in order to provide impartial answers—that follow from objective analysis—to policy questions of the time. Moreover, addressing some of the big policy issues that cut across inter-departmental areas of responsibility may require that the administrative data held by various Australian Government departments and agencies are shared for policy research purposes.

Evaluations, reviews and performance monitoring are at the heart of programme delivery, and these functions help the department to learn more about the effectiveness of particular programmes and how it can be adapted to changing environments. The department has undertaken a number of initiatives to strengthen the evidence base of its programmes and policy advice. Several research projects have been undertaken using the department's administrative data, some of which have involved both internal and external collaboration. The Data Ginger Group has also been established to enhance cooperation and data-sharing within the department and to facilitate the use of administrative data for research purposes.

This chapter also provided an example of how administrative data as well as surveys can be used to inform stakeholders of businesses performance after programme participation. The results, based on rigorous analysis of the department's programme data showed that firms of certain industries accessing tailored business advisory services largely outperformed similar non-participant firms.

While there are limitations to research based on administrative data, the department aims to harness the potential of its administrative data holdings by utilising them to answer policy-relevant research questions through effective use of resources and collaboration with other organisations.

Appendix A
Industry and sector classifications

The Australian and New Zealand Standard Industrial Classification (ANZSIC) is the industry classification system used by the ABS and therefore the industry classification system that we use in this publication, as the ABS is our primary data source. ANZSIC was updated in 2006 from the original classification structure which was created in 1993. Since 2006, there have been 19 industries at the most aggregated 'one digit' or division level, up from 17 in ANZSIC 1993. The 19 ANZSIC industries are listed in the first column of Table A.1.

Of the 19 ANZSIC industries, 16 can be considered services. That is, all industries except Agriculture, Forestry & Fishing, Mining and Manufacturing. Throughout this report the 16 service industries are often aggregated into sectors, for ease of presentation or to draw conclusions through grouping industries with similar functions. The service sectors are grouped into either one service sector (the four sector model), 5 service sectors (the 8 sector model) or 7 service sectors (the 10 sector model). The various sector models are detailed in Table A.1.

As mentioned, the 19 ANZSIC industries listed in Table A.1 are at the 'one digit' or division level, the highest level of aggregation in ANZSIC. However, ANZSIC goes all the way down to the 'four digit' level at which the Classes are quite specific.

Table A.1: ANZSIC sector models

ANZSIC industry division	4-sector model (Chapters 1 & 2)	8-sector model (Chapter 2)	10-sector model (Chapter 1)
Agriculture, Forestry & Fishing	Agriculture, Forestry & Fishing	Agriculture	Agriculture
Mining	Mining	Mining	Mining
Manufacturing	Manufacturing	Manufacturing	Manufacturing
Electricity, Gas, Water & Waste Services	Services	Distribution Services & Utilities	Utilities
Construction	Services	Construction	Construction
Wholesale Trade	Services	Distribution Services & Utilities	Distribution Services
Retail Trade	Services	Distribution Services & Utilities	Distribution Services
Accommodation & Food Services	Services	Personal Services	Personal Services
Transport, Postal & Warehousing	Services	Distribution Services & Utilities	Distribution Services
Information, Media & Telecommunications	Services	Distribution Services & Utilities	Distribution Services
Financial & Insurance Services	Services	Business Services	Financial & Insurance services
Rental, Hiring & Real Estate Services	Services	Business Services	Other Business Services
Professional, Scientific & Technical Services	Services	Business Services	Other Business Services
Administrative & Support Services	Services	Business Services	Other Business Services
Public Administration & Safety	Services	Social Services	Social Services
Education & Training	Services	Social Services	Social Services
Health Care & Social Assistance	Services	Social Services	Social Services
Arts & Recreation Services	Services	Personal Services	Personal Services
Other Services	Services	Personal Services	Personal Services

Appendix B

Industry skills classifications

The Australian and New Zealand Standard Classification of Occupations (ANZSCO) published by the ABS assigns a skill level ranging from 1 to 5 to each occupation depending on the level of formal education and training required to competently perform the set of tasks required for the occupation. The skill levels designated by ANZSCO provide a good indication of the level of qualification required for entry to an occupation. That said, ANZSCO also allows for cases in which previous experience and on the job training may substitute for formal qualifications. Such cases are more prevalent in certain skill level 4 and 5 occupations in which persons may more readily gain employment without formal post-school qualifications. The relationship of ANZSCO skill level to the Australian Qualifications Framework (AQF) qualification level is listed in table B.1 below:

Table B.1: Relationship of ANZSCO skill level to AQF qualification level

Skill Level	Qualification Level
1	Bachelor degree or above
2	AQF Associate Degree, Advanced Diploma or Diploma
3	AQF Certificates III or IV
4	AQF Certificate II or III
5	AQF Certificate I

Source: ABS, Australian and New Zealand Standard Classification of Occupations, First Edition, cat. no. 1220.0.

In terms of occupation, ANZSCO skill level 1 is fairly closely aligned with ANZSCO Manager and Professional occupations, whereas Skill levels 2 and 3 are closely aligned with ANZSCO Technician and Trades Worker occupations. Occupations in these ANZSCO Major Groups are typically considered higher skilled occupations than those in the remaining Major Groups, which include: Community and Personal Service Workers, Clerical and Administrative Workers, Sales Workers, Machinery Operators and Drivers, and Labourers.

Appendix C

Industry contributions to market sector multi-factor productivity, labour productivity and unit labour costs growth

Multifactor productivity

As described by Parham[282], the Australian Bureau of Statistics (ABS) does not calculate market sector multifactor productivity (MFP) from estimates of industry MFP, and 'it is not possible to reproduce accurately the market sector MFP estimates from an aggregation of the ABS industry MFP estimates'. The methodology for calculating industry contributions to multi-factor productivity (MFP) growth applied in this report is based on the aggregate production function approach, which is understood to most closely aggregate to market sector MFP data produced by the ABS.

The alternative approach to compiling MFP statistics is by using the Domar weighting scheme (known as the direct aggregation method). The difference between the approaches is that the direct aggregation method derives market sector MFP measures as the weighted sums of industry MFP growth rates, with the weights equal to the shares of industry gross output to the market sector value added. By contrast, the aggregate production function approach uses the shares of capital and labour in aggregate income as weights.

According to the ABS, the disadvantage of the aggregate production function approach is that 'the impact on the aggregate productivity performance of output and input reallocations between industries are missing in the market sector MFP measures'[283].

Wei and Zhao[284] have found that the aggregate production function approach 'is not appropriate for approximating underlying industry data for the Australian economy, which has been experiencing a significant structural change largely driven by the mining boom. In particular, the aggregate production function approach underestimates labour and capital input growth and hence overestimates aggregate MFP growth, leading to a biased view of aggregate productivity performance'.

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282 Parham D (2012) *Australia's Productivity Growth Slump: Signs of Crisis, Adjustment or Both?,* Productivity Commission, Melbourne, p.59.

283 Australian Bureau of Statistics (2013) *Australian System of National Accounts: Concepts, Sources and Methods*, cat. no. 5216.0, Canberra, p.438.

284 Wei H & Zhao P (2014) *Industry Sources of Australia's Aggregate Productivity Slowdown*, Australian Bureau of Statistics, p.15.

Despite this disadvantage, it was decided the aggregate production function approach should be applied in order to maintain consistency with the current approach used by the ABS to compile market sector MFP statistics. The approach used in this report to calculate industry contributions to market sector MFP can be replicated using the following equation:

$$MFPcon_i = \mathbf{w}^{\mathrm{Y}}_{\mathrm{i,t-1}} \cdot \Delta y_{i,t} - \mathbf{w}^{\mathrm{K}}_{\mathrm{MS,t}} \cdot \mathbf{w}^{\mathrm{K}}_{\mathrm{i,t}} \cdot \Delta k_{i,t} - \mathbf{w}^{\mathrm{L}}_{\mathrm{MS,t}} \cdot \mathbf{w}^{\mathrm{L}}_{\mathrm{i,t}} \cdot \Delta l_{i,t}$$

Where:

$\mathbf{w}^{\mathrm{Y}}_{\mathrm{i,t-1}}$ = the industry i's share in current price GVA in year t-1 (data source: ABS 5204.0).

$\Delta y_{i,t}$ = growth in industry i's chain volume value added over one year to year t (growth is calculated by taking the first difference in the natural logs) (data source: ABS 5204.0).

$\mathbf{w}^{\mathrm{K}}_{\mathrm{MS,t}}$ = total capital share of income in the market sector, averaged over periods t and t-1 (source: ABS 5260.0).

$\mathbf{w}^{\mathrm{K}}_{\mathrm{i,t}}$ = industry i's share in total market sector capital income, averaged over periods t and t-1 (source: ABS 5204.0 and ABS 5260. Industry and market sector capital income is calculated by taking the capital income shares from ABS 5260.0 and multiplying by industry value added in ABS 5204.0).

$\Delta k_{i,t}$ = growth in industry i's capital services over one year to year t (growth is calculated by taking the first difference in the natural logs) (source: ABS 5260).

$\mathbf{w}^{\mathrm{L}}_{\mathrm{MS,t}}$ = total labour share of income in the market sector, averaged over periods t and t-1 (source: ABS 5260.0).

$\mathbf{w}^{\mathrm{L}}_{\mathrm{i,t}}$ = industry i's share in total market labour income, averaged over periods t and t-1 (source: ABS 5204.0 and ABS 5260.0. Industry and market labour capital income is calculated by taking the labour income shares from ABS 5260.0 and multiplying by industry value added in ABS 5204.0).

$\Delta l_{i,t}$ = growth in industry i's labour income over one year to year t (growth is calculated by taking the first difference in the natural logs) (source: ABS 5260.0).

A variation on this approach is to use hours worked instead of labour income shares in $\mathbf{w}^{\mathrm{L}}_{\mathrm{i,t}}$ and $\Delta l_{i,t}$. This is the approach used by the PC and is described by Parham (2012). Based on advice from the ABS, and the Department of Industry's own estimates of both approaches and comparing the sum of the absolute differences with the official ABS MFP statistics, it was decided that aggregation of industry contributions using labour income shares provided a more accurate representation of the ABS's market sector MFP statistics.

Labour productivity

Estimates of industry contributions to labour productivity are based on the method recommended by the Australian Bureau of Statistics[285] value added concept of labour productivity (which excludes the impact of intermediate inputs intensity on labour productivity):

$$LPcon_{i,t} = \frac{\mathbf{w}_{i,t}^{Y} + \mathbf{w}_{i,t-1}^{Y}}{2} \cdot \Delta LP_{i,t} + \left(\frac{\mathbf{w}_{i,t}^{Y} + \mathbf{w}_{i,t-1}^{Y}}{2} - h_{i,t-1} \right) \cdot \Delta H_{i,t}$$

where:

$\mathbf{w}_{i,t}^{Y}$ = the industry i's share in current price GVA in year t (data source: ABS 5204.0).

$\Delta LP_{i,t}$ = growth in industry i's labour productivity over one year to year t (growth is calculated by taking the first difference in the natural logs) (source: ABS 5260.0).

$h_{i,t-1}$ = industry i's share in total hours worked in period t-1 (source: ABS 6291.0)

$\Delta LP_{i,t}$ = growth in industry i's hours worked over one year to year t (growth is calculated by taking the first difference in the natural logs) (source: ABS 6291.0).

The term $\frac{\mathbf{w}_{i,t}^{Y} + \mathbf{w}_{i,t-1}^{Y}}{2} \cdot \Delta LP_{i,t}$ is considered the 'direct productivity effect', i.e. the impact of productivity growth in each industry.

The term $\left(\frac{\mathbf{w}_{i,t}^{Y} + \mathbf{w}_{i,t-1}^{Y}}{2} - h_{i,t-1} \right) \cdot \Delta H_{i,t}$ is considered the 'labour reallocation effect'.

Unit labour costs

Because the ABS does not publish industry estimates of unit labour costs, industry contributions to unit labour costs have been approximated by the ratio of nominal compensation of employees to real industry value added. The ABS defines unit labour costs[286] as the ratio of average labour costs to average labour productivity, where average labour costs are defined as the ratio of labour costs to hours worked by employees and average labour productivity is defined as real GVA to total hours worked by employees and the self-employed. The relationships are shown below:

$$\mathrm{ULC} = \frac{Average\ labour\ costs}{Average\ labour\ productivity}$$

$$= \frac{\left(\frac{labour\ costs}{hours\ worked\ by\ employees} \right)}{\left(\frac{\frac{Gross\ value\ added}{GDP\ deflator}}{Total\ hours\ worked\ by\ employees\ \&\ self\ employed} \right)}$$

$$\approx \frac{Nominal\ compensation\ of\ employees}{Real\ GVA}$$

285 ABS (2013) *Australian System of National Accounts: Concepts, Sources and Methods*, cat. no. 5216.0, Canberra, p.437.

286 ABS (2013), *Australian System of National Accounts: Concepts, Sources and Methods*, cat. no. 5216.0, Canberra, p.452.

Thus, industry contributions to estimated unit labour cost growth can be estimated by:

$$ULCcon_{i,t} = \frac{w^{Y}_{i,t} + w^{Y}_{i,t-1}}{2} \cdot \Delta ULC_{i,t} + \left(coe_{i,t-1} - \frac{w^{Y}_{i,t} + w^{Y}_{i,t-1}}{2} \right) \cdot \Delta COE_{i,t}$$

where:

$coe_{i,t-1}$ = industry i's share nominal compensation of employees in period t-1 (source: ABS 5204.0)

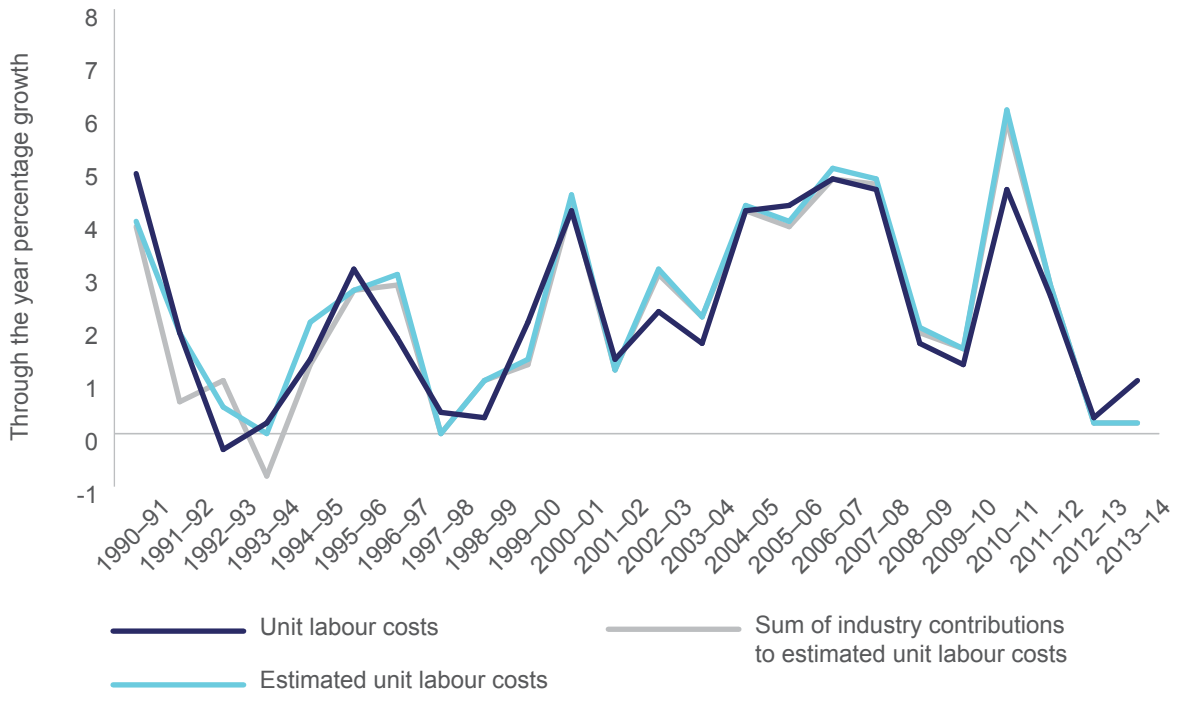
$\Delta ULC_{i,t}$ = growth in industry i's estimated unit labour costs over one year to year t (growth is calculated by taking the first difference in the natural logs) (source: ABS 5204.0).

$\Delta COE_{i,t}$ = growth in industry compensation of employees over one year to year t (growth is calculated by taking the first difference in the natural logs) (source: ABS 5204.0).

As with the calculation for labour productivity, the second term, $\left(coe_{i,t-1} - \frac{w^{Y}_{i,t} + w^{Y}_{i,t-1}}{2} \right) \cdot \Delta COE_{i,t}$ is the reallocation effect. In this case, it relates to the value of labour rather than the volume of labour (i.e. compensation of employees rather than hours worked).

The sum of industry contributions to estimated unit labour costs correlate reasonably well with published unit labour costs figures. However, as shown in Chart C.1, there is a slight overestimate in the years 2010–11 to 2013–14.

Chart C.1: Comparison of published unit labour costs data and Department of Industry estimates, 1990–91 to 2013–14



Source: ABS cat. no. 5204.0, Department of Industry calculations.

Appendix D
Key Sector Methodology

Sources of information and sector definitions

The analysis of the key sectors draws on a variety of information sources; namely publicly available data, private sector reports (particularly IBIS World), surveys and customised ABS data.

The ABS has been engaged by the department to provide a number of measures on these five sectors, using ANZSIC-based definitions of activity, in order to learn the current state of and monitor developments in these sectors. Financial information on these sectors has been extracted by the ABS from the Business Activity Statements (BAS) of firms, including total sales, export sales, other sales, capital purchases, non-capital purchases and wages and salaries. These variables and other related data have been used to examine the profile and performance of these five sectors throughout this chapter. In addition, the survival rates of firms within these sectors were also provided in a customised data request from the ABS Count of Australian business, including entries and exits publication (cat. no. 8165.0). This allows comparison of survival rates, in conjunction with entries and exits, to explore the dynamics of firm lifecycles in these sectors.

The five key sectors do not directly align with official statistical classifications. The ABS is the source of official statistics in Australia and as such, uses the Australian and New Zealand Standard Industrial Classification (ANZSIC), which is based on the international industry classification.[287]

Hence, for the purpose of obtaining official statistics, the department developed a list of industry codes based on ANZSIC (2006) in consultation with expert policy areas across the department. For each key sector, the department has developed a list of 4-digit ANZSIC Classes (see Appendix B) that approximates these sectors. The ANZSIC Class (or 4 digit) level is the most disaggregated level of economic activity identified by the ABS.

Challenges arise when trying to use this classification system to define the key sectors. First, definitions of the key sectors do not neatly align with ANZSIC-based definitions of economic activities. Second, the diversity of key sector businesses, in terms of the industries they service and the range of outputs they generate, makes data compilation difficult. For example, components of Mining Equipment, Technology & Services can be found across eight ANZSIC Divisions and over 20 Subdivisions. Third, the five sectors can overlap as some activities may conceptually fall under more than one key sector. Fourth, the ABS compiles and disseminates economic data according to ANZSIC-based industries, and not at the level of individual firms.

For these and other reasons, the ANZSIC Classes corresponding to the key sectors will only ever be a proxy.

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287 International Standard Industrial Classification (ISIC) United Nations Statistics Division, see www.unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27

Defining the five sectors for analytical purposes and the methodology to derive preliminary employment and output estimates

The selection of the ANZSIC Classes sought to use the best available data to link the department's conceptual understanding of the sectors with the set of ANZSIC Classes available. This primarily involved analysis using the ABS's Input-Output Tables, to look at the flow of products throughout the economy, in particular key inputs to sectors, and measure key variables such as R&D intensity and the employment of professional workers.

The department drew upon the ABS 2009-10 National Account Input-Output tables (ABS cat. no. 5215.0). These tables provide highly disaggregated data that look at supply and use of goods and services throughout the economy. This data can be used for analysing:

- The industry groups that produced certain products;
- The use of these products within the key sectors; and,
- The further use of goods and services produced by the key sectors – be it for domestic consumption, for export or as an input into other products.

The department's analysis of Input-Output tables sought to identify key relationships between different products and sectors to help determine appropriate bounds for data collection. The Input-Output tables provide data spanning about 1,300 products and looks at the use of each of these products across 115 different product groups. The Input-Output tables can therefore be used as a basis for looking at the relative importance of different inputs to particular economic sectors.

Further data used in the development of the proposed definitions includes R&D intensity and ABS data regarding the skills and education level of employees in different ANZSIC subdivisions was also used for the Advanced Manufacturing sector.

The analysis was supplemented by additional data and knowledge held by the department on firms and key sectors from policy and program experience.

It was recognised that the areas of professional, scientific and technical and computer system design services were important across all the key sectors, however, there was no identified methodology for allocating the economic activity of these services to the key sectors. The department has undertaken to continue to work with the ABS on a methodology for doing this.

Bringing these observations together allowed for the identification of a list of ANZSIC Classes that approximates the five key sectors. Despite the limitations of this framework, it will help organise useful information and enable analysis of these sectors with increasing detail in the future.

These definitions enabled the ABS to provide the department with preliminary financial information on these sectors. Once defined according to ANZSIC, a number of other measures were also derived to track sector performance. These include employment, contribution to GDP through estimates of GVA, and levels of labour productivity. Although the ABS has identified areas of economic activity at the 4-digit ANZSIC level, published statistics for employment are only available at the 3-digit ANZSIC group level outside of the Census (or in the case of Manufacturing, outside the ABS publication

Australian Industry, cat. no. 8155.0). For GVA, published statistics from the ABS National Accounts collection are only available at the 1-digit Division level or 2-digit sub division level depending on the sector. (GVA is also reported in Australian Industry, cat. no. 8155.0, although the official ABS National Accounts collection provides better estimates of sectoral contributions to GDP).

For these reasons, a proportional approach is required in cases where key sectors are not made up of complete ANZSIC categories. In the case of employment, the Census can be used to provide a proportional account of the distribution of ANZSIC 4-digit classes that make up the key sectors, within 3-digit ANZSIC groups. These proportions can then be applied to the quarterly industry and occupation publication of the ABS Labour Force Survey to provide estimates of employment within the key sectors. In the case of GVA, estimates of output per employee can be calculated using the same proportional approach. These estimates can then be combined with hours worked to provide estimates of labour productivity.

Appendix E

Key Sector ANZSIC Classes

This Appendix details a list of 4-digit ANZSIC Classes that comprise the five key sectors as defined under the department's methodology. Some ANZSIC Classes belong in two key sectors, and hence they appear twice in the following list.

It is important to note that the methodology that was adopted to define these sectors was developed for analytical purposes only. It has no bearing on eligibility for the Industry Growth Centres Initiative or other complementary initiatives including the *Entrepreneurs' Infrastructure Programme; and Industry Skills Fund*.

Food & Agribusiness

1111 Meat Processing

1112 Poultry Processing

1113 Cured Meat and Smallgoods Manufacturing

1120 Seafood Processing

1131 Milk and Cream Processing

1132 Ice Cream Manufacturing

1133 Cheese and Other Dairy Product Manufacturing

1140 Fruit and Vegetable Processing

1150 Oil and Fat Manufacturing

1161 Grain Mill Product Manufacturing

1162 Cereal, Pasta and Baking Mix Manufacturing

1171 Bread Manufacturing (Factory based)

1172 Cake and Pastry Manufacturing (Factory based)

1173 Biscuit Manufacturing (Factory based)

1174 Bakery Product Manufacturing (Non-factory based)

1181 Sugar Manufacturing

1182 Confectionery Manufacturing

1191 Potato, Corn and Other Crisp Manufacturing

1192 Prepared Animal and Bird Feed Manufacturing

1199 Other Food Product Manufacturing n.e.c.

1211 Soft Drink, Cordial and Syrup Manufacturing

1212 Beer Manufacturing

1213 Spirit Manufacturing

1214 Wine and Other Alcoholic Beverage Manufacturing

2461 Agricultural Machinery and Equipment Manufacturing

0121 Mushroom Growing

0122 Vegetable Growing (Under Cover)

0123 Vegetable Growing (Outdoors)

0131 Grape Growing

0132 Kiwifruit Growing

0133 Berry Fruit Growing

0134 Apple and Pear Growing

0135 Stone Fruit Growing

0136 Citrus Fruit Growing

0137 Olive Growing

0139 Other Fruit and Tree Nut Growing

0141 Sheep Farming (Specialised)

0142 Beef Cattle Farming (Specialised)

0143 Beef Cattle Feedlots (Specialised)

0144 Sheep-Beef Cattle Farming

0145 Grain-Sheep or Grain-Beef Cattle Farming

0146 Rice Growing

0149 Other Grain Growing

0151 Sugar Cane Growing

0159 Other Crop Growing n.e.c.

0160 Dairy Cattle Farming

0171 Poultry Farming (Meat)

0172 Poultry Farming (Eggs)

0180 Deer Farming

0192 Pig Farming

0193 Beekeeping

0199 Other Livestock Farming n.e.c.

0201 Offshore Longline and Rack Aquaculture

0202 Offshore Caged Aquaculture

0203 Onshore Aquaculture

0411 Rock Lobster and Crab Potting

0412 Prawn Fishing

0413 Line Fishing

0414 Fish Trawling, Seining and Netting

0419 Other Fishing

0529 Other Agriculture and Fishing Support Services

1521 Corrugated Paperboard and Paperboard Container Manufacturing

1831 Fertiliser Manufacturing

6620 Farm Animal and Bloodstock Leasing

Mining Equipment, Technology & Services

1012 Mineral Exploration

1090 Other Mining Support Services

2491 Lifting and material handling manufacturing

2462 Mining and Construction Machinery Manufacturing

3109 Other heavy and civil engineering construction

6922 Surveying and mapping services

6923 Engineering design and engineering consulting services

6925 Scientific testing and analysis services

6962 Management advice and related consulting services

Oil, Gas & Energy Resources

0600 Coal Mining

0700 Oil and Gas Extraction

1011 Petroleum Exploration

1701 Petroleum Refining and Petroleum Fuel Manufacturing

1709 Other Petroleum and Coal Product Manufacturing

2700 Gas Supply

5021 Pipeline Transport

Medical Technologies & Pharmaceuticals

1841 Human Pharmaceutical and Medicinal Product Manufacturing

1842 Veterinary Pharmaceutical and Medicinal Product Manufacturing

2411 Photographic, Optical and Ophthalmic Equipment Manufacturing

2412 Medical and Surgical Equipment Manufacturing

3491 Professional and Scientific Goods Wholesaling

3720 Pharmaceutical and Toiletry Goods Wholesaling

Advanced Manufacturing

1811 Industrial Gas Manufacturing

1812 Basic Organic Chemical Manufacturing

1813 Basic Inorganic Chemical Manufacturing

1821 Synthetic Resin and Synthetic Rubber Manufacturing

1829 Other Basic Polymer Manufacturing

1831 Fertiliser Manufacturing

1832 Pesticide Manufacturing

1841 Human Pharmaceutical and Medicinal Product Manufacturing

1842 Veterinary Pharmaceutical and Medicinal Product Manufacturing

1851 Cleaning Compound Manufacturing

1852 Cosmetic and Toiletry Preparation Manufacturing

1891 Photographic Chemical Product Manufacturing

1892 Explosive Manufacturing

1899 Other Basic Chemical Product Manufacturing n.e.c.

2311 Motor Vehicle Manufacturing

2312 Motor Vehicle Body and Trailer Manufacturing

2313 Automotive Electrical Component Manufacturing

2319 Other Motor Vehicle Parts Manufacturing

2391 Shipbuilding and Repair Services

2392 Boatbuilding and Repair Services

2393 Railway Rolling Stock Manufacturing and Repair Services

2394 Aircraft Manufacturing and Repair Services

2399 Other Transport Equipment Manufacturing n.e.c.

2411 Photographic, Optical and Ophthalmic Equipment Manufacturing

2412 Medical and Surgical Equipment Manufacturing

2419 Other Professional and Scientific Equipment Manufacturing

2421 Computer and Electronic Office Equipment Manufacturing

2422 Communication Equipment Manufacturing

2429 Other Electronic Equipment Manufacturing

2431 Electric Cable and Wire Manufacturing

2432 Electric Lighting Equipment Manufacturing

2439 Other Electrical Equipment Manufacturing

2441 Whiteware Appliance Manufacturing

2449 Other Domestic Appliance Manufacturing

2451 Pump and Compressor Manufacturing

2452 Fixed Space Heating, Cooling and Ventilation Equipment Manufacturing

2461 Agricultural Machinery and Equipment Manufacturing

2462 Mining and Construction Machinery Manufacturing

2463 Machine tool parts and parts manufacturing

2469 Other specialised machinery and equipment manufacturing

2491 Lifting and handling equipment manufacturing

2499 Other machinery and equipment manufacturing

GLOSSARY

Administrative data – Data that is collected to fulfil administrative, reporting and accountability functions.

Australian and New Zealand Standard Industrial Classification (ANZSIC) – The industry classification system used by the Australian Bureau of Statistics (see Appendix A for details).

Australian Trade-Weighted Index – A measure of the Australian dollar weighted against the currencies of Australia's major trading partners.

Backward participation (in Global Value Chains) – The import of foreign inputs which are then used in exports.

Barriers to trade/trade barriers – Government imposed restraints on the flow of international goods or services. Examples include tariffs (taxes on imports), quotas (restrictions on the number of total value of a particular good that can be imported) and embargoes (the partial or complete prohibition of trade with a particular nation or group of nations).

Capital – Durable goods that are used in the production of other goods and services (such as machinery and equipment). One of the factors of production, along with labour and land.

Capital intensity – The amount of capital present in relation to the amounts of the other factors of production (labour and land), used in the production process.

De-industrialisation – A fall in the economy's heavy industrial capacity or the relative share of industrial production.

Deflation – A fall in the general level of prices.

Developed countries/economies – A country that has a high standard of living and advanced technological infrastructure, compared to less developed nations. Typically measured by income per capita. Most OECD economies (see OECD) are considered developed countries.

Developing countries/economies – A nation or economy with a lower standard of living, less developed industrial base and technological infrastructure, relative to other countries. Typically measured by income per capita.

Disposable income – Total personal income less taxes (income that can be spent on goods and services).

Economic growth – An increase in the market value of the goods and services produced by an economy. Usually measured by changes in Gross Domestic Product (GDP).

Emerging economies – Refers to less developed economies which are growing rapidly and quickly bridging the gap between a developing country and developed country. Examples include China and India.

Endowments – A country's factor endowment is commonly understood as the amount of land, labour and capital that a country possesses and can exploit for producing goods and services.

Export intensity – Export sales to total sales ratio.

Foreign direct investment (FDI) – A controlling ownership in a business enterprise in one country by an entity based in another country.

Forward participation (in Global Value Chains) – The supply of inputs that are then used in another country's exports.

Global Financial Crisis (GFC) – The global recession which began in mid-2008 and was triggered by financial market upheaval in the United States.

Global value chains (GVCs) – Networks of production located across multiple countries.

Globalisation – The increasing interconnectivity of economies and markets.

Gross Domestic Product (GDP) – The total market value of goods and services produced in a national economy within a given period less the cost of goods and services used in the production process, but before deducting allowances for the consumption of fixed capital. GDP is the sum of total industry GVA (see Gross Value Added), ownership of dwellings, taxes less subsidies and the statistical discrepancy.

Gross Value Added (GVA) – The total value of goods and services produced by an industry, sector or area less the cost of the goods and services used in the production process. The sum of total industry GVA can be thought of as total industry output. The terms GVA and output are often used interchangeably in this report, but it should be noted that at the industry or sector level, GVA is net output, rather than gross output, i.e. total output less the value of intermediate goods used in production.

Imports – Goods or services produced in overseas markets and sold domestically.

Industrialisation – The process of modernisation whereby an economy increases its heavy industrial capacity and transforms from one based mainly on agricultural production to one based mainly on industrial production.

Inflation – A measure of the change (increase) in the general level of prices.

Interaction jobs – Jobs which are characterised by higher levels of reasoning, judgement and the ability to manage non-routine tasks.

Intermediate goods – Goods that are used as inputs in the production process of other goods.

Labour – Work done by human beings. One of the factors of production along with capital and land.

Labour mobility – The movement of people between jobs. This includes the concept of geographic labour mobility (where people move location and job), as well as movements between jobs without changing location (changes in occupation, for example).

Labour productivity – The ratio of output to labour inputs used in the production process.

Labour utilisation – The number of hours worked per person of 15 years of age and over.

Longitudinal data – Data characterised by repeated observations of the same variables over time.

Market concentration – A measure of the proportion of a market or industry that is dominated by a small number of firms.

Modern services – Information and communications technology 'heavy' services that can be digitally stored and traded (and are therefore similar in some ways to manufactured products).

Nominal output – The total value of production (price x quantity).

Offshoring – The relocation of a business process from one country to another—typically an operational process, such as manufacturing, or supporting processes, such as accounting.

Open economy – An economy in which there are economic activities between the domestic community and those outside it. Trade and capital can flow across the border, into and out of the domestic economy.

Output – See Gross Value Added (GVA).

Outsourcing – The contracting out of a business process to another party or firm.

Per capita – Per person.

Productivity – The ratio of output produced to inputs used in the production process.

Purchasing power parity (PPP) – The rate of currency conversion that eliminates the differences in price levels between countries.

R&D intensity – The ratio of company spending on research and development to its sales revenue.

Real exchange rate – The purchasing power of a currency relative to another at current exchange rates and prices. It is the ratio of the number of units of a given country's currency necessary to buy a basket of goods in the other country, after acquiring the other country's currency, to the number of units of the given country's currency that would be necessary to buy that basket directly in the given country.

Real Net National Disposable Income (RNNDI) – A measure of the real purchasing power of income.

Real output – Nominal output adjusted for changes in prices. Can be thought of as the quantity of output rather than the value of output (nominal output), because the impact of relative price changes has been removed.

Real wages – Wages adjusted for changes in the price level (inflation).

Savings ratio – Savings as a percentage of household disposable income.

Servitisation – Where manufacturing firms in developed economies incorporate more service-like activities, blurring the distinction between manufacturing and service delivery.

Skill-biased technical change – Where advances in technology lead to increased demand for workers with the skills to use the new technology.

Skills mismatches – A mismatch between the skills required for available jobs and the skills that job seekers have.

Structural change – Long-term shifts in the sectoral composition of an economy. A constant and natural part of the economic development process that occurs as output, investment and employment shifts between industries, sectors or regions. This concept can be broadened to include changes within industries and within firms.

Structural Change Indices (SCIs) – SCIs report the extent of movements of a measure, such as output or employment, between sectors or industries over a given period. Commonly used to measure the pace of structural change.

Terms of trade – Refers to the relative price of exports in terms of imports and is defined as the ratio of export prices to import prices.

The Organisation for Economic Co-operation and Development (OECD) – An international economic organisation comprising 34 countries. Member countries are typically those with advanced economies, although some less advanced countries such as Mexico, Chile and Turkey are also members. As a result, the OECD is often used as a point of comparison for advanced countries for a wide variety of statistics.

Unit labour costs – The average cost of labour per unit of output.

Unit record data – Firm-level or individual-level data.