# 6 Resources: a case study in structural adjustment

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| Key points |
| * Australia’s natural resources sector experienced significant adjustment pressures during the decade to 2012. * Export prices rose substantially from the early 2000s onward, driven by demand from China and other Asian countries, although they have declined since 2012. * Price increases encouraged resource businesses to expand their output. Those with easy access to additional reserves and capacity were able to do so at relatively low cost. * Many resource businesses, however, faced capacity or ore grade constraints and were only able to respond by using substantially more inputs or by investing. * The construction boom in new projects is generally expected to yield substantial increases in output over the next few years, thereby increasing the sector’s output as well as measured multifactor productivity. * Dramatic declines in the prices of some inputs, such as information and computing technologies, have allowed many resource operations to increase their automation, continuing a long‑term trend towards mechanisation in the sector. * Australia’s resources workforce more than trebled between 2002 and 2012. It is likely that workers who moved into that sector from other industries mainly came from manufacturing (in the early years) and construction (in subsequent years). Service industries were also a source of new labour. * The natural resources sector has increasingly made use of a ‘Fly‑in, Fly‑out’ (FIFO) workforce. In 2011, there were at least 34 000 resources and construction FIFO workers employed in Australia’s main mining regions. * The rising prevalence of FIFO workers can be attributed to multiple factors affecting the costs and benefits of this work arrangement, including: the shrinking population and housing shortages of remote towns; technological advances shortening the time taken to complete resources projects; the short‑term nature of the construction component of resources projects; the greater availability of regional flights; and tax changes that have made it more cost effective for employers to provide their staff temporary accommodation rather than permanent residence onsite. * The natural resources sector has also relied on migrants to address skilled labour shortages, more so than most industries. Yet, some skill shortages are still reported. |
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Australia’s natural resources (minerals and energy) sector[[1]](#footnote-1) faced significant adjustment pressures during the decade from the early 2000s. The economic growth of Asia in general, and China in particular, increased world demand for minerals and energy which, in turn, increased prices for those resources and Australia’s terms of trade to historically high levels (chapters 1 and 2). Beginning in 2008, the Global Financial Crisis (GFC) dampened the demand for, and prices of, many commodities. By the end of 2011‑12, many export prices had risen again to levels observed before the GFC, although some have fallen back significantly since then (chapter 2).

The pattern of natural resource price rises and declines provides an opportunity to examine how resource businesses and their workforces have adjusted to the pressures placed upon them.

Section 6.1 describes the main drivers of structural change facing the resources sector in recent years. Section 6.2 analyses the effect of these factors on the sector’s output. Section 6.3 describes some of the implications for the sector’s capital and productivity. Finally, section 6.4 considers some of the implications for the sector’s workforce of the recent rapid growth in its activity.

## 6.1 Recent drivers of change facing the resources sector

The most important driver of structural change affecting the natural resources sector in recent years has been the sharp rise in resource prices (figure 6.1). This rise marked the first phase of the resources boom, during which the growth in demand for minerals and energy exceeded the growth in supply in world markets. This led directly to the observed rise in prices and ensuing increase in the terms of trade and the exchange rate.

Figure 6.1 Selected resource (minerals and energy) prices, September 1988 to December 2011**a, b, c, d**

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a Quarterly data are from ABARES (2011). Updated crude oil prices are from OPEC (2013). Exchange rate data are from RBA (2012). b Indexed to 100 at June quarter 2002‑03 based on US dollar prices, except liquid natural gas which is indexed to 100 at June quarter 1997‑98. c Alumina, iron ore, thermal and metallurgical coal and liquid natural gas prices based on average export values. Nickel and zinc prices based on London Metal Exchange cash price. Uranium price based on the industry’s spot price. Crude oil price based on world trade (OPEC) basket price which is a weighted average of OPEC oil prices. d The correspondence between the commodities appearing in the figures above and the industries they belong to is given in appendix A.

*Sources*: ABARES (2011); RBA (2012); OPEC (2013).

Price increases, however, were not uniform across commodities. Furthermore, the prices of many commodities fell sharply after the GFC of 2008. Although some prices subsequently recovered to match or exceed their levels of 2007‑08 by 2011, others did not. For example, by December 2011, the price(s) of:

* silver was seven times higher than in 2002‑03
* iron ore and metallurgical coal were six times higher
* gold was five times higher
* thermal coal, copper and crude oil were over four times higher
* alumina, zinc and nickel were about twice as high (figure 6.1).

One year on, by the end of 2012, many of these commodity prices had fallen from their previous peaks (data not shown).

Along with the change in commodity prices, the prices of many capital inputs used by the resources sector also changed.[[2]](#footnote-2) Some key assets, such as Non‑dwelling construction, Industrial machinery and equipment, Other plant and equipment and Road vehicles recorded price increases after 2002‑03. By 2010‑11, the quality‑adjusted prices of these inputs were between 25 and 200 per cent higher than they were in 2002‑03.[[3]](#footnote-3) Topp et al. (2008) attributed the price increases to the resources boom, which increased the demand for these inputs and led to shortages and delays in obtaining key capital equipment, despite the appreciation of the Australian dollar. In a further illustration of rising input prices, Connolly and Orsmond (2011) report that, from the mid‑2000s onward, the price index for materials and services used in coal mining grew at twice the rate of prices in the broader domestic economy.

Conversely, the quality‑adjusted prices of Computer equipment, Computer software and Electrical and electronic equipment declined substantially, at least from 1989‑90, and were about 20, 90 and 70 per cent respectively, of their 2002‑03 prices in 2011-12 (figure 6.2). While some of the falls in quality‑adjusted prices can be attributed to declines in nominal prices, much of those falls was the result of substantial increases in the capabilities of the inputs, such as the processing power of Computer equipment.

The two trends in input prices have had opposing implications for resource businesses. First, the increases in the prices of capital and intermediate inputs increased the cost base of resource businesses.

Second, the rapid reduction in the quality‑adjusted prices of information and communication technologies (ICT) contributed to a surge of ICT investment (Topp et al. 2008) that has led to technological change in the natural resources sector. For example, for Exploration and services to mining, the new assets allowed the use of three‑dimensional seismic surveys and global positioning systems to target ore bodies more accurately. In many businesses, ICT allowed stages of the mining and resource‑extraction processes to be automated (Topp et al. 2008; CSIRO 2013). For example, technology has enabled Rio Tinto to manage some of its resources operations remotely to overcome the difficulties in recruiting staff with the necessary expertise (Rio Tinto 2013).

Figure 6.2 Quality‑adjusted prices of selected capital items used by incorporated resource businesses, 1989‑90 to 2011‑12**a, b**

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a Year ending 30 June. b Capital rental price, in terms of dollars per unit of 2009‑10 capital, indexed to 100 in 2002‑03.

*Source*: ABS (*Estimates of Industry Multifactor Productivity*, Cat. no. 5260.0.55.002).

Although the technological change in favour of ICT‑enabled production pre‑dated the recent boom, the increase in commodity prices gave it added impetus. Moreover, the adoption of ICT‑enabled production processes is part of a longer‑term trend in favour of innovation in the natural resources sector, such as the substitution towards open‑cut mining instead of underground mining, the use of draglines instead of trucks and shovels and the use of deep‑water drilling and slant‑drilling offshore (Topp et al. 2008). More recent research and development efforts have focused on identifying low‑energy cost mining methods, exploring advanced underground mining techniques (such as block caving) as an alternative to open‑cut mining, and removing minerals from ore *in situ* as an alternative to moving the ore first (Rio Tinto 2013).

## 6.2 What were the effects on output?

In terms of the resources sector as a whole, despite high prices, the rate of real output growth was lower during the resources boom than before it (as discussed in chapter 3). To what extent have individual industries within the natural resources sector increased their output since 2002‑03, in response to improved commodity prices? What other factors may have influenced the decision of businesses in those industries to increase their output during the boom years?

There were significant differences across industries within the resources sector. The output of some commodities (such as iron ore, liquefied natural gas (LNG)) and Exploration and services to mining grew more quickly after 2002‑03 than it did earlier. For example, iron ore production grew by 12.1 per cent per year after 2002‑03, compared with 7.1 per cent per year prior to this (figure 6.3). In contrast, coal production grew by 1.6 per cent per year after 2002‑03, compared with 5.7 per cent per year in the preceding period, while the output of crude oil and naturally occurring liquid petroleum gas (LPG) declined after 2002‑03.

There are three main reasons why output expanded more for some commodities than for others during the 2000s. First, some commodities, such as iron ore, experienced relatively large increases in prices that provided a strong incentive to increase output. Conversely, the prices of a number of non‑ferrous metals (such as aluminium) grew more slowly after 2002‑03 and were not sufficient to induce new investment and, in some cases, to offset higher energy costs (Barber et al. 2012).

Figure 6.3 Production indexes of selected resources and industries**a, b, c**

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a Output for ‘Exploration and services to mining’ and ‘All mining’ are financial year data and are based on a chain volume measure of gross value added as reported in ABS (2012a). The annual data series were indexed to 100 relative to 2002‑03. b All other output data were drawn from quarterly mine production (tonnages or volume) data reported by ABARES (2011) and BREE (2012b), and were indexed to 100 relative to the June quarter 2003. There are breaks in the data for oil and gas between September 2006 and June 2009. c The correspondence between the commodities appearing in the figures above and the industries they belong to is given in appendix A.

*Sources*: ABARES (2011); BREE (2012b); ABS (*Australian System of National Accounts*, Cat. no. 5204.0).

Second, for some commodities, output expanded relatively quickly because of access to known high‑quality deposits and the ability of producers to expand the capacity of their existing projects at relatively low cost. For example, the rapid growth in iron ore output after 2002‑03 was partly the result of a relative abundance of iron ore reserves that could be readily accessed by expanding existing operations (Geoscience Australia 2012; Barber et al. 2012).

Finally, the ability of some industries to increase output was limited by diminishing reserves or grades of natural resources. For example, the output of crude oil and LPG declined after 2002‑03 because of diminishing economically demonstrated reserves (BREE 2012a; Barber et al. 2012; figure 6.3). Similarly, gold production declined after 2002‑03 because of declining ore grades.[[4]](#footnote-4) The role of reserves as an enabler of output expansion underlines the importance of natural resources endowments for structural change (chapter 1). Such endowments are only partly a function of the total amount of minerals in the ground. They are more directly influenced by the *known* amount of resources, which are a function of exploration activity.

In the short run, extraction of marginal deposits required substantial expansion in the use of variable inputs (such as labour). In the medium term, undertaking additional on‑site or off-site investment became necessary. Many producers thus undertook large infrastructure investments and consequent increases in output have yet to materialise. Overall, 45 resource and resource‑related projects were completed between April 2012 and April 2013 (table 6.1). While some of these projects are likely to be producing at full capacity already, others are not, suggesting that there is a prospect of output increases after April 2013. Another 73 projects (as at April 2013) have received a final investment decision and are about to start or have started construction (table 6.1).[[5]](#footnote-5)

Recently-completed investments have tended to be in non‑energy mineral commodities (such as copper and gold), whereas committed projects are dominated by energy commodities, in particular LNG, LPG and petroleum, and infrastructure facilities (Barber et al. 2012).

Table 6.1 Recently completed and committed natural resource projects

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|  | Recently completeda | |  | Committedb | |
| Resource | No. of  projects | Investment value |  | No. of  projects | Investment value |
|  |  | $m |  |  | $m |
| Bauxite, alumina, aluminium | 2 | 3 185 |  | – | – |
| Coal | 11 | 4 258 |  | 16 | 14 194 |
| Copper, goldc | 13 | 3 816 |  | 8 | 1 759 |
| Infrastructured | na | na |  | 15 | 21 067 |
| Iron ore | 10 | 9 832 |  | 8 | 22 022 |
| Lead, zinc, silver | 1 | 303 |  | 4 | 1 933 |
| LNG, LPG, petroleum | 3 | 2 240 |  | 18 | 204 912 |
| Other commodities | 5 | 3 582 |  | 3 | 1 595 |
| Uranium | – | – |  | 1 | 98 |
| Total | 45 | 27 216 |  | 73 | 267 579 |

a Completed between April 2012 and April 2013. Data not separately available for infrastructure projects in April 2013. b Final investment decision issued as at April 2013. c Includes silver from the Mt. Carlton (Silver Hill) project. d Infrastructure projects include investments in road, rail and port facilities. – Nil.

*Sources*: Barber et al. (2012, tables 5 and 7) and Barber et al. (2013, tables 5 and 6).

Only one new resource project received a final investment decision between October 2012 and April 2013 (Barber et al. 2012 and 2013). The authors attributed the decline in the number of committed projects to an emerging trend of project delays and cancellations, with about $150 billion of projects having been delayed, cancelled or re‑assessed in the preceding 12 months. They forecast the total value of committed investment to drop slightly to $256 billion by the end of 2013 and then to about $70 billion in 2017. This suggests that investment has peaked in the ‘second phase’ of the current resources boom, and that the third ‘production’ phase of the boom has started in some industries such as iron ore (Plumb, Kent and Bishop 2012; Sheehan and Gregory 2012; Stevens 2012). Following these large investments, resource exports are estimated to at least double in volume between 2010‑11 and 2020‑21 (Sheehan and Gregory 2012).

## 6.3 Some implications for capital use

As well as varying their output, resource businesses can also adjust to the pressures of structural change by varying their use of factors of production such as capital and labour (investment and employment are discussed extensively in chapters 3 and 4). As mentioned, labour usage tends to vary in the short term, while changes in capital use take longer to implement.

There is clear evidence that capital stocks in the resources sector have increased in recent years (figure 6.4). Stocks increased most rapidly for Computer equipment, Computer software, Electrical and electronic equipment, Research and development intellectual property, Other plant and equipment and Other transport equipment. These assets grew more quickly than the sector’s output. For example, Computer equipment grew by 28 per cent per year and Computer software by 18 per cent per year between 1994‑95 and 2011‑12 (figure 6.4).

The three key determinants of how much capital is used by an industry are the:

* technology of production, which refers to the method by which resources are extracted
* price of capital relative to other inputs
* output level of the industry, including any returns to scale.

Figure 6.4 Resource sector capital stocks and overall output,  
1986 to 2012**a, b, c, d**

Index value, 1985-86=100

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a Incorporated mining businesses. b Capital stock and output are chain volume measures with 1985‑86 as their reference year. c Year ended June. d The resources sector is as defined in appendix A.

*Sources*: ABS (*Estimates of Industry Multifactor Productivity*, Cat. no. 5260.0.55.002; *Australian System of National Accounts*, Cat. no. 5204.0).

As mentioned, resource projects employ a variety of technologies to extract minerals and energy. Access and geological considerations play a large part in determining the type of technology used. Some technologies are inherently more capital‑intensive than others. For example, ‘longwall’ and ‘room and pillar’ mining are two commonly used underground mining methods. Longwall mining is more capital intensive and is better suited for coal deposits that follow a long and even stratum. The older room and pillar technique, although more labour‑intensive, can be more flexibly configured to accommodate a variety of coal deposit formations.

Changes in the relative prices of factors of production influence how a business uses those factors. Businesses attempt to economise on factors that are relatively costly in favour of less expensive ones, within the constraints imposed by the technology of production. For example, mines are often located in remote locations, making it costly to attract and retain skilled labour. Mining work is also very hazardous, making occupational health and safety an important consideration for mine management (Fisher and Schnittger 2012). Both characteristics contribute to the cost of labour. The price of ICT and Electrical and electronic equipment, as noted, declined dramatically from about 1989‑90 onward, especially in comparison with the cost of labour (figure 6.2). These price declines influenced the decision of resource businesses to invest more heavily in ICT, not only to increase the productivity of capital, but also to reduce labour‑related costs (such as those associated with workplace accidents).

Finally, the use of capital also depends on whether a project is experiencing increasing, constant or diminishing returns to scale. A resource project will tend to exhibit increasing returns if it is operating below capacity and it has ready access to proven and economic reserves. Such a project will be able to expand its production at relatively little cost. Conversely, a project will experience diminishing returns to scale if it is constrained by either capacity utilisation or diminishing resource reserves and grades. In such cases, a project will only be able to expand its output in the short term by employing more variable inputs, such as labour, whose marginal contribution to production would gradually diminish. In the longer term, such a project would need to invest in additional capacity, discover new deposits or identify new methods to better extract existing reserves.

### Implications for productivity

Each of the factors reviewed above contributed to the observed changes in the capital stocks of the resources sector. As a result, they also contributed to changes in the sector’s capital–labour ratio and multifactor productivity. Like many industries in the Australian economy, the resources sector experienced strong multifactor productivity (MFP) growth in the 1990s (Zhao 2012). ABS data show that in the years leading up to 2001‑02, output grew more quickly than labour and capital use jointly, and capital use grew more quickly than labour use. Since 2001‑02, however, employment has increased faster than capital use, and both employment and capital use have increased faster than output (ABS 2012k). These trends suggest that both MFP and the capital–labour ratio increased before 2001‑02 and decreased afterwards, in part due to the fact that the construction phases of a mine are more labour‑intensive than the production phases.

Topp et al. (2008) reported that the decline in productivity and capital–labour ratio was the result of diminishing returns to scale among resource businesses. Many projects experienced declines in ore grade (metal per tonne of ore), ore quality (impurities), reservoir pressure, or experienced increases in the overburden ratio (the proportion of overburden to ore).[[6]](#footnote-6) Other projects experienced increased mine or well depth and increased complexity in the terrain or mine geology. This meant that production could only be maintained, in the short run, through incurring higher unit costs. Nonetheless, the large increase in resource prices offset those rising costs, thereby allowing many lower‑productivity mines to continue operating. In addition, prices also made it worthwhile for miners to exploit lower‑quality ore grades.

Adding to this, the substantial investment program for many resources (table 6.1) has not yet led to a substantial increase in output. As a result, the long lead times of these investment projects is contributing to the lack of growth in MFP. In coming years, it is generally expected that this new capital base will generate sizable increases in resource output that should eventually lead to increases in MFP.

## 6.4 What were the implications for labour?

Alongside the recent boom in demand for its products, the natural resources sector has recorded a rapid increase in its workforce. While Australia’s total workforce grew by just under 25 per cent between 2002 and 2012, the resources workforce more than trebled in that time. Rising from around 80 000 to 260 000 workers, the resources sector was the fastest-growing of all 19 industry divisions during this period. This section describes the expansion of the resources workforce and analyses how the sector was able to source additional labour to meet the increasing demand for its output.

### Where has the growth of the resources workforce occurred?

The rapid expansion of the resource sector workforce during the recent natural resources boom is illustrated in figure 6.5, by industry subdivision. From 2000 onwards, the largest increase in employment, in absolute terms, occurred in Metal ore mining. This industry subdivision has long been, and continues to be, the largest component of the resources workforce, with most of these workers involved in Iron ore or Gold ore mining (ABS 2011b).[[7]](#footnote-7) The fastest rates of employment growth from 2000 onwards, however, occurred in Coal mining and Exploration and other mining support services.[[8]](#footnote-8) Employment in Oil and gas extraction also expanded rapidly, although from a relatively small base. Figure 6.5 illustrates that the recent surge in resources employment was unprecedented, compared to the preceding 15 years. Moreover, during the 1990s, employment numbers in some subdivisions within the sector actually fell.

Around 40 per cent of Australia’s resources workforce is currently located in Western Australia, with the next largest shares found in Queensland (almost 30 per cent) and New South Wales (almost 20 per cent) (ABS 2012h). Western Australia’s position as the largest employer of resource workers only emerged from around 2000 onwards (figure 6.6). In the preceding 15 years, its resources workforce was not much larger than that of New South Wales or Queensland.

To give a sense of the rapid expansion of the regional workforces within the resource‑rich states, the total number of people employed in regional Western Australia almost doubled between 2008 and 2012, while the number employed in the Mackay‑Fitzroy‑Central West region of Queensland swelled by 40 per cent (ABS 2012h).[[9]](#footnote-9) In 2011, the Western Australian Outback region recorded an employment‑to‑population rate of around 70 per cent, which was around 9 percentage points higher than that for Australia overall. In the Pilbara, a part of this region, that rate reached 84 per cent (ABS 2011b).

Machinery operators and drivers currently make up the largest occupational share (around one‑third) in the resources sector (figure 6.7). Of these workers, most are employed as Drillers, miners or shot firers (ABS 2011b). Technicians and trades workers and Professionals constitute the next largest occupational categories within the sector. Employers in the resources sector reported that, in recent years, the most difficult occupation to fill was the Professional occupation of Mining engineers (DEEWR 2012b).

Figure 6.5 Employment in the resources sector, by subdivision,  
1985 to 2012**a, b**

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a Annual count of persons employed for each year based on averaged original quarterly data. See appendix A.2 for explanation of mining industry subdivisions. b The commodities produced and services delivered by the resource sector subdivisions listed in the figure above are detailed in appendix A.

*Source*: ABS (*Labour Force, Australia, Detailed, Quarterly*, Cat. no. 6291.0.55.003).

The profile of occupations required by a firm in the natural resources sector are partly determined by the phase in which the resources project is engaged. During the exploration and early ‘planning’ phases of a project, the skills of Professionals (such as Geologists, Surveyors and Mining and mechanical engineers) are generally in high demand. During the construction and operational phases, the skills of Technicians and trades workers and Machinery operators and drivers (such as Engineering technicians, Machinists and Truck drivers) are more in demand. Overall demand for labour generally peaks during the construction phase, although workers employed during this phase are typically employed on a short‑term, rather than ongoing, basis (CMEWA 2011a; MCA, CMEWA and QRC 2010; Western Australian Regional Cities Alliance 2011). These patterns, however, are not clearly visible in the aggregated data in figure 6.7, because the many projects currently underway are at different stages of their life cycle.

Figure 6.6 Resource sector employment, by jurisdiction,  
1985 to 2012a, b, c

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a Annual count of persons employed for each year based on averaged original quarterly data. b Estimates for the ACT have been excluded due to the low sample count and high sampling variability for this jurisdiction. Some estimates for Victoria for 1996 to 2001 were subject to high sampling variability. c The scope of the resources sector is defined in appendix A.

*Source*: ABS (*Labour Force, Australia, Detailed, Quarterly*, Cat. no. 6291.0.55.003).

Figure 6.7 Resource sector employment, by occupation, 1998 to 2012a, b

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**a** Annual count of persons employed for each year based on averaged original quarterly data. Figure excludes Community and personal services workers and Sales workers, due to the low and inconsistent count. b The scope of the resources sector is defined in appendix A.

*Source*: ABS (*Labour Force, Australia, Detailed, Quarterly*, Cat. no. 6291.0.55.003).

### Nominal wage growth in the resources sector

The growing demand for resource workers has translated into strong growth in their nominal wages.[[10]](#footnote-10) While earnings in the resources sector have long exceeded earnings in the rest of the workforce due to the hazardous and remote nature of this work, the gap has widened in recent years (figure 6.8). Between 2006 and 2010, average weekly earnings across the whole of the workforce plateaued, while earnings in the resources sector continued to climb. Even after accounting for differences in hours worked (by measuring average hourly wage), this industry differential persists.

Figure 6.8 Average weekly earnings and hourly wage, resources sector and all industries, 2000 to 2012a, b, c

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a Nominal earnings and wages, including overtime, of full‑time non‑managerial employees. b ‘All industries’ includes the resources sector. c The scope of the resources sector is defined in appendix A.

*Source*: ABS (*Employee Earnings and Hours, Australia*, Cat. no. 6306.0).

Within the natural resources sector, earnings have generally been highest in Coal mining and Oil and gas extraction (figure 6.9). The average earnings of the lowest‑paid subdivision in the resources sector are still significantly higher than in other industries. Looking at growth in earnings within the resources sector, from 2004 to 2012, the fastest rate of increase occurred in Oil and gas extraction. In 2006, Oil and gas extraction overtook Coal mining as the highest‑paying one within the resources sector. As noted earlier, Oil and gas extraction also experienced one of the highest rates of employment growth of all the resource sector subdivisions during this time.

Figure 6.9 Average weekly earnings in resources sector, by subdivision, 2004 to 2012a, b, c

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a Nominal weekly earnings, including overtime, of full‑time non‑managerial employees for May of the respective year (except for 2008 which, due to data availability, is for August). b The large jump in earnings for ‘Non‑metallic mineral mining and quarrying’ from 2010 and 2012 could be due to the large standard errors associated with the overtime component of these measurements and to changes in the approach used by the ABS to measure these data. c The commodities produced and services delivered by the resource sector subdivisions listed in the figure above are detailed in appendix A.

*Source*: ABS (*Employee Earnings and Hours, Australia*, Cat. no. 6306.0).

### Where has the additional labour come from?

Given the unprecedented rate of expansion of the resources workforce in the past decade, analysing the way in which the sector was able to satisfy its booming demand for labour can shed light on some of the labour dynamics of structural adjustment occurring within Australia’s economy.

#### Workers from other industries

In the course of its expansion, the resources sector drew some of its new workers from other industries. D’Arcy et al. (2012) estimate that, in the five years to 2010, the number of workers moving to the resources sector from other parts of the economy more than doubled.

Although it is difficult to track precisely the movements of workers into the resources sector from other industries, due to the small size of the destination workforce, it is possible to produce some indicative estimates using several sources. These estimates should be interpreted with care, but the fact that various data sources generate a consistent picture lends weight to their robustness.

Estimates drawn from the Household, Income and Labour Dynamics in Australia (HILDA) Survey suggest that, during the early years of the 2000s, most workers moving into the resources sector were coming from manufacturing. In later years of the decade, proportionally more came from construction. Estimates drawn from the ABS Labour Mobility Survey generate a similar picture: workers that moved into the resources sector between 2009 and 2010 were found to have mainly moved from construction and, to a lesser degree, manufacturing (ABS 2010b). The HILDA Survey data also indicate that various services industries — including Wholesale trade, Transport, postal and warehousing and Professional, scientific and technical services —provided sources of new labour for the resources sector throughout the 2000s (see appendix C for more details). Observations from some resource businesses further confirm these general findings: for example, Waratah Coal noted that manufacturing tends to be the main industry from which the sector’s workers were being drawn throughout the 2000s (Waratah Coal 2011, cited in Denniss and Grudnoff 2012).

The relative prominence of manufacturing workers as a source of resource sector workers is attributable, in part, to the similarity, and hence transferability, of their skills set (Waratah Coal 2011, cited in Denniss and Grudnoff 2012). It can also be explained by the fact that, at the same time that the resources sector was seeking new workers, manufacturing was shedding workers. These observations illustrate that, even though the resources price boom and resultant exchange rate appreciation displaced some workers in trade‑exposed industries, it also opened up potential job opportunities for them elsewhere in the economy.

Insofar as socio‑demographic factors can partly explain employment patterns (Salma et al. 2008), it is expected that workers are more likely to move between industries that have similar socio‑demographic profiles. Of all 19 industry divisions, mining has the smallest shares of part‑time workers and female workers (DEEWR 2012a). This helps to explain why industries with similarly low shares of female or part‑time workers — namely Manufacturing, Construction, Transport, postal and warehousing and Wholesale trade — have been sources of new workers for the resources sector.

Another factor influencing workers’ capacity to switch industries into resources ― given the remote location of most mining jobs — is their capacity to move geographic location. Although it was previously observed that relatively few workers changing residence for work purposes moved further than 50 kilometres, it was also noted that the propensity of workers to move location is higher if it is to take up a job in the resources sector (chapter 5).

#### Indigenous population

Given the remote geographic location of most mining and gas extraction sites, and the high representation of the Indigenous population in the remote, resource‑rich regions,[[11]](#footnote-11) it might be expected that the rapid expansion of the resources sector provided a large number of job opportunities for the Indigenous population.

There are indications that, to some extent, the resources sector did draw upon the Indigenous population as a source of new workers during its expansion. Between 2006 and 2011, the number of Indigenous persons employed in the resources sector roughly doubled, from 3150 to 6170 workers (ABS 2011b). Furthermore, the resources sector’s share of the total Indigenous workforce grew considerably during the 2000s, rising from 1.8 per cent to 3.1 per cent between 2006 and 2011 (ABS 2006c and 2011b). However, the proportional increase in Indigenous employment numbers in the resources sector was similar to the growth of the sector’s workforce size overall. Consequently, Indigenous workers’ share of the total resources sector’s workforce remained unchanged between 2006 and 2011, at around 3 per cent (ABS 2006c and 2011b).[[12]](#footnote-12)

Around half of all Indigenous workers who were employed in the sector in 2011 were employed in Metal ore mining, which was the fastest‑growing of the resource sector subdivisions. This industry specialisation underpinned strong local Indigenous employment growth in some resource‑rich regions. For example, in the Pilbara region, the employment rate of the working‑age Indigenous population rose from 45 per cent to 51 per cent between 2006 and 2011. The 2011 figure was five percentage points higher than the Indigenous employment rate nationwide (ABS 2006c and 2011b). By contrast, in the Goldfields, Kimberley and Mid‑West regions of Western Australia’s outback, the Indigenous employment rate in 2011 was lower than the employment rate of the Indigenous population for Australia overall.

#### Skilled migrants

In circumstances where employers cannot find suitably skilled workers who are Australian citizens or permanent residents, ‘Temporary Work (Skilled) (subclass 457)’ visas (formerly ‘Temporary Business (Long Stay) (subclass 457)’ visas) ― referred to here as ‘temporary work’ visas — can be granted to skilled workers from outside Australia who have been sponsored and nominated by a business to work in Australia on a temporary basis.[[13]](#footnote-13)

Around 9 per cent of all primary temporary work visa holders at June 2012 worked in the resources sector, and another 13 per cent worked in construction (DIAC 2012b). These industries appear to have been relatively more reliant than others on this visa program as a source of labour (box 6.1). Nonetheless, almost as many temporary work visa holders work in the Health care and social assistance industry as work in construction.

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| Box 6.1 Use of Temporary Work (Skilled) visas in resources |
| At June 2012, there were 7860 primary visa holders of Temporary Work (Skilled) (subclass 457) visas (or ‘temporary work’ visas) sponsored to work in Australia’s natural resources sector (equivalent to about 3 per cent of the sector’s workforce). There were a further 11 730 primary visa holders sponsored to work in construction (equivalent to about 1 per cent of that sector’s workforce).  In **Western Australia**, 4630 temporary work visa holders were sponsored to work in the resources sector and a further 4270 in construction. Collectively, they constituted almost half of Western Australia’s temporary work visa holders across all industries. The number of temporary work visa holders in the resources sector was equivalent to 4 per cent of Western Australia’s total resources workforce.  Although Western Australia provided around 11 per cent of all jobs in Australia, its share of the total number of temporary work visa holders in Australia stood at just over 20 per cent at June 2012. Around one‑quarter of all newly-issued temporary work visas in WA during the 2011‑12 financial year were for occupations related to the resources sector, including Mechanical engineers, Civil engineers, Mechanical engineering technicians, Geologists, Metal fabricators, Welders, Fitters, Construction project managers and Engineering managers. |
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| Box 6.1 (continued) |
| In **Queensland**, 2070 temporary work visa holders were sponsored to work in the resources sector and another 2550 in construction. Together, they amounted to around 30 per cent of all temporary work visa holders in Queensland. The number of temporary work visa holders working in Queensland’s resources sector represented around 3 per cent of that state’s total resource sector workforce. Civil engineers, Mechanical engineering technicians, Geologists, Construction project managers, and Program or Project administrators were among the most common occupations of new visa recipients in the financial year 2011-12.  While the **Northern Territory**’s resources workers constitute a small share of Australia’s total resources workforce, 15 per cent of all temporary work visa holders in the Territory were sponsored to fill resource sector jobs, and a further 15 per cent worked in construction. As a proportion of all temporary work visa holders in **New South Wales**, those working in the resources sectors did not make up a significant share. This suggests that employers in the resources sector in New South Wales did not encounter the same degree of difficulty in sourcing labour, compared to those in other jurisdictions. |
| *Sources*: Productivity Commission estimates using ABS (*Labour Force, Australia, Detailed, Quarterly*, Cat. no. 6291.0.55.003) and DIAC (2012b). |
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In addition to temporary work visas, Australia’s regional migration scheme offers employer‑sponsored visas to skilled migrants who are prepared to live and work outside of the Gold Coast, Brisbane, Newcastle, Sydney, Wollongong and Melbourne. Nearly 16 500 skilled migrants were granted these visas in 2011‑12, with almost one‑quarter filling positions in Western Australia (DIAC 2012a).

#### Workers from other states or regions

There is some evidence that the natural resources boom attracted workers into resource‑rich states, with Queensland and Western Australia experiencing the largest net intakes of interstate migrants (and nearly every other jurisdiction experiencing negative net flows) during the 2000s (figure 6.10). In Western Australia, the ongoing inflow of interstate migrants reversed the net outflow of interstate migrants experienced prior to the boom. The interstate migrant intake in Western Australia was largely comprised of young professionals working in the field of engineering and science (CMEWA 2011b).

Figure 6.10 Net interstate migration of working‑age population, by destination, 2001 to 2011a

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a ‘Working age’ refers to the population aged 15 to 64 years.

*Source*: ABS (*Migration Australia*, Cat. no. 3412.0).

Despite some workers migrating to the resource‑rich states, that flow has not been substantial, relative to the total size of the resource sector workforce. This may be partly reflective of the length of time required for workers in one location to respond to higher wages or lower unemployment in another location, as discussed in chapter 5. At the same time, however, interstate migration data do not capture the sizeable flow of workers moving into the resources sector and resource‑rich states, but not necessarily moving their place of permanent residence, by way of ‘Fly‑in, Fly‑out’ (FIFO) and ‘Drive‑in, Drive‑out’ (DIDO) employment.

### A closer look at Fly‑in, Fly‑out employment

To attract a sufficient number of new workers during the recent resources boom, employers in the resource industries have made strong use of FIFO and DIDO work arrangements.[[14]](#footnote-14) Such arrangements see workers commuting to work at mines or wells in (usually) remote locations without changing their permanent residence. FIFO and DIDO workers generally work and live at the project site for relatively short periods of time (9 days every fortnight, or 14 days every 3 weeks) during which food, temporary accommodation and travel between the project site and the worker’s permanent place of residence are usually provided by the employer (House of Representatives Standing Committee on Regional Australia 2013). Another distinguishing feature of FIFO work is that workers typically work twelve-hour shifts, rather than the traditional eight‑hour shift.

Long‑distance commuting arrangements are not a new phenomenon within the wider workforce. In the provision of the health and education services, for example, it has been common for workers to fly in and out of remote towns as required. Such arrangements have also long been used by the construction industry to supply workers for short‑term projects (NRSET 2010b). Even within the resources sector, during the 1960s and 1970s, specialist workers were often flown in to the work sites and housed temporarily in camps (CMEWA 2011a).

Yet, perhaps never before in Australia’s history has FIFO been so closely associated with the booming growth of a single industry. According to some peak bodies in the sector, FIFO workers have provided ‘a significant and growing proportion of the workforce needed by the resources sector’ (CMEWA 2012, p. 2). As the mining boom took hold throughout the 2000s, the number of resource sector workers employed under FIFO arrangements not only increased substantially in absolute terms, but also as a proportion of the resources workforce (CMEWA 2011a; Hogan and Berry 2000; House of Representatives Standing Committee on Regional Australia 2013; Morris 2012; WALGA 2012).

While the prevalence of FIFO within the resources sector varies from project to project, a snapshot of Rio Tinto’s workforce illustrates its prevalence in some parts of the sector. Within its iron ore operations in Western Australia, around 46 per cent of Rio Tinto’s workforce (equivalent to 10 700 workers) were employed on FIFO arrangements in 2011 (Rio Tinto 2011b). It is especially common for FIFO arrangements to be adopted during the construction phase of a mining project, given the short‑term nature of construction work. In Western Australia, it has been forecast that 92 per cent of all construction workers involved in resources projects between 2012 to 2015 would be employed on a FIFO basis (CMEWA 2011b).

#### How many Fly-in, Fly-out workers are there?

Notwithstanding the widespread perception that FIFO has grown in prevalence in the resources sector, there are some pragmatic difficulties in measuring the total number of workers employed under FIFO arrangements in Australia’s resources sector. This was acknowledged in the Parliamentary Inquiry report on FIFO work practices (House of Representatives Standing Committee on Regional Australia 2013) and by the ABS (ABS 2012c and 2012d). One major impediment is that many datasets collect information about workers’ residential location but not their work location. If FIFO workers live in metropolitan or inner regional areas, there might be no way of knowing that they work in remote areas.

Nevertheless, some broad estimates are feasible. Using the most recent Census data, it is estimated that, in 2011 — in the main mining regions of Western Australia, Queensland and New South Wales alone — there were around 34 000 Mining and Construction workers employed under FIFO arrangements (see Productivity Commission estimates in box 6.2).[[15]](#footnote-15) The total number of FIFO workers across all regions of Australia is upwards of this figure.

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| Box 6.2 Estimating the number of Fly-in, Fly-out workers in the resources sector |
| The latest ABS Census of Population and Housing, collected in August 2011, allows the number of ‘Fly-in, Fly-out’ (FIFO) workers employed in the resources sector to be estimated, insofar as some workers reported a different place of usual residence from their place of work. Table 6.2 presents the number of workers employed in the Mining industry in Australia’s major mining regions who usually lived outside of these regions. These workers are likely to be working on mining projects under FIFO arrangements. Since these projects frequently also employ construction workers under FIFO arrangements, an estimate of Construction workers is also computed.  According to these data, roughly one in four mining workers in Western Australia, and one in six mining workers in Queensland, were employed under FIFO arrangements.  Another way to gauge the FIFO workforce size is to look at the number of workers residing in ‘staff quarters’ in mining and gas extraction regions on Census night. In Western Australia’s resource regions, around 13 500 Mining workers and 6300 Construction workers were residing in staff quarters. In Queensland’s main resource regions, there were around 6200 Mining workers and 2800 Construction workers in staff quarters. These numbers generally corroborate the derived estimates reported in the table below.  In addition to staying in staff quarters, Mining and Construction workers tended to be the most common type of worker residing in hotels and motels, which is another form of temporary accommodation for FIFO employees. |
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| Box 6.2 (continued) |
| Table 6.2 Estimated Census count of FIFO workers in the Mining and Construction industries, 2011a, b, c   |  |  |  |  | | --- | --- | --- | --- | |  | *WA* | *Queensland* | *NSW* | | **Mining workers** |  |  |  | | Work in region, but live outside region | 15 000 | 7 400 | 1 000 | | Share of state’s total mining workforce | 23% | 16% | 3% | | **Construction workers** |  |  |  | | Work in region, but live outside region | 5 600 | 3 700 | 1 100 | | Share of state’s total construction workforce | 6% | 3% | 0.7% |   a WA refers to the WA‑Outback statistical area (comprised of the Esperance, Gascoyne, Goldfields, Kimberley, Mid‑West and Pilbara areas). Queensland refers to the Darling Downs‑Maranoa; Fitzroy; Mackay; and Queensland‑Outback statistical areas. NSW refers to the Central West; Far West and Orana; and Hunter Valley (excluding Newcastle) statistical areas. All areas also include workers who worked offshore (for example, on oil rigs and drilling platforms) or were in long‑distance transit for work purposes (classified as Migratory/Offshore/Shipping).  b Estimates of the shares exclude workers who gave insufficient information about their place of work.  c The Mining industry is defined as in in appendix A and equates with the resources sector. That sector does not include the Construction industry, which is added to the table above for completeness.  *Source(s)*: Productivity Commission estimates using ABS (*Census of Population and Housing 2011, TableBuilder*, Cat. no. 2072.0; *Labour Force, Australia, Detailed, Quarterly*, Cat. no. 6291.0.55.003).  Summing up the figures in table 6.2, in 2011, in the main mining regions of Western Australia, Queensland and New South Wales, there were in the vicinity of 23 500 Mining workers and 10 500 Construction workers employed under FIFO arrangements.  These estimates — totalling almost 34 000 workers — are most likely a lower bound of Australia’s total FIFO resource and resource‑related workforce, since they do not capture FIFO activity in other, smaller mining or gas extraction regions within Australia. Nor do they include workers who are ancillary to the core resource and construction workforces (such as transport, cleaning, and catering staff) who also fly in and out of mining sites.  Some other caveats apply to table 6.2. First, since these estimates are based on large‑scale statistical areas, and exclude workers who live relatively close to their work location, they mainly capture FIFO (not DIDO) workers. Second, some workers living outside mining regions who did not provide information about their location of work could not be included the estimates, even though some of them are expected to be FIFO workers. Third, not all non‑residential construction workers commuting to mining regions for work are involved in the resources sector. This caveat is more likely to affect estimates for the mining regions of NSW, given their greater diversity of economic activity.  Improvements to data collection, as recommended by the House of Representatives Standing Committee on Regional Australia (2013), would facilitate a more precise count of Australia’s FIFO resource workforce. |
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Using alternative approaches, other researchers have constructed similar (albeit significantly higher) estimates from Census data. RBA research estimates that the total number of FIFO workers involved in mining and construction in 2011 was at least 50 000 (D’Arcy et al. 2012).[[16]](#footnote-16) Analysis commissioned by the Minerals Council of Australia (MCA) estimated that in 2011 there were around 44 600 mining workers, and 23 400 construction workers, across the whole of Australia, who undertook ‘long‑distance commuting’ (KPMG 2013).[[17]](#footnote-17) This analysis found that around 18 700 workers in the Pilbara were long‑distance commuters, with almost half employed in mining and one‑quarter employed in construction. In the Bowen Basin, this figure stood at 16 500 workers, with almost two‑thirds of these employed in mining (KPMG 2013).

#### Why has Fly-in, Fly-out employment grown in the resources sector?

As is true for any form of work, the use of FIFO reflects the interaction of labour supply and demand, mediated by the relevant institutions (Shomos, Turner and Will 2013). The fact that the prevalence of FIFO has grown in the last decade suggests that some of the determinants of supply and demand for mining workers have shifted and/or that institutions affecting that market have changed. Such changes would have altered, in turn, the relative balance between the benefits that FIFO provides, the costs that it entails and the costs associated with alternative work arrangements, from the perspectives of both employers and workers.

On the demand side of the labour market, it is possible to identify a number of developments that have made the use of FIFO relatively more attractive for employers than employing local workers:

* FIFO broadens the pool of labour available, as more workers with appropriate skills and qualifications can be transported from wherever they permanently reside in the country or internationally, to wherever they are required. This enhances the numerical and functional flexibility of mining operations.
* Prior to the natural resources boom, the permanent population in remote areas had grown less quickly than in regional and metropolitan areas. This made it difficult for employers to source sufficient workers from the local residential population — as had been the practice previously — when the boom began (CMEWA 2011a; Rio Tinto 2011b; FMG nd; Mount Isa Chamber of Commerce 2012).
* The resources sector’s move to continuous 12‑hour shifts rather than weekday 8‑hour shifts has lowered the relative cost of transporting and housing workers for resource businesses.
* A greater number of direct public flights have become available to mining regions from urban centres such as Brisbane, Melbourne and Sydney (NRSET 2010b). For example, in 2012, Karratha airport in Western Australia’s mining region served five times more passengers than it did ten years earlier (BITRE 2012).
* Due in large part to advances in technology, the length of time that mining or construction workers are required to remain at a given location has generally become compressed (Buchanan, Baldwin and Wright 2011).

On the supply side of the labour market, some factors have also increased the relative attractiveness of FIFO for workers:

* This form of work enables resource sector employees to take up high‑paying jobs in remote locations while maintaining their lifestyle, family commitments and social networks in their permanent place of residence. In addition, FIFO work is better able to accommodate the rising prevalence of two‑income families, for whom the prospect of securing non‑resource jobs in the same remote area is minimal.
* Technological advances in communications and transport technology have helped alleviate some of the sense of isolation and separation that FIFO workers would otherwise experience.

Finally, as is the case in any market, the interaction of supply and demand is shaped by the nature of institutions governing, or influencing, that market:

* Various components of the tax system influence the financial incentives faced by both employers and workers regarding FIFO. General tax provisions of particular relevance to the resources sector because of the remote location of much of its operations are the: (i) Fringe Benefits Tax (FBT); (ii) Goods and Services Tax (GST); and (iii) Zone tax offset. In some circumstances, the application of the FBT and GST can make it cost-effective for employers to provide travel and temporary accommodation to their employees at work sites, rather than provide or subsidise permanent residential accommodation for them at those sites (ARC Research Team 2011; Buchanan, Baldwin and Wright 2011; Haslam McKenzie 2010; CMEWA 2011a; House of Representatives Standing Committee on Regional Australia 2013; NRSET 2010a; Storey 2001; Western Australian Regional Cities Alliance 2011). The effects of the zone tax offset on the tax-effectiveness of workers opting for FIFO work rather than permanent relocation are not easily predicted, as they depend on the frequency and length of stays in remote areas.
* While the expansion in airline services to mining areas is in part a response to booming demand, changes in policies governing the airline industry, resulting in improved performance and flexibility, have also played a role (MCA 2011).

To date, the combination of supply, demand and institutional factors outlined above has resulted in the growth of FIFO numbers in the resources sector. To what extent this growth will continue is difficult to predict. Recent changes to tax arrangements governing FBT exemptions for living-away-from-home allowances appear to favour the provision of FIFO work over longer, temporary relocation (ATO 2013). On the other hand, the current transition from the construction phase of the resources boom to its production phase should see the demand for FIFO workers abate, all else equal (CMEWA 2011b).

1. The terms ‘natural resources sector’, ‘resources sector’, ‘mining industry’, and ‘mining sector’ are used interchangeably in this chapter. Unless otherwise indicated, the data used to describe this sector are based on the ABS’s ‘Mining’ division (ABS 2006b). Definitions of that division, its subdivisions and the commodities and services they produce are provided in appendix A. [↑](#footnote-ref-1)
2. The issue of changing labour requirements and their effect on wages is discussed in section 6.4. [↑](#footnote-ref-2)
3. Quality-adjusted prices are the prices paid for capital items after accounting for changes in the quality (as measured by the productive potential) of the item. For example, computers in 2013 have much more powerful processors than they did in 1980. After accounting for computing power improvements, and notwithstanding inflation, computers in 2013 are only a fraction of the price of those in 1980. [↑](#footnote-ref-3)
4. Despite large price increases, the output of uranium declined after 2002-03 due to the fact that it is governed by regulatory, rather than economic, considerations. [↑](#footnote-ref-4)
5. The BREE notes that projects can still experience a change in scope and schedule, or even be halted, even after their final investment decision is reached. [↑](#footnote-ref-5)
6. These authors estimated that, after accounting for resource depletion, the growth in mining MFP over the 1974-75 to 2006-07 period was 2.50 per cent per annum, compared to the 0.01 per cent measured by the ABS (Topp et al. 2008). [↑](#footnote-ref-6)
7. Unless otherwise indicated, all citations of Census data in the remainder of this chapter refer to Productivity Commission estimates drawn from the ABS *Census of Population and Housing* andcalculated using ABS *TableBuilder 2006* (Cat. no. 2065.0) and ABS *TableBuilder 2011* (Cat. no. 2072.0). [↑](#footnote-ref-7)
8. Excluding the industry subdivision ‘Mining (not further defined)’. [↑](#footnote-ref-8)
9. ‘Regional Western Australia’ refers to the ‘Balance of Western Australia’ statistical region, which includes Kalgoorlie, Port Hedland, East Pilbara, Roebourne, Ashburton and Broome (among other regions). Employment numbers refer to August. [↑](#footnote-ref-9)
10. Nominal wages are an appropriate comparator of wages across industries and regions, provided consumer prices do not differ much geographically. [↑](#footnote-ref-10)
11. Although the Indigenous population makes up around 2.5 per cent of Australia’s total population, this share is much higher in many mining regions. For example, 40 per cent of the people living in the Kimberley region are Indigenous (ABS 2011b). [↑](#footnote-ref-11)
12. This statistic notwithstanding, anecdotal evidence suggests that the representation of Indigenous workers within the workforce of individual resource businesses has grown considerably over recent decades. For instance, Rio Tinto reported that, as a share of its company’s total workforce, the proportion of Indigenous workers increased from less than half of one per cent during the mid-1990s to 8 per cent by 2010 (Rio Tinto 2011a). [↑](#footnote-ref-12)
13. This visa applies only for occupations that have been approved by the Australian Government. [↑](#footnote-ref-13)
14. This analysis focuses mainly on FIFO, rather than DIDO, employment. While FIFO arrangements appear to be most commonly used in Western Australia, DIDO arrangements are used in many regions of Queensland and New South Wales, where there are a larger number of established regional centres that can serve as a permanent residential base for workers in driving distance to the work sites (MCA 2011). [↑](#footnote-ref-14)
15. Based on the number employed in Mining or Construction, working in the main mining regions (limited to a selection of statistical areas known to be predominantly mining regions), but not permanently residing there. Where the distance between a worker’s place of residence and the mining region in which s/he worked was sufficiently large, s/he was assumed to be employed under FIFO arrangements (that is, workers who: worked in Darling Downs–Maranoa and lived in Toowoomba; worked in Fitzroy and lived in Mackay (or vice versa); or worked in the Hunter Valley and lived in Newcastle–Lake Macquarie.) Includes workers who worked offshore or were in long-distance transit for work purposes (classified as Migratory/Offshore/Shipping). [↑](#footnote-ref-15)
16. The RBA publication’s estimate is a count of the number of ‘visitors’ in mining regions on Census night, but includes all visitors regardless of their industry of employment or whether or not they are employed. This approach has the benefit of capturing ancillary workers involved in the resources sector, who also work under FIFO arrangements (such as cleaning or transport workers contracted by mining companies), yet it also captures people who are visiting the area but not involved in mining (including workers involved in non-mining industries and tourists). [↑](#footnote-ref-16)
17. KPMG’s estimate is a count of the number of mining or construction workers who commuted at least 100 kilometres to work (measured by the distance between the geographic centres of the statistical area in which they lived and the statistical area in which they worked). However, this count was not limited to workers commuting to mining regions: it encompasses workers who commuted to *any* region in Australia, which included metropolitan cities such as Sydney. [↑](#footnote-ref-17)