

The Evolution of Mining Employment

By NAB Group Economics

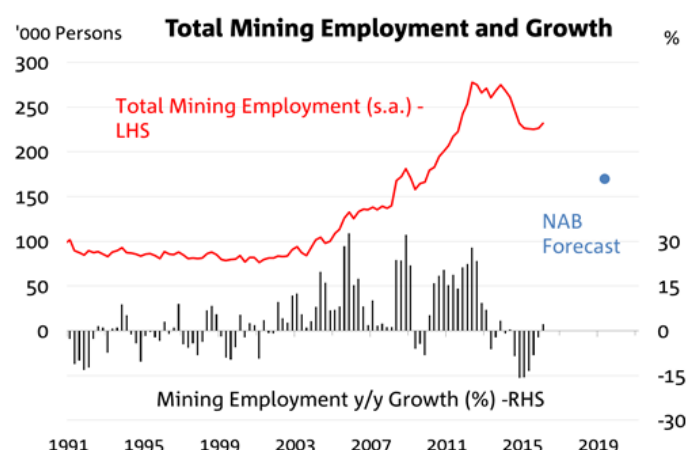


Key Points:

- Mining employment has been relatively resilient given the extent of the mining investment downturn so far. We believe that mining investment is currently more than half-way through the cycle, while employment is slightly below the half-way mark – with the difference likely to be related to the significantly higher labour intensity of LNG projects in the late stages (near –completion/completion) of the construction phase.
- We undertook a different approach from the Reserve Bank of Australia (RBA) in identifying the employment trends through the three main mining developmental stages of “exploration”, “construction” and “operation”. Leveraging on micro ABS employment data by occupation, we estimate that 122k mining construction jobs were created between the start of the mining boom (in 2004-05) and the peak (2012-13), compared to the creation of 34k operational jobs and 13k exploration-related jobs.
- We estimate that 46k mining jobs were shed between the peak in 2012-13 and 2014-15 and around 50k more will be cut going forward. The majority of the job losses are likely to come from WA due for a number of reasons, including that: 1) WA’s mining investment and employment cycles are currently less progressed than Queensland, 2) WA accounts for a larger share of total investment and employment in the country, and 3) the labour intensity of commodity projects in their operational phase in WA is lower than in Queensland.
- This will cause significant headwinds, especially in geographically affected regions and in certain specialised skill groups. However, it is not unmanageable at the national level with offsetting job creation elsewhere (particularly in services sectors) - we are forecasting 18k additional jobs to be created per month over the next few years, with the unemployment rate to track down towards 5½% by mid-2017 before inching up thereafter.
- The larger-than-expected declines in commodity prices from their 2014 levels and the forecast prolonged nature of the low-commodity price

environment will continue to limit the number of new projects, suggesting limited upside to mining investment and employment going forward.

Chart 1: Mining Employment

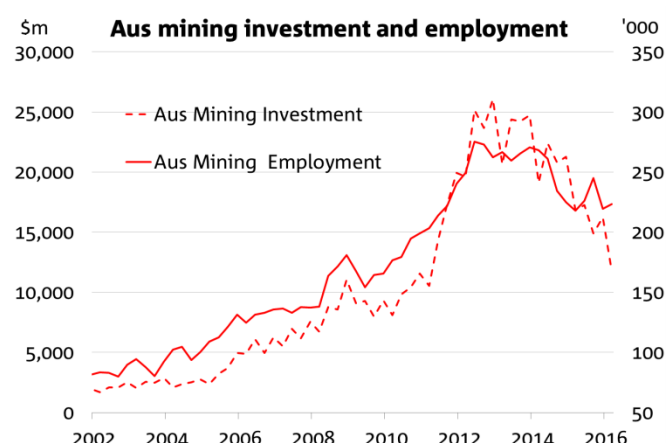


Source: ABS, NAB Group Economics

Background

The run-up in mining investment from mid-2000s to 2012 led to a surge in resources sector-related employment, as a large number of workers were required to build new mining facilities. According to ABS employment by industry data, mining employment rose sharply between May 2005 and May 2012, equivalent to 13.6% of annual growth and representing the fastest growing industry over the period *in percentage terms*. In level terms however, labour-intensive services sectors such as health (+364k), education (+244k) and professional services (+174k) added more jobs than mining (+164k).

Chart 2: Aus mining investment and employment

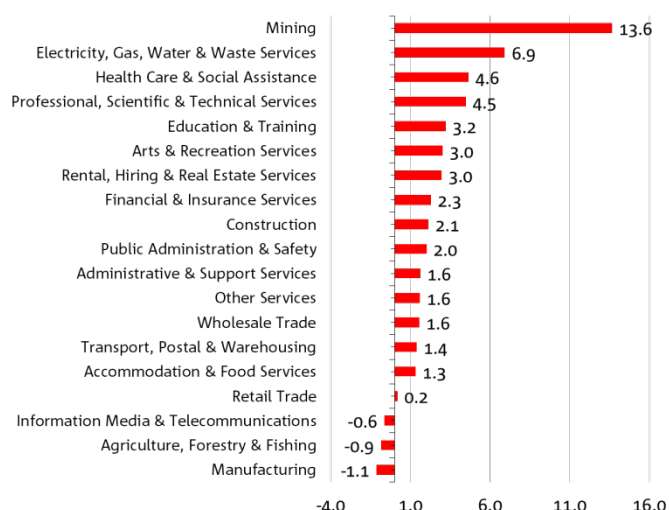


Source: ABS, NAB Group Economics

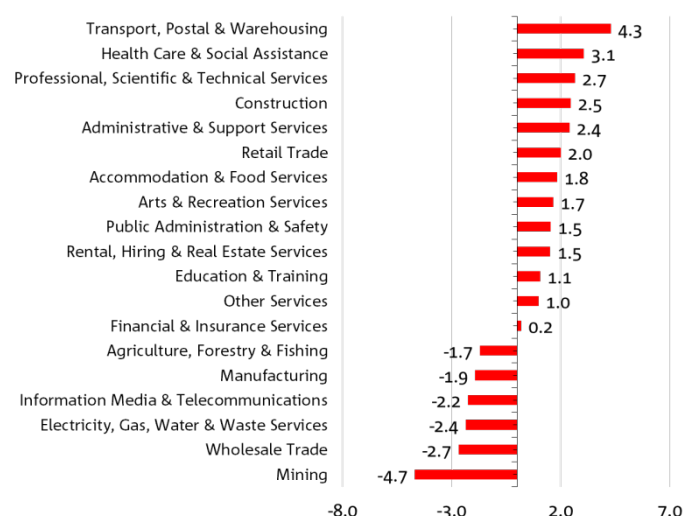
As the significantly more labour-intensive mining construction phase transitions into the less labour-intensive operational phase, the large number of temporary construction jobs created will be cut back. We observe that the job shedding process has already taken place to some extent since the peak of mining investment in 2012-13, but the job loss to-date has not been as severe as previously anticipated for this point in the mining investment cycle. Some of the possible factors contributing to this phenomenon will be discussed in the second last section of this document.

Charts 3 and 4: Annual Growth in Employment by Industry

Annual Growth in Employment by Industry Between May 2005 and May 2012 (%)



Annual Growth in Employment by Industry Between May 2012 and Feb 2016 (%)



Source: ABS, NAB Group Economics

Mining Employment Characteristics

Mining employment can be broadly categorised into three types based on the development stages of the resource production cycle: exploration, construction and production (operation). However, given that the ABS employment by industry data is only disaggregated by the employers' industry classification rather than the nature of employment, it is not easy to accurately distinguish between the three types of mining employment and hence their evolutionary patterns throughout the mining cycle.

Mining employment classifications by the ABS

There have been a few studies undertaken by institutions and industry bodies, including the RBA, which attempted to estimate the size and composition of mining employment through time using official ABS data. However, we believe that the way in which the ABS industry classification data have been interpreted in these studies is debatable. **The few studies conducted to-date¹, including the one by the RBA², have made the assumption that employment classified by the ABS to the mining industry includes only those engaged directly in mining production (please see Appendix A for further discussion of this approach).**

However, we were explicitly informed by the ABS that the employment data has been categorised based on the registered business types of employers, and not based on the nature of activity engaged in by the

¹ AWP (Australian Workforce and Productivity Agency) (2013), *Resources Sector Skills Needs 2013*, AWP, Canberra.

² Doyle, M. (2014). "Labour Movements during the Resources Boom", *RBA Bulletin*, Dec qtr 2014, p. 12

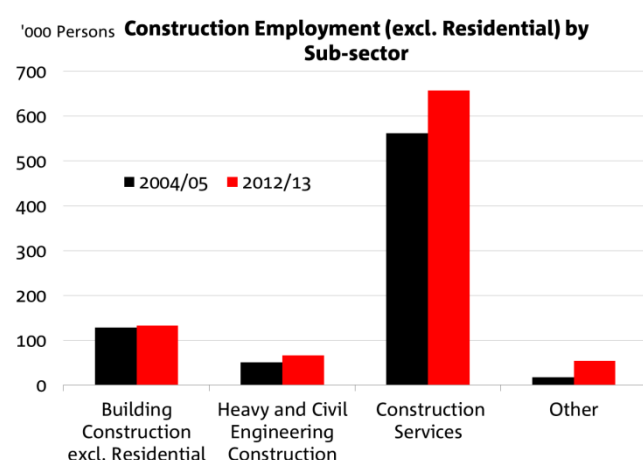
workers. For example, employees by Santos, an oil and gas extraction company, could have undertaken a range of different activities (exploration, construction and operational) but their employment would still be classified under “oil and gas extraction” in the official data. As such, we are sceptical of the claim that all employment classified under “mining” is solely to do with mining operations, while construction-related jobs within the mining sector is classified under “construction”. Furthermore, the sharp increase in mining employment between 2004-05 and 2012-13 is difficult to explain satisfactorily through a pick-up in operational jobs, given that the mining investment phase was associated with a disproportionate increase in construction jobs.

NAB's approach

Based on the arguments above, we propose an alternative hypothesis that the additional jobs created during the mining boom, both construction and operational, were mostly classified under “Mining” in the ABS employment by industry data. Leveraging detailed ABS occupation data, we attempt to shed some light on the split between construction and operational jobs within mining employment, as well as to identify the extent to which they have changed over the mining investment cycle.

That said, we acknowledge that there were likely to have been some employment “spill-over effects” due to indirect employment into other industries, especially business and professional services and construction. However, quantifying the latter remains a challenge.

Chart 5: Construction employment



Source: ABS, NAB Group Economics

Mining employment characteristics in 2004-05, 2012-13 and 2014-15

To distinguish between construction and operation-related jobs within the mining employment data, we first obtained detailed ABS occupation data (at 4-digit level) for the mining industry from the Labour Force Survey for the years of 2004-05 (representing the start of the mining boom), 2012-13 (peak of mining boom) and 2014-15 (the most recent yearly data). The idea was to then allocate the highly detailed occupational data within each year across the three types of employment typically found in the mining cycle (exploration, construction and operation) to varying degrees based on the specificity of their titles.

For any single year, exploration-related occupations are separately identified as the first step and, and in any case, only represent a small share of total employment. For the remaining occupations, the ones that come across as straightforward in terms of being construction or operation-related are then assigned to those two categories accordingly, while occupations which suggest a mix of both construction and operation activities are classified under the “part-construction” category until the relative weights of construction versus operation employment within those occupations are determined. For example, “construction managers” and “general clerks” are clearly suggestive of being associated with construction and operation respectively, but there are many occupations which are not as clear-cut, such as “machine operators” and “mining engineers”, which potentially encompass a mix of construction and operational activity. Occupations which we believe to be solely related to construction are shown in **Table A in Appendix B**, production-only jobs are in **Table B**, while occupations which are “part-construction” are shown in **Table C**.

The next step involves the estimation of the relative size of construction and operation employment within the “part-construction” occupations during each of the three years of 2004-05, 2012-13 and 2014-15. To accomplish that, we have to make further assumptions for the shares of construction employment in those occupations in each of those three years which denote a different stage of the mining cycle. The assumptions are made based on our understanding of the relative distribution of labour intensity across the different types of mining activity overtime. The employment figures contained within the occupations under the three categories of exploration, construction and operation are subsequently aggregated for each of those years.

Fair to say, estimates of the different types of employment based on this approach are associated with a high degree of uncertainty, which we would seek to address by presenting two different scenarios. For both scenarios, we have assumed that the average ratio for construction to operation employment (for the “part construction” occupations) was 3 to 1 during the mining investment peak of 2012-13 – based on the employment estimates published by the Department of Industry – but they have different starting (2004-05) and ending (2014-15) ratios.

In the first scenario (our central case), the construction share for “part-construction” occupations is set at 0.25 in 2004-05, 0.75 in 2012/13 and 0.55 in 2014-15 respectively. This stems from our assumption that construction jobs constituted a relatively small share in the “normal” period prior to the boom, and then momentum intensified greatly during the boom period, before easing over the last three years. In the second scenario, construction jobs are assumed to be more “sticky” with a higher starting threshold share of 0.4 in 2004-05, 0.75 in 2011/12 and 0.60 in 2014-15 respectively. The results of this exercise for Scenario 1 & 2 are shown in Table 1 and 2 respectively below:

Tables 1&2: Occupational structure of mining industry

Scenario 1 (Central Case):

| | Exploration | Construction | Operation | Total |
|--|-------------|--------------|-----------|---------|
| 2004/05 | | | | |
| Persons | 12,965 | 22,394 | 68,499 | 103,858 |
| % | 12% | 22% | 66% | 100% |
| 2012/13 | | | | |
| Persons | 25,988 | 144,046 | 102,428 | 272,462 |
| % | 24% | 53% | 38% | 152% |
| Change between 04/05 and 12/13 (Persons) | 13,023 | 121,652 | 33,930 | 168,604 |
| 2014/15 | | | | |
| Persons | 28,636 | 91,346 | 106,196 | 226,178 |
| % | 13% | 40% | 47% | 100% |
| Change between 12/13 and 14/15 (Persons) | 2,648 | -52,700 | 3,768 | -46,284 |

Scenario 2:

| | Exploration | Construction | Operation | Total |
|--|-------------|--------------|-----------|---------|
| 2004/05 | | | | |
| Persons | 12,965 | 31,616 | 59,277 | 103,858 |
| % | 12% | 30% | 57% | 100% |
| 2012/13 | | | | |
| Persons | 25,988 | 144,046 | 102,428 | 272,462 |
| % | 10% | 53% | 38% | 100% |
| Change between 04/05 and 12/13 (Persons) | 13,023 | 112,430 | 43,151 | 168,604 |
| 2014/15 | | | | |
| Persons | 28,636 | 98,002 | 99,540 | 226,178 |
| % | 13% | 43% | 44% | 100% |
| Change between 12/13 and 14/15 (Persons) | 2,648 | -46,044 | -2,888 | -46,284 |

Source: ABS, NAB Group Economics

The results from our Scenario 1 (our central case) suggest that the increase in construction-related employment (+121,652) was more than 3 times the increase for operation-related employment (+33,930) between the start (2004-05) and the peak (2012-13) of the mining boom. Since then, the gradual transition of the mining cycle from the high labour-intensity construction phase to lower labour-intensity operational phase has witnessed some degree of construction-related job shedding. **In the two years to 2014-15, our central case suggests that around 53k construction-related jobs were terminated, but they were partly offset by a 3k and 4k increase in exploration and operation jobs respectively, creating a net loss of 46k jobs between 2012-13 and 2014-15.**

Meanwhile, Scenario 2 points to a slightly smaller increase of 112k construction jobs in the boom period between 2004-05 and 2012-13, and a similar decrease since the latter year to 2014-15 of around 46k jobs. Operation jobs decline by around 3k in this scenario, which seem unlikely given the magnitude of the increase in operation activity.

That said, the two scenarios do come to a relatively similar conclusion that construction-related mining employment continued to remain at an abnormally elevated level by the end of 2014-15 and has a fair way to decline, even if we were to assume for a slightly higher equilibrium level of construction employment at the end of the current cycle.

More recent developments in mining employment:

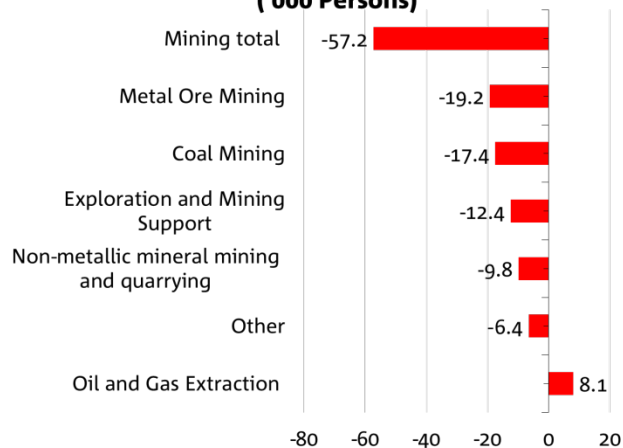
Mining employment fell notably between May 2012 and Feb 2015, before showing signs of stabilisation over most of 2015, and a minor uptick more recently.

At its current level, mining employment is moderately higher than previously anticipated given the level of mining investment. Based on original quarterly data, the sub-industry sectors of metal ore mining and coal mining showed the largest declines over this period of 19,100 and 17,400 jobs respectively. Meanwhile, oil and gas extraction employment rose by 8,000. This potentially reflects the completion of a number of smaller coal and iron ore projects during this time, and the intensifying construction activity of a number of larger LNG projects.

In 2015, stronger labour requirements on the back of the completion/near-completion of several major LNG mining projects such as Pluto, Queensland Curtis LNG (QCLNG) and Gladstone LNG (GLNG), which are significantly more labour-intensive than most other types of commodity projects, appear to have propped up mining employment. **This suggests further downside risks to mining employment once the construction phase of these “lumpy” projects wind down.**

Chart 6: Change in mining employment by sub-sector

Change in Employment by Mining Sub-industry over May 2012 and Feb 2015 ('000 Persons)

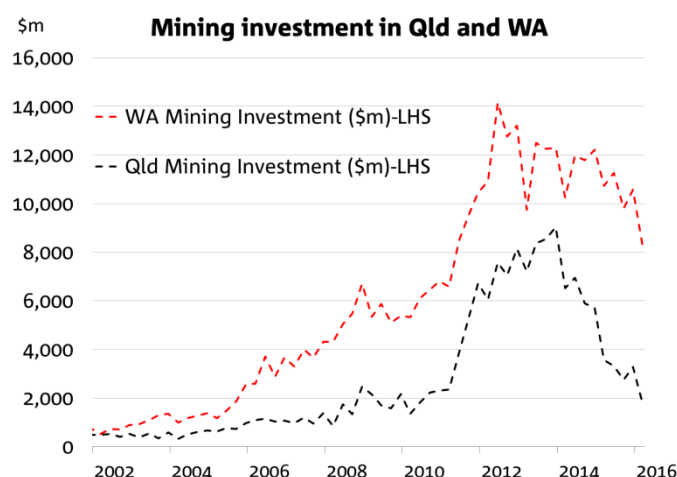


Source: ABS, NAB Group Economics

State details

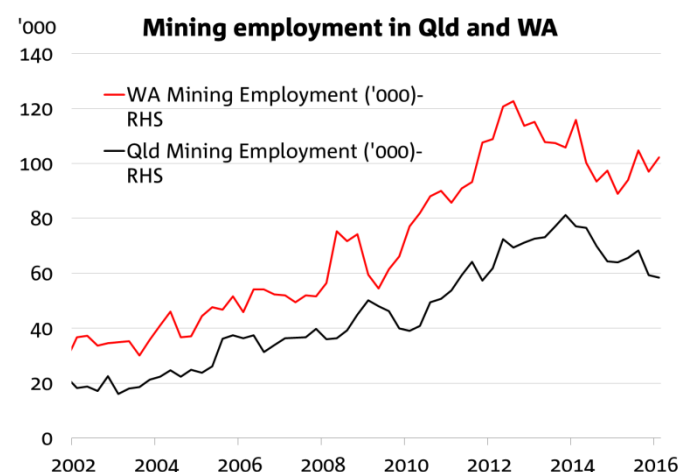
The dramatic rise in mining investment and employment from the mid-2000s to 2012-13 has been largely driven by Western Australia and Queensland. However, the type and timing of mining projects that have dominated in each state have varied across time. **This has resulted in investment trajectories which are quite different, with Queensland at a more advanced stage in its mining employment cycle (see Chart 7).** However, the employment trajectories for Queensland and WA have been more in sync (Chart 8).

Chart 7: Mining investment in WA and Qld



Source: ABS, NAB Group Economics

Chart 8: Mining employment in WA and Qld



Source: ABS, NAB Group Economics

As can be seen quite clearly from Chart 7 above, the pick-up in mining investment in WA occurred slightly earlier than in Queensland, and its trajectory is generally less “lumpy” over time. This is largely attributable to the large iron ore mining projects commenced in the early 2000s in the Pilbara region by Rio Tinto and BHP. This included the development of the Hope Downs and Cloud Break mines, before the commencement of the large LNG projects of Pluto and Gorgon in the second half of the 2000s, followed by the Wheatstone (LNG) and Roy Hill (iron project) projects in 2011. Besides iron ore, there was also significant mining investment in WA over the 2000s in commodities such as nickel, alumina and gold which contributed to a relatively diverse range of projects.

In the case of Queensland, coal projects in the Bowen Basin constituted most of the mining investment prior to 2010, before the significantly

more capital-intensive LNG projects of Queensland Curtis LNG (QCLNG), Australia Pacific LNG (APLNG) and Gladstone LNG (GLNG) took centre stage (please refer to Appendix C for a table on major resource projects in Qld and WA and their associated costs and employment projections) and which resulted in an intensive flow of capital and labour to the Surat Basin and Gladstone within a short period of time.

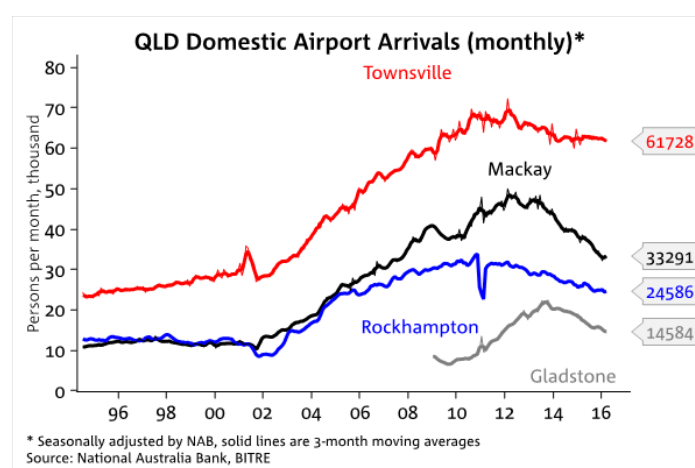
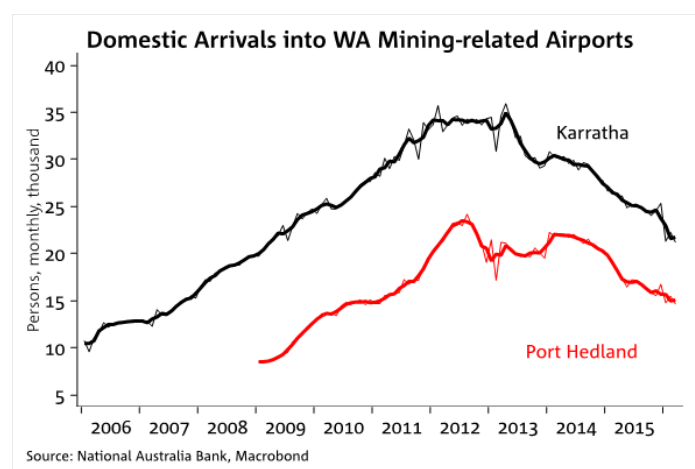
Based on the latest data (which is released with a lag), the mining investment cycle in Queensland is nearing its end, while WA is around half-way through. The construction phase of the major LNG projects in Queensland is mostly complete. The trains of QCLNG and GLNG are currently in operation, leaving the second train of APLNG the only one that is yet to begin production.

Meanwhile the construction phase of the Wheatstone and Prelude projects is still ongoing in WA, while Gorgon and Roy Hill have recently transitioned to the operational phase but their investment slowdown has yet to be captured in the official data. As such, we expect the mining investment profile in WA to drop off more sharply in coming months.

Meanwhile, the mining employment profiles for WA and Queensland have exhibited similar growth trajectories over time (Chart 8), rising by close to three times between late 2004 and their corresponding peaks of 2012 and 2013, compared to 10 times and 13 times respectively for mining investment. **The gentler rises in employment have reflected two factors: 1) the presence of a required minimum level of operational mining employment prior to the investment boom, and 2) the high capital to labour ratio of LNG projects relative to other types of commodity projects.**

Moreover, in the post-mining boom period, mining employment so far has not fallen to the same extent as mining investment, especially in the case of Queensland where the investment cycle is more progressed. This is due to an increase in operational jobs in Queensland as a result of a number of major coal projects. **The labour intensity of coal projects in the operational phase relative to the construction phase is higher than for iron ore and LNG projects.** Based on the estimates in the *Resources and Energy Major Projects* publication by the Department of Industry, the ratio of employees required in the construction to operation phase for coal projects is around 3:2, while it is around 2:1 and 5:1 for iron ore and LNG projects respectively.

Charts 9 and 10: Domestic arrivals in mining-related airports in WA and Qld



Overall, we expect further net falls in mining employment in both states as the reduction in construction jobs outpaces the increase in operational jobs. Most of the job cuts in the mining sector going forward are likely to stem from WA for a number of reasons: 1) WA's mining investment and employment cycles are currently less progressed than Queensland, 2) WA accounts for a larger share of total investment and employment in the country, and 3) the labour intensity of commodity projects in their operational phase in WA is lower than in Queensland. The relatively more concentrated industry structure of WA also renders it to be more vulnerable to a prolonged period of subdued economic and labour market activity as a result of the mining downturn. That said, the fact that investment in Queensland has fallen more sharply than employment also points to a substantial adjustment in the Queensland labour market to come.

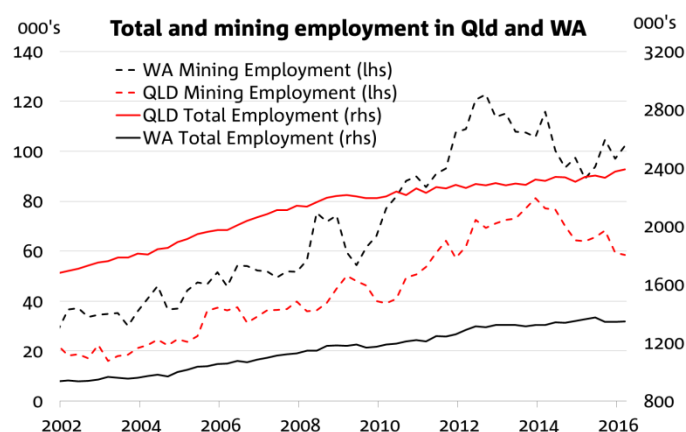
In charts 9 and 10 above, which show the domestic arrivals into mining-related airports in WA and Qld,

inbound passengers (which likely include the movements of fly-in-fly-out workers) have slowed sharply for both states since their respective peaks, but still have a fair way to fall.

Mining Employment Outlook

Our earlier discussion on mining investment in the note [*"The Mining Cliff: How far have we come?"*](#) concluded that we are a little over half-way through the unwinding mining investment cycle. In terms of mining employment, our analysis using our mining investment and export forecasts and their relationship with mining employment suggest that the employment cycle is lagging the investment cycle slightly and is currently just under half way through the downturn. We expect approximately 50k more mining jobs to be shed, which is expected to bottom out in the next 2½ years (before starting to recover). **This is likely to consist of around 65k construction jobs (to stabilise slightly above the levels seen in 2004-05), offset by a 15k increase in operation-related jobs, while exploration jobs are expected to stay largely unchanged or fall only marginally.** As a consequence, the equilibrium level of mining employment in 2019 is likely to be higher than the pre-boom era at around 170 to 180k persons, reflecting the increase in operation-related employment.

Chart 11: Total employment vs. mining employment in Qld and WA



To put these estimates into context, we expect employment growth for the next few years to average around 18k persons per month, and if our growth figures are correct, the further mining job loss of around 50k predicted should be offset by other jobs created within the domestic labour market. Furthermore, the job losses are expected

to take place relatively gradually over the next few years, which should be manageable at the national level. That said, there are certain geographical regions and specialised skill groups which will be disproportionately affected due to structural "mismatches".

At the same time, the larger-than-expected declines in commodity prices from their 2014 levels and the likely prolonged nature of the low-commodity price environment has restricted the number of new projects announced. This suggests that mining investment will fall by more than otherwise would be the case. Also, there has been evidence to suggest that many mineral and petroleum producers have responded to the commodity downturn by resorting to a series of cost-cutting programs, including a reduction in their headcount. According to the Department of Industry, the development of a number of iron ore projects has been stalled as a result. The data on total mineral and petroleum exploration expenditure from the ABS also highlights that actual expenditure has consistently fallen below expected expenditure by producers from December 2014 to December 2015, while total metres drilled declined by 8% in 2014-15. This is consistent with the observation that many producers have cut back on their exploration programs, especially at greenfield sites. **Based on the above, there is likely to be very little upside to mining investment and employment going forward.**

That said, the overall Australian economy has weathered the effects of the mining slowdown relatively well so far and continues to be one that grows moderately, with unemployment forecast to fall further. Growth has been particularly concentrated in services sectors which are more labour-intensive and in the eastern states, and this pattern is likely to continue. We expect the unemployment rate to ease gradually to 5.6% by end-16 and stabilise around that level until end-2017, before inching up in 2018.

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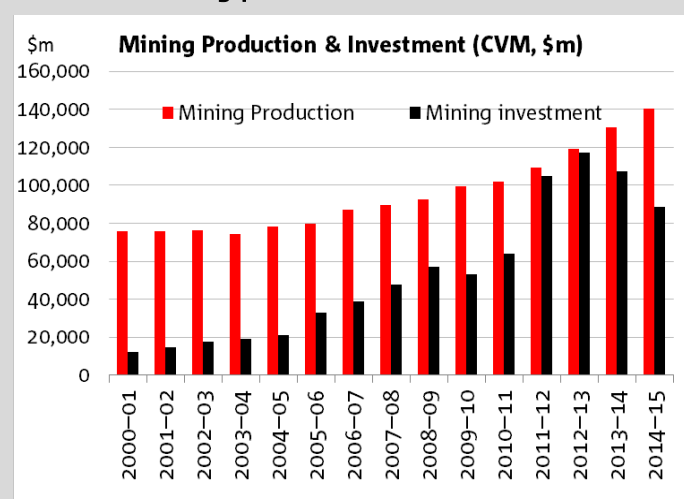
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APPENDIX A: Analysis of the RBA's approach

The few studies conducted to-date on mining employment by institutions and industry bodies, including the RBA, have made the assumption that employment classified by the ABS to the mining industry includes only those engaged directly in mining production. For instance, the RBA states that “the operational part of the resources sector currently employs around 240,000 people ..., the majority of whom work on-site in production roles”, and this figure is in line with the number of employed persons classified to the mining industry by the ABS in August 2014. From its liaison program, the RBA estimated employment in resource construction at 90,000 in 2013 which, in the RBA's view, would have to be classified by the ABS to the construction industry.

RBA's approach is based on a narrow interpretation of the sub-sector categories in the ABS mining employment data which include “metal ore mining”, “coal mining” and “oil and gas extraction” etc. as implying operational activities. Under this approach, there was a disproportionately strong increase in operation-related employment relative to construction employment when there has been a much larger proportional increase in mining investment than in mining operations between 2004-05 and 2012-13. The value of work done in engineering construction on oil, gas, coal and other minerals increased close to nine-fold between 2004-05 and 2012-13, and there has been similarly strong growth in work done on harbours and railways. Estimates of mining investment on a national accounts basis have risen by around 5½ times (in chain volume measure). Over the same period, mining production rose only by around 50% and exports 40%. Hence the above approach implies a much higher labour productivity for construction workers compared to operational ones.

Chart A1: Mining production and investment



Source: ABS, NAB Group Economics

While there was in fact a surge in construction employment (excluding those in dwelling construction) based on the ABS categorisation of around 163k between 2004-05 and 2012-13, the most relevant sub-group for mining construction, heavy and civil engineering (which includes harbours, bridges and railways associated with private mining development), only showed an employment increase of 16,000 over this period.

The rise in construction employment over that period mainly reflects increases in other construction sub-groups: building installation services (+70,000), building construction (+16,000), construction nfd (+36,800), land development and site preparation services (+9,100) and other construction services (16,400). The sharp rise in building installation services, which include plumbing, electrical, fire and security alarm, as well as air-conditioning installation services etc., coincided with the strong growth in the housing market over the period and possibly reflects the associated pick-up in the number of self-employed tradespersons in response to the heightened demand for home improvement services over the period. It is possible that some additional building construction employment might have been associated with mining, but even so, adding the increase in the category (+16,000) over the time period would be too low to satisfy the RBA's assumption of 90,000 jobs created.

APPENDIX B: Industry Occupation Classifications

Table A: Construction-only Occupations

| |
|--|
| Construction Managers |
| Surveyors and Spatial Scientists |
| Civil Engineering Professionals |
| Natural and Physical Science Professionals nfd |
| Agricultural and Forestry Scientists |
| Environmental Scientists |
| Geologists, Geophysicists and Hydrogeologists |
| Other Natural and Physical Science Professionals |
| Building and Engineering Technicians nfd |
| Architectural, Building and Surveying Technicians |
| Mechanical Engineering Draftspersons and Technicians |
| Bricklayers and Stonemasons |
| Carpenters and Joiners |
| Painting Trades Workers |
| Plumbers |
| Electrotechnology and Telecommunications Trades Workers nfd |
| Electrical Distribution Trades Workers |
| Clay, Concrete, Glass and Stone Processing Machine Operators |
| Plastics and Rubber Production Machine Operators |
| Building and Plumbing Labourers |
| Concreters |
| Fencers |
| Paving and Surfacing Labourers |
| Railway Track Workers |
| Structural Steel Construction Workers |
| Other Construction and Mining Labourers |
| Forestry and Logging Workers |

Table B: Operations-only Occupations

| |
|--|
| Managers nfd |
| Chief Executives and Managing Directors |
| General Managers |
| Specialist Managers nfd |
| Advertising, Public Relations and Sales Managers |
| Corporate Services Managers |
| Finance Managers |
| Human Resource Managers |
| Policy and Planning Managers |
| Research and Development Managers |
| Importers, Exporters and Wholesalers |
| Manufacturers |
| Production Managers |
| Supply, Distribution and Procurement Managers |
| Education, Health and Welfare Services Managers nfd |
| Child Care Centre Managers |
| Health and Welfare Services Managers |
| School Principals |
| Other Education Managers |
| ICT Managers nfd |
| ICT Managers |
| Miscellaneous Specialist Managers nfd |
| Commissioned Officers (Management) |
| Senior Non-commissioned Defence Force Members |
| Other Specialist Managers |
| Hospitality, Retail and Service Managers nfd |
| Accommodation and Hospitality Managers nfd |
| Cafe and Restaurant Managers |
| Caravan Park and Camping Ground Managers |
| Hotel and Motel Managers |
| Licensed Club Managers |
| Retail Managers nfd |
| Retail Managers |
| Miscellaneous Hospitality, Retail and Service Managers nfd |
| Amusement, Fitness and Sports Centre Managers |
| Call or Contact Centre and Customer Service Managers |
| Conference and Event Organisers |
| Other Hospitality, Retail and Service Managers |
| Professionals nfd |
| Arts and Media Professionals nfd |
| Arts Professionals nfd |
| Actors, Dancers and Other Entertainers |

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|--|
| Music Professionals |
| Photographers |
| Visual Arts and Crafts Professionals |
| Media Professionals nfd |
| Artistic Directors, and Media Producers and Presenters |
| Authors, and Book and Script Editors |
| Film, Television, Radio and Stage Directors |
| Journalists and Other Writers |
| Business, Human Resource and Marketing Professionals nfd |
| Accountants, Auditors and Company Secretaries nfd |
| Accountants |
| Auditors, Company Secretaries and Corporate Treasurers |
| Financial Brokers and Dealers, and Investment Advisers nfd |
| Financial Brokers |
| Financial Dealers |
| Financial Investment Advisers and Managers |
| Human Resource and Training Professionals nfd |
| Human Resource Professionals |
| ICT Trainers |
| Training and Development Professionals |
| Information and Organisation Professionals nfd |
| Actuaries, Mathematicians and Statisticians |
| Archivists, Curators and Records Managers |
| Economists |
| Intelligence and Policy Analysts |
| Librarians |
| Management and Organisation Analysts |
| Other Information and Organisation Professionals |
| Sales, Marketing and Public Relations Professionals nfd |
| Advertising and Marketing Professionals |
| ICT Sales Professionals |
| Public Relations Professionals |
| Technical Sales Representatives |
| Air Transport Professionals |
| Marine Transport Professionals |
| Architects, Designers, Planners and Surveyors nfd |
| Fashion, Industrial and Jewellery Designers |
| Graphic and Web Designers, and Illustrators |
| Interior Designers |
| Chemists, and Food and Wine Scientists |
| Vocational Education Teachers |
| Nutrition Professionals |

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|---|
| Medical Imaging Professionals |
| Occupational and Environmental Health Professionals |
| Optometrists and Orthoptists |
| Pharmacists |
| Other Health Diagnostic and Promotion Professionals |
| Health Therapy Professionals nfd |
| Chiropractors and Osteopaths |
| Complementary Health Therapists |
| Dental Practitioners |
| Occupational Therapists |
| Physiotherapists |
| Podiatrists |
| Audiologists and Speech Pathologists \ Therapists |
| Medical Practitioners nfd |
| General Practitioners and Resident Medical Officers |
| Anaesthetists |
| Specialist Physicians |
| Psychiatrists |
| Surgeons |
| Other Medical Practitioners |
| Midwifery and Nursing Professionals nfd |
| Midwives |
| Nurse Educators and Researchers |
| Nurse Managers |
| Registered Nurses |
| ICT Professionals nfd |
| Business and Systems Analysts, and Programmers nfd |
| ICT Business and Systems Analysts |
| Multimedia Specialists and Web Developers |
| Software and Applications Programmers |
| Database and Systems Administrators, and ICT Security Specialists nfd |
| Database and Systems Administrators, and ICT Security Specialists |
| ICT Network and Support Professionals nfd |
| Computer Network Professionals |
| ICT Support and Test Engineers |
| Telecommunications Engineering Professionals |
| Legal Professionals nfd |
| Barristers |
| Judicial and Other Legal Professionals |
| Solicitors |
| Social and Welfare Professionals nfd |
| Counsellors |

| |
|---|
| Ministers of Religion |
| Psychologists |
| Social Professionals |
| Welfare, Recreation and Community Arts Workers |
| Agricultural Technicians |
| Medical Technicians |
| Primary Products Inspectors |
| ICT Support Technicians |
| Telecommunications Technical Specialists |
| Vehicle Painters |
| Gardeners |
| Greenkeepers |
| Chemical, Gas, Petroleum and Power Generation Plant Operators |
| Ambulance Officers and Paramedics |
| Welfare Support Workers |
| Bar Attendants and Baristas |
| Cafe Workers |
| Fire and Emergency Workers |
| Security Officers and Guards |
| Driving Instructors |
| Gallery, Museum and Tour Guides |
| Tourism and Travel Advisers |
| Travel Attendants |
| Other Personal Service Workers |
| Fitness Instructors |
| Contract, Program and Project Administrators |
| Practice Managers |
| General Clerks |
| Keyboard Operators |
| Call or Contact Centre Workers |
| Information Officers |
| Receptionists |
| Bank Workers |
| Insurance, Money Market and Statistical Clerks |
| Couriers and Postal Deliverers |
| Filing and Registry Clerks |
| Mail Sorters |
| Purchasing and Supply Logistics Clerks |
| Court and Legal Clerks |
| Debt Collectors |
| Human Resource Clerks |
| Inspectors and Regulatory Officers |
| Insurance Investigators, Loss Adjusters and Risk Surveyors |
| Other Miscellaneous Clerical and Administrative Workers |

| |
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| Sales Representatives |
| Real Estate Sales Agents |
| Sales Assistants and Salespersons nfd |
| Sales Assistants (General) |
| ICT Sales Assistants |
| Motor Vehicle and Vehicle Parts Salespersons |
| Pharmacy Sales Assistants |
| Retail Supervisors |
| Models and Sales Demonstrators |
| Agricultural, Forestry and Horticultural Plant Operators |
| Automobile Drivers |
| Storepersons |
| Cleaners and Laundry Workers nfd |
| Car Detailers |
| Domestic Cleaners |
| Housekeepers |
| Laundry Workers |
| Factory Process Workers nfd |
| Packers and Product Assemblers nfd |
| Packers |
| Product Assemblers |
| Metal Engineering Process Workers |
| Plastics and Rubber Factory Workers |
| Product Quality Controllers |
| Other Factory Process Workers |
| Crop Farm Workers |
| Other Farm, Forestry and Garden Workers |
| Fast Food Cooks |
| Kitchenhands |
| Freight and Furniture Handlers |
| Shelf Fillers |
| Caretakers |
| Deck and Fishing Hands |
| Handypersons |
| Motor Vehicle Parts and Accessories Fitters |
| Vending Machine Attendants |

Table C: Part-construction Occupations

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| Construction, Distribution and Production Managers nfd |
| Engineering Managers |
| Other Accommodation and Hospitality Managers |
| Transport Services Managers |

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| |
| Engineering Professionals nfd |
| Chemical and Materials Engineers |
| Electrical Engineers |
| Electronics Engineers |
| |
| Industrial, Mechanical and Production Engineers |
| Mining Engineers |
| Other Engineering Professionals |
| Technicians and Trades Workers nfd |
| Engineering, ICT and Science Technicians nfd |
| Science Technicians |
| Civil Engineering Draftspersons and Technicians |
| Electrical Engineering Draftspersons and Technicians |
| Electronic Engineering Draftspersons and Technicians |
| Safety Inspectors |
| Other Building and Engineering Technicians |
| |
| Automotive and Engineering Trades Workers nfd |
| Automotive Electricians |
| Motor Mechanics |
| Metal Casting, Forging and Finishing Trades Workers |
| Sheetmetal Trades Workers |
| Structural Steel and Welding Trades Workers |
| Aircraft Maintenance Engineers |
| Metal Fitters and Machinists |
| Precision Metal Trades Workers |
| Toolmakers and Engineering Patternmakers |
| Panelbeaters |
| Electricians |
| Airconditioning and Refrigeration Mechanics |
| Electronics Trades Workers |
| Telecommunications Trades Workers |
| Chefs |
| Cooks |
| Other Miscellaneous Technicians and Trades Workers |
| Office Managers |
| Personal Assistants |
| Secretaries |
| Accounting Clerks |
| Bookkeepers |
| Payroll Clerks |

| |
|--|
| |
| Transport and Despatch Clerks |
| Machinery Operators and Drivers nfd |
| Machine and Stationary Plant Operators nfd |
| Machine Operators nfd |
| Industrial Spraypainters |
| Other Machine Operators |
| Crane, Hoist and Lift Operators |
| Drillers, Miners and Shot Firers |
| Engineering Production Workers |
| Other Stationary Plant Operators |
| Mobile Plant Operators nfd |
| Earthmoving Plant Operators |
| Forklift Drivers |
| Other Mobile Plant Operators |
| |
| Road and Rail Drivers nfd |
| Bus and Coach Drivers |
| Train and Tram Drivers |
| Delivery Drivers |
| Truck Drivers |
| Labourers nfd |
| Commercial Cleaners |
| Other Cleaners |
| Garden and Nursery Labourers |
| Printing Assistants and Table Workers |
| Other Miscellaneous Labourers |

Appendix C: Major projects in WA and Qld and their associated costs and employment projections

| Project | State | Type | Estimated Start Up | Committed | Completed | Estimated New Capacity | Capacity Unit | Resource | Indicative Cost Estimate \$m | Construction Employment Estimate | Operating Employment Estimate |
|--|-------|-------------|--------------------|-----------|-----------|------------------------|---------------|------------------|------------------------------|----------------------------------|-------------------------------|
| Gorgon LNG | WA | New project | 2016 | y | | 15.6 | Mt | LNG | 60,000 | 10,000 | 300 |
| Wheatstone LNG | WA | New project | 2016 | y | | 8.9 | Mt | LNG | 32,200 | 5,000 | 400 |
| Prelude Floating LNG | WA | New project | 2017 | y | | 3.6 | Mt | LNG | 12,600 | n/a | n/a |
| Roy Hill | WA | New project | 2015 | y | | 55000 | kt | Hematite | 10,700 | 3,600 | 2,000 |
| Greater Western Flank - Phase 1 | WA | Expansion | 2016 | y | | n/a | n/a | Gas/LNG | 2,500 | | 900 |
| Greater Western Flank - Phase 1 | WA | Expansion | 2016 | y | | n/a | | Gas | 2300 | | |
| WAIO optimisation (port blending and rail yards) | WA | Expansion | 2017 | y | | n/a | | Iron Ore | 2050 | | |
| Julimar Development Project | WA | New project | 2016 | y | | 100 | PJ pa | Gas/LNG | 1,200 | | |
| Persephone Gas Field | WA | New project | 2018 | y | | 100 | PJ pa | Gas/LNG | 1,200 | | |
| Australia Pacific LNG | QLD | New project | 2015 | y | | 9 | Mt | LNG | 24,700 | 6,000 | |
| Gladstone LNG | QLD | New project | 2015 | y | | 7.8 | Mt | LNG | 21,200 | 5,000 | 1,000 |
| Queensland Curtis LNG project | QLD | New project | 2014 | y | | 8.5 | Mt | LNG | 19800 | 5000 | 1,000 |
| Grosvenor underground | QLD | New Project | 2016 | y | | 5 | Mt | coking coal | 1950 | 400 | 1000 |
| Yarwun Alumina Refinery Expansion | QLD | Expansion | 2012 | | y | 2000 | kt | Alumina | 2500 | | 380 |
| Goonyella to Abbot Pt (rail) (X50) | Qld | Expansion | mid 2012 | | y | 50000 | ktpa | Black coal | 1100 | 700 | |
| Moranbah Ammonium Nitrate Project | Qld | New project | 2012 | | y | 330 | kt | Ammonium nitrate | 935 | | |

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