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AT THE COALFACE: WHAT HAPPENS TO WORKERS DISPLACED BY DECARBONISATION?

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Continued progress on climate goals will require careful management of the political economy of job displacement in polluting sectors. We illustrate the value of microdata in informing net zero policy considerations by studying workers' earnings after they are made redundant from coal-fired power plants. We find:

- Earnings loss following redundancy is higher for workers in coal-fired power plants than in other sectors.
- These relative losses are larger for lower-skilled occupations.

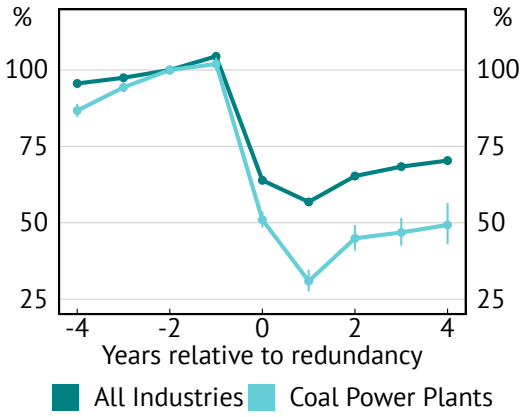
In the past decade, approximately one-third of coal-fired power stations closed, underpinning declining employment in that sector (Figure A.1). And more power plant closures are to come.[1]

While Burke et al. (2019) examine the effects on local labour markets, detailed quantitative evidence on the lived experience of displaced workers from coal-fired power plants in Australia - and how this compares to displaced workers in other sectors - is non-existent.

We estimate the link between redundancy and lost earnings over time by using those not made redundant as a counterfactual, while also controlling for a range of worker characteristics and time factors.[2] By using microdata to compare the earnings trajectories of displaced workers from coal-fired power stations to the broader economy, we hope to inform the design of future structural adjustment policies in light of coming plant closures.

While the results are not necessarily causal estimates of the cost of job loss from power plant closures[3], three key facts emerge (Figure 1):

Figure 1: Earnings after redundancies
Relative to pre-redundancy earnings*



* Control group are workers never made redundant between 2010-2020, age and time controls added.
Sources: ABS; e61

1. **Redundant workers have a large drop in earnings**, earning around 43% less in the year after redundancy.[4]
2. **Coal-fired power plant workers experience a larger earnings drop**, with earnings declining 69% in the year after redundancy.
3. **Relative earning losses are persistent over time.** After four years, coal-fired power plant workers earned around 50% less, compared to 29% for all other workers.

Using the AUSEI Index (where each occupation is ranked from 0 to 100 using an algorithm that maps income and educational attainment of those working in each occupation in the 2006 Census) to capture the skill content of an occupation, we find that low-skilled occupations in coal plants see similar earnings losses to high-skilled occupations.[5] But these low-skilled occupations have greater losses relative to low-skilled occupations in other sectors: after four years, low-skilled occupations in coal power plants earned around 51% less, compared to 26% for low-skilled occupations in other sectors (Figure 2).[6]

Any policies seeking to address the heightened cost of jobs loss in carbon-based industries also needs to be informed by evidence and research into what is driving these differences (Figure 3).

1 See Appendix A.1.
2 See Appendices A.2 and A.3 for further details.
3 For example, there may be selection bias if workers with more transferable skills leave before being made redundant.
4 Hours data is not available so we are not able to decompose how much of the decrease is due to a reduction in hours worked versus reduction in hourly wage rates. Both mechanisms are important when considering the impact on workers earnings.
5 Low-skilled defined as AUSEI score lower than 50.
6 As we use redundancy payments as our proxy for job displacement, this will exclude casual workers let go and those employed through labour-hire companies.

Figure 2: Earnings after redundancies
Relative to pre-redundancy earnings, by skill*

* Control group are workers never made redundant between 2010-2020, age and time controls added.
** Skill level proxied by AUSEI06 rank. High skill denotes AUSEI06 > 50
Sources: ABS; e61

Figure 3: Why is job displacement from coal-fired power plants more costly?

Worker age →	Earnings decline more with job displacement for older workers throughout the economy (Figure A.3) and coal-fired power plants tend to employ older workers (Figure A.4).
Job-specific human capital →	Workers at coal-fired power stations may have high job-specific human capital that may be difficult to transfer to a new job in a different industry (Lachowska et al., 2020; OECD, 2023). For example, Jobs and Skills Australia lists familiarity with specialised equipment as an important skill for this industry.
Bargaining power →	If workers in coal-fired power plants derive higher wages from strong union representation, then job displacement will be particularly costly if they are re-employed in less unionised sectors (Audoly et al., 2022).
Localised impacts →	Coal-fired power plants are often a major source of local employment and sustain many auxiliary suppliers. If geographical workforce mobility is low, their closures can trigger an increase in unemployment rates in affected regions (Burke et al., 2019).

The net zero transition will bring many benefits but it is important that any transition costs are carefully managed. The question remains about whether additional support – beyond the current income support and re-training system – is warranted. The share of potential jobs directly impacted is very small in the context of the 500,000 people who exit and enter the labour force each month. But if the concentrated local impacts and the political salience of these closures undermine public support for climate change policies, then there may be a case for more targeted support.

The rapid improvement in Australia's administrative microdata over the past five years creates a unique opportunity for the new national Net Zero Authority to form a data-driven view on this question. Future research could help shed light on the mechanisms identified in Figure 3 and the potential for geographical and occupational mobility to mitigate some of the impacts identified.

References

Audoly, R., Pace, F. D., & Fella, G. (2022). *Job ladder, human capital, and the cost of job loss* (tech. rep.). The IFS. https://ifs.org.uk/publications/job-ladder-human-capital-and-cost-job-loss

Burke, P. J., Best, R., & Jotzo, F. (2019). Closures of coal fired power stations in australia: Local unemployment effects. *Australian journal of agricultural and resource economics*, *63*(1), 142–165.

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OECD. (2023). *OECD economic surveys: Germany 2023*. https://doi.org/10.1787/9642a3f5-en

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APPENDIX: AT THE COALFACE: WHAT HAPPENS TO WORKERS DISPLACED BY DECARBONISATION?

A.1. Future coal-fired power plant closures

Based off current public information, the remaining coal-fired power plants have the following scheduled closure dates (noting that these may change, e.g. Eraring):

Table A.1: Coal-fired power plants scheduled closure dates

State	Power station	Scheduled closure year	Capacity (MW)
New South Wales	Eraring	2025	2,880
New South Wales	Bayswater	2033	2,640
New South Wales	Vales Point B	2033	1,320
New South Wales	Mt Piper	2040	1,400
Queensland	Callide B	2028	700
Queensland	Gladstone	2035	1,680
Queensland	Tarong	2037	1,400
Queensland	Tarong North	2037	443
Queensland	Kogan Creek	2042	750
Queensland	Stanwell	2046	1,460
Queensland	Millmerran	2051	850
Queensland	Callide C	TBA	810
Victoria	Yallourn	2028	1,480
Victoria	Loy Yang A	2035	2,210
Victoria	Loy Yang B	2047	1,200
Western Australia	Collie	2027	340
Western Australia	Muja	2029	854
Western Australia	Bluewaters	TBA	440

A.2. Data

We use payment summary data provided by firms on wages paid to each of their employees to track the earnings of employees employed in 2009-10, through to 2019-20. We proxy for full-time employees by restricting to individuals earning more than the annual full-time minimum wage in a given tax year, as employment status is not reported [7]. We are able to observe if and when an employee was made redundant based on information provided in these payments summaries, as defined by the ATO here.

We use the firm's reported industry to identify whether the worker is in the coal-fired power sector prior to being made redundant. We us ANZSIC Class 2611 - Fossil Fuel Electricity Generation to identify this sector. Some individuals who work at coal-fired power plants may be employed through arrangements such as labour hire, and may not be covered by this ANZSIC class. This will also likely not include workers at firms that provide services to coal-fired power plants (e.g. cleaning services).

Earnings are defined as wage and salary earnings only. We use nominal earnings, however the inclusion of time fixed effects in the regression specification controls for national price trends.

7 We estimate a version of the analysis without imposing this restriction and find the results are similar. See Figure A.2 for analysis without this restriction

A.3. Regression specification

To estimate the event study, we use the differences-in-differences methodology of Sun and Abraham (2021).

$$\log(Earnings_{i,t}) = \lambda_t + \alpha_i + \sum_g \sum_{k \neq -2} \delta_{g,k} 1\{G_g = g\} D^k_{i,t} + \beta_1 age^2 + \beta_2 age^3 + \varepsilon_{i,t}$$

Where:

- $\log(Earnings_{i,t})$ is the natural logarithm of total earnings reported in an individual *i*'s payment summaries for the income tax year *t*.
- λ_t, α_i are time and individual fixed effects
- $G_g = g$ indicates whether worker *i* belongs to redundancy cohort *g* (see below).
- $D^k_{i,t}$ is a variable indicating if the worker was initially given a redundancy payment *k* years ago. $k = -2$ is the reference period and is omitted.
- age^2, age^3 are worker age-related polynomial terms
- $\varepsilon_{i,t}$ is an error term

This particular method estimates the change in log earnings following redundancy for each redundancy cohort (i.e. workers who were initially made redundant in a given time period) relative to workers who are never made redundant in the sample. In other words, these estimates are relative to what these individuals would have earned had there earnings trajectory followed that of those not made redundant. We are not claiming this estimate is necessarily causal, rather that it is indicative.

For a causal estimate a range of analysis is required on the pre-trends of earnings across separate groups, as well as testing of other assumptions. In particular, our analysis has a clear pre-redundancy difference in earnings trends, which suggests the control and treatment groups may be different on unobserved characteristics. Future e61 work will investigate the costs of job displacement in a more causal manner.

We define earnings as total wages across all jobs, noting we are not able to break this down between wage rates and hours. Further work could investigate total income impacts more broadly, which includes income such as transfer payments that may have a mitigating impact.

We require individuals to be employed in 2009-10. We allow them to move in and out of employment (and the sample) in each time period. By removing individual-year observations where an individual has zero wage earnings in that year we focus on the intensive margin impact. This may overstate the impact on earnings of redundancy for workers in the coal-fired power sector if they are relatively less likely to leave work altogether and more likely to work a smaller number of hours, or at a job with lower wages, instead (and vice versa).

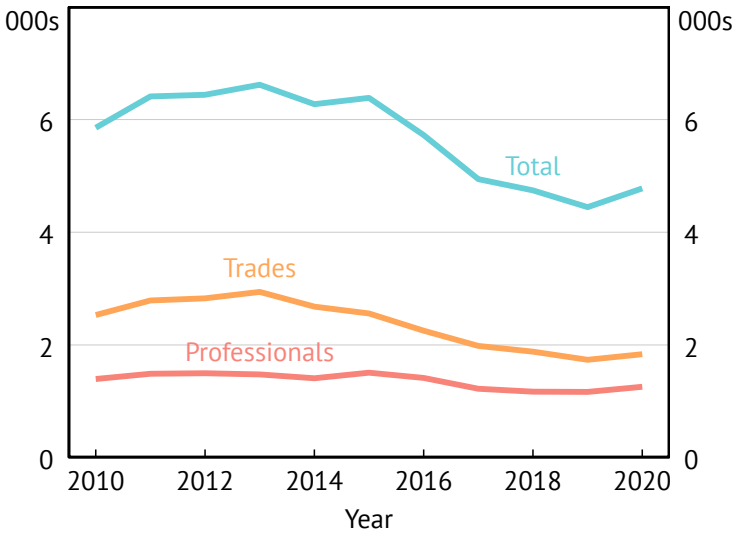
We do not apply any restrictions on tenure with employer. Due to computational (memory allocation) limitations, in Figure 1, we bootstrap a 10% sample of individuals 50 times to obtain our overall estimates.

Our analysis focuses on the *relative* earning declines of individuals. This is likely to be more relevant than absolute earning declines for understanding the potential impact on an individual's outcomes, such as consumption, and ability to self-insure. This is also more salient for the political economy of job displacement - e.g. public concern for a $10,000 loss in earnings will be greater for an individual with annual earnings of $50,000 compared to one with annual earnings of $250,000.

A.4. Additional figures

Figure A.1: Employment in coal-fired power plants

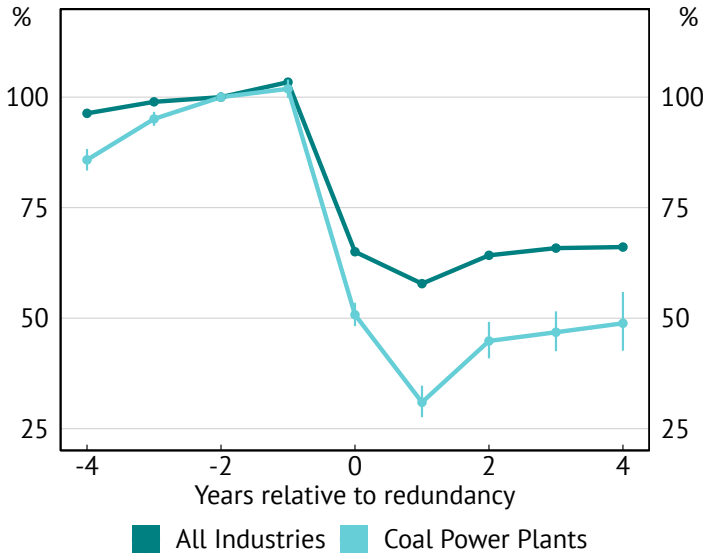
As reported in PAYG summaries



Sources: ABS; e61

Figure A.2: Earnings after redundancies, no earnings restrictions

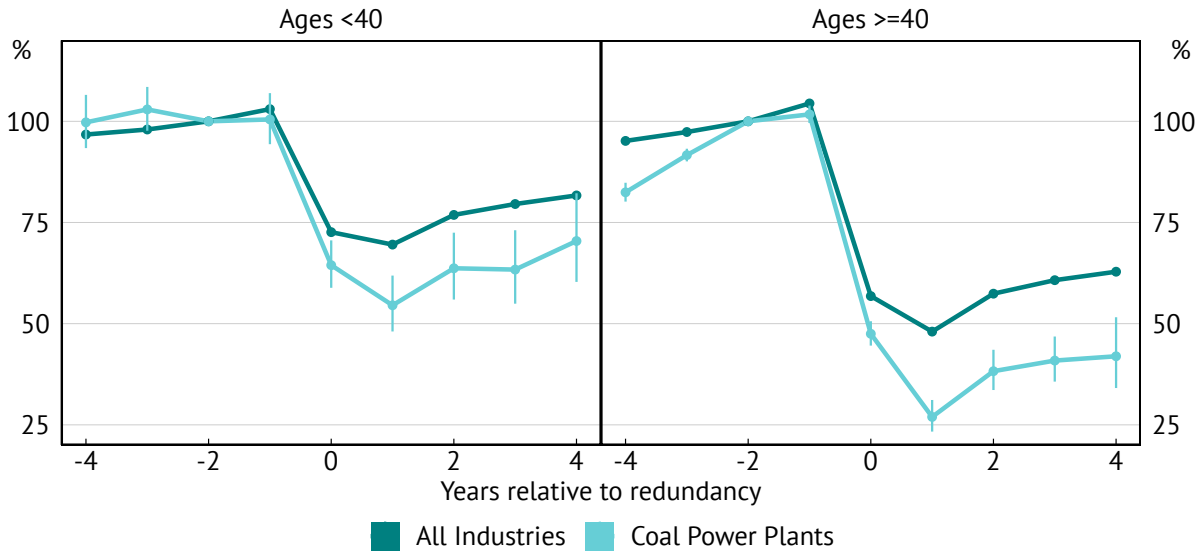
Relative to pre-redundancy earnings*



* Control group are workers never made redundant between 2010-2020, age and time controls added.
Sources: ABS; e61

Figure A.3: Earnings after redundancies

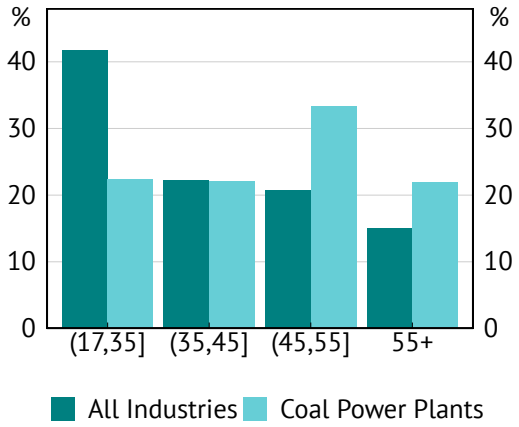
Relative to pre-redundancy earnings, by age*



* Control group are workers never made redundant between 2010-2020, age and time controls added.
Sources: ABS; e61

Figure A.4: Share of workers by age group*

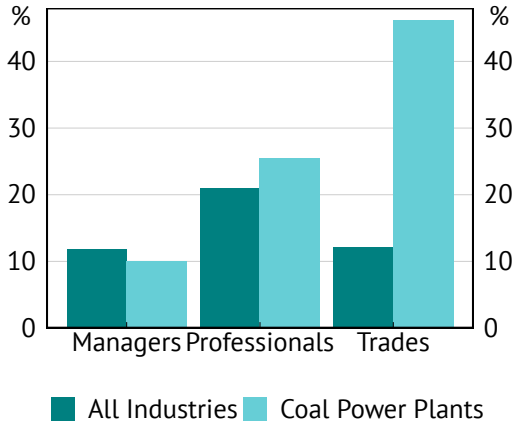
By industry



* Based on 2010 employment.
Sources: ABS; e61

Figure A.5: Share of workers by occupation*

By industry, top 3 occupations



* Based on 2010 employment.
Sources: ABS; e61

A.5. Disclaimer

The results of these studies are based, in part, on data supplied to the ABS under the Taxation Administration Act 1953, A New Tax System (Australian Business Number) Act 1999, Australian Border Force Act 2015, Social Security (Administration) Act 1999, A New Tax System (Family Assistance) (Administration) Act 1999, Paid Parental Leave Act 2010 and/or the Student Assistance Act 1973. Such data may only used for the purpose of administering the Census and Statistics Act 1905 or performance of functions of the ABS as set out in section 6 of the Australian Bureau of Statistics Act 1975. No individual information collected under the Census and Statistics Act 1905 is provided back to custodians for administrative or regulatory purposes. Any discussion of data limitations or weaknesses is in the context of using the data for statistical purposes and is not related to the ability of the data to support the Australian Taxation Office, Australian Business Register, Department of Social Services and/or Department of Home Affairs' core operational requirements.

Legislative requirements to ensure privacy and secrecy of these data have been followed. For access to MADIP and/or BLADE data under Section 16A of the ABS Act 1975 or enabled by section 15 of the Census and Statistics (Information Release and Access) Determination 2018, source data are de-identified and so data about specific individuals has not been viewed in conducting this analysis. In accordance with the Census and Statistics Act 1905, results have been treated where necessary to ensure that they are not likely to enable identification of a particular person or organisation."