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Diverging labour market trajectories of Australian graduates from advantaged and disadvantaged social backgrounds: A longitudinal analysis of population-wide linked administrative data

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Abstract. *Despite mounting evidence that university participation enhances labour market prospects, there are growing concerns about its unequal returns. This study uses novel large-scale linked administrative data covering the full population of individuals graduating from Australian universities over the 2005–11 period to examine the labour market trajectories of graduates from multiple disadvantaged social backgrounds (based on socio-economic, migration and disability status, ethnicity and location) in comparison with their more advantaged peers, over a ten-year observation window. The findings reveal substantial heterogeneity in the income and unemployment benefit receipt trajectories of graduates from different groups. This has important implications for labour market policies aimed at improving social equity.*

Keywords: *administrative data, Australia, education, inequality, labour market analysis, social disadvantage, university graduate.*

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1. Introduction

University-level education has a range of positive impacts on individuals over the life course, including enhancing their labour market prospects (for example, Desjardins and Lee 2016; Heckman, Humphries and Veramendi 2018). However, there are ongoing debates as to whether higher education helps to reduce, or in fact reinforces, social inequalities (for example, Forster, Werfhorst and Leopold 2021; Zhou 2022). Social origins remain an important factor affecting the probability of enrolling in and completing university studies (Tomaszewski et al. 2022). Moreover, research indicates that students from privileged backgrounds are more likely to access more prestigious degrees and higher education paths (Borgen and Mastekaasa 2018). Recent studies also point to gaps in post-graduation outcomes between individuals from advantaged and disadvantaged backgrounds – considering socio-economic background and ethnicity (Richardson, Bennett and Roberts 2016; Triventi 2013) – although there is some evidence that these gaps fade over time (Jacob, Klein and Iannelli 2015; Tomaszewski et al. 2021). Differential or delayed returns to university education among graduates from disadvantaged social backgrounds represent a loss of productivity, a threat to social equity and a policy challenge.

These differences in outcomes must be understood in the context of broader inequalities at various stages of the student life cycle, including higher education access, participation and completion (Bennett et al. 2015). Traditionally, higher education equity policies have pursued a "widening participation" agenda – that is, they have focused on promoting equitable access to university. More recently, there has been a growing emphasis on monitoring outcomes at later stages of the student life cycle, including course completion and post-graduation labour market performance (Bennett et al. 2015; Pitman et al. 2019). Widening participation policies have been successful in countries such as Australia (where this study was conducted), resulting in more students from disadvantaged social backgrounds enrolling in higher education institutions. However, the growing representation of such students at university has simultaneously led to concerns about inadequate support during the participation stage, resulting in increased drop-out rates and poorer graduate outcomes (Harvey, Burnheim and Brett 2016; Pitman et al. 2019; Productivity Commission 2019). Within this context, understanding the post-graduation trajectories of individuals from advantaged and disadvantaged population groups is an important endeavour.

Our study addresses this gap by examining the post-graduation outcomes of individuals from disadvantaged backgrounds, including graduates from low socio-economic status (SES) and non-English-speaking backgrounds (NESB), Indigenous people, residents of regional/rural/remote (RRR) areas and individuals with a disability. By capitalizing on unique linked administrative data on the full population of recent graduates in Australia (3,107,085 observations from 565,318 graduates), the study makes several contributions to the international literature. The scale and richness of our data allow us to provide a distinctively comprehensive account of the post-graduation labour market trajectories of individuals from multiple disadvantaged groups, as well as addressing various methodological and scope limitations affecting the research carried out until now.

Existing studies are mostly survey-based, rely on cross-sectional designs, have small samples and model self-reported outcomes. As detailed below, these methodological shortcomings have the potential to compromise their findings. In contrast, our data allow us to analyse objectively measured outcomes (employment earnings and unemployment benefits, based on official government records) that are free from measurement error and report bias; estimate longitudinal models that are better able to account for unobserved confounders; and conduct full-population analyses that enhance the generalizability of any findings. We are, therefore, able to provide more reliable and accurate estimates, even for minorities of policy concern that are severely under-represented among university graduates (such as Indigenous Australians); investigate each group's labour market outcomes while controlling for membership in other groups; and paint a more nuanced picture of the temporal dynamics characterizing post-graduation labour market trajectories. Furthermore, we expand the scope of the existing literature by generating first-time evidence on the labour market disadvantage faced by individuals who simultaneously belong to multiple socially disadvantaged groups.

The remainder of this article is organized as follows. The second section reviews the literature on this subject and discusses how our study contributes to it, in particular outlining the research gaps that we seek to address. The third section describes the data and methods used in our empirical analyses. Our results are presented in the fourth section and discussed in the fifth, where we also offer some conclusions. We consider both the limitations of our study and the possible avenues for further research that it opens up, reflecting on the implications for policy and practice.

2. Literature review

A sizeable body of empirical research has examined the returns to higher education by comparing the outcomes of individuals with and without university qualifications (for example, Corliss, Daly and Lewis 2020; Desjardins and Lee 2016; Heckman, Humphries and Veramendi 2016; van der Velden and Wolbers 2007). However, various studies suggest that the hierarchical social statuses of university graduates lead to heterogeneity in the returns to higher education (for example, DiPrete and Eirich 2006; Elder, Johnson and Crosnoe 2003; Witteveen and Attewell 2020). Potential factors contributing to worse outcomes among graduates from disadvantaged social groups include lower social and cultural capital (Burke, Scurry and Blenkinsopp 2020; Coleman 1988; Franzen and Hangartner 2006; Lin 2001), smaller social networks through which to secure "good" jobs (Friedman and Laurison 2019; Manroop and Richardson 2016) and implicit and/or explicit discrimination by employers (for example, Quadlin 2018; Rivera 2020). Collectively, these factors may diminish the chances of graduates from disadvantaged social backgrounds leveraging their educational credentials to access good jobs, negotiate high wages and achieve upward career mobility (Tomaszewski et al. 2021; Witteveen and Attewell 2020).

Empirical research documenting heterogeneity in outcomes among different groups within the graduate population is, however, limited. The few available international studies have found that graduates from disadvantaged social groups tend to perform less well on the labour market than graduates from other social

groups (for example, Friedman and Laurison 2019; Manzoni and Streib 2019; Rafferty 2012; Witteveen and Attewell 2017; Zarifa, Walters and Seward 2015). Australian studies have largely focused on graduates from low SES backgrounds, operationalized using area-based indicators of disadvantage or, less often, parental occupation (for example, Edwards and Coates 2011; Pitman et al. 2019; Richardson, Bennett and Roberts 2016). There is limited Australian empirical scholarship focusing on other disadvantaged social statuses, such as regional/rural residence (Li et al. 2017; Pitman et al. 2019), Indigenous status (Coates and Edwards 2009; Pitman et al. 2019), NESB (Li et al. 2017; Pitman et al. 2019) and disability (Coates and Edwards 2009; Richardson, Bennett and Roberts 2016).

Despite emerging concerns about the labour market outcomes of graduates who belong to more than one disadvantaged social group (Harvey, Burnheim and Brett 2016), there is a paucity of empirical evidence in this regard in Australia. Existing studies of cumulative disadvantage have instead focused on higher education participation and attainment. They find that belonging to multiple disadvantaged social groups is associated with greater difficulties in accessing, and graduating from, university (for example, Shalley et al. 2019). We may, therefore, expect to encounter a similar pattern in relation to post-graduation labour market trajectories.

2.1. The present study: Research aims and addressing gaps in knowledge

Our study makes several contributions to the international literature, both in terms of methodology and scope. Conceptually, we widen the scope of existing international evidence on the post-graduation labour market outcomes of graduates from diverse social backgrounds by considering the role of cumulative disadvantage. Studies in the field have largely restricted their focus to comparisons between individuals in and outside a single disadvantaged group, all else being equal. As such, these studies have largely neglected the fact that some graduates belong to more than one disadvantaged group – in other words, some graduates experience multiple or cumulative disadvantage (Harvey, Burnheim and Brett 2016). In this study, we analyse the potentially compounding effect of belonging simultaneously to multiple socially disadvantaged groups (namely, low SES, Indigenous status, RRR residence, NESB and disability).

Importantly, we are also able to address a number of data-driven methodological limitations afflicting existing international scholarship through the innovative use of administrative data. Specifically, we leverage a unique data set comprising integrated administrative records drawn from several Australian Government agencies, including records on higher education enrolment and completion, personal income tax and welfare payments covering a full population of domestic undergraduate students graduating from Australian universities between 2005 and 2011.

First, a majority of existing studies comparing the post-graduation outcomes of individuals from different social groups have utilized self-reported measures of labour market outcomes contained in social surveys. Yet survey measures of key markers of labour market success, such as income and earnings, are prone

to measurement error (due to recall issues, among others) and report bias (for example, when individuals provide socially desirable responses) (Krumpal 2013). These measures are also subject to disproportionately high rates of non-random missing data, whereby a large share of responses in major social surveys are imputed. For example, up to 15 per cent of the personal labour income responses and 29 per cent of the household income responses were subject to imputation in the Australian flagship household panel, the Household, Income and Labour Dynamics in Australia Survey (HILDA) (Frick and Grabka 2010). In contrast, the administrative data set that we leveraged for this study provides access to personal income information drawn from individuals' tax records, offering precise, reliable and largely complete data.

Second, most studies of graduate labour market outcomes have relied on employment and income as the core measures of graduate performance. While these are unambiguously important indicators, we posit that the receipt of income support is another key measure to be taken into consideration, since it reflects the benefits of higher education from the perspective of government and official institutions (National Board of Employment Education and Training 1996). An important argument for widening participation in higher education among socially and/or economically disadvantaged groups is to enhance stable employment, financial security and economic self-reliance among them. As such, it is important to gauge the extent to which obtaining a university degree helps graduates secure stable employment. To our knowledge, no studies in this field have compared the unemployment benefits received by graduates in different population groups. The administrative data used in this study allow us to run these comparisons, and to do so using an objective measure of welfare receipts obtained from official government records.

Third, survey-based studies comparing the labour market outcomes of graduates from advantaged and disadvantaged social backgrounds often rely on small sample sizes for key subgroups. This occurs because some disadvantaged groups are also minorities (Indigenous Australians, for example, comprise less than 3 per cent of the Australian population[1]), or represent a small share of students (for example, individuals with a recognized disability account for about 7 per cent of university students in Australia[2]). As a result, the analyses in many existing studies may be underpowered, inflating standard errors and enhancing the risk of type-II estimation errors (that is, failing to observe a relationship in the sample that exists in the population). In contrast, the administrative data set leveraged in this study allows us to observe the outcomes of the full population of domestic university students in Australia graduating over the 2005–11 period. This maximizes the external validity of our findings and minimizes estimation errors. As a point of illustration, using a large household panel survey of over 20,000 respondents (HILDA), Tomaszewski et al. (2019) observed the post-graduation outcomes of 18 Indigenous individuals and 42 individuals with

[1] ABS, "Census of Population and Housing: Reflecting Australia – Stories from the Census, 2016" (2071.0 release), 2018.

[2] Australia, Department of Education, "Selected Higher Education Statistics – 2019 Student Data", Equity performance data, 2020.

a disability. The linked administrative data utilized in this study allow us to track the outcomes of 7,011 Indigenous graduates and 25,986 graduates with a disability. Furthermore, as noted above, the large numbers in our data enable novel analyses of cumulative disadvantage.

Fourth, most studies in this space have used cross-sectional rather than longitudinal data. Compared with longitudinal models, cross-sectional models are less able to account for unobserved sources of confounding, making the results more vulnerable to omitted-variable bias (Singer and Willett 2003). Perhaps more importantly, the single-point data sets used by most studies do not allow for more nuanced analyses of post-graduation trajectories in outcomes, which provide important information about whether any differences between social groups in returns to university education change over time (Tomaszewski et al. 2021). In this study, we observe individual graduates for up to six years and track outcomes across different cohorts of graduates for up to ten years after graduation. This enables us to identify temporal dynamics in the relationships of interest.

Lastly, few studies have provided robust and comprehensive evidence on differences in graduate outcomes across social groups. Among the ones that have, most have been conducted in the United States and Western Europe (in particular, the United Kingdom), while Australian evidence remains limited and largely inconclusive. Australia therefore represents an interesting and relatively novel institutional environment for examining this subject. Internationally, Australia has a high living standard, sustained economic growth[3] and a strong labour market with relatively low unemployment (5.2 per cent in 2019[4]). Decades of rapid higher education expansion have resulted in high rates of educational attainment. In 2018, the proportion of 25–34-year-olds with tertiary education exceeded 50 per cent in Australia, compared with 44 per cent on average across Member countries of the Organisation for Economic Co-operation and Development (OECD 2019). Moreover, the Australian higher education system constitutes an interesting case because of policymakers' interest in equity. As a corollary to their focus on increasing participation in higher education in order to shape a competitive workforce in the global economy (Australian Government 2008), successive Australian governments since the 1960s have developed an interest in equity in this domain (National Board of Employment, Education and Training 1996). However, despite the policy relevance of the topic, surprisingly little Australian research has investigated differences in graduate outcomes across social groups (Whitney and Purchase 2018). Our study therefore offers comprehensive evidence for a country and area that have thus far received little attention.

3. Methodology

3.1. Data set and sample selection

We utilize a customized Multi-Agency Data Integration Project (MADIP) data set made available to the research team by the Australian Government

[3] OECD, "Gross Domestic Product (GDP) (Indicator)", accessed 18 August 2021. doi: 10.1787/dc2f7aec-en.

[4] OECD, "Unemployment Rate (Indicator)", accessed 18 August 2021. doi: 10.1787/52570002-en.

Department of Education, Skills and Employment.[5,6] The Higher Education Information Management System (HEIMS) data set constitutes the cornerstone of the linked data set and contains the higher education records of all domestic undergraduate students who graduated from an Australian higher education institution between 2005 and 2011.[7] Among other things, the data include information on the timing of enrolment in a higher education institution, type of course attended, field of study and completion date, as well as students' characteristics (such as age, gender, country of birth, language spoken at home and disability). The Personal Income Tax (PIT) and Social Security and Related Information (SSRI) data sets add rich and accurate information on labour market outcomes, including different types of income (PIT) and income-support payments (SSRI). The Australian Bureau of Statistics (ABS) is responsible for linking the information across these data sets, providing a high linkage rate (95 per cent of all graduates), and facilitates access to de-identified unit-level records.[8]

The PIT and SSRI data cover six financial (tax) years from 2010/11 to 2015/16 and we start tracking individuals' labour market outcomes from their first *full* financial year as a graduate.[9] This means that, for the most recent cohort of graduates in HEIMS (that is, those completing their degrees in 2011), we observe labour market outcomes in the first four financial years after graduation. Meanwhile, for the oldest cohort of graduates (that is, those finishing in 2005), we observe labour market outcomes for five to ten years after graduation.[10]

The data drawn from HEIMS comprised 3,107,085 annual observations from 565,318 graduates. About 3 per cent of person-year observations were excluded

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[5] Under an Administrative Arrangement Order of 1 June 2022, the Department of Education, Skills and Employment became the Department of Education and the Department of Employment and Workplace Relations.

[6] This data set is based, in part, on tax data supplied by the Australia Taxation Office to the Australian Bureau of Statistics under the Taxation Administration Act 1953, which requires that such data be used only for the purpose of administering the Census and Statistics Act 1905. Data limitations or weaknesses are discussed in the context of using the data for statistical purposes and not the data's ability to support the Australian Taxation Office's core operational requirements. Legislative requirements to ensure privacy and secrecy of these data have been followed. For access to MADIP data under Section 16A of the Australian Bureau of Statistics Act 1975 or enabled by section 15 of the Census and Statistics (Information Release and Access) Determination 2018, source data are de-identified such that data about specific individuals have 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 organization. Accordingly, the source data cannot be shared.

[7] This includes public universities, private universities and accredited non-university higher education institutions.

[8] For more detailed information about the standard MADIP data set, including the linkage methodology, see ABS, "Microdata: Multi-Agency Data Integration Project, MADIP" (1700.0 release), 2018.

[9] In Australia, a financial (tax) year begins on 1 July each calendar year and runs until 30 June the following calendar year, while the academic year starts in January and ends in December. As a result, most students finish education in the middle of the financial year.

[10] For more detailed information on the years captured for each cohort, see figure A1 in the online appendix.

from analysis owing to missing data. The final analytical sample consists of 3,015,028 observations from 563,391 graduates, where individuals were tracked for 5.53 years on average.

3.2. Employment income and unemployment benefits

Employment income and unemployment payments are our primary outcome variables. The employment income variable was obtained from PIT data and captures any income received as an employee or for any service rendered over a calendar year.[11] The unemployment benefit variable, which proxies unstable employment histories, was obtained from SSRI data and captures the sum of unemployment payments received by an individual in a given financial year.[12] Both outcome variables are adjusted for inflation and expressed in 2016 Australian dollars (A$). As shown in table 1, the average employment income in the pooled sample is A$61,543 (standard deviation = A$41,081), whereas average unemployment benefits received amount to A$260 (standard deviation = A$1,706).

3.3. Social background

Our key explanatory variables identify graduates from disadvantaged social backgrounds that approximate five of the officially designated equity groups in the Australian higher education system. We construct these variables approximating the official definitions used by the Australian Government as closely as possible.

Low socio-economic status (low SES) graduates are those who in the year before starting university lived in the 20 per cent of areas with the lowest values in the Index of Education and Occupation of the Socio-Economic Index for Areas (SEIFA).[13] RRR graduates are those who in the year before starting university lived in areas other than major cities, based on the ABS's "remoteness areas". Non-English-speaking-background (NESB) graduates are foreign-born individuals who, during their studies, reported coming from a household in which a language other than English was spoken.[14] Graduates with a disability are individuals

[11] As a sensitivity analysis, we tested models of (i) gross income and (ii) the sum of income from personal exertion and business income. The results were very similar.

[12] The specific payments covered by this measure are the Newstart Allowance and Youth Allowance (Other), the two primary out-of-work benefits in Australia in the period covered by this study.

[13] These data come from MADIP and address histories compiled from multiple sources, including individuals' interactions with the Australian public service, Medicare and welfare system, and from census records.

[14] Owing to highly selective migration policies, NESB (non-refugee) migrants in Australia perform better than native-born individuals across multiple markers of socio-economic status, including their primary- and secondary-school educational outcomes (Tomaszewski et al. 2018). However, evidence for university and post-university outcomes is more mixed, with some studies showing negative effects of NESB status on post-graduation labour-market performance (Tomaszewski et al. 2021). NESB students are also explicitly recognized as a designated "equity group" within the Australian Government's higher education equity framework (Martin 1994). Indeed, our results demonstrate that NESB graduates exhibit worse labour market outcomes than their English-speaking peers. The reasons for this disadvantage may include discrimination by employers, a lack of social networks and lower English proficiency (Tang et al. 2022a and 2022b).

Table 1. Mean and standard deviations for analytic variables

	Mean/ % (standard deviation)
Outcomes	
Income from personal exertion (A$)	61 543 (41 081)
Total unemployment payments (A$)	260 (1 706)
Key predictors	
Disadvantaged social backgrounds (%)	
Low SES	12.0
Disability	4.6
NESB	8.4
RRR	22.2
Indigenous	1.2
Cumulative disadvantage (%)	
0 groups	60.5
1 group	31.2
2 groups	7.7
3+ groups	0.6
Controls	
Gender (%)	
Female	61.5
Male	38.5
Age group (%)	
≤25 years	14.0
26–30 years	48.6
31–35 years	21.0
36–40 years	5.8
41–45 years	3.9
46–50 years	2.8
51+ years	4.0
Field of study (%)	
Agriculture	0.6
Architecture and urban environment	1.1
Building	0.6
Communications	4.0
Dental studies	0.4
Education	12.4
Engineering and related technologies	5.8
English language	0.4
Environmental studies	1.2
Humanities (including history, geography and languages)	2.9
Information technology	3.2
Management and commerce	19.2
Mathematics	0.3
Medical	2.1
Medical science	0.9
Nursing	7.9
Other creative	5.0
Other health	7.8
Other science	6.7

(continued overleaf)

Table 1. Mean and standard deviations for analytic variables *(concl.)*

	Mean/ % (standard deviation)
Political science	0.4
Psychology	2.9
Society and culture – economics	0.9
Society and culture – law	3.7
Social work	2.1
Society and culture (other)	7.4
Veterinary science	0.3
Dual/multiple degrees (%)	9.4
Graduation year (%)	
2005	11.7
2006	13.0
2007	15.4
2008	15.8
2009	16.8
2010	14.8
2011	12.5
State of residence (%)	
Australian Capital Territory	3.2
New South Wales	31.3
Northern Territory	0.8
Queensland	18.3
South Australia	6.8
Tasmania	1.8
Victoria	27.6
Western Australia	10.1
Other	< 0.1
Receives business income (%)	9.3
Is enrolled in further education (%)	13.6

Note: SES = socio-economic status; NESB = non-English-speaking background; RRR = regional, rural or remote.
Source: Data from customized MADIP data set (2011–16).

who, during their studies, self-reported having a disability.[15] Lastly, Indigenous graduates are those who reported being of Aboriginal and/or Torres Strait Islander descent in their interactions with the Australian Government.[16] Pooling all observations in our data set, we find that 22.2 per cent of graduates qualify as RRR, 12.0 per cent as low SES, 8.4 per cent as NESB, 4.6 per cent as having a disability and 1.2 per cent as Indigenous (table 1).

We also ran additional analyses using a measure of cumulative disadvantage. This took the form of a categorical variable capturing the number of the above groups to which an individual belongs. The categories are "0 groups" (60.5 per

[15] Students self-report whether they have a "disability or long-term condition", indicating also the broad type of disability (hearing, learning, mobility, visual, medical or other). The percentage of students who self-reported having a disability in our data (~4.6 per cent) is consistent with official statistics (Australia, Department of Education, "2020 Section 11 Equity Groups" (Ref. D22/70069), 2022).

[16] The variable is based on a flag that uses any available data set across the MADIP to check whether an individual *ever* identified themselves as being Indigenous.

cent of the person-year observations), "1 group" (31.2 per cent), "2 groups" (7.7 per cent) and "3 or more groups" (0.6 per cent).

3.4. Control variables

In our models, we control for a set of variables that may confound the relationships between disadvantaged social background and post-graduation labour market outcomes. The control variables include several time-invariant variables, such as gender (female; male), field of study (26 categories), a dummy variable identifying graduates who completed dual/multiple degrees (yes; no) and a categorical variable denoting the number of years since graduation (2005 to 2011). We further include four time-varying control variables: age (seven age brackets), state of residence, receiving business income (yes; no) and being currently enrolled in further education (yes; no). The indicator variable capturing receiving business income is included in the models to control for the fact that people running a business are less likely to have employment income. Being enrolled in further study is included among the controls to account for the fact that graduates undertaking further study might not yet fully participate in the labour market.[17] Table 1 presents descriptive statistics for all analytic variables.

3.5. Analytic approach

To investigate differences in post-graduation trajectories between graduates from advantaged and disadvantaged social backgrounds, we fit a series of growth models. Growth models are a type of multilevel model that is useful in understanding how a certain outcome evolves over time from a defined starting point (in our case, graduation from university).[18] Our models take the following general form:

$$O_{gt} = \alpha + \boldsymbol{\beta}_1 \boldsymbol{D}_g + \beta_2 Y_{gt} + \boldsymbol{\beta}_3 (\boldsymbol{D} \times \boldsymbol{Y})_{gt} + \beta_4 C_{gt} + u_g + e_{gt}$$

Where the g and t subscripts denote graduates and time points, respectively; O is a continuous-type labour market outcome (employment income or unemployment benefits); α is the model's grand intercept; D is a set of dummy variables for belonging to a disadvantaged social group; Y is a categorical variable capturing the number of years since graduation (1 through to 10); $D \times Y$

[17] As a sensitivity analysis, we also estimated models that excluded all observations where individuals were enrolled in further study. The overall conclusions remained the same.

[18] This study's main concern is determining the shape of the post-graduation labour market trajectories of different groups of graduates, rather than making causal claims about the time variables. While fixed effects or correlated random effects models may better capture unobserved confounders, these models are unable to (i) generate predictions for the student background main effects; (ii) track the initial disparity in outcomes at the year of graduation; and (iii) determine the full shape of the post-graduation labour market trajectories. For this reason, as in other studies (for example, Klein 2021; Kratz and Netz 2018), we opt for growth modelling in our main analyses. Reassuringly, robustness checks replicating our analyses using fixed effects models (presented in tables A3 and A4 in the online appendix) revealed that the key coefficients on the interaction effects are virtually identical.

is the focal interaction effect between the previous two variables; C is a set of control variables, as described above; β_1 to β_4 are coefficients (or vectors of coefficients) to be estimated; u is an individual-level random effect (or random intercept) capturing unobserved effects assumed to be normally distributed and orthogonal to the model variables; and e is the usual individual-level regression error. In a second set of analogous models, we replace the dummy variables for belonging to a disadvantaged social group (D) by the categorical cumulative disadvantage measure described above.

The key parameters of interest are the β_3 coefficients on the interaction effects, which indicate whether the post-graduation trajectories of individuals who belong to a disadvantaged social group differ from those of their more advantaged peers in the reference group. Our use of a categorical variable to capture time since graduation (through ten annual dummy variables) allows the post-graduation labour market trajectories to take a fully flexible, non-parametric shape. This is preferable to imposing a uniform function (linear, quadratic or cubic) across all groups, as this may not reflect the true shape of the group trajectories. To comment on the magnitude and practical significance of our results, we present and discuss their results as average marginal effects, holding the random effects at zero.

4. Results

4.1. Descriptive patterns

Table 2 compares the average employment income and unemployment benefits of individuals from advantaged and disadvantaged groups in the first, fifth and tenth year after graduation, as well as for all years pooled together.

Graduates with a disability appear to be the most disadvantaged,[19] earning A$7,503 (or 15.6 per cent) less than graduates without a disability in the first year after graduation and A$12,519 (or 17.3 per cent) less ten years after.[20] NESB graduates also earn less than other graduates in the first year after graduation, but this gap closes over time – from A$3,597 (7.5 per cent) to A$942 (1.3 per cent). In contrast, graduates from other disadvantaged social backgrounds (low SES, RRR and Indigenous) earn more than their peers immediately after graduation, but this relationship reverses over time. For example, Indigenous graduates earn A$3,129 (or 6.6 per cent) more than non-Indigenous graduates one year after graduation, but A$5,667 (or 7.9 per cent) less ten years after.

[19] In additional analyses we compared the results for various disability types. The pattern of results is similar across all disability types, with individuals with any disability being worse off than those without those disabilities (figures A2 and A3 in the online appendix). There is, however, some variation in the level of disadvantage associated with having a disability, such that graduates with a visual disability are relatively better off than graduates with "other" disabilities, and graduates with a mobility disability are the worst off.

[20] The percentage differences in earnings and unemployment payments were calculated by dividing the difference between the values for the advantaged and disadvantaged groups by the values of the advantaged group.

Table 2. Mean employment income and unemployment benefits, by student social background characteristics and time since graduation

	Employment income (in A$)				Unemployment benefits (in A$)			
	All years pooled	1 year after	5 years after	10 years after	All years pooled	1 year after	5 years after	10 years after
Low SES	61 502	48 768	63 968	70 346	328	542	276	235
Not low SES	61 548	47 533	64 273	72 283	250	367	223	190
Disability	51 885	40 549	54 612	60 040	543	737	479	360
No disability	62 009	48 052	64 696	72 559	246	370	218	188
NESB	59 372	44 387	62 265	71 191	357	679	292	245
Not NESB	61 741	47 984	64 417	72 133	251	361	224	191
RRR	61 015	49 850	63 299	69 428	295	440	264	208
Not RRR	61 693	47 049	64 503	72 771	249	372	220	192
Indigenous	60 976	50 771	63 479	66 455	557	628	505	539
Not indigenous	61 550	47 642	64 246	72 122	256	385	226	191
0 groups	62 493	47 725	65 289	73 761	215	303	195	171
1 group	60 149	47 374	62 758	69 480	308	483	265	225
2 groups	60 209	48 766	62 447	68 834	380	609	333	256
3+ groups	54 970	45 420	57 373	63 375	675	929	579	491

Note: SES = socio-economic status; NESB = non-English-speaking background; RRR= regional, rural or remote.
Source: Data from customized MADIP data set (2011–16).

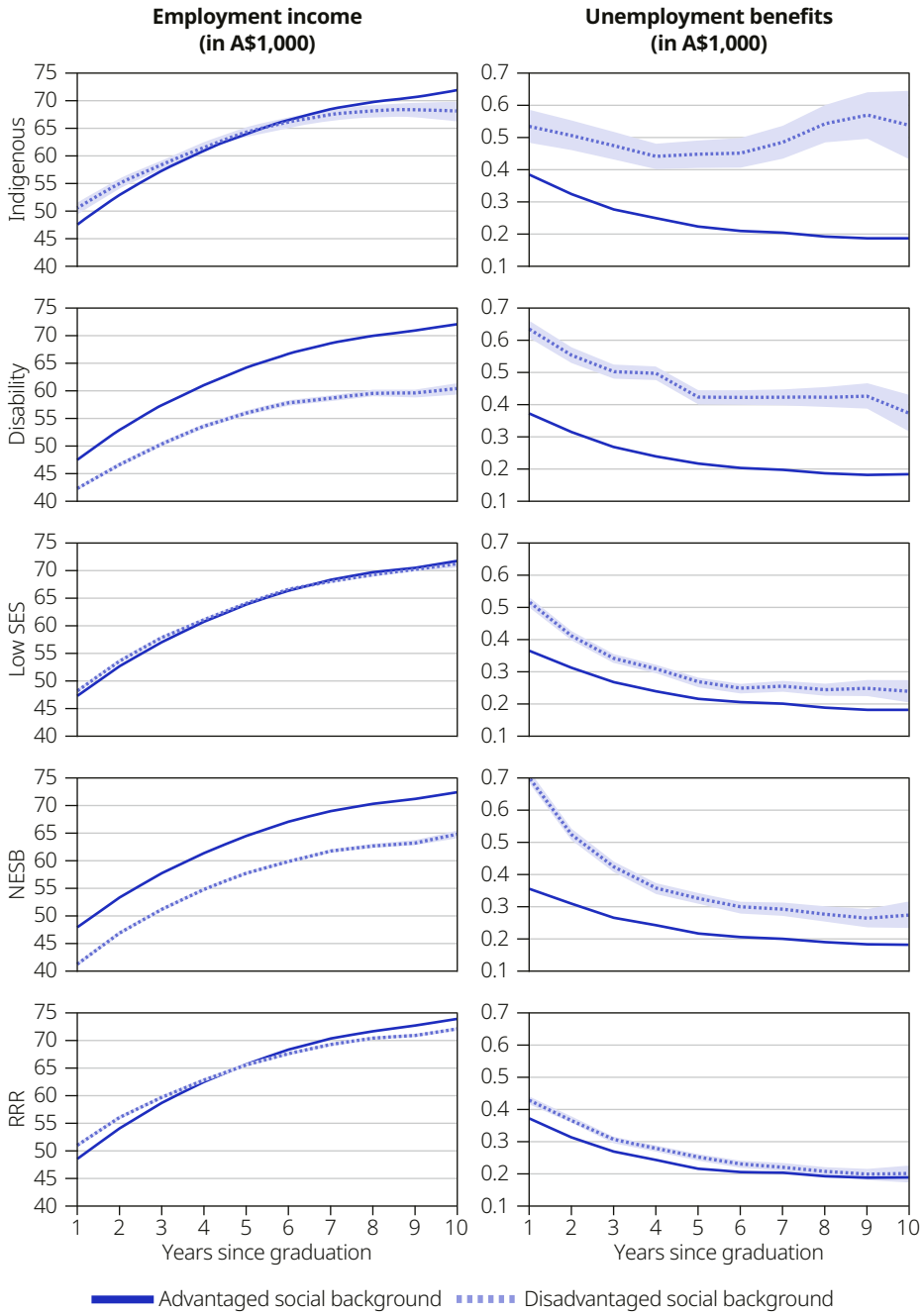
Graduates from all disadvantaged groups receive on average higher unemployment benefits than the advantaged graduates at all times. The gap between disadvantaged and advantaged graduates closes over time for all groups but Indigenous graduates. The difference shrinks fastest in the case of NESB graduates. It drops from A$318 (88.1 per cent) in the first year to A$68 (30.4 per cent) in the fifth year and A$54 (28.3 per cent) in the tenth year. In contrast, the gap with Indigenous graduates rises from A$243 (or 63.1 per cent) in the first year to A$279 (123.5 per cent) in the fifth and A$348 (182.2 per cent) in the tenth.

4.2. Growth modelling

To verify our descriptive results, we turn to multivariable growth models that are adjusted for a range of potential confounders. The models incorporate an individual-level random intercept (to account for unobserved effects) and interaction terms between the disadvantaged social background indicators and time since graduation (to capture longitudinal trends). Figures 1 to 4 plot the key results from these analyses (namely, differences between advantaged and disadvantaged groups of graduates over time). Full sets of model parameters are presented in tables A1 and A2 in the online appendix.

Figure 1 presents the estimated outcome trajectories (based on predictive margins) for graduates from the five disadvantaged social backgrounds and their counterparts from reference advantaged groups, that is, not having a particular type of disadvantage. Concerning income from employment (left panel), the picture is consistent for all groups of graduates: income increases at a faster

Figure 1. Predicted employment income and unemployment benefits, by student social background characteristics and time since graduation



Notes: SES = socio-economic status; NESB = non-English-speaking background; RRR = regional, rural or remote. Based on the model results presented in online appendix table A1. The shaded areas denote 95 per cent confidence intervals.

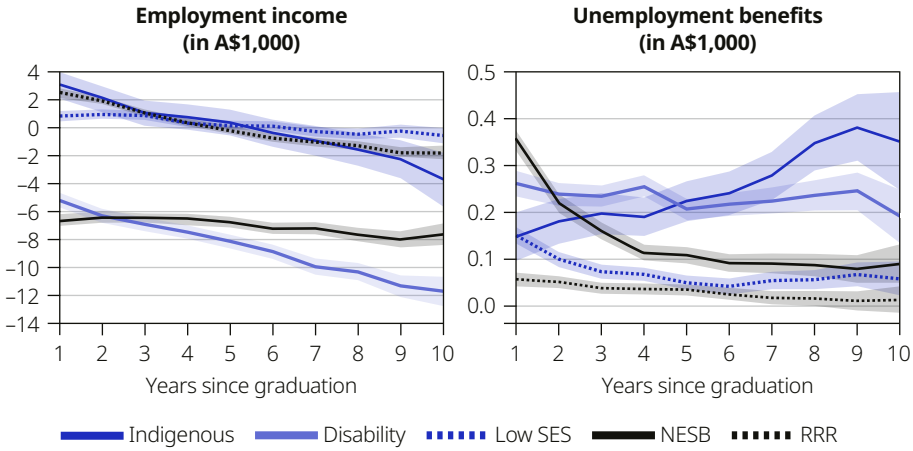
Source: Data from customized MADIP data set (2011–16).

pace during the initial years after graduation, tapering off towards the end of the observation period. There are, however, marked differences among graduates from different disadvantaged social backgrounds. Low SES graduates follow an almost identical trajectory to non-low SES graduates. Their adjusted average employment income grows linearly over time, from A$48,291 in the first year to A$64,105 in the fifth year, and to A$71,304 in the tenth year. Indigenous and RRR graduates initially earn slightly more than their non-Indigenous and non-RRR counterparts, respectively. However, the relationship reverses four to six years after graduation. For NESB graduates and those with a disability, a gap appears early on and becomes visibly wider over time.

Concerning unemployment payments (right panel), we observe that these are highest in the early years after graduation and decrease over time. The pace of decline is fastest over the first few years, and it flattens out towards the end of the observation window. Graduates from all disadvantaged social backgrounds receive, on average, higher amounts of unemployment benefits than their peers from the advantaged reference groups. However, these differences vary markedly depending on the group. On the one hand, there is relatively little difference between RRR and low SES graduates and their respective advantaged counterparts. In contrast, differences between Indigenous graduates and those with a disability and their comparison groups are much greater. NESB graduates start with the highest gap, but this declines rapidly between the second and fifth year and remains stable thereafter.

Figure 2 extends these analyses by directly focusing on the gap (differential) between the advantaged and disadvantaged graduates and how it changes over time. To this end, we plot the marginal effects of being a graduate from a

Figure 2. Average marginal effects of student social background characteristics on employment income and unemployment benefits, by time since graduation



Notes: SES = socio-economic status; NESB = non-English-speaking background; RRR = regional, rural or remote. Based on the model results presented in online appendix table A1. The shaded areas denote 95 per cent confidence intervals.

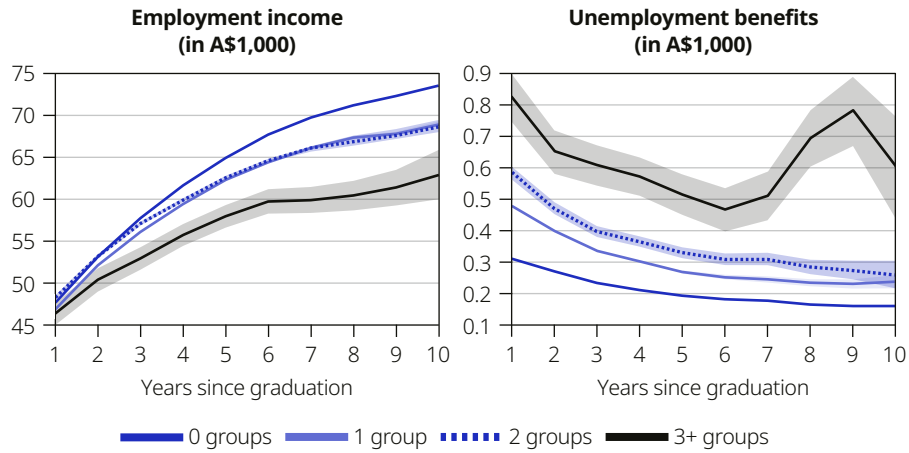
Source: Data from customized MADIP data set (2011–16).

disadvantaged social background relative to being in the corresponding advantaged category. Concerning income, the results show that differences between graduates from advantaged and disadvantaged social backgrounds increase over time for all groups. This process is most pronounced for graduates with a disability and those of Indigenous descent. For the former, the gap increases from A$5,239 (or 11.0 per cent) in the first year to A$8,174 (12.7 per cent) in the fifth year and A$11.733 (16.2 per cent) in the tenth year. Similarly, Indigenous graduates initially earn A$3,064 (6.4 per cent) more than non-Indigenous graduates but earn almost A$3,751 (or 5.2 per cent) less in the tenth year.

Concerning unemployment benefits, differences are stable over time for most groups. Notable exceptions include Indigenous graduates, where the gap relative to non-Indigenous students grows markedly over time, and NESB graduates, where the gap relative to other graduates declines over the first few years and then stabilizes.

Figure 3 shows the effects of cumulative disadvantage. The gaps between categories can also be appreciated by inspection of the marginal effects in figure 4. Both in terms of income and unemployment payments, graduates who do not belong to any disadvantaged group fare best. Their employment income grows at the fastest rate and their unemployment benefits stay consistently low, resulting in widening gaps between these and other groups of graduates. Overall, the higher the number of disadvantaged groups a graduate belongs to, the lower their income from employment and the higher their unemployment benefits. This pattern of results is particularly pronounced in the case of graduates belonging to three or more disadvantaged groups. These graduates achieve the worst outcomes by far, and gaps between these graduates and other graduates increase over time. The gap in employment income between graduates who do not belong

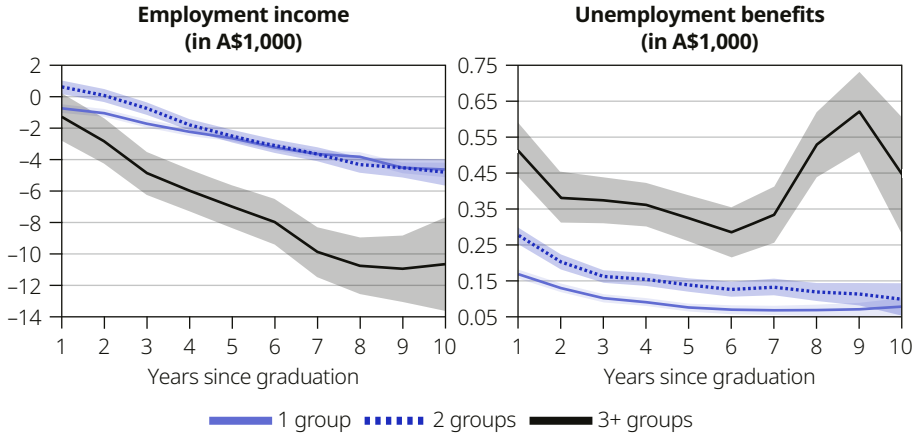
Figure 3. Predicted employment income and unemployment benefits, by student cumulative disadvantage and time since graduation



Notes: Based on the model results presented in online appendix table A2. The shaded areas denote 95 per cent confidence intervals.

Source: Data from customized MADIP data set (2011–16).

Figure 4. Average marginal effects of student cumulative disadvantage on employment income and unemployment benefits, by time since graduation



Notes: Based on the model results presented in online appendix table A2. The shaded areas denote 95 per cent confidence intervals.

Source: Data from customized MADIP data set (2011–16).

to any disadvantaged group and those who belong to three or more groups grows from A$1,266 (or 2.6 per cent) in the first year to A$6,999 (10.8 per cent) in the fifth year, and to A$10,638 (14.5 per cent) in the tenth year. In turn, the gap in unemployment benefits shrinks from A$512 to A$285 during the first six years, to start growing again and reach A$621 in the ninth year, before dropping to A$443 in the tenth year. This means that the most disadvantaged graduates receive, on average, 1.66 times more in unemployment benefits than those not belonging to any disadvantaged group in the first year after graduation, and 2.8 times more ten years on.

5. Discussion and conclusion

5.1. Aims and contributions

In this article, we have leveraged unique linked administrative data on entire cohorts of Australian graduates to investigate differences in the labour market trajectories of graduates from advantaged and disadvantaged social backgrounds. In doing so, we make significant contributions to the literatures on social inequality and the returns to higher education. We do so by extending the analysis beyond income inequalities, modelling long-term trends in labour-market outcomes and simultaneously investigating multiple dimensions of disadvantaged social background (SES, ethnicity, migration, location and disability). A major feature of the study is the robustness of the evidence provided, owing to the quality of our data. Using linked administrative population data allowed us to overcome a number of shortcomings constraining previous studies, such as small sample sizes, cross-sectional designs and self-reported outcome measures.

5.2. Disparities in labour market outcomes

Our results reveal increasing returns to higher education over time since graduation across all groups of graduates, marked by both increasing earnings and decreasing reliance on income-support payments. This evidence is consistent with the notion of career development and certain core tenets of human capital theory, as well as corroborating findings from previous empirical studies (for example, Friedman and Laurison 2019; Jacob, Klein and Iannelli 2015; Tomaszewski et al. 2021). The rate of growth in returns is generally highest in the first three years after graduation and tapers off towards the end of our observation period – at approximately seven to ten years after graduation.

Despite the overall growth pattern, our findings also highlight noticeable disparities in outcomes depending on graduates' social backgrounds. Specifically, and consistent with previous studies (for example, Pitman et al. 2019; Richardson, Bennett and Roberts 2016; Tomaszewski et al. 2021), we observe poorer post-graduation outcomes among students from disadvantaged social backgrounds relative to their more advantaged counterparts. On the whole, NESB graduates and those with a disability experience the worst outcomes relative to their comparison groups, whereas low SES graduates achieve the most similar outcomes. As we detail below, the picture for Indigenous and RRR graduates is more complex, with their relative outcomes changing markedly over the observation period. While these findings are largely consistent with those of previous studies, the scale and richness of our data allowed us to better assess outcome disparities for multiple disadvantaged groups and to do so using a single analytic framework. Furthermore, unlike most previous studies, we were able to provide robust evidence for groups that are typically difficult to capture in sufficient numbers in other data sources – notably, graduates with a disability and those of Indigenous descent.

5.3. Diverging pathways of Australian graduates

The key aim of this study was to move beyond the cross-sectional or short-term picture offered by earlier research, leveraging the longitudinal properties of linked administrative data. Applying growth modelling techniques for panel data, we investigated trends in labour market disparities between advantaged and disadvantaged graduates for up to ten years since graduation. This allowed us to ascertain how the gaps evolve as graduates gain experience in the labour market. In this regard, our results provide novel and important evidence that gaps in graduates' labour market trajectories differ across groups. This underscores the importance of accounting – both theoretically and empirically – for differences in the labour market experiences of graduates from different socially disadvantaged groups, and the possibility that different barriers and mechanisms are at play for different groups.

Our analyses reveal two core dimensions on which the trajectories differ. The first is the initial magnitude of the disparities which, as revealed by the average marginal effects, is substantial. Of the five groups considered, NESB graduates experience the worst outcomes one year after graduation, earning an average of A$6,668 (or 13.9 per cent) less than their English-speaking background

peers. Graduates with a disability achieve somewhat better outcomes, but still lag behind graduates without a disability. For them, the average gap in earnings one year after graduation is estimated at A$5,238 (or 11.0 per cent). In contrast, Indigenous, RRR and low SES graduates fare comparatively well. Their earnings one year after graduation exceed those of their more advantaged counterparts by A$3,063 (6.4 per cent), A$2,445 (5.2 per cent) and A$831 (1.8 per cent), respectively. The observed pattern of results is consistent with previous research focusing on individual groups, including graduates with a disability (Richardson, Bennett and Roberts 2016), NESB graduates (Li et al. 2017) and Indigenous graduates (Pitman et al. 2019).

The second dimension on which the trajectories diverge is the rate at which the disparities expand or contract over time, including the possibility of reversals in the dominant group. We find little evidence that the initial earnings gaps between socially advantaged and disadvantaged groups close over time. Furthermore, for the three groups that experienced better outcomes in the first years after graduation, we observed a reversal in the dominant group over time, at approximately four to six years after graduation. The disparities in earnings then persist up to the end of our observation period, a full decade after graduation. Even graduates from low SES backgrounds, who fare comparatively well, fail to catch up with their more advantaged counterparts. Again, average marginal effects reveal that the magnitude of the disparities is substantial. The diverging group pathways result in a different ordering of groups a decade after graduation, with the earnings disparities being largest for graduates with a disability (A$11,733, or 16.2 per cent), followed by NESB (A$7,640, 10.6 per cent), Indigenous (A$3,751, 5.2 per cent), RRR (A$1,810, 2.5 per cent) and, lastly, low SES (A$556, 0.8 per cent) graduates. Taken together, these findings emphasize the importance of "taking the long view" when evaluating the post-graduation outcomes of students from different social groups. Analyses that consider a single time point (for example, one year or five years after graduation) fail to provide a fuller picture of disparities and may lead to questionable policy decisions.

5.4. Additional insights: Unemployment benefits and cumulative disadvantage

In addition to the above, the present study makes several other contributions to the stock of knowledge on graduates' labour market outcomes and how these differ by social background. First, we not only considered graduates' earnings trajectories, but also their trajectories in terms of unemployment benefits. Including this outcome enabled us to assess stability of employment among graduates and to shed light on the level of support that might be required from government. As expected, graduates from disadvantaged social backgrounds not only earn less but also receive greater amounts in unemployment benefits than their advantaged counterparts – suggesting more unstable employment patterns. All differences between advantaged and disadvantaged groups persist until the end of the observation period, but they vary in magnitude in the last year across groups. For example, while RRR graduates receive A$14 (or 7.2 per cent) more than graduates from major cities, Indigenous graduates receive

A$352 (or 290 per cent) more than non-Indigenous graduates, after adjusting for the control variables. Interestingly, Indigenous graduates are the only group that do not reduce their reliance on unemployment payments over time. This pattern of results serves to highlight the complexity of indigeneity as a marker of disadvantage in contemporary Australian society. Even those Indigenous individuals who manage to break through the glass ceiling, attaining university degrees and gaining graduate employment, are disproportionately reliant on income support compared with their non-Indigenous peers.

Another contribution made by this study is the consideration given to the role of cumulative disadvantage. Owing to data constraints, researchers have rarely had the opportunity to investigate how belonging to more than one disadvantaged social group affects graduates' labour market prospects. Our analyses demonstrate that graduates experiencing cumulative disadvantage are significantly worse off than those experiencing "only" one marker of disadvantage. The negative effect on both earnings and the receipt of unemployment benefits of adding one additional disadvantaged social status is substantial. Compared with graduates who do not belong to any equity group, those who belong to three or more equity groups receive A$10,638 (or 14.5 per cent) less income and A$443 (or 2.8 times) more unemployment benefits.

5.5. Study limitations and avenues for further research

Despite the importance and robustness of our findings, we must acknowledge some limitations in our study, which point to potentially fruitful avenues for further inquiry. First, our data are limited to post-graduation information from university graduates. They do not include detailed pre-university information from these individuals, or any information from comparable individuals who did not engage in higher education. Accordingly, our analyses do not account for selection into higher education. Individuals from a disadvantaged social background are less likely to enter higher education in the first place (Tomaszewski et al. 2018) and those who do are more likely to drop out (Productivity Commission 2019). As a result, individuals from disadvantaged social backgrounds who obtain a degree may not be representative of their groups and the results reported here may not portray the full extent of the labour market disadvantage experienced by graduates from these groups. In our view, this does not detract from the key message from our study: our findings demonstrate that even these positively selected graduates from disadvantaged social backgrounds have worse labour market prospects than their peers from advantaged backgrounds. Future studies could address issues of selection by using data that capture both graduates and non-graduates and by employing appropriate modelling strategies (see, for example, Toutkoushian, Shafiq and Trivette 2013).

Second, despite their richness and robustness, the administrative data that we used in this study lacked measures allowing us to explore the mechanisms generating disparities in outcomes between graduates from different social backgrounds. For example, some theoretical perspectives focusing on divergences in social and cultural capital indicate that factors such as social networks and cultural fit may be implicated (for example, Burke, Scurry and Blenkinsopp

2020; Coleman 1988; Franzen and Hangartner 2006; Lin 2001). However, these measures are rarely available in administrative data sets. Gaining a better understanding of the factors driving the observed disparities will necessitate moving away from administrative data sets, relying instead on targeted social surveys or in-depth qualitative analyses of graduates from diverse social backgrounds.

Lastly, owing to data availability, this study uses an area-based measure of SES. This measure matches the Australian Government's official classification of equity groups (Martin 1994), enabling comparability with official statistics and an easier extrapolation of our findings into policy. However, area-based measures of SES may not capture individuals' social background as accurately as individual- or family-level measures, such as parental income or parental education. Future studies should explore the effects of other measures of low SES on post-graduation labour market trajectories.

5.6. Implications for policy and practice

While our analyses are not designed to pinpoint specific policy levers, our findings carry broad lessons for equity policy and practice. First, they highlight the importance of looking beyond graduation when assessing the connections between social background and the higher education system. Most equity policies in developed countries focus on widening participation or equalizing higher education experiences, whereas comparatively little effort has been directed at ensuring equal returns to university participation. Our findings demonstrate that inequalities observed at the access and participation stages of the student life cycle extend well beyond university graduation, underscoring the need for urgent policy attention to that phase.

Second, our analyses reveal significant heterogeneity in the extent to which graduates from different disadvantaged groups experience difficulties in the labour market, as measured by employment income. These divergences indicate that focused policy approaches and targeted support that recognize different experiences across groups are preferable over more general, "broad-brush" approaches. While our research does not provide evidence on which specific skills or resources these efforts should tap into, the longitudinal patterning in our results can provide important insights into sensitive or critical periods, and how these may differ across groups. Based on our results, NESB graduates and graduates with disabilities seem to experience comparatively greater barriers in the labour market, exhibiting wider and more immediate outcome gaps after graduation. Accordingly, these groups should be the priority focus of policy efforts to equalize career prospects. The fact that these divergences manifest shortly after graduation suggests that university-led interventions to boost employability and enhance employee–job matches are critical for graduates in these social groups. According to Tomaszewski et al. (2021), this finding is particularly consequential for NESB individuals, who have received little dedicated policy attention as a result of previous evidence suggesting that the group does not suffer from educational disadvantage. Our findings indicate that, even though they may not encounter educational barriers earlier on, NESB graduates experience substantial disadvantage in their labour market outcomes. This suggests that initiatives to boost these graduates' employability

while at university could be particularly beneficial. After relatively good initial outcomes for low SES, RRR and Indigenous graduates, their prospects worsen rapidly. This late onset of labour market disadvantage for these groups calls for long-term outcome monitoring and continued government-led support outside the education sector, including through labour market institutions.

Lastly, our findings reveal that graduates who belong to multiple socially disadvantaged groups receive particularly high levels of unemployment benefits. This suggests that, over time, such graduates experience greater instability in their employment pathways and they are more reliant on government financial support. Bridging the gaps in their post-graduation labour market outcomes requires targeted support – during and after university participation – addressing the greater complexity of the needs they may face.

In summary, the evidence presented in this article highlights the importance of building up employability skills for graduates from socially disadvantaged groups as part of their university experience. Universities should consider providing more training and development to boost graduates' employment prospects, such as offering students from socially disadvantaged groups targeted career guidance. Although many such programmes already operate in Australian universities supported by the Government's Higher Education Participation and Partnerships Program (HEPPP), owing to the parameters of the funding scheme, these programmes have predominantly targeted low SES students. Recent higher education reforms, including the establishment of the Indigenous, Regional and Low SES Attainment Fund (IRLSAF), offer a unique opportunity for universities to broaden the scope of these initiatives and extend them to other socially disadvantaged groups beyond the low SES. Judging from our findings, this is a move in the right direction, given the outcome disparities between graduates from advantaged and disadvantaged social groups, even after controlling for their SES. At a broader level, our study serves to showcase the power of leveraging novel data sources (in our case, linked administrative data sets) and deep cross-sectoral partnerships (in our case, between government and academia) to improve the stock of evidence-based knowledge at the intersection between social disadvantage and education.

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