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Factors influencing the employment of Australian PhD graduates

Abstract

It has long been argued in many western countries that having a highly skilled workforce is crucial to innovation and national competitiveness. Ensuring the employment of the most highly educated members of a country's population is integral to helping achieve such economic outcomes. Therefore, the objective of this study is to identify the major factors that account for the initial full-time employment of Australian-trained PhD graduates. It draws on a national survey conducted in 2011 ($n=2761$) and 2012 ($n=3181$) of PhD graduates in Australia across all major disciplines conducted four to six months after conferral of their degree. The findings reveal that previous work experience; attendance at a research-intensive university; completing one's degree off campus; part-time status; the use of certain job search strategies and access to research culture and networking opportunities; as well as certain demographic characteristics influence initial post-graduation job attainment. Implications of the findings are discussed.

Key words

PhD graduates; job attainment; employment factors, Australia; employability

Introduction

The importance of having a highly qualified workforce capable of meeting the demands and challenges of modern, advanced economies has been identified by a number of researchers (e.g. Harman 2002; Neumann and Tan 2011). Underlying part of this focus has been interest in increasing the number of doctoral-qualified graduates and quality of doctoral education as key drivers in knowledge creation, innovation and national competitiveness. Consequently, studies have sought to enhance our understanding of doctoral issues including skill development (Gilbert et al. 2004; Holmes and Miller 2000), graduate attributes (Bridgstock 2009; Manathunga et al. 2009; Platow 2012), and supervisor development (Bills 2004; Sinclair 2004). Discussion surrounding doctoral education has also been mindful of the diversity of programs on offer including those that are research-only degrees, research and coursework-based degrees, as well as the emphasis within these programs on the acquisition of basic as opposed to applied research knowledge (Usher 2002).

There are also differing expectations among stakeholders on the outcomes of graduating doctoral students. Industry seeks graduates with relevant skills for employment, while students seek job security but are also concerned the growing focus on skill outcomes does not detract from the importance of their contribution to knowledge (Pearson and Brew 2002; Mowbray and Halse 2011). At the same time, higher education practitioners periodically raise concern that the focus on demonstrating tangible value to societies as a result of doctoral research does not jeopardise the educational function of the doctoral degree (Gilbert et al. 2004).

Against this backdrop, there has been a strong need to ensure that national investment in doctoral education is achieving the expected outcomes both for the individual graduate and

more generally at the national level (Harman 2002; Vitae 2012). Unsurprisingly, this has precipitated research on the longer term satisfaction and skill utilisation of doctoral graduates (e.g. Nerad and Cerny 2000; Nerad et al. 2007; UQSRC 2007). One study of doctoral graduates in education from the University of London revealed the majority believed their studies had been worthwhile and their qualification had resulted in career advancement over time (Leonard et al. 2005). However, what currently remains less clear are those factors that account for the initial full-time employment of doctoral qualified graduates.

The aim of this paper seeks to address this gap by modelling the initial employment outcomes of recent PhD graduates in Australia to explain what influences job attainment among those graduating from doctoral degrees. The focus is specifically on those PhD graduates who have completed research-only doctorates, rather than those degrees including elements of formalised course work which are more typically referred to as professional doctorates. The research objective is to test a proposed model of full-time employment attainment in PhD graduates. The objective will be addressed using data gathered in the 2011 ($n=2761$ respondents) and 2012 ($n=3181$ respondents) Australian Graduate Survey; more specifically, the Postgraduate Research Experience Questionnaire (PREQ) which is a national survey of recent Australian postgraduates.

The paper will be structured by first presenting the proposed model of job attainment in PhD graduates. This will be followed by an outline of methodology and results. The findings will be discussed in the context of implications and strategies for major stakeholders in PhD degrees including employers, higher education providers and students.

Background

Proposed model

The model is derived from extant literature on factors influencing job attainment and other employment outcomes in graduates of higher degrees by research (HDR) in developed economies. The term ‘HDR’ typically refers to a broad group – Masters by Research, PhDs and professional doctorates. While there are lessons to be learned from the HDR portfolio, our focus lies exclusively in the ‘flagship’ HDR degree – the PhD – and there is no analytical distinction drawn between the PhD and its variant term of presentation, the Doctor of Philosophy (DPhil), offered in some institutions.

The dependant variable in this study relates to job attainment, classified as full-time employment among those seeking and available to work, within a defined period of PhD graduation. Although there are some similarities with other studies on post-graduate employment outcomes, there are variations relating to selected samples of universities as some have focused only on research-intensive institutions (e.g. Nerad et al. 2007; Morrison et al. 2008). Further, variations in length of time since graduation complicate comparisons with some studies concentrating on the six to 12 month period post-graduation (Neumann and Tan 2011), while others focus on more long-term employment outcomes (Nerad et al. 2007; Morrison et al. 2008; UQSRC 2007).

Predictor variables

There are a number of variables considered to potentially influence job attainment in PhD graduates. These are outlined below.

Supervision. The supervisor is considered pivotal in influencing PhD graduate employment pathways (Platow 2012; Hill and Walsh 2010) and career motivations (Edwards et al. 2010). Platow argues appropriate supervisory support is essential for PhD student success, ultimately determining employment opportunities. Hill and Walsh (2010) assert supervisors influence employment outcomes through nurturing networking, such as presenting at and attending conferences; encouraging publication - which is a significant recruitment criteria in academe - and advising students on a range of career options. Many supervisors are under pressure to improve their practice, given the increasing focus on skill outcomes in research graduates, and their important and changing role is critical for student learning (Pearson and Brew 2002). In addition to the quality of supervision, the number of supervisors may be pertinent to employment outcomes (Platow 2012).

Skill development. Platow's (2012) examination of 1258 Australian PhD graduates found a relationship between skill development and overall satisfaction with the PhD experience. He did not, however, detect an influence on certain employment outcomes such as time spent seeking work and gross salary. Others, however, highlight the importance of PhD graduates mastering a range of non-technical skills in order to secure employment (Pearson and Brew 2002; Manathunga et al. 2009). These skills, including communication, planning and project management, problem-solving and analytical skills (Manathunga et al. 2007; Nerad et al. 2007), are considered highly relevant for PhD graduates and their growing importance is prompting universities to consider ways of incorporating their development into research degrees (Manathunga et al. 2009). This creates tension among various stakeholders in PhD education as some consider the skills agenda as detracting from the traditional goal of significantly contributing to a particular field of research (see Gilbert et al. 2004).

There is some suggestion in the literature of a potentially moderating influence of the quality of supervision on skill outcomes. Many believe that PhD skill outcomes are enhanced by higher levels of supervisor support (Platow, 2012; Hill and Walsh, 2010). Hill and Walsh argue supervisors assist students in their understanding of the skills and capabilities required in their chosen profession. Borthwick and Wissler's (2003) review of Australian higher education provider practices in addressing non-technical skill outcomes in HDR students highlights the pivotal role of the supervisor in identifying, articulating and nurturing skill development. Platow's findings, however, indicate stronger perceptions of skill outcomes on the perceived usefulness of the PhD experience among graduates as a means of overcoming poor supervisory support and supervisory influence flattening out weaker perceptions of skill outcomes.

Quality of research experience. The quality of the graduate research experience is multi-faceted. Access to learning communities and conditions purporting to PhD success; a timely, fair and efficient thesis examination; access to adequate learning spaces, equipment and finance; and the clarity and articulation of learning structures, requirements and standards are all considered key dimensions to the research experience (Graduate Careers Australia 2012a). The importance of learning in communities of practice, captured by the 'intellectual climate' predictor, was introduced by Lave and Wenger (1991) and their role in enhancing student productivity and knowledge for research students is reiterated by Pearson and Brew (2002). The need for PhD candidates to access general and specialised resources during their studies, including funding support for conference attendance and networking opportunities, may be important for job attainment.

It was deemed unnecessary to include the thesis examination and the goals and expectations of the research process (the result of the former is arguably related to the latter in any case) as important variables in explaining initial employment outcomes of PhD graduates. Here, thesis examination is treated as a qualifying event (PhD awarded/not awarded) rather than as a possible job search strategy. This is not to deny that thesis examination, for example, the selection of PhD examiners can sometimes be ‘strategic’ with some consideration of future employment prospects but this was considered insufficient by itself to warrant inclusion.

Degree-related factors. The influence of a number of degree-related factors on PhD employment outcomes have been examined in previous studies and are included in our model. These are discipline area (Purcell and Elias 2002) with some well-defined pathways and high demand for certain areas; study mode (on-campus versus off-campus) – perceived to influence PhD completion (Wright and Cochrane 2000); attendance status (full-time versus part-time) and whether candidates are supported with a scholarship (Platow 2012). Scholarships may be considered a proxy for financial security. Evidence also suggests some employers continue to favour graduates from certain institutions (Brown and Hesketh, 2004), prompting the inclusion of institution type in the model.

Demographic characteristics and other factors. Platow (2012) and Purcell et al. (2007) advocated evaluating the influence of age, sex (male versus female) and residency status (domestic versus international student) on employment outcomes. Work experience during PhD studies is also considered, by students at least, to assist employment outcomes (Vitae 2012) and is included as a control variable by Platow (2012) as a likely influence on outcomes. The importance of job search strategies on employment outcomes has also been

examined among those completing undergraduate degrees (Purcell et al. 2013). In these cases the focus is on the value of career development opportunities available through higher education providers as well as various networking opportunities. Consideration of the type of job search strategies adopted is therefore considered highly pertinent to PhD graduates.

Method

Instrument

The Australian Graduate Survey (AGS) is a national annual survey of newly qualified graduates of Australian universities and higher education colleges. Postgraduate research graduates are administered the Graduate Destination Survey (GDS) and Postgraduate Research Experience Questionnaire (PREQ). The GDS gathers data on the employment outcomes of recent graduates, in addition to their previous work and education, continuing study, job seeking behaviour and demographic/background characteristics as detailed in Table 1. GDS data for each candidate is merged with that gathered from the PREQ which examines the quality of the higher education research environment. The PREQ comprises 28 attitudinal statements relating to the research experience which participants indicate their level of agreement on using a five-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’.

Procedures

The AGS is conducted at an institution level and is typically completed in two cycles: 31 October for graduates completing in the first half of that year, and 30 April onwards for those completing in the second half of the preceding year. Graduate Careers Australia’s (GCA) national distribution framework (see GCA 2012a) encourages uniformity in the distribution of the survey which is typically administered at graduation ceremonies, or by

email, mail, online or telephone. The majority of universities use a mixed-method approach to achieve responses (Nair and Shah 2011). Institutions are responsible for collating returns and following up on non-respondents. Processing of gathered data is completed by the GCA or to their specifications at institution level. The GCA is responsible for collating the national data file and prepares a number of reports.

The Australian Graduate Survey containing the PREQ was distributed to 6964 research graduates in 2011 and 7399 research graduates in 2012 with a 60.7% and 65% response rate respectively; a total of 41 higher education providers participated in the 2011 PREQ and 40 providers in 2012 (GCA 2011; Guthrie 2013). Achieved institutional responses rates ranged from 14.3 to 100% across the two years.

Participants

The number of Australian-educated PhD graduates who responded to the GDS and PREQ for 2011 was 3539 and 4024 for 2012. Table 1 summarises the characteristics of those who were available for full-time employment at the time of data collection. The included asterisks relate to reference categories for dummy variables. Those persons who were not available for full-time employment, totalling 778 students in 2011 (22% of the sample) and 843 in 2012 (20.9%) were not included in the analysis; reducing the 2011 sample to 2761 respondents and to 3181 respondents in 2012. This group was omitted from the analysis since their motivation for commencing a PhD, other than securing full-time employment upon completion, is unknown. This may have influenced their various choices en route and the importance of skill development, if their PhD was not instrumental to job attainment, may differ from others. In percentage terms there is considerable stability in the distribution of responses in the 2011 and 2012 surveys. Two-thirds of people holding doctorates in Australia

are males (Edwards et al. 2009: 32) which suggest that our particular sample under-represented male respondents and over-represented female respondents. However, on other criteria (e.g. age distribution, distribution across discipline), the sample was broadly representative of the national population of PhD graduates (Edwards et al. 2009).

[Insert Table 1 about here]

Variables

The predictor variables for the study are as follows.

Quality of research experience. The overall quality of the research experience is measured by a single item in the PREQ (“overall, I was satisfied with the quality of my higher degree research experience”). This self-report of how satisfied a PhD graduate was with their degree is considered, for the purposes of this study, synonymous with the quality of the research experience. Further, there are self-reported measures for the quality of six different aspects of the research experience: supervision, skill development, intellectual climate, infrastructure, thesis examination and goals and expectations. There were multiple items relating to each of these six different variables. A composite measure, equally weighted across the items, was computed for the four predictor variables; thesis examination and goals and expectations were not included in the analysis. For detail on the development of PREQ items, see Graduate Careers Australia (2012b).

Table 2 presents the AGS’ descriptor of each variable, the number of items relating to each, the Cronbach alpha (α) scores for variables with two or more items and the means and standard deviations of each composite measure. The alpha scores are above the widely accepted value of 0.7 (Hair et al. 2010) for both sample groups (2011 and 2012), indicating

they are reliable measures of the associated construct. Validity is assured by the rigorous process of constructing the variables and their associated items.

[Insert Table 2 about here]

Degree-related variables. Degree-related variables are defined in Table 1 and comprise the number of supervisors, attendance status, study mode, discipline, and whether a scholarship was awarded during the degree period. With respect to discipline area, the similar/allied areas as classified in the Australian research landscape were referred to.

Demographic and other variables. Age is included as a continuous variable. The remaining predictor variables which relate to demographic characteristics – namely sex and domestic/international status – are dummy control variables. Difficulties in determining the residency status of international students, due to the potential award of permanent residency status upon course completion, is acknowledged by GCA and using a variable relating to residency status at the time of enrolment is considered most appropriate (GCA 2013). Some of the demographic data is provided by institutions from their own student records using the respondent's unique student identifier from their AGS response.

The remaining variables are paid work experience, measured by employment in the final year of study and types of job search strategies. Following Purcell et al.'s (2013) analysis of the impact of different job search strategies on employment outcomes among Bachelor degree graduates, these were placed into three categories: traditional pathways (responding to advertisements, speculative applications and employment agencies); university (career development opportunities offered through the higher education provider); and networking (via work contacts, family or friends). Variations in institution type are

captured by the Group of Eight (Go8) and non-Group of Eight distinction. In Australia, the Go8 universities are eight elite, research-intensive universities – similar in status and profile to the Russell Group of universities in the UK – which collectively receive higher levels of competitive government research grants than the 31 non-Go8 universities and two higher education colleges.

The outcome variable relates to job attainment and is measured by a derived variable in the AGS data set. This aggregates and categorises respondents who were available for full-time employment into those currently in full-time work and those still seeking full-time employment. As noted earlier, those who were not available for full-time employment were not included in the analysis reducing the 2011 sample to 2761 and 2012 to 3181.

Analysis

Logistic regression is the preferred method for analysing the binary outcome variable (Hair et al., 2010), with the statistical analysis conducted in SPSS. The analysis was initially run on the 2012 data and the results are presented in the following section. The results were then subsequently validated by testing the model using the 2011 national data set (a summary of which is presented at the end of the Results section).

Limitations

This study relies on self-report data from a national cohort of students graduating in 2011 and 2012. Concerns for inaccuracy in self-assessing one's learning and development are highlighted by Sitzmann et al. (2010). Further, there are documented concerns for evaluating job attainment using data gathered within a short time period, in this case four to six months, since graduation. However, it is important to note that typical delays between thesis

completion and graduation mean surveyed graduates are likely to have submitted their thesis up to one year earlier. The study also adopts a ‘big-picture’ approach by investigating employment outcomes across all PhD graduates while disparities exist, discussed later in the paper, in job attainment among different discipline groupings. A further limitation is the reduction of the sample, for both 2011 and 2012, due to approximately 20% of the sample not being available for full-time employment. Reasons for this lack of availability are not known but may extend to carer commitments or continuation of academic study beyond their PhD.

Given the parameters of the PREQ instrument, there are certain variables not included in the model. Other factors deemed influential on employment outcomes, albeit those graduating from Bachelor degrees, which are not included are socio-economic status (Wilton 2012); parental education (Purcell et al. 2013); and life experience and extra-curricular activities (Wheeler 2008). Also, the skill development component of the research experience does not include items relating to team work, acknowledged as important in postgraduates (Nerad 2004).

Results

It is important to note the study’s concentrated focus in regard to employment outcomes. Given the dichotomous nature of the outcome variable – achieving full-time employment or not – it does not explore underemployment among PhD graduates. This could include, for example, PhDs which are seeking full-time work but have only managed to secure part-time employment. Further, there may be graduates who have successfully attained a full-time position yet are not satisfied with it, possibly due to a lack of alignment with their level of education or area of expertise, and are still seeking alternative employment. A detailed breakdown of the employment outcomes for graduates, expressed as a proportion of

those available for full-time work and also for the entire PhD sample, is provided in Table 3. The figures show there has been little change over the two year period, indicating ongoing stability in the Australian labour market. Outcomes are favourable with just over 7% of PhDs available and seeking full-time work not being able to secure employment of any kind. It is important to note, however, that approximately 11% of those wishing to work full-time were only working in a part-time role at the time of the survey.

[Insert Table 3 about here]

An initial univariate analysis was conducted for both 2011 and 2012 sample data. Casewise deletion was undertaken for any missing values, accounting only for 4.5% of those seeking full-time employment in the 2011 sample and 3.5% of the 2012 sample. This is a relatively small loss which reduced the 2011 sample to $n=2636$ and the 2012 sample to $n=3071$ respondents. There are no inflated standard errors among the coefficients, suggesting multicollinearity is not present.

2012 Model fit and regression coefficients

The results yield a significant ($p=.000$) chi-squared value of 1757.636, although this must be treated with caution due to the relatively large sample size (Hair et al. 2010). The percentage of correct predictions is 67.6 for those seeking full-time work and 74.8 for those in full-time work, with an overall hit rate of 78.6. The pseudo R^2 measure, Nagelkerke R^2 , is 0.581 and the Hosmer and Lemeshow test statistic is 0.127. Hair et al. recommend using a combination of measures to assess model fit. Based on these, the model is deemed a good fit. It is important to note that 41.9% of variance in the model is not explained although measures of R^2 can be lower for models with a binary response outcome variable (Cox and Wermuth 1992).

The coefficients are presented in Table 4. The categorical polytomous predictor variables were unpacked to create a set of binary dummy variables. The Wald statistic, and its associated p -value, indicates the statistical significance for how each estimated coefficient impacts the likelihood of attaining full-time employment. Significant ($\alpha=0.05$) positive original coefficients (B) are designated by an asterisk and indicate an increased probability of securing full-time work. Exponentiated coefficients, denoted by $\text{Exp}(B)$, above 1 indicate a positive effect on the odds of achieving full-time employment while values less than 1 suggest they will make full-time employment less likely to occur.

[Insert Table 4 about here]

Institution type significantly impacts on the odds of securing full-time employment. Those graduating from a 'Group of Eight' (Go8) university are almost 30% more likely to attain a full-time job than those graduating from non-Go8 universities. Attendance status is also important with part-time graduates doubling their chances of full-time employment in comparison to those who studied on a full-time basis. Age has a negative impact on employment prospects with more mature graduates having less chance of attaining a full-time position. Importantly, the odds ratios for continuous variables – such as age – tend to be closer to zero even if significant (Hair et al. 2010), possibly explaining the relatively weak 3% reduction in the chance of achieving full-time employment with a one year incremental increase in age. Undertaking paid employment during the final year of study is important for job attainment; increasing the likelihood by almost half. Discipline area is also important as those who graduate with a non-Medical and Health Science based PhD degree will almost halve their odds of achieving full-time employment. As one might predict, residential status is also important with those classed as a non-overseas resident at the time of enrolment into their PhD significantly increasing their chances of full-time employment by almost 50% in

comparison with overseas residents. Further, higher perceptions of the quality of intellectual climate in the attended institution significantly increase the chances of job attainment by 22%. Finally, the job search strategies used by PhD graduates are important with university-based methods more than tripling one's likelihood of obtaining a full-time job and networking methods more than doubling one's chances of employment in respect to more traditional methods.

In order to explore the possibility of an interaction effect between quality of supervisory support and quality of skill development, deemed as a proxy of skill outcomes, an interaction term was introduced for the two composite predictor variables. The term was not, however, significant nor did it vary the significance of other coefficients or model fit. The inclusion of the moderating effect of the supervisor on skill outcomes was therefore discounted and the original model retained.

Validation of model using 2011 data

The model was validated using the 2011 data. Measures of model fit include a log likelihood value (-2LL) of 2177.116 and significant ($p=.000$) chi-squared value of 1475.770. The percentage of correct predictions is 63.8 for those seeking full-time work and 74.1 for those in full-time work, with an overall hit rate of 72.2. Nagelkerke R^2 is a respectable .572 and the Hosmer and Lemeshow test statistic is 0.512. These measures combine to indicate good model fit. Again, the absence of inflated standard errors precludes multicollinearity.

Regression coefficients are presented in Table 5 and produce a similar pattern, in both magnitude and direction, in significant results to the 2012 analysis for institution type; mode of attendance; age; paid employment during final year of study; completion of a Medical and

Health Science-based PhD – in comparison with the Agriculture, Building, Engineering and Surveying grouping; and the use of university-based and networking approaches rather than traditional methods for seeking full-time employment. The significant result for recent PhD graduates completing their degree in off-campus mode was not replicated in the 2011 data set, nor was the influence of perceived quality in the intellectual climate of the attended institution or residency status. An additional significant influence, however, was detected for graduate perception of the quality of infrastructure in the attended institution positively impacting on job attainment in 2011, increasing chances of full-time employment by approximately 30%. Overall, the validation exercise generally substantiates the 2012 model and strengthens the argument for its consideration in evaluating factors which account for initial job attainment after the completion of a PhD degree.

[Insert Table 5 about here]

Discussion and implications

In drawing comparisons with extant literature, it is important to note the potential impact of differences in length of time since graduation and measures of employment outcomes employed in previous studies. The importance of attended institution (Go8 status) on job attainment confirms conjecture, albeit at the undergraduate level, that PhD graduates may not always be recruited on merit but on the reputation of the awarding institution (Wilton 2011). Wilton's study of business and management Bachelor degree graduates found the distinction between new and old universities in the UK heavily influenced employment prospects, even for those suitably equipped with the skills deemed necessary by industry for effective workplace performance. Given the usual exclusion of institution type in the distribution of PREQ data, comparing the employment outcomes among those graduating from a research-intensive university (Go8) in Australia with other higher education providers

has been largely unexplored and proffered explanations are speculative. The disparities in job attainment may simply reflect the meritocratic recruitment process into the eight elite universities whereby their PhD students achieved relatively stronger academic results as undergraduates. Another possibility may be greater access to resources for doctoral students to attend conferences, network and participate in relevant training among Go8 universities. An alternative perspective is employers are largely ignoring the virtues of quality PhD graduates based on the reputation of their awarding institution. PhD graduates' vital role in expanding on and establishing new knowledge economies (Harman 2002) necessitates equitable recruitment processes based on the candidate's ability to contribute to the field, not what a particular higher education provider's reputation suggests the candidate may be capable of.

The apparent success of part-time students initially defies conventional wisdom. Part-time students are often more challenged with work-life balance issues and financial concerns (Gardner and Gopaul 2012), which may ultimately impact on their performance and subsequent employment prospects. This finding contradicts Platow's (2012) study where part-time PhDs had greater delays in job attainment following thesis submission. The success of both part-time and off campus graduates may also be attributed to a greater opportunity for reflecting on and enacting initial employment, rather than being constrained by what is available – perhaps casual positions – in the immediate environment of their awarding institution. The implication that these types of graduates are more effective in seeking employment, more employable, or have more time to dedicate or increased exposure to professional networking, is softened by the high proportion securing employment during their final year of study. In support of enhanced efficiency or effectiveness, literature on part-time

PhD students is scarce although there is some evidence to suggest they – along with off-campus students – have relatively faster completion rates (Neumann and Rodwell 2009).

The findings may be explained, however, by greater opportunity for professional networking as a large proportion may already be currently employed. To explore this further, cross-tabulation was conducted on attendance/mode status against whether employment was secured prior to 1 May in the final year of study. This revealed that of those in full-time employment, 63% of graduates who studied part-time had attained full-time employment in their final year, in comparison to 17% of those who studied full-time. As 83% of these part-time graduates were still with their final year employer, this does suggest continuity of employment although it is not possible to assert that these part-time students were with the same employer for the duration of their studies and indeed with them upon commencing their PhD.

The negative impact of age on job attainment aligns with Platow (2012) who found younger PhD graduates to be without employment for fewer months. Neumann and Tan (2011), however, found the initial employment patterns of doctoral graduates in two universities with quite different age profiles were broadly similar. The residency status factor is marginally within the significant threshold ($\alpha=.05$) for 2012 and is insignificant in 2011. Rising importance may be attributed to the Australian government's tightening of student visa requirements although it is important to remember the findings only relate to those currently available for full-time employment, excluding those without required work visas. Given the continually shifting policies governing visa regulations and apparent limited empirical examination of variations in employment outcomes by residency, exploration of this area is important yet beyond the scope of this paper.

The importance of securing paid employment in the final year of study is illuminated and aligns with Vitae's (2012) assertion that related work experience has a positive experience on the career plans of doctoral researchers. Conversely, Platow (2012) did not detect a significant difference in the number of months to obtain employment among those who had, or had not, worked during their studies. Although there is relatively little in the literature on the value of employment during postgraduate studies, there is a growing body of evidence highlighting the importance of work experience – paid and/or via work-integrated-learning opportunities – on job attainment among Bachelor graduates (Brooks 2012) although some argue supporting evidence is tenuous (Wilton 2012).

Regarding differences among discipline groupings in job attainment, Platow found those graduates in natural or physical sciences – thus featuring in the 'Other Science' grouping in the current study – were less likely to have a job immediately upon thesis submission than those from other discipline areas. The stronger initial employment prospects of Medical/Health Sciences PhD graduates are clearly reflected in the findings. The important role of discipline in determining employment outcomes is further highlighted by the job attainment data for the discipline groupings in Table 3. The data indicates a slight decline in those in full-time employment across the two years for graduates in certain disciplines and confirms the more favourable employment outcomes experienced by those graduating from Medical and Health Science degree programs.

The growing importance of intellectual climate – essentially the research ambience, access to a broader social network and strong integration into the research community – supports university developments highlighting the benefits of creating a research culture for PhD students. Transition from an insignificant model variable in 2011 to an important

predictor of job attainment in 2012 may further illuminate the importance of this determinant of job attainment in a softening of the labour market where 'who you know', rather than 'what you know' comes increasingly into effect.

Finally, the importance of different types of job search strategies is highlighted with both university-based and networking methods extremely important to initial job attainment. Vitae (2012) found only one-third of UK final year doctoral researchers had used their institution's career service although two-thirds acknowledged they would have benefited from its usage. Others (see Neumann and Tan 2011) bemoan the lack of career development and guidance offered to doctoral students during studies. The importance of networking is widely acknowledged, particularly in relation to employment prospects (Baker and Pifer 2011).

The lack of influence of perceived skill development on job attainment is interesting, particularly given its growing focus in PhD education (Platow 2012). Although Platow detected a positive relationship between perceived non-technical skill acquisition in PhD graduates and post-PhD productivity outcomes, he did not detect a relationship with time seeking employment upon graduation, aligning with the findings of this study. To some degree, our findings are also consistent with Manathunga et al. (2009) who found – to their surprise – better preparation in certain non-technical skills did not assist PhD graduates in Science in their current employment. Again, differences in measures are relevant here as this study may relate more to performance than attainment. Given that doctoral programs can produce “overly specialised graduates who struggle to adapt to the workplace” (Manathunga et al. 2009, p. 91) and PhD outcomes now extend beyond the traditional goals of high quality research skills and a significant contribution to the chosen field of research (Manathunga et

al. 2007), this creates tension in addressing the void between higher education provision and industry expectations.

Unlike previous research (Platow 2012; Sinclair 2004), the quality of supervision did not positively influence initial job attainment. The moderating influence of the supervisor on the impact of skill development on employment outcomes was also not supported. It should be noted, however, that those supervisory factors asserted by Hill and Walsh (2010) as critical for employment outcomes – nurturing networking and careers advice – are identified as important in the study but as an independent and direct pathway to job attainment. Further investigation of a possible moderating effect of the supervisor on these predictors may create a somewhat different picture of the importance of supervision.

There was no relationship detected for sex, contravening previous studies which have detected an influence on other PhD outcomes, such as men earning higher salaries (Platow, 2012). Rudd et al's (2007) study of the influence of sex on PhD career paths suggests variations relate to the robustness of non-academic labour markets in particular sectors. Where fewer labour market alternatives existed, gender tenure ratios favoured males and the opposite with a strong array of quality labour market opportunities; highlighting the complexities of the relationship between sex and employment outcomes. Holding a scholarship also made little difference to job attainment, contrary to previous studies (e.g., Higher Education Funding Council for England 2005; Sinclair 2004) yet broadly aligning with Platow's (2012) findings.

Implications for stakeholders

Universities and potential employers should collaborate on ways to encourage related work experience during PhD study. This may include developing and promoting opportunities for integrating work placements into course design or encouraging part-time paid employment in academia or relevant industry. This could be achieved through the relaxation of sometimes prohibiting restrictions on hours worked, particularly for those in receipt of scholarships, and introducing schemes and/or awards to encourage tutoring and lecturing at the home institution. Given elevated job attainment in younger PhD graduates and graduates of higher status universities, various employers should also review their recruitment and selection practices to ensure they are equitable and meritocratic.

Universities should also be actively encouraging their PhD students to make better use of available career services (Vitae 2012). This is important not only for securing full-time employment but also to encourage early thinking on career pathways. Furthermore, as suggested by Nerad and Cerny (2000), greater resourcing for careers advice, planning and guidance for PhD students could be provided to further improve employment outcomes. Neumann and Tan (2011) argue that a better understanding of the short and long-term career trajectories is needed to productively integrate career planning into PhD programs. The lack of supervisory influence urges practitioners to review their advisory and mentoring practices in guiding PhD students on seeking and securing employment during or immediately post-graduation.

There is an emergent theme in the findings of the importance of the student's immediate social and cultural environment when completing their PhD. The strong influence of the items relating to intellectual climate and the role of networking and institution-based

resources in attaining employment combine to illuminate the critical need for graduates to be aware of and capitalise on those around them (McAlpine and Turner 2012). This is equally important for those completing their PhDs on a part- or full-time basis and in off-campus or mixed-mode. Just as Wenger (2010) promotes the landscape of community practice for personal advancement, PhDs should learn to navigate the wealth of tangible and human resources – whether it is their supervisor, careers advisory service, professional or personal network with whom they have the opportunity for interaction during their program – to enhance their employment prospects.

Conclusion

This study has tested a proposed model of full-time job attainment in very recent PhD graduates. It has contributed to the literature by enhancing our understanding, and explanation of, initial PhD graduate employment outcomes (Manathunga et al. 2009). It does not provide a perfect answer to why one graduate may attain full-time work while another cannot but it does provide new insights into those factors that account for post-PhD employment outcomes. Our contribution is highly salient for knowledge-based economies seeking to align research training policy with national-level innovative practices and competitiveness.

As investigations of the career pathways of PhD graduates continue to grow, so will the opportunities for researching into the factors driving why certain PhDs achieve employment more easily than others. There are several ways this study could be extended into future research to add further value to our understanding of employment outcomes in PhD graduates. This study has looked at factors influencing initial job attainment following completion of a PhD program. However, it makes no comment on the destination of PhD

graduates into post-degree employment. Knowing that only about 26% of all doctoral graduates end up employed in the university and vocational education sector (Edwards et al. 2009, p. 39), a more fine-grained analysis could track the initial pathways of PhD graduates into higher education, industry and other employer types to identify the factors specific to each. Further, the model could be tested at the discipline level to identify variations in determining factors for different discipline groups and/or cultural and international contexts. A more longitudinal approach could also be employed to explore relationships between short and long-term employment outcomes and identify variations in determining factors for the different stages of PhD careers. This could be investigated using the Beyond Graduation data (GCA 2011) which is administered three years post-graduation. Examining the link between PhD job attainment and the expectations of students (using, for example, Edwards et al. 2011) would further enrich our understanding of PhD career pathways and success. Finally, exploration of ‘employment while studying’ and its link to gaining full-time employment upon graduation would be beneficial, particularly in comparing effective job search strategies at different stages of study and evaluating which vocations tend to translate more seamlessly from study to employment than others.

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Table 1 Summary of participant characteristics

Characteristic	Sub-group	2011		2012	
		<i>n</i>	Valid %	<i>n</i>	Valid %
Sex	Male*	1439	52.1	1665	52.3
	Female	1322	47.9	1516	47.7
Age	0 - 24 years	7	0.3	15	.5
	25 - 29 years	661	23.9	791	24.9
	30 - 39 years	1166	42.2	1359	42.7
	40 - 54 years	713	25.8	787	24.7
	55+ years	214	7.8	229	7.2
Employment in final year of study	Yes*	2115	76.6	2395	75.3
	No	646	23.4	786	24.7
Scholarship	Yes (APA/RTS)	1834	66.4	2105	66.2
	No*	927	33.6	1076	33.8
Attendance status	Mainly full-time	2021	73.2	2315	72.8
	Mainly part-time*	740	26.8	866	27.2
Study mode	Internal (on-campus)*	2117	76.7	2416	75.9
	External (off-campus)	368	13.3	429	13.5
	Mixed mode	276	10.0	336	10.6
Number of supervisors	Single*	909	32.9	966	30.4
	Multiple	1852	67.1	2215	69.6
Residency status	Non-overseas resident at enrolment*	2249	81.5	2569	80.8
	Overseas resident at enrolment	512	18.5	612	19.2
Job search strategies	Traditional methods*	725	24.4	839	24.2
	University methods	1391	46.8	1605	46.4
	Networking	854	28.8	1016	29.4
Discipline	Agriculture, Building, Engineering and Surveying*	474	17.2	545	13.9
	Arts, Humanities, Social Sciences and Education	788	28.5	872	27.4
	Business, Accounting, Economics and Law	262	9.5	317	10.0
	Medical and Health Science	354	12.8	470	14.8
	Other Science	883	32.0	977	
Institution	Group-of-Eight*	1475	53.4	1769	55.6
	Non Group-of-Eight	1286	46.6	1412	44.4

Table 2 Summary of measures adopted in proposed model

Measure	Descriptor	Items	<i>Mean</i>		<i>SD</i>		<i>α</i>	
			2011 (<i>n</i> =2636)	2012 (<i>n</i> =3071)	2011	2012	2011	2012
Supervision	Accessibility and quality of research degree supervision	6	4.08	4.10	.88	.88	.924	.921
Intellectual climate	Learning community and conditions provided by the institution	5	3.73	3.76	.90	.90	.872	.875
Skill development	Extent of generic, analytical and communication skill development	5	4.50	4.52	.62	.58	.903	.893
Infrastructure	Quality of learning infrastructures such as space, equipment and finance	5	4.02	4.03	.80	.80	.840	.843
Age	Age on 30 April		37.34	37.01	9.77	9.61		

Table 3 Summary of job attainment in PhD graduates (2011 and 2012)

Characteristic	Sub-group	2011		2012	
		<i>n</i>	Valid %	<i>n</i>	Valid %
Job attainment (for those available FT employment; <i>n</i> =2761 in 2011, <i>n</i> =3181 in 2012)	In full-time (FT) employment	2247	81.4	2582	81.2
	Seeking FT employment, working PT	302	10.9	364	11.4
	Seeking FT employment, not working	212	7.7	235	7.4
Job attainment (for all PhDs; <i>n</i> =3539 in 2011, <i>n</i> =4024 in 2012)	In full-time (FT) employment	2247	63.5	2582	64.3
	Seeking FT, Working PT	302	8.5	364	9.0
	Seeking FT, Not Working	212	6.0	235	5.8
	Total available for employment	2761	78.0	3181	79.1
	Not available for FT employment	778	22.0	843	20.9
Job attainment by discipline (for all PhDs; <i>n</i> =3539 in 2011, <i>n</i> =4024 in 2012)	<i>Agriculture, Building, Engineering and Surveying:</i>				
	In full-time (FT) employment	388	69.5	433	65.1
	Seeking FT, Working PT	37	6.6	53	8.0
	Seeking FT, Not Working	49	8.8	59	8.9
	Total available for employment	474	84.9	545	82.0
	Not available for FT employment	84	15.1	120	18.0
	<i>Arts, Humanities, Social Sciences and Education:</i>				
	In full-time (FT) employment	607	54.3	657	53.9
	Seeking FT, Working PT	126	11.3	156	12.8
	Seeking FT, Not Working	55	4.9	59	4.8
	Total available for employment	788	70.5	872	71.5
	Not available for FT employment	330	29.5	347	28.5
	<i>Business, Accounting, Economics and Law:</i>				
	In full-time (FT) employment	216	66.7	276	71.0
	Seeking FT, Working PT	29	9.0	29	7.4
	Seeking FT, Not Working	17	5.2	12	3.1
	Total available for employment	262	80.9	317	81.5
	Not available for FT employment	62	19.1	72	18.5
	<i>Medical and Health Science:</i>				
	In full-time (FT) employment	309	62.4	427	70.3
	Seeking FT, Working PT	28	5.6	24	4.0
	Seeking FT, Not Working	17	3.4	19	3.1
	Total available for employment	354	71.4	470	77.4
	Not available for FT employment	142	28.6	137	22.6
	<i>Other Science:</i>				
	In full-time (FT) employment	727	69.7	789	69.0
	Seeking FT, Working PT	82	7.9	102	8.9
	Seeking FT, Not Working	74	7.1	86	7.5
	Total available for employment	883	84.7	977	85.4
	Not available for FT employment	159	15.3	167	14.6

Table 4 2012 logistic coefficients

	B	S.E.	Wald	Sig.	Exp(B)
Institution type	.257	.104	6.138	.013*	1.294
Attendance status	.706	.150	21.991	.000*	2.025
Off-campus mode	.622	.210	8.771	.003*	1.863
Mixed mode	.067	.169	.159	.690	1.069
Number of supervisors	-.041	.111	.135	.713	.960
Sex	-.106	.105	1.028	.311	.899
Age	-.032	.006	30.578	.000*	.968
Scholarship	.208	.162	1.658	.198	1.232
Paid work experience	.392	.116	11.474	.001*	1.479
Arts	.249	.135	3.388	.066	1.283
Business	-.246	.186	1.754	.185	.782
Medical	-.552	.180	9.436	.002*	.576
Other Science	-.082	.135	.369	.544	.921
Residency status	.383	.188	4.144	.042*	1.467
University job search strategies	1.195	.110	118.156	.000*	3.303
Networking job search strategies	.862	.111	60.662	.000*	2.367
Supervision	.024	.075	.106	.744	1.025
Intellectual climate	.206	.076	7.295	.007*	1.229
Skill development	-.029	.096	.092	.762	.971
Infrastructure	.075	.086	.761	.383	1.078

*Significant ($p=.05$)

Table 5 2011 logistic coefficients

	<i>B</i>	<i>S.E.</i>	<i>Wald</i>	<i>Sig.</i>	<i>Exp(B)</i>
Institution type	.305	.112	7.356	.007*	1.356
Attendance status	.848	.167	25.663	.000*	2.335
Off-campus mode	.178	.202	.778	.378	1.195
Mixed mode	.053	.188	.079	.778	1.054
Number of supervisors	-.062	.118	.276	.599	.940
Sex	-.014	.113	.016	.901	.986
Age	-.028	.006	21.685	.000*	.972
Scholarship	-.093	.160	.336	.562	.911
Paid work experience	.720	.121	35.300	.000*	2.054
Arts	.121	.143	.715	.398	1.128
Business	-.108	.191	.323	.570	.897
Medical	-.493	.191	6.662	.010*	.611
Other Science	-.198	.141	1.971	.160	.821
Residency status	.018	.191	.009	.925	1.018
University-based job search strategies	1.103	.117	88.301	.000*	3.012
Networking job search strategies	.748	.117	40.742	.000*	2.112
Supervision	.031	.079	.154	.695	1.031
Intellectual climate	.081	.081	.985	.321	1.084
Skill development	-.074	.099	.558	.455	.929
Infrastructure	.259	.091	8.114	.004*	1.296

*Significant ($p=.05$)