

DECISION SCIENCES INSTITUTE**Evaluating How Doctorate Recipients Make Their Career Decisions**

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ABSTRACT

Doctorate recipients have two choices for their career: academic or non-academic. The purpose of this paper is to examine various factors that affect their decisions in seeking and accepting academic or non-academic jobs. In addition, job satisfaction levels of doctorate recipients working for non-academic organizations are also evaluated. The paper proposes theoretical frameworks to capture how doctorate recipients make their career decisions and develops multilevel models to test the effects of individual and organizational variables.

KEYWORDS: doctorate recipients, academic job, non-academic job, job satisfaction, multilevel modeling

INTRODUCTION

Doctorate recipients are known as the primary knowledge producers in the society, and hold high-ranking positions in many employment sectors, including education, government, and private industry. They possess advanced skills in critical thinking, problem solving, research method, data analysis, communication, and academic writing. Doctorate recipients usually have a great record of teaching and research experience with peer reviewed journal publications and academic presentations, and they promise substantial intellectual contributions to the economy, especially in the area of sciences, engineering, and health. Accordingly, organizations seek them as the most valuable workers to create competitive advantages. Bureau of Labor Statistics (BLS) reports indicate that the demand for workers with a doctoral degree will increase, especially in the area of sciences and engineering. It was projected that between 2010 and 2020, the expected total growth in job openings that require a doctorate or professional degree will be increased by 19.9% (Lockard & Wolf, 2012). This percentage represents an increase of 876,600 jobs that will require an advanced degree. As the demand for human workforce with highest degree increases, it is vital to study how doctorate recipients make their career choice. The realities of the job market have forced some doctorate recipients to make a decision on seeking and accepting academic or non-academic jobs. Doctorate recipients may have different inspiration and intention in their career. Some choose to be a faculty member at a university, while others choose to work for government or private sectors. While academic jobs involve mainly teaching, research, and services, non-academic jobs for doctorate recipients mainly involve research, publications, and development works with no teaching obligations. NSF report indicates that in 2008, 44.72% of employed doctorate recipients in science and engineering areas work for academic institutions as faculty members, 48.79 % of them chose to work for corporations or governments (NSF, 2012).

A split decision of accepting academic or non-academic jobs raises a question about how doctorate recipients make their career choice. Specifically, education policy makers would want to know what contributing factors and effects that they have on doctorate recipients' career

decision. In addition, organization leaders may be concerned with the issue of employment retention and productivity. It is important for an organization to determine whether doctorate recipients are satisfied with their job. Job satisfaction refers "to an overall affective orientation on the part of individuals toward work roles which they are presently occupying" (Kalleberg, 1977). Thus, if the determinants of job satisfaction are understood, organizations can improve the human resource policy, resources, and support to retain its best employees.

Despite the importance of these issues to the economy, they have not been addressed adequately in existing studies. Substantial information is available on the career choice from the baccalaureate degree recipient perspective; however, very limited studies have examined the career decision of doctorate recipients. In addition, while a number of studies have examined factors affecting job satisfaction of doctorate recipients as faculty, far too little is known about factors affecting the job satisfaction of the ones working for non-academic sectors such as government or private organizations.

This study seeks to shed light on these important issues. The purpose of this research is twofold. First, this research examines factors affecting doctorate recipients' decision in accepting an academic job or non-academic job. Second, it examines factors that influence the job satisfaction level of doctorate recipients working for non-academic organizations. This research has some significant contributions from both theoretical as well as practical standpoints. The results of this research will deliver a prediction model that helps predict the supply in the labor market for doctorate recipients in the field of sciences, engineering, and health. It also provides academic institutions, government organizations, and private organizations useful information about what make doctorate recipients choose to accept a job in their domain, which in turn will enable them to form appropriate strategies to attract more high skilled workers with a doctoral degree. Additionally, this research will fill the gap in the literature by determining factors that affect job satisfaction levels of doctorate recipients in non-academic sectors. Due to the differences between academic and non-academic sectors, a separate set of job satisfaction determinants must be developed. Higher job satisfaction will result in higher work productivity and job retention. Doctorate recipients have often been considered as key sources for innovation and technological development (Bender & Hayward, 2006); therefore, the results of this study will help non-academic organizations form appropriate working environment, rewards, and support for their employees.

Research Questions

1. What effects do personal back ground variables, institutional variables, education experience variables, and personal barriers variables have on the doctorate recipients' career decision on academic vs. non-academic jobs?
2. What are differences of job satisfaction levels of doctorate recipients between non-academic and academic sectors?
3. What effects do demographics variables, motivator and hygiene variables, employer variables, and education and job variables have on job satisfaction level of doctorate's recipients in non-academic sectors?

LITERATURE REVIEW

Prior related research

This section reviews related literature in career choice of doctorate recipients and their job satisfaction in non-academic organizations. While a number of studies have been done in the career path for baccalaureate recipients, only a few studies focus on the perspective of doctorate recipients; most of them examined factors that affect doctorate recipients' pathway to academic jobs. Golde & Dore (2001) and Nettles & Millet (2006) pointed out that doctorate recipients in humanities, sciences, and mathematics generated the most interest in faculty careers. In another study, the results show that while 80 % of English doctorate recipients become faculty, recipients in chemistry choose career opportunities outside academia (Golde & Dore, 2004). Figueroa (2004) indicated enjoyment, lack of appeal of other careers, and the ability to raise a family and lead a balanced life, as strong predictors of faculty choice. Focusing on underrepresented students, Moore (2007) addressed three major predictors to career decision: background characteristics, educational prestige and experience, and personal barriers. She found that underrepresented doctorate recipients chose academic careers over non-academic career opportunities. Additionally, Cognard-Black (2004) highlighted that the impact of pre-graduation publications, race, gender, and department prestige varied depending on the field of study. According to Su (2013), postdoctoral training is a predictor of doctorate recipients' career choice and this path is shaped by demographics, especially citizenship. As for the job satisfaction literature, a comprehensive review shows that majority of studies are focused on academic positions and only a handful of research actually mentioned the job satisfaction in non-academic sectors. Specifically, Bender & Hayward (2006) found that female scientists has lower job satisfaction than males in academia but higher satisfaction than males in the non-academic sector. Additionally, academic scientists with tenure have substantially greater job satisfaction than non-academic scientists, but the extent of this influence varies by gender. In another study, Moguerou (2002) addressed that while job security and earning had positive effects on job satisfaction for both academics and non-academics, other factors varied by the gender. Focusing on private chemical organizations, Mirza (2005) indicated job characteristics and leadership practices as strong predictors of scientists' job satisfaction levels. In summary, although existing studies provide useful insights on doctoral recipients' pathway to faculty choice, inadequate attention has been paid to how they decide between academic and non-academic jobs. In addition, it is still unclear what factors that drive the job satisfaction of these advanced scientists in non-academic sectors such as private or government organizations; thus, requiring further study to shed light on these issues.

Theoretical Frameworks

The purpose of this research is to fill the gap in the literature by examining factors that affect doctorate recipients' career choice and their job satisfaction levels in non-academic sectors. A theoretical framework is used as the ground for the selection of independent variables. For the career choice model, the social learning theory of career decision-making is used to guide the development of this study. This theory was developed by Krumboltz (1975) to provide a coherent explanation of a person's career path (Mitchell & Krumboltz, 1996). Krumboltz (1975) explained why people entered particular jobs by four influential factors: genetic endowment and special abilities, environmental conditions, learning experiences, and task approach skills. This theory has been used by several studies (Lindholm, 2004; Moore, 2007) to determine predictors of doctorate recipients' career choice.

Based on that theory, a conceptual framework is developed that consists of four types of independent variables for the career choice model: *personal background variables*, *institutional variables*, *educational experience variables*, and *personal barriers variables*. First, individuals are different based on their demographics such as race, gender, age, citizenship, parent education, and individuals with different background may have different career choices (Krumboltz, 1975; Cognard-Black, 2004; Mirza, 2005; Moore, 2007; Su, 2013). Second, institutional variables (ranking, size, tuition, student composition) do have effects on doctorate recipients in deciding their future job (Cognard-Black, 2004; Moore, 2007; Kim & Otts, 2010; Krumboltz, 2009). Third, educational experience is important since each individual has a unique history of learning experiences that leads to their career choice (Krumboltz, 1975, 2009). Different fields of study generate different interest in faculty careers (Cognard-Black, 2004; Golde & Dore, 2004; Nettles & Millet, 2006; Moore, 2007). Additionally, time to degree completion and postdoc training can impact the career choice and sector of employment (Nerad & Cerny, 1999; Kim & Otts, 2010; Su, 2013). Fourth, personal barriers such as marriage, number of children, and educational debt, are considered social and economic forces that influence individuals in their career decision (Krumboltz, 1975, 2009; Figueroa, 2004; Moore, 2007).

As for the job satisfaction model, over the years several theories have been presented to explain the concept of job satisfaction. The most influential theory is Herzberg et al. (1959)'s study on job attitudes with two categories: motivators and hygienes. Based on Herzberg's theory, Hagedorn (2000) developed a framework to predict job satisfaction with three types of variables (demographics, motivators and hygienes, and environmental conditions). This conceptual framework is adopted in the context of non-academics and developed predictors of job satisfaction levels in non-academic sectors. First, *demographics variables* include gender, race, citizenship, marriage, number of children, minority, and year of degree (Tack & Patitu 1992; Hagedorn 2000; Leung et al., 2000; Seifert & Umbach, 2008; Bender & Heywood 2009; Sabharwal & Corley, 2009; Sabharwal, 2011). Second, motivators increase satisfaction, while hygienes decrease satisfaction (Hagedorn, 2000). *Motivator and hygiene variables* include salary, benefit, supervising responsibility, work training, professional development, federal support, and working hours (Tack & Patitu, 1992; Pfeffer & Langton, 1993; Hagedorn, 1996, 2000; Oshagbemi 1997; Bender & Heywood, 2006; Sabharwal & Corley, 2009; Hesli & Lee, 2013). Third, *employer variables* are associated with characteristics of the employer and include geographic location, size, and type (Liu, 2001; Gupta, 2004; Mirza, 2005; Sabharwal, 2011; Hesli & Lee, 2013). Fourth, *educational and job variables* include field of study, job category, work activities, work relation to degree, and length of employment (Oshagbemi, 2000; Sabharwal & Corley 2009; Sabharwal, 2011; Hesli & Lee, 2013).

RESEARCH METHODOLOGY

In order to find the answers to these research questions, this project will use the National Science Foundation (NSF) Survey of Doctorate Recipients (SDR) dataset in 2010, the most recent data available. The SDR is a longitudinal study that surveys individuals who received a doctoral degree in a science, engineering, or health (SHE) field from U.S. institutions. The primary sponsor of the SDR is NSF through its National Center for Science and Engineering Statistics (NCSES) (<http://www.nsf.gov/statistics/srvydoctoratework/>). The survey is conducted every two years and follows doctorate recipients throughout their career. Some of the data on education and demographic information in the SDR come from the Survey of Earned Doctorates (SED), and these demographic data are added to the SDR restricted data file (Milan, 2014). The 2010 SDR sample frame consists of two cohort frames: the existing cohort frame represents

individuals who had received their SEH doctorate before 1 July 2007 and the new cohort frame represents individuals who had received an SEH doctorate between 1 July 2007 and 30 June 2009. The total number of cases selected for the 2010 SDR sample was 45,697 (Milan, 2014). The data were collected through three main protocols: self-administered paper questionnaire (SAQ), computer-assisted telephone interview (CATI), and self-administered online questionnaire (Web). According to Milan (2014), the overall unweighted response rate is 79.8% (weighted response rate was 79.9%).

The SDR data set includes necessary variables to find the answers to the research questions. First, the dataset will be explored to fully understand variables and scales. Descriptive analysis will be used to evaluate missing values and outliers. Based on these analyses, missing values will be treated appropriately through imputation, listwise deletion, or pairwise deletion. Outliers will also be taken care of. Next, assumptions for proposed statistical tests will be examined to make sure they are met. Data transformation will be done as needed if any assumption is violated.

To answer the research question 2, ANOVA (Analysis of Variance) will be used to test the differences of job satisfaction levels of doctorate recipients between academic and non-academic sectors.

To answer the research question 1, multilevel logistic regression model will be used. First, since the dependent variable is a binary variable (academic or non-academic jobs) logistic regression is needed. Logit transformation will be performed on this dependent variable for the estimation purpose (Hair et al., 2010). Second, because students within institutions (or within the same field of study) are more similar than those who attend different institutions and because students are influenced by characteristics of the institutions they attend, students are not randomly distributed across institutions. Rather, they are grouped within institutions. Recognizing the nested structure of the data, a 2-level multilevel logistic regression model will be used to more accurately assess estimates of the effects of level-2 variables on level-1 outcome measures (Goldstein, 2011). Specifically, the following 2-level multilevel logistic regression model is proposed

Level 1

$$\log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_{0j} + \beta_{1j}X_{1ij} + \beta_{2j}X_{2ij} + \dots + \beta_{nj}X_{nij} + \varepsilon_{ij}$$

where

Y_{ij} is the career choice for individual i in institution j . Y_{ij} is a binary variable (0: academic job; 1: non-academic job)

p_{ij} the probability that $Y_{ij} = 1$

β_{0j} is the intercept of institution j

β_{1j} is the slope of variable X_{1ij} of institution j

...

β_{nj} is the slope of variable X_{nij} of institution j

X_{1ij} to X_{nij} are individual-level predictors of the dependent variable. In this study, these predictors include: personal background variables (race, gender, age, citizenship, parent education, and current employment), educational experience (field of study, time to doctoral

degree, and postdoc training), and personal barriers (marriage status, number of children, and educational debt)

ε_{ij} is the level-1 random effect

Level 2

The level-1 intercept and slopes become dependent variables being predicted from level-2 variables ($p= 1, \dots, n$)

$$\beta_{pj} = \gamma_{p0} + \gamma_{p1}W_{1j} + \gamma_{p2}W_{2j} + \dots + \gamma_{pm}W_{mj} + \mu_{pj}$$

where

γ_{p0} is the intercept term in the institution level model for β_{pj}

γ_{p1} is the slope of institution-level predictor W_{1j}

...

γ_{pm} is the slope of institution-level predictors W_{mj}

W_{1j} to W_{mj} are institution-level predictors of β_{pj} . In this study, these predictors include Carnegie classification, institution size, tuition, and student composition

μ_{pj} is the level-2 random effect

Using similar justification, in order to answer the research question 3 multilevel regression model will be used to estimate the job satisfaction of doctorate recipients in non-academic organizations. The following 2-level multilevel regression model is proposed (note that different notations for the dependent variable and predictors are used to avoid confusion with the previous model)

Level 1

$$O_{ij} = \beta_{0j} + \beta_{1j}P_{1ij} + \beta_{2j}P_{2ij} + \dots + \beta_{nj}P_{nij} + \varepsilon_{ij}$$

where

O_{ij} is the job satisfaction level of individual i in organization j

β_{0j} is the intercept of organization j

β_{1j} is the slope of variable P_{1ij} of organization j

...

β_{nj} is the slope of variable P_{nij} of organization j

P_{1ij} to P_{nij} are individual-level predictors of the dependent variable. In this study, these predictors include: demographic variables (gender, race, citizenship, marriage, number of children, minority, year of degree), motivator and hygiene variables (salary, benefit, supervising responsibility, work training, professional development, federal support, and working hours), and educational and job variables (field of study, job category, work activities, work relation to degree, and length of employment).

ε_{ij} is the level-1 random effect

Level 2

The level-1 intercept and slopes become dependent variables being predicted from level-2 variables ($q= 1, \dots, n$)

$$\beta_{qj} = \gamma_{q0} + \gamma_{q1}Z_{1j} + \gamma_{q2}Z_{2j} + \dots + \gamma_{qm}Z_{mj} + \mu_{qj}$$

where

γ_{q0} is the intercept term in the organization level model for β_{qj}

γ_{q1} is the slope of organization-level predictor W_{1j}

...

γ_{qm} is the slope of organization-level predictor W_{mj}

W_{1j} to W_{mj} are organization-level predictors of β_{qj} . In this study, these predictors include business type, size, and geographic location.

μ_{qj} is the level-2 random effect

CONCLUSIONS

This paper proposes a theoretical framework that captures how doctorate recipients make their choices between academic and non-academic jobs. Due to the nested structure of NSF datasets, multilevel logistic models are proposed to examine the effects of various variables on their career decisions and job satisfaction. The first level includes individual variables such as personal background variables, educational experience, and personal barriers. The second level includes institutional variables such as Carnegie classification, institution size, tuition, and student composition. For job satisfaction model, individual variables include demographic variables, motivator and hygiene variables, and educational and job variables, and organizational variables include business type, size, and geographic location.

Doctorate recipients are considered as key sources for innovation and technological development. Accordingly, this research helps organizations develop necessary strategies to attract more skilled workers with a doctoral degree and form appropriate working environment, rewards, and support to retain these employees. Future research should focus on testing and validating these models with NSF datasets.

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