

CHAPTER 5

**Perceived career prospects and their influence on the sector
of employment of recent PhD graduates**



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Abstract

We studied the perception of career prospects in their own sector and elsewhere of recent PhD graduates in academia, non-academic research and outside research. Data are from a survey of 1,133 respondents who obtained a PhD from one of five Dutch universities between early 2008 and mid-2012. Career prospects in academia are seen as slimmer than outside. This is associated with the current sector of employment: outside academia the negative image of academic careers is still stronger than inside. This association remains when other factors, such as the appeal of certain job attributes and several personal characteristics are controlled for. The chance that PhDs seek employment outside academia because of career prospects depends on how they value positive job aspects, such as intellectual challenge. This leads to selection against certain types of PhD graduates in academia, such as those with a taste for societal impact.

5.1. Introduction

As in many countries, the number of PhD graduates from Dutch universities has been increasing over the past ten years (Auriol, Misu, & Freeman, 2013; Vereniging van Nederlandse Universiteiten, 2014). For many PhD students, academic research is the preferred sector of future employment (Sauermann & Roach, 2012). However, in the U.S. only up to twenty-five per cent of PhD graduates will obtain a (permanent) faculty position (Stephan, 2012, p. 170), and in the Netherlands fewer than thirty per cent of all PhD graduates work in higher education (Auriol et al., 2013, p. 19).

PhD graduates in the United States can spend up to ten years in temporary postdoctoral positions before obtaining a faculty position (Nerad & Cerny, 1999). For PhD graduates in the Netherlands this also holds true (van Balen & van den Besselaar, 2007). Furthermore, a survey of PhD students and postdoctoral researchers in Germany, Austria and Great Britain shows that these early career scientists report high levels of insecurity about their careers (Höge, Brucculeri, & Iwanova, 2012). The lack of permanent positions in academia and the long periods during which scientists are employed on temporary contracts are also regarded as a problem by opinion makers in *Nature* and *Science* editorials, as they make an academic career less attractive to young researchers (Waaijer, 2013). However, no studies have previously been undertaken that relate the perception of career prospects and actual sector of employment of PhD graduates.

In this study we determine how recent PhD graduates rate several dimensions of career prospects in the academic sector, in non-academic R&D and outside R&D, such as the long-term career perspectives in general, availability of permanent positions, and the quality of career policy. Furthermore, we investigate whether this perception of career prospects is related to the sector in which these PhD graduates work. In the final section we discuss the implications of our findings for the effectiveness of the academic career system.

5.2. Literature background

5.2.1. Post-PhD employment internationally

Since 1957, the National Science Foundation (NSF) has conducted an annual survey of new U.S. PhD graduates, the Survey of Earned Doctorates (SED; National Science Foundation/National Center for Science and Engineering Statistics, 2014a). This survey collects several characteristics of PhD graduates and their post-graduation plans. Furthermore, the NSF conducts a biennial survey of all PhD graduates from U.S. research universities, called the

Survey of Doctorate Recipients (SDR; NSF/NCSES, 2014b). The 2013 survey showed that directly after PhD, most PhDs work in academia: seven in ten PhDs work as postdoctoral fellows or in academic employment (NSF/NCSES, 2014b, Table 52, own calculations¹). However, this share declines with the time elapsed since PhD graduation. Of all PhDs, slightly more than four in ten are employed in academia (NSF/NCSES, 2014b, Table 12). Other important sectors of employment include private for-profit organizations (employing one third of PhDs) and government (employing one in ten PhDs).

High quality, internationally comparable data on PhD graduates used to be lacking for other countries, but have become available for more countries with the implementation of the Careers of Doctorate Holders (CDH) survey. It has been carried out in 2006, 2009, and 2014 in the United States, Taiwan and several European countries (OECD, 2013). Although the quality and content of the surveys differed by country, for the Netherlands it provided the first high quality data on post-PhD employment.

5.2.2. Post-PhD employment in the Netherlands

In this paper, we focus on the Netherlands, a country in which the number of PhD graduations has only increased in the past decade (Auriol et al., 2013; VSNU, 2014, cf. for example the U.S., where the number of PhD graduates has fluctuated; NSF/NCSES, 2014a, Table 1). Opportunities for academic employment do not keep pace with this increase of PhD graduates (VSNU, 2015). This raises the question in which sector graduates find employment after their PhD, and what influenced their choice. Are recent PhDs primarily attracted by job attributes, or do the career prospects in a particular sector influence their choice as well?

For the Netherlands, the CDH found that just over twenty per cent of all employed PhD graduates are employed as a researcher in the higher education sector (Maas, Korvorst, van der Mooren, & Meijers, 2014, Table 21). Another six in ten are employed as researchers in another sector, which adds to a total of eighty per cent of all PhDs being employed as researchers. The remaining twenty per cent are employed as non-researchers, of which most are working in the private non-profit sector. Compared to other countries, the Netherlands have a high share of PhDs working outside of higher education; the highest of all countries surveyed in the CDH (Auriol et al., 2013, p. 19). For the Netherlands, the 2008 Netherlands Survey of Doctorate Recipients found that directly after the PhD, sixty-four per cent are employed in academia (Sonneveld, Yerkes, & van de Schoot, 2010). The current study is a follow-up of this survey.

¹ Numbers of PhD graduates who have a definite commitment to postdoctoral study or academic employment in the U.S. divided by the total number of PhDs of whom the sector of definite commitment is known.

5.2.3. Career prospects in academia and other sectors

Here, we define career prospects as the chance of (future) success in a profession. This future success may entail many different aspects, such as employment versus unemployment, level of education required for a job, salary, obtaining a job of the first choice, obtaining a permanent position, etcetera. The percentage of PhD graduates who are economically active is slightly higher than for other university graduates, and among the economically active, unemployment is low (Statistics Netherlands, 2014). As to salary, the advantage of having a PhD on the labor market varies by country. Stephan (2012, pp. 156-157) compared the estimated lifetime earnings of a PhD in the biological sciences to a Master of Business Administration (MBA) degree, and found that the lifetime earnings of PhDs are much lower. On the other hand, estimated lifetime earnings of PhDs in the Netherlands are higher than of master graduates, though it takes twenty years to achieve a positive rate of return on doing a PhD (van der Steeg, van der Wiel, & Wouterse, 2014). In addition, during a PhD several types of knowledge and skills that are useful in future careers may be acquired (Lee, Miozzo, & Laredo, 2010).

Still, many scientists, journalists and policymakers write about bleak career prospects after a PhD, especially within academia (e.g., Cyranoski, Gilbert, Ledford, Nayar, & Yahia, 2011; “The disposable academic”, 2010; Weissmann, 2013; see Waaijer, 2013 for a detailed discussion). However, few systematic examinations of the perception of career prospects of PhDs have been conducted. One exception is a study by Fox and Stephan (2001) that examined how PhD students in science and engineering perceive their career prospects. They found that PhD students judge career prospects in academia as poorer than in industry and government. The availability of jobs after a PhD in science and engineering is more positively perceived for industry employment than for faculty positions (Roach & Sauermann, 2010). Finally, a survey of PhD students at Leiden University found that a majority think finding employment in academia or research will be (very) difficult, more so than finding employment outside of academia and research (Heyer, Kuli, Vis, & Waaijer, 2013, p. 40).

In Australia, long-term career prospects in academia are perceived more positively by postdoctoral fellows (Åkerlind, 2005). In Germany, a detailed study of career prospects showed that postdoctoral fellows perceive the competition for a successful academic career in their field as (very) strong, but do assess their own prospects to pursue such a career as rather good (Fitzenberger & Schulze, 2014). Furthermore, the study showed that postdoctoral fellows judge their employment prospects in jobs outside academia rather positively, but also assume these prospects will worsen if they continue to work in academia.

5.2.4. Factors influencing job choice of PhD graduates

Several factors may influence the job choice of PhD graduates. First of all, PhDs may have personal preferences for certain job attributes. For many PhD students, academia is the preferred sector of employment. This sentiment is arguably even stronger for postdoctoral fellows, who have already made an initial decision to work in academic research (Fitzenberger & Schulze, 2014; Puljak & Sharif, 2009). Features of academia and research in industry differ due to divergent purposes and reward systems (Dasgupta & David, 1994). Having a “taste for science” (i.e., valuing intellectual challenge, work circumstances, independence, and contribution to society) and having a preference for academia have been found to be correlated in several studies (Bloch, Krogh Graversen, & Skovgaard Pedersen, 2015; Roach & Sauermann 2010). The non-pecuniary rewards such as, for example, higher levels of freedom and intellectual challenge, thus offset the lost pecuniary rewards related to a job in industry (Agarwal & Ohyama, 2013; Janger & Nowotny, 2013; Stern, 2004). On the other hand, PhD graduates who value access to resources have a greater preference for employment in industry (Roach & Sauermann, 2010) and those who have a “taste for business” (i.e., valuing salary, benefits, career progression, and job security) have a higher probability of actually working in industry (Balsmeier & Pellens, 2014).

In addition, the (perceived) availability of jobs in a given sector may play a role. We incorporate this factor in our analysis, although it must be noted that in previous studies on the job preferences and job choices of PhDs, its effect has been found to be limited: Roach and Sauermann (2010) found no effect of the perceived availability of academic positions on the preferred employment sector, and Bloch et al. (2015) found little effect of actual industry labor demand on sector of employment. Other factors that may play a role are field of PhD (field of PhD may determine the number of available jobs in different sectors, and PhDs from one field may value different job characteristics than PhDs from another field), years since PhD (as this may affect the number of available jobs) and personal characteristics.

5.3. Material and methods

5.3.1. Sample and survey methodology

Two sources of PhD graduates were used as a sample for our survey. The first was the survey sample of the 2008 Netherlands Survey of Doctorate Recipients (Sonneveld et al., 2010). This survey was sent to close to 1,100 individuals obtaining a PhD between April 2008 and March 2009 at Utrecht University (a large, broad research university), Delft University of Technology (a university of technology), Wageningen University (a university focused on agricultural, environmental and life sciences), and Erasmus University Rotterdam (focused

on medicine and social sciences, especially economics and management). The second source of PhD graduates in the present study were all individuals who obtained their PhD at Leiden University (a large, broad research university) between January 2008 and May 2012: a total of 1,319 PhD graduates. This amounted to a total of 2,410 PhDs, of which 2,193 could be contacted (see Waaijer, Belder, van Bochove, Sonneveld, & van der Weijden, 2015 for a complete description of the survey distribution). PhDs were contacted regardless of whether they were working inside the Netherlands or outside of it. The five universities and its PhD graduates cover all major research fields: medical and health sciences, natural sciences, social sciences, humanities and engineering. The survey was open from 23 October 2013 until 21 January 2014. During this period a total of three reminders was sent to potential respondents who had not visited the survey or not completed it.

Of the 2,193 sample, 1,133 PhDs started our survey, a response rate of 51.7%. A total of 960 progressed to the final question (43.8%). A comparison of the characteristics of the respondents and the 2,410 PhDs in the complete set shows that the respondents are a good representation with regards to year of PhD, city of PhD, gender, and age (Waaijer et al., 2015). However, there is an overrepresentation of Dutch nationals compared to other nationalities among the respondents.

5.3.2. Variables

Our questionnaire contains mainly multiple-choice questions but also a small number of open questions. Questions cover employment status, job choice, perception of career prospects, job satisfaction, use of skills developed during the PhD, and mentoring during the career. In this paper, we will focus on the first three aspects. The complete questionnaire can be consulted in Waaijer et al. (2015).

5.3.2.1. Sector of current employment

The main dependent variable is the sector of current employment. We distinguish three sectors: academic R&D (further dubbed “academia” for brevity), non-academic R&D (“non-academic research”), and non-R&D (“outside research”). This distinction requires some elaboration. It is modeled after a further partition of categories that has been used in most studies on factors influencing post-PhD employment (academia vs. industry employment; e.g., Balsmeier & Pellens, 2014; Roach & Sauermann, 2010) and is more similar to the five categories distinguished by Bloch et al. (2015). Arguably, PhDs who perform research (or experimental development) in non-university settings still use skills they were mainly trained in during their PhD. On the other hand, some PhDs are no longer involved in R&D. In the Netherlands, two in ten of all PhD graduates do not work as researchers (Maas et al., 2014).

Table 1. Variable definition and descriptive statistics

Variable	Type	N	Mean	SD	Min	Max
Sector of employment	Dummy	1024	0.60	0.49	0	1
Academia	Dummy		0.28	0.45	0	1
Non-academic research	Dummy		0.12	0.32	0	1
Outside research	Dummy		2.90	1.17	1	5
Perception of career prospects	5-point	859	3.39	0.92	1	5
Long-term career perspectives	5-point	733	3.48	0.91	1	5
Academia	5-point	697	2.19	1.12	1	5
Non-ac. research	5-point	864	3.05	1.01	1	5
Outside research	5-point	712	3.31	0.98	1	5
Availability of permanent positions	5-point	680	2.61	1.04	1	5
Academia	5-point	748	3.13	0.84	1	5
Non-ac. research	5-point	528	3.26	0.81	1	5
Outside research	5-point	503	2.71	1.01	1	5
Length of period holding temporary positions	5-point	717	3.26	0.87	1	5
Academia	5-point	491	3.32	0.81	1	5
Non-ac. research	5-point	457	3.37	1.25	1	5
Outside research	5-point	457	2.97	1.35	1	5
Academia	5-point	947	2.63	1.30	1	5
(Self-reported) influence of career prospects	5-point	929	2.31	1.21	1	5
Long-term career perspectives	5-point	940	2.63	1.30	1	5
Academia	5-point	926	2.31	1.21	1	5
Non-ac. research	5-point	929	0.62	0.49	0	1
Outside research	5-point	1016	0.83	0.38	0	1
Availability of permanent positions	Dummy	1017	0.59	0.49	0	1
Length of period holding temporary positions	Dummy	1017	0.70	0.46	0	1
Quality of HRM/career policy	Dummy	1017	0.70	0.46	0	1
Academia	Dummy	1017	0.52	0.50	0	1
Non-ac. research	Dummy	1017	0.21	0.40	0	1
Outside research	Dummy	1014	0.21	0.40	0	1
Factors playing a role in job choice	Dummy	1016	0.62	0.49	0	1
<i>Job content and intellectual development</i>	Dummy	1017	0.83	0.38	0	1
Creativeness	Dummy	1017	0.59	0.49	0	1
Intellectual challenge	Dummy	1017	0.70	0.46	0	1
Level of responsibility	Dummy	1017	0.70	0.46	0	1
Degree of independence	Dummy	1017	0.70	0.46	0	1
Possibility to develop new skills	Dummy	1017	0.70	0.46	0	1
Contribution to society	Dummy	1017	0.52	0.50	0	1
Social status	Dummy	1014	0.21	0.40	0	1

Workload	Dummy	1016	0.18	0.38	0	1
Infringement on personal life	Dummy	1015	0.19	0.39	0	1
<i>Terms of employment</i>						
Salary	Dummy	1014	0.31	0.46	0	1
Benefits	Dummy	1014	0.22	0.42	0	1
Job security	Dummy	1014	0.33	0.47	0	1
Availability of permanent jobs within organization	Dummy	1014	0.22	0.41	0	1
Job opportunities within organization	Dummy	1014	0.23	0.42	0	1
Organization's career policy and HRM	Dummy	1014	0.11	0.32	0	1
Degree to which job provided opportunities for career advancement (also outside of organization)	Dummy	1014	0.48	0.50	0	1
Travelling distance from home to job	Dummy	1015	0.28	0.45	0	1
Personal and family-related circumstances	Dummy	1014	0.22	0.41	0	1
Sufficient positions available in preferred sector of employment	5-point	1025	3.03	1.17	1	5
Years since PhD	Count	1133	3.97	1.24	1	5
Field of PhD	Dummy	1065	0.34	0.47	0	1
Medical and health sciences	Dummy		0.26	0.44	0	1
Natural sciences	Dummy		0.17	0.37	0	1
Social sciences	Dummy		0.13	0.33	0	1
Humanities	Dummy		0.11	0.31	0	1
Engineering and technology	Dummy		0.45	0.50	0	1
Female	Dummy	1096	0.45	0.50	0	1
Nationality of high income OECD country	Dummy	875	0.90	0.29	0	1
Age at PhD	Count	1101	34.10	7.50	11*	69
Married or living together?	Dummy	938	0.79	0.40	0	1
Children below the age of 6	Dummy	935	0.40	0.49	0	1

Dummy variables: 1 if yes, 0 if no. Perception of career prospects on a five-point scale from 1=very bad to 5=very good; "don't know" values were removed. Influence of career prospects on a five-point scale from 1=not at all to 5=very much or very strongly. Sufficient positions available in preferred sector of employment on five-point scale from 1=strongly disagree to 5=strongly agree with statement. Age at PhD calculated by subtracting year of birth from year at PhD. Years since PhD calculated by subtracting year of PhD from year at filling in survey. Two resultant values were very low ("11" and "21") and are assumed to be outliers and excluded from further analyses with age at PhD as a variable.

This is the reason we classified the PhDs according to the two criteria “involvement in R&D” and “type of employer”, leading to the three sectors introduced above.² To obtain the needed information, PhDs were asked whether they were involved in basic research, applied research and/or experimental development in their main job (following OECD definitions [OECD, 2002, pp. 77-82]). If they were not, they were classified as working outside research. If they were, a further distinction according to type of employer was made; if the employer was a university, university of applied sciences or college, academic hospital, or research institute, we classified PhDs as working in academia. Researchers and engineers working elsewhere (e.g., at a private business, government institution, or non-academic hospital) were classified as working in non-academic research.

5.3.2.2. Perception of career prospects and their reported influence

PhDs were asked to rate the career prospects in all three sectors on a five-point Likert scale (1=very bad, 2=bad, 3=neutral, 4=good, 5=very good, 99=don't know). These were separated into: long-term career perspectives, the availability of permanent jobs, the usual length of the period holding temporary positions, and the quality of HRM and career policy. We asked the PhDs to what extent these factors had influenced their job choice. The influence was measured on a five-point scale (1=not at all, 5=very much).

5.3.2.3. Job attributes that have played a role in job choice

To determine which job attributes attracted the PhDs to their current job, we asked them to tick which attributes played a role in choosing their current job. These were roughly divided into job content and intellectual development (creativity, intellectual challenge, level of responsibility, degree of independence, possibility to develop new skills, contribution to society, social status, workload, infringement on personal life), and terms of employment (salary, benefits, job security, job opportunities within the organization, availability of permanent jobs within organization, organization's career policy and HRM, degree to which job provided opportunities for career advancement (also outside the organization), travelling distance from home to job, and personal and family-related circumstances).

5.3.2.4. Other variables

We also asked the respondents about other factors that might mediate job choice. These included the availability of jobs, years since PhD, field of PhD, gender, nationality, and age at PhD. Nationality is measured as a dummy with value one for high income OECD countries and zero for elsewhere (see appendix 4 for more details and a list of countries). This was done because exploratory analysis showed that PhDs with a nationality from high income OECD

² Bloch et al. (2015) also distinguished PhDs working in non-academic research and outside research by whether they were working in the public sector or in the private sector. Due to our smaller number of respondents we chose to distinguish three sectors instead of five.

countries were (much) more negative about career prospects in academia. The descriptive statistics of all variables from closed questions are shown in Table 1. Correlations are shown in Figure S1 (appendix 4).

Furthermore, we used the answers to the open question “Which long-term career prospects have been the most important in choosing your career, and why?”. Answers were coded according to the variables from closed questions when possible, but also other codes were added when needed. The main classes we delineated for our analysis are career prospects, short-term job availability, career goals, personal circumstances, and job attributes. A second individual coded a random 10% sample of filled-in answers to assess inter-observer reliability. A description of our classification and coding rules is given in Table S1 (appendix 4).

5.4. Results and discussion

5.4.1. Perception of career prospects

In this section of the paper, we first look at how PhD graduates perceived career prospects in different sectors: academia, non-academic research, and outside research. The investigated dimensions are the long-term career perspectives PhD graduates envision for themselves, the availability of permanent positions, the usual length of the period holding a temporary position, and the quality of HRM and career policy. Respondents were asked to rate these dimensions on a five-point Likert scale, from very bad to very good. All dimensions were rated more negatively for academia than for non-academic research and outside research (Fig. 1; $p < 0.001$ for all items in Pearson’s chi-squared test of independence). Long-term career perspectives were rated as “bad” or “very bad” for academia by more than forty per cent of respondents, whereas this figure was only fifteen for non-academic research and just over ten outside research. Academia was rated especially low regarding the availability of permanent positions: seven in ten respondents rated this dimension as “bad” or “very bad”, whereas they were more positive about non-academic research and outside research. The same rating difference existed for the usual length of the period holding a temporary position, but more respondents were neutral about this dimension. Finally, the quality of HRM and career policy was again rated lower on average for academia, but many respondents held a neutral position. Our findings are similar to Fox and Stephan’s (2001), who found that PhD students judge their career prospects in academia more negatively than prospects in industry and government. In relation to data on the employment of PhDs in the long run, which shows non-academic employment to be more common than academic employment (e.g., Lee et al., 2010; Maas et al., 2014), such judgments may not be unfounded.

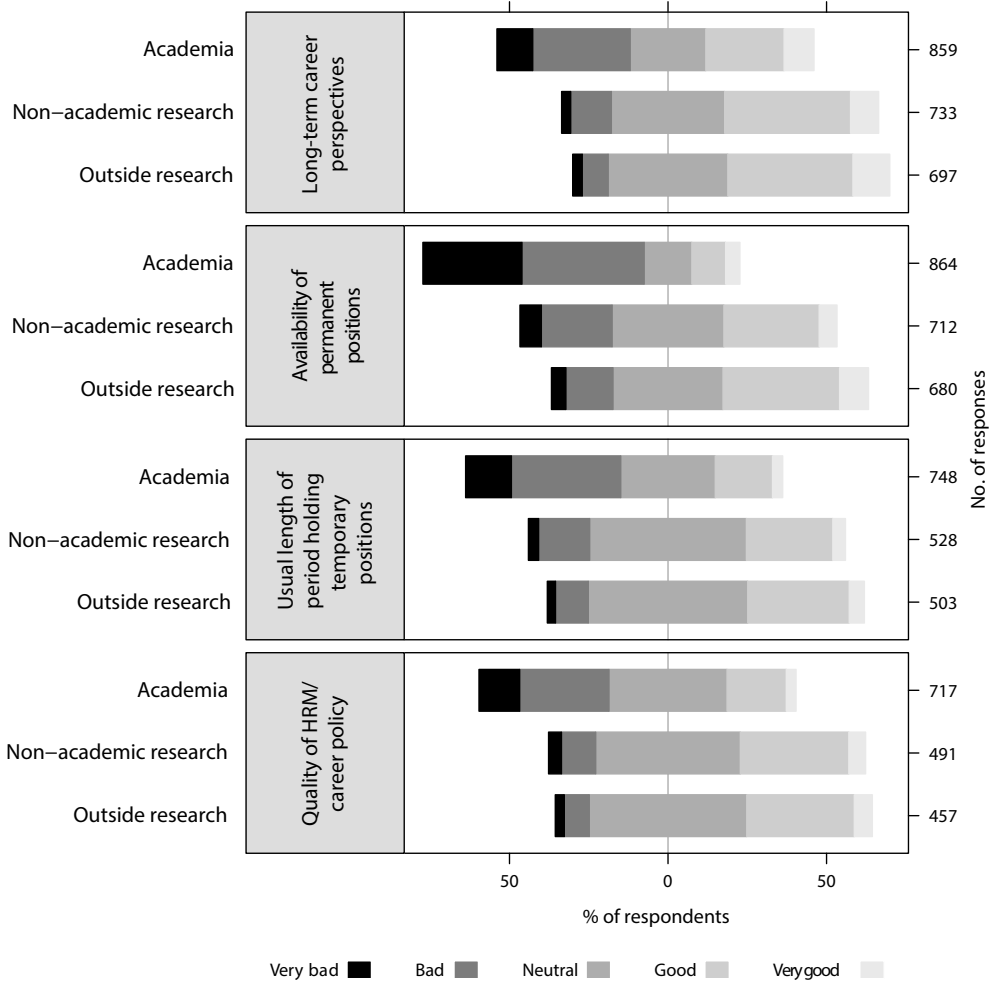


Figure 1. Perception of four aspects of career prospects in academia, non-academic research and outside research.

5.4.2. Self-reported influence of career prospects on job choice

These results raise the question whether a negative perception of career prospects in academia influences the job choice of PhD graduates: does it discourage them to aspire to a career in academia? To investigate, we put the question to our respondents to what extent the four different dimensions of career prospects in academia have influenced the choice for their current job. Furthermore, we assessed whether the strength of any such influence depended on the perception of career prospects.

The dimensions of career prospects that have influenced the PhDs' job choice predominantly are long-term career perspectives and the availability of permanent positions (Table 2). More than half of the respondents said they had been influenced "very strongly" or "strongly" by long-term career perspectives, and four in ten by the availability of permanent positions. In comparison, the usual length of the period of holding temporary positions and career policy played a lesser role, according to the respondents.

Table 2. Self-reported influence of career prospects in academia on job choice

Aspect of career prospects	Influence				
	<i>Very strong</i>	<i>Strong</i>	<i>Moderate</i>	<i>A little</i>	<i>Not at all</i>
			%		
Long-term career perspectives	19	34	25	10	13
Availability of permanent positions	15	24	26	13	22
Usual length of period holding temporary positions	8	19	32	11	30
Quality of HRM/career policy	4	12	30	16	37

N.B. Percentages may not add up to 100 due to rounding.

The extent to which career prospects in academia have influenced job choice differs by how positive respondents were about them. PhDs who were positive about the different dimensions of career prospects in academia reported a greater influence than those who are neutral or negative. Thus, there appear to be two situations. On the one hand, PhDs who were optimistic about career prospects in academia indicated they based their job choice on these prospects. On the other hand, PhDs who were pessimistic (the majority) tended to be less influenced by career prospects and appear to have based their job choice on other factors. If these pessimistic PhDs stayed in academia, there should be an "attractive force" of academia that makes its bleak career prospects relatively unimportant.

In the section after the next we will go into this attractive force in more detail. First, however, we will analyze whether the results presented in the current section on the influence of career prospects reported by the respondents themselves are confirmed by the PhDs' *actual* job choice. In other words, do PhDs who think negatively about career prospects in academia actually leave this sector to work elsewhere?

5.4.3. Influence of perception of career prospects on actual job choice

At the time of the survey, almost all respondents were had a job (Table S2 in appendix 4). Their main job was in academia for sixty per cent, in non-academic research for 28 per cent and outside research for 12 per cent (Table 1).

To determine whether the perception of career prospects influences job choice, one would ideally like to know what the PhDs' perception was at the precise moment that they decided on a new job. However, it is not feasible to ask for this information retrospectively, because memory effects would be likely to bias the reports to an unknown extent. Recalling attitudes is notoriously unreliable, especially if such an attitude was not remembered consciously (Smith, 1982), and the fact itself that a choice for a new job was actually made may easily influence the memory of the attitude at the moment of choice. Thus we have to confine ourselves to a simple question: do PhDs who work outside academia think more negatively about career prospects in academia than those who do work in academia? And is there a correlation between the perception of career prospects outside academia and the current sector of employment?

We do indeed observe that respondents outside academia were even more negative about the long-term career perspectives in academia than those who worked there. PhDs working in non-academic research were more positive about all four measured career prospects in their own sector than those in academia or outside research. PhDs working in academia were the least positive about the long-term career perspectives and the availability of permanent positions outside research. This shows that the influence of career prospects reported by the respondents themselves is not refuted by our measurement of their actual behavior, but is, in fact, confirmed.

5.4.4. Influence of other factors on actual job choice

Previously, we inferred that academia must have an autonomous force of attraction that compensates its relatively slim career prospects. This can be verified by means of the answers to questions about other factors that might have played a role in job choice. In the current section, we describe one that warrants special attention: job attributes that could have attracted PhDs towards their current job.

Naturally, there are variations in individuals' preferences for certain job attributes. Some individuals are more sensitive to factors relating to job content and intellectual development, whereas others are more sensitive to terms of employment. In the questionnaire we included nine items relating to job content and intellectual development, and nine relating to terms of employment. The respondents were asked to indicate which items played a role in the choice of their current job.

On the whole, factors relating to job content and intellectual development were more frequently ticked than factors relating to terms of employment (Table 3). Of the job content aspects, especially intellectual challenge (83%), degree of independence (70%), possibility to develop new skills (70%), creativeness (62%), level of responsibility (59%) and contribution

to society (52%) played a role in job choice. Of the terms of employment, the opportunities for career advancement the job provides (47%), job security (33%) and salary (31%) were the most important factors.

The factors playing a role in job choice differed by sector of employment. Intellectual challenge, degree of independence and creativeness in a job, and personal and family-related circumstances were mentioned most often by PhDs working in academia (Table 3). Terms of employment such as salary, benefits, job security, job opportunities within the organization, permanent jobs within the organization, and the organization's HRM and career policy played a role more often for PhDs working in non-academic research. Contribution to society was also more often mentioned by non-academic researchers than others. Influence of career prospects on actual job choice: controlling for other factors.

Table 3. Job attributes that played a role in job choice by sector of employment

Job attributes	Sector of employment			Total	p-value
	Academia	Non-ac. res.	Outside res.		
<i>Relating to intellectual development and job content</i>					
Intellectual challenge	87	80	68	83	< 0.001
Degree of independence	76	65	57	70	< 0.001
Possibility to develop new skills	69	75	62	70	0.038
Creativeness	66	61	39	62	< 0.001
Level of responsibility	57	64	57	59	0.087
Contribution to society	49	58	55	52	0.022
Social status	20	21	23	21	0.605
Infringement on personal life	20	17	18	19	0.435
Workload	17	17	21	17	0.596
<i>Relating to terms of employment</i>					
Opportunities for career advancement	50	45	43	47	0.218
Job security	28	37	43	33	0.002
Salary	24	43	38	31	< 0.001
Travelling distance	26	29	37	28	0.084
Job opportunities within organization	19	32	24	23	< 0.001
Benefits	21	28	17	22	0.024
Availability of permanent jobs within the organization	21	25	21	22	0.301
Personal and family-related circumstances	25	17	17	22	0.010
Organization's HRM and career policy	8	18	11	11	< 0.001

N.B. Percentages may not add up to 100 due to rounding. P-values from Pearson's chi-squared test of independence between sector of employment and job attribute playing a role in job choice.

The findings presented above suggest that perceived career prospects in academia influence the choice of sector of employment, an effect that may be offset or rather amplified by other factors, such as desirable job attributes.

In every survey study there is a hazard that any association found between one factor and a certain observed outcome disappears when other independent variables are also taken into account. To assess whether this is the case for the relation between perception of career prospects and sector of employment, we used multinomial logit regression on sector of employment with the factors mentioned above, *and* other factors such as gender, nationality, etcetera, as independent variables. Thus we could determine whether perception of career prospects is associated with actual sector of employment independently from these other factors. The multinomial logit regression model reflects that a PhD can be employed in one of three sectors: academia, non-academic research, and outside research. We modeled the odds of being employed in non-academic research and of being employed outside research, both relative to being employed in academia.

The regression was performed first with only the perception of four dimensions of career prospects in academia as independent variables, next with only the control variables (so excluding the perception of career prospects), and finally with both perception of career prospects and control variables. All models were estimated using only respondents for whom no data are missing in the final model. It is worth noting that the “missingness” of data is not related to the outcome variable; the shares of PhDs in academia, non-academic research and outside research are comparable for all respondents for whom the sector of work is known (Table 1) and for those for whom no data are missing in the final model. We employed a stepwise backward elimination to include only those variables that explain a significant share of variance. Only including the perception of career prospects results in a pseudo- R^2 of 0.076; a model with only control variables in a pseudo- R^2 of 0.308 (Table 4). Including all variables gives a pseudo- R^2 of 0.351. These results indicate that perception of career prospects in academia is indeed an explanatory factor of sector of employment, though its explanatory power is not very strong.

The perception of career prospects in academia is independently associated with sector of employment: the more positive PhDs were about the long-term career perspectives in academia, the less likely they were to work in non-academic research (model 3; Table 4). This variable is not independently associated with working completely outside research, but the related variable of the availability of permanent positions is quite important here: the more positive PhDs were about the latter, the less likely they were to work outside research. Phrased differently: a lack of permanent positions drives people out of research, whereas those who are

not deterred by this may move from academia to non-academic research if they think their perspectives of academic advancement are meager. Intriguingly, the more positive PhDs were about the quality of HRM and career policy in academia, the more likely they were to work outside research.

Job attributes also explain sector of employment. PhDs for whom intellectual challenge, degree of independence and creativeness played a role in job choice were less likely to work in non-academic research. Intellectual challenge and creativeness are also determinants of the odds to work outside research. Valuing the level of responsibility, contribution to society, salary and job opportunities within the organization are associated with working in non-academic research. PhDs who valued job security were more likely to work outside research than in academia. Finally, if personal and family-related circumstances played a role in job choice, the odds to be employed in academia increase. These findings are by and large in agreement with previous studies that found that PhDs working in academia have a greater “taste for science” than those not working in it (cf. Balsmeier & Pellens, 2014; Bloch et al., 2015; Roach & Sauer mann, 2010). Also in agreement with the aforementioned studies we found that on the whole PhDs working outside academia found terms of employment more important than PhDs in academia. A slight difference to Roach and Sauer mann’s study (2010), however, is that we found that for PhDs working outside academia their contribution to society influenced their job choice more often than for PhDs in academia, whereas Roach and Sauer mann found this item to more valued by PhD students who wished to work in academia than by those who wished to work in industry.

Job availability is another explanatory factor. The more positive about the number of jobs available in their preferred sector of work, the more likely PhDs were to work in non-academic research. Field of PhD also plays a role: engineering and technology PhDs were significantly more likely to be working in non-academic research than medical and health sciences, social sciences, and humanities PhDs. Interestingly, gender had no independent effect on sector of employment and was thus not included in the regression model. The same is true for years since PhD: the length of the period since the PhD was obtained does not explain the sector of employment for the respondents in our survey.

Table 4. Multinomial logistic regression on sector of employment

	Model 1		Model 2		Model 3	
	Non-ac. research B (S. E.)	Outside research B (S. E.)	Non-ac. research B (S. E.)	Outside research B (S. E.)	Non-ac. research B (S. E.)	Outside research B (S. E.)
Intercept	-0.65 (0.36)	-0.93 (0.57)	-4.00 (1.33)**	-4.10 (2.13)	-3.50 (1.38)	-3.95 (2.33)
<i>Perception career prospects academia</i>						
Long-term career perspectives	-0.43 (0.13)**	-0.50 (0.20)*	-	-	-0.38 (0.16)*	-0.43 (0.23)
Availability of permanent positions	0.13 (0.15)	-0.60 (0.27)*	-	-	-0.01 (0.18)	-0.90 (0.32)**
Period holding temporary positions	-0.07 (0.12)	0.14 (0.18)	-	-	-0.08 (0.14)	0.20 (0.21)
Quality of HRM/career policy	0.34 (0.13)*	0.42 (0.19)*	-	-	0.27 (0.16)	0.51 (0.21)*
<i>Job attributes</i>						
Intellectual challenge	-	-	-1.21 (0.37)**	-1.26 (0.46)**	-1.17 (0.38)**	-1.25 (0.50)*
Degree of independence	-	-	-0.92 (0.29)**	-0.24 (0.42)	-0.91 (0.30)**	-0.13 (0.45)
Creativeness	-	-	-0.48 (0.27)	-0.97 (0.38)*	-0.58 (0.28)*	-1.15 (0.41)**
Level of responsibility	-	-	0.64 (0.27)*	0.67 (0.41)	0.73 (0.28)**	0.90 (0.44)*
Contribution to society	-	-	0.60 (0.26)*	0.10 (0.35)	0.66 (0.26)*	0.03 (0.37)
Opportunities for career advancement	-	-	0.39 (0.25)	-0.61 (0.37)	0.39 (0.26)	-0.77 (0.40)
Job security	-	-	0.43 (0.27)	0.98 (0.38)**	0.40 (0.28)	1.02 (0.40)*
Salary	-	-	1.06 (0.27)**	0.63 (0.39)	0.97 (0.28)**	0.52 (0.41)
Job opportunities within organization	-	-	0.85 (0.28)**	0.97 (0.39)*	0.84 (0.28)**	1.12 (0.42)**
Personal and family-related circumstances	-	-	-0.89 (0.31)**	-1.74 (0.59)**	-0.86 (0.31)	-1.91 (0.62)**
<i>Other factors</i>						
Job opportunities available	-	-	0.30 (0.11)**	-0.04 (0.16)	0.36 (0.12)**	0.15 (0.17)
Field of PhD (ref. engineering)	-	-	-0.88 (0.42)*	-0.31 (0.67)	-0.88 (0.42)*	-0.33 (0.71)
Medical and health sciences	-	-	-0.59 (0.42)	-0.11 (0.69)	-0.57 (0.43)	-0.29 (0.73)
Natural sciences	-	-	-1.11 (0.48)*	-1.33 (0.80)	-1.01 (0.49)*	-1.23 (0.84)
Social sciences	-	-	-1.68 (0.60)**	-0.71 (0.80)	-1.54 (0.62)*	-0.47 (0.84)
Humanities	-	-	-	-	-	-
<i>Personal characteristics</i>						
Nationality high income OECD	-	-	0.73 (0.38)	2.48 (1.08)*	0.51 (0.41)	2.34 (1.17)*
Living with partner	-	-	0.65 (0.35)	-0.60 (0.42)	0.64 (0.36)	-0.85 (0.44)
Cox & Snell pseudo R ²		0.076		0.308		0.351

Model 1: only incl. perception of career prospects, model 2: excl. perception of career prospects, model 3: all variables incl. perception of career prospects. *, **, and *** denote statistically significant difference of the independent variable at the 5, 1, and 0.1% levels, respectively. The variables of perception of career prospects in academia and of field of PhD were always included in the regression; the other variables were included following stepwise backward elimination (using p-value 0.10 of the F-test as threshold).

5.4.5. Main influencers of job choice: answers to open question

Phrasing of questions in a survey can easily influence the statistical results in unforeseen ways, especially in case of subjective phenomena, such as feelings and opinions. One way to prevent this is to ask open questions that give respondents the opportunity to provide background and to qualify their answers. We therefore included an open question in which respondents were asked what the main long-term career aspects were that had played a role in their career choices. Out of the 1,133 respondents, 754 (67%) answered the question. This unexpected bonus made it necessary to code the answers into a classification. Wherever possible, we coded them according to the variables delineated in our questionnaire. Still, a considerable number of other codes were needed and added iteratively. The main classes we delineated for our analysis are career prospects, short-term job availability, career goals, personal circumstances, and job attributes. We counted how often factors were mentioned by the respondents, and if they played a decisive factor in career choice. For example, quite a few people did mention slim long-term career perspectives in academia, but said other factors made them choose a job in academia anyway:

“Prospects for an academic career anywhere are not very high, let alone one in the Netherlands. My main motivations for pursuing this career path are the intellectual challenge and the freedom of picking research topics.”

In line with this, we made a distinction between factors playing a (decisive) role and those that did not.

The answers to the open question show that job attributes are the main factors that influenced the career choice of PhD graduates (Table 5). The most important job attribute is a fit with interest, previous experience or skills (e.g., *“I like research!”*, *“I want to be able to do research and teach in my field of expertise”*, *“I am a better doctor than an [sic] scientist”*). Following closely is the practical application of knowledge and contribution to society. Other major factors are the possibility to develop new skills and personal development in general, the degree of independence, job satisfaction in general (e.g., *“I like my job very much”*, *“For me, the most important are job satisfaction and the prospect of being able to continue doing this type of work for at least the near future (a few years)”*), and colleagues, teamwork, or work environment.

Table 5. Main influencers of career choices (%): answers to open-ended question*

	Played a role?				
	Yes	No		Yes	No
<i>Career prospects</i>			<i>Job attributes</i>		
Job security	19	1	Fit with interest, previous experience and/or skills	18	1
Degree to which job provided opportunities for career advancement	13	< 1	Practical application and contribution to society	18	-
Long-term career perspectives	7	5	Personal development	14	< 1
Job availability	2	< 1	Degree of independence	11	< 1
Required mobility	2	< 1	Job satisfaction in general	9	< 1
Quality of HRM/career policy	< 1	-	Colleagues/teamwork/work environment	8	< 1
<i>Short-term job availability</i>			Intellectual challenge	7	< 1
No alternative job available	2	-	Management position	5	< 1
<i>Career goals</i>			Pecuniary rewards	5	-
Career in academia	10	< 1	Variety in work	4	-
Career development	4	< 1	Pressure due to competition, obtaining grants and publishing	4	< 1
Career in non-academic research or outside research	3	< 1	Creativeness	3	-
Career in general	1	< 1	Infringement on personal life	3	-
<i>Personal circumstances</i>			Level of responsibility	3	-
Partner or family	4	-	International character	2	-
Location and travelling distance	1	-	Support by organization	1	< 1
Other personal circumstances	< 1	-	Social status	1	-
<i>None</i>			Workload	1	< 1
None	2	-	<i>Other</i>		
No answer	2	-	Other	3	-

* Based on 754 answers. Variables in bold were also measured through close-ended questions in the survey and presented in earlier paragraphs of this paper.

Although mentioned less often than job attributes, career prospects do play an important role in the career choices of many PhDs. Of the several aspects of career prospects, job security is the main one. For one in five PhDs it had played a decisive role in their career choice. Furthermore, for thirteen per cent of PhDs the degree to which the current job would provide opportunities for career advancement was decisive. Long-term career perspectives in general had played a decisive role for seven per cent of PhDs. Another five per cent acknowledged they played a role, though non-decisively (as in the answer mentioned above). Finally, a fit with career goals is a factor that plays a role in career choices. One in ten PhDs indicated their career choices had been guided by a wish to have a career in academia.

We also observed differences between sectors of employment. Job security played a key role in career choice more often for those outside academia than for those working in it. The same is true for pecuniary rewards, work environment (including colleagues and teamwork), and pressure due to competition, obtaining grants and publishing. Conversely, the degree of independence played a bigger role for PhDs in academia. An example of a respondent working in academia for whom independence was important:

“The possibility of gaining independence so that you can follow your own interests.”

Those working in non-academic research found the practical application of knowledge and contribution to society more important than PhDs working in other sectors. For example, one respondent working in non-academic research said:

“Moreover the importance of first and last authorships does not promote collaboration. I discovered that teamwork and data quality are valued much more in the industry than academia which made me decide to leave academia.”

PhD graduates working outside research indicate that their family had played a role in their job choice more often than PhDs in other sectors. Almost half of those also mention job security, e.g.,:

“For me the most important thing has always been to have a job that interests me and in which I feel I am contributing to society. Since I have a family income stability is getting more and more important.”

Finally, and unsurprisingly, career goals are in agreement with the current sector of employment. PhDs in academia much more often said that their career choices had been guided by a wish to work in academia. Likewise, PhDs outside academia more often had the goal of a career outside academia, in non-academic research or outside research.

5.5. Conclusions and policy implications

Career prospects of recent PhDs is a much debated topic, but few studies have systematically addressed how PhD graduates view these prospects. Our present study addresses this question, through a survey of recent PhD graduates from five Dutch universities. The central conclusion emerging from the survey results reported in preceding sections is that PhD graduates have a negative view of career prospects in academia and that this negative view influences their job choice. What does this mean for the adequacy of the career system at universities and other academic institutions?

Clearly, the negative view of career prospects in academia puts this sector at a comparative *disadvantage* with competing sectors of employment. All other things being equal, the PhDs' preference would be to leave academic research for other sectors. However, all other things are not equal. Our results also show that, first and foremost, a job must be interesting to PhDs. When choosing a job, what guides them most is how fulfilling the job is: how intellectually challenging, what is the degree of independence, what are the possibilities for personal development, and which contribution it can make to society. For PhDs who work in academia, intellectual challenge and degree of independence played a role in job choice more often than for PhDs working elsewhere. Other studies have called a preference for such attributes a "taste for science", which is more easily satisfied in academia than elsewhere (e.g., Balsmeier & Pellens, 2014; Bloch et al., 2015; Roach & Sauermann, 2010). This factor gives academia a comparative *advantage* to other sectors. The interplay of this comparative advantage with the career disadvantage determines how the latter influences the comparative labor market position of academia.

In this respect a major question is, of course, which factor is the strongest: the negative influence of the career system (a push factor) or the positive influence (a pull factor) of the intellectual aspects of jobs in academia. Our survey cannot determine this, but since there is no shortage of PhDs willing to work in academia, it is clear that *quantitatively* universities can afford the comparative disadvantage at which the present career system places them.

Qualitatively, however, the situation is quite different. The interplay of the push and pull factors must have influence on the composition of the academic work force. First, there is no guarantee that there is a perfect correlation between the importance that PhDs attach to a job's intellectual aspects and their research capabilities. Since it is well known that the distribution of research capabilities is quite skewed (cf. De Solla Price, 1963) any push factor that is not precisely compensated at the individual level by a pull factor, must cause some of the best researchers to leave academia. If the share of the best researchers that is pushed out is equal to that of "average" researchers, the skewed talent distribution implies that there is a substantial loss of academic output that would not occur if a larger share of the best researchers could be retained. Although these researchers could have considerable societal impact through their work outside academia, from the perspective of universities it is a loss if they work elsewhere.

In our survey we have no knowledge about research capabilities and therefore cannot determine whether some of the best researchers are indeed driven out of academic research by the career prospects. However, an aspect we do have information on, is the attitude with respect to societal impact (translating research results into societally relevant applications, science communication, and so on). We found that for PhDs outside academia, contribution to

society played a role in job choice more often than for PhDs in academia. Furthermore, PhDs who attach such importance to their contribution to society also attach greater importance to job security. In the light of the increasing focus on societal impact at universities (de Jong, Smit, & van Drooge, 2016), this is an important finding. It means that the present career systems may well be selective against PhDs with an affinity for impacting society.

In summary, recent PhD graduates' negative view of the academic career opportunities does not cause a shortage of academic researchers. However, it quite possibly drives out some of the most capable researchers and selects against academic researchers with an affinity for making an impact on society.

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