CHAPTER 7

Effects of appointment types on the availability of research infrastructure, work pressure, stress, and career attitudes of PhD candidates of a Dutch university

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Abstract

Several types of PhD candidates exist in the Netherlands, based on how they are remunerated. The default remuneration is through employment by the university, which gives PhD candidates a salary, benefits, and legal protection through collective labour agreements. We call this group "internal" PhD candidates. However, there is also a large, heterogeneous group of "external" PhD candidates, who are not employed by the university and may be funded through scholarships (usually from foreign governments or funding organizations), or who do a PhD next to another job. In this study, we compare the experiences of internal and external PhD candidates by a survey among 218 PhD candidates of a Dutch university. Several aspects of the research infrastructure were assessed: financial situation, supervision, and access to office facilities. Furthermore, we measured work pressure, stress, and career attitudes. We found PhD candidates to be quite satisfied with their PhD on the whole, but regarding many infrastructural aspects, externals were at a disadvantaged position. They have less funding for research, a (much) lower personal income, and less access to office facilities such as a desk and a computer. Furthermore, they experience stress more often than internals. Externals are slightly more positive about their career prospects in academia than internals, but this difference is not statistically significant. Our findings indicate that type of appointment affects the PhD experience in the Netherlands, with non-employed PhD candidates at a disadvantaged position compared to employed PhD candidates.

7.1. Introduction

In the Netherlands, there are several types of PhD candidates. These can be distinguished along two lines: type of appointment and working full-time or part-time on the PhD. This results in four groups of PhD candidates: (1) employees with PhD research as their main task ("assistants-in-training" or *AIO's*), (2) other types of university employees who work part-time on the PhD next to other tasks, (3) non-employed PhD students for whom the PhD is the main task, usually non-Dutch PhD students with a scholarship (scholarship PhD students or *beurspromovendi*), and (4) other non-employed PhD students, for whom the PhD is not the main task and who usually do research next to another job (external PhD students or *buitenpromovendi*; Vereniging van Nederlandse Universiteiten [2013]).[1]

This classification reveals that different types of legal status and remuneration exist for a group that is essentially expected to deliver the same output: a doctoral dissertation. To our knowledge, no previous studies have been performed into how the type of appointment affects the experience of PhD candidates. Our study fills this gap by assessing the effect of appointment type (i.e., employed by the university [categories 1 and 2] vs. not employed by the university [categories 3 and 4]) on the availability of research infrastructure, work pressure and stress, and career preferences and perception of career prospects. These results are discussed in the context of the discussion on increasing precariousness of academic careers (including the careers of those past the PhD stage).

7.2. Literature background

7.2.1. Contingent academic careers?

In many countries, the academic career system has been changing. The "traditional" academic career of permanent (or tenured) faculty positions is giving way to careers of successive contingent positions (Schuster & Finkelstein, 2006, pp. 323-325). For example, in the United States there is an increasingly dual labor market of positions on the tenure track (typically research intensive positions) and positions off the tenure track (typically more teaching oriented), with little opportunities to move from "off" to "on" (Schuster & Finkelstein, 2006, pp. 217-223). In addition, there has been a large growth in the number of postdoctoral positions, which are temporary positions for (recent) PhD graduates. For example, in the

[1] Please note that this is a high-level classification of PhD statuses in the Netherlands, and individual circumstances vary, especially for non-employed PhD students. For example, whereas non-employed PhD students for whom the PhD is the main task are often funded through scholarships, they may also obtain funding by finding part-time employment or from sources other than employment (own savings, family, or retirement benefits).

United States the number of postdoctoral researchers more than tripled from 1979 (18,101) to 2013 (61,942; NSF, 2015, Table 27), a much larger increase than the increase in the number of traditional, full-time faculty positions, which increased from 146,000 in 1969 to 205,000 in 1998 (Schuster and Finkelstein, 2006, p. 46).

In Europe, the shift in academic appointments and contracts is also observed (e.g., Musselin, 2005; Enders & Musselin, 2008). In Germany, the opportunities for temporary positions at universities have only increased since the 1950s, whereas the opportunities for permanent positions have been decreasing since 1975 (Waaijer, 2015). In Portugal, only 22 per cent of academics are tenured (Carvalho, Cardoso, & Branco Sousa, 2014). This figure is 38 per cent for academic staff at Dutch universities (VSNU 2015). These career prospects affect academics: Höge, Brucculeri, & Iwanova (2012) showed that temporary employment among postdoctoral researchers in Germany, Austria and the UK decreases well-being due to insecurity. Among PhD graduates in the Netherlands, temporary employment decreases the job satisfaction (Waaijer, Belder, Sonneveld, van Bochove, & van der Weijden, 2016). These effects of temporary employment in academia are also seen as a problem by leading opinion makers in science, as they decrease the attractiveness of academic careers (Waaijer, 2013).

The previous paragraphs painted the picture of changing contractual arrangements for PhD-holding academics. Next to these changes, the contractual arrangements for PhD candidates have also been transformed. For example in Germany, from the 1960s, research affiliate (*wissenschaftliche Mitarbeiter*) positions were used not only to employ PhD-holding academics, but also persons working on their PhD (Bock, 1972, p. 205). In 1980, over half of these positions were permanent positions (Waaijer, 2015). However, by 1990 this percentage had dropped to one quarter. The Netherlands saw a similar development. For example according to the memoirs of a Dutch historian, in the 1970s one could be a "scientific employee" (*wetenschappelijk medewerker*) without having a PhD (Ebels-Hoving, 2011, p. 201-202). Indeed, in 1970 only a third of the academic staff in the Netherlands had obtained a PhD degree (CBS, 1973, p. 13). This changed with, among others, the introduction of a more formal PhD training in 1986. With this measure, a specific position was created for PhD candidates: the "researcher-in-training" (*assistent-in-opleiding* or *onderzoeker-in-opleiding*). In the following section we will describe the status of PhD candidates in the Netherlands in more detail.

7.2.2. The PhD in the Netherlands

At the time of the survey, if a university in the Netherlands wanted to appoint a PhD candidate paid from their own funds (including those obtained from third-party funding), an appointment as an employee was mandatory (Bartelse, Oost, & Sonneveld, 2007).[2] This was quite a unique situation, as in Europe the only other countries with such a system are Bosnia-Herzegovina and Denmark (European University Association, 2007, p. 29). Appointment was usually as an assistant-in-training (*AIO*) and on a four-year fixed-term contract. For such a position, a vacancy to which interested university graduates can apply is announced, after which job interviews take place and the most suitable candidate is selected.[3] Employee PhD candidates receive a salary, including a vacation and end-of-year bonus, and can incur benefits such as pension benefits, unemployment benefits, and maternity leave. Other types of university employees also enjoy these remunerations. However, other types of PhD candidates can also receive a PhD from Dutch universities. These are not paid directly by a Dutch university, but by another source. Scholarship PhD students typically receive a scholarship from a foreign government or funding organization (thus most scholarship PhD students do not have the Dutch nationality), and work on a PhD full-time. Often, the governments or funding organizations award such scholarships through competitive procedures. Scholarship PhD students are usually appointed as guest researchers by universities, as are external PhD students.

The Dutch PhD is characterized by a focus on doing research, which results in the writing of a dissertation, which takes the form of a book, or a collection of research papers already published in peer-reviewed journals. As in the Nordic countries, the former type of dissertation is common in the humanities and to a lesser degree the social sciences, whereas the journal-based dissertation is common in the natural sciences, life sciences, medicine, and some social sciences (Fridlund, 2010). A survey of recent PhD graduates from Dutch universities has shown that on average, PhD candidates have 4.25 papers accepted in international, peer-reviewed journals (Sonneveld, Yerkes, & van de Schoot, 2010, p. 50).

All PhD dissertations should meet the regulations of the university the candidate wishes to obtain the PhD degree from, regardless of appointment type. For every PhD degree the university that grants it obtains a fixed sum of income, which in 2014 was set to €95,434 (Government of the Netherlands, 2014). This sum is also incurred regardless of type of appointment. This implies that external PhD candidates who are successful in obtaining a PhD actually yield the university a net inflow of funds.

[2] Very recently a plan to allow an experiment with student PhD candidates paid by universities themselves has been introduced by the Dutch Minister of Education, Science and Culture, starting January 2016 (Government of the Netherlands, 2015).

[3] Although quite often, positions are also filled by persons from the supervisor's own network, e.g., recent university graduates who did a successful bachelor's or master's research project with the supervisor.

PhD candidates' demographics have been evolving in the Netherlands, as they have in other countries. The share of women among doctorate recipients has been increasing, from less than a quarter in 1990 to almost half in 2010 (de Goede, Belder, & de Jonge, 2013, p. 5). Furthermore, internationalization has taken place: whereas in 2003 64 per cent of PhD candidates had the Dutch nationality, this percentage had dropped to 57 by 2011 (de Goede et al., 2013, p. 8). These developments mirror international trends regarding the achievement of gender balance (Auriol, Misu, & Freeman, 2013) and an increasing importance of foreign born in the academic workforce (e.g., Stephan, 2012, pp. 183-202 for the U.S.).

7.2.3. Previous studies on the effect of PhD status and other characteristics on the experience of PhD candidates

In this study, we compare PhD candidates who are employed by the university (further dubbed internals) to those who are not employed (further dubbed externals). We measure both objective outcomes, such as the frequency of meetings and availability of office facilities, and subjective outcomes, such as satisfaction with supervision. It must be borne in mind that job satisfaction is a relative measure rather than an absolute one. For example, both the expectations that an individual has of a job, and comparisons with other persons are important factors in determining job satisfaction. Persons with lower expectations of a job tend to report higher job satisfaction (affect theory; e.g., Poggi, 2010). This mechanism is also a reason why women are on average more satisfied with their job than men, despite objectively having worse jobs: they expect less (Clark, 1997). However, here it must be noted that highly educated women do not have these lower expectations and are actually *less* satisfied than men. Furthermore, individuals compare their own situation to other persons rather than deriving satisfaction from their objective situation: for example, if an individual finds they are remunerated less than comparable workers, this will decrease their satisfaction (equity theory; Clark & Oswald, 1996).

Our distinction of employed versus non-employed PhD candidates is not often used in the international literature, probably because few other countries have an employee status for PhD candidates. An exception is another Dutch study among PhD candidates of all Dutch universities, which found no or very small differences between employed PhD candidates and PhD candidates with a scholarship in their supervision (de Goede, Belder, & de Jonge, 2014). This study did find differences between the employed PhD candidates and PhD candidates who did a PhD next to another job; the latter have meetings with their supervisor less often. Studies from other countries find larger differences by mode of funding: for the United States, Ehrenberg and Mavros (1995) found that PhD students supported by fellowships or research assistantships finish their PhD faster than those supported by teaching assistantships, tuition waivers, and especially self-supporting PhD students. Among PhD students in the field of

special education, Wasburn-Moses (2008) found that those with a grant are more satisfied with their doctoral experience, both with regards to how well prepared they feel for future positions, and overall. There have also been studies comparing the satisfaction of full-time and part-time PhD students, with part-time students usually doing their PhD next to other work. For Australia, Neumann and Rodwell (2009) compared the satisfaction of part-time to that of full-time research students (of whom the majority were PhD students). They found that part-time students are less satisfied with the research climate and infrastructure than full-time students. This might be related to how often PhD students see their advisor: Heath (2002) found that PhD students who meet with their supervisor at least fortnightly are more satisfied with the frequency of these meetings. Furthermore, they complete their PhD more often than those who meet every month or even less. A similar result was found by Harman (2003a) who found higher satisfaction with course experience when PhD students met with their advisor more often.

In our analysis, we adjust for other factors that might influence the PhD candidates' satisfaction with research infrastructure, the levels of work pressure and stress they report, and their career preferences and prospects where necessary, and possible. One category of such factors are personal characteristics. For example, Harman (2003a) found that in two Australian research-intensive universities, female PhD students are less satisfied with their supervision and the facilities they were offered. Furthermore, female PhD students have been found to experience more stress than their male counterparts (Toews et al., 1997). Nationality could play a role, as well: in Australia, domestic PhD students have a higher income at their disposal than international PhD students (Harman, 2003b). In addition, internationals have less financial support available for their research project. Interestingly, internationals reported a higher overall satisfaction with their experience as a PhD student in the same study. In Denmark, international PhD candidates experience their work environment as less stressful than their Danish counterparts (Kolmos, Kofoed, & Du, 2008). These latter two findings may be related to the literature on job satisfaction as described above: international PhD students may compare their situation to the situation of PhD students in their home country and feel that in comparison, their own situation is better, leading to high satisfaction levels.

There are also characteristics of the PhD that might influence the research infrastructure and experience of PhD candidates. For example, Barnes and Randall (2012) studied satisfaction among PhD students in the United States across different disciplines. Although the overall satisfaction with their doctoral experience did not differ significantly, the authors did find differences in satisfaction with specific aspects, such as whether PhD students received sufficient financial support. PhD students in engineering and physical science programmes that are research extensive are more satisfied than PhD students in research intensive

humanities programmes.[4] In addition, the time into the PhD could influence our dependent variables. For example, Russo (2011) found that the percentage of PhD students who are satisfied or very satisfied with their graduate school experience went down from close to 80 in the first year to about 50 in the fifth year.

Next to satisfaction with research infrastructure, and work pressure, we assess the career preferences of PhD candidates, and determine whether these differ between types of appointment. Furthermore, we inquire how the PhD candidates perceive their post-PhD career prospects. Preferences for a career in academic research decrease during the PhD (Sauermann & Roach, 2012), but at the end of the PhD and onwards, there are still more PhD students and graduates who would like to continue working in academia than there are academic positions available (Stephan, 2012, p. 170). Career prospects in academia are seen as bad by many, including PhD students (Fox & Stephan, 2001; Waaijer, 2013; Waaijer, 2016). Here, we determine whether internal and external PhD candidates differ in their career preferences and perception of career prospects.

7.3. Data and methods

The data obtained in this study were obtained by a survey among PhD candidates at Leiden University, a large and broad research university in the Netherlands. In this section, we first describe which variables were included. Second, we expand on the survey methodology and description of respondents.

7.3.1. Variables

The main independent variable measured was type of appointment. Dependent variables were several aspects of the financial situation of PhD candidates, aspects of supervision, access to several office facilities, experienced levels of work pressure and stress, and post-PhD career attitudes. Other characteristics that are possible confounders in some of our analyses were measured as well: the PhD characteristics field of PhD and time working on PhD, and the personal characteristics gender and citizenship.

7.3.1.1. Type of employment

In our analysis, we distinguish the PhDs by two types of appointment: internal and external PhD candidates. Internals have an employment contract with Leiden University (categories 1 and 2 in the Introduction section); external PhDs do not (categories 3 and 4). Arguably, externals differ in source of funding and time allocation to the PhD, as our introduction

[4] In addition to comparing PhD students by research field, this specific study (Barnes & Randall, 2012) distinguished PhD students by institutional type, i.e., research intensive and research extensive.

explains. Externals who receive a scholarship and work on their PhD full-time might well have different needs and experiences than externals who have other employment and do a PhD next to that job. However, the latter group is limited in number (only six out of 65 externals are funded solely by another job). Therefore, we only distinguished internals and externals.

7.3.1.2. PhD characteristics

PhD characteristics that were measured were field of PhD, that is, the faculty in which respondents do their PhD. The faculties are Humanities, Law, Social and Behavioural Sciences (including the separate faculty of Public Administration), Science, and Other (including respondents from the faculty of Archaeology, and the ones who indicated they were from an "Other" faculty). The survey was also put to respondents from the Leiden University Medical Center (LUMC; which performs medical and biomedical research). However, the question which distinguishes internals and externals was whether respondents had an employment contract with *Leiden University* as a PhD candidate. Many candidates from the LUMC indicated they were external (as they would have been employed by the LUMC, not Leiden University). Therefore, the distinction between internal and external is problematic for medical PhD candidates and they were thus excluded from our analysis. Finally, we measured in which year of their PhD period respondents were.

7.3.1.3. Personal characteristics

Personal characteristics measured were gender and citizenship (Dutch or non-Dutch).

7.3.1.4. Financial situation

Aspects of the financial situation were the source of funding for the PhD research, whether sufficient funding was available for research material, research trips, and PhD-related training, and what the monthly disposable income of the PhD was (i.e., after tax deduction). The response categories to the latter question were "less than 500 euros", "500-1000 euros", "1000-1500 euros", and "more than 1500 euros".

7.3.1.5. Supervision

Variables of supervision included frequency of meetings with the main supervisor, rating of this frequency, and overall satisfaction with the supervision. Satisfaction was measured on a five-point Likert scale ranging from "very dissatisfied" to "very satisfied" throughout the questionnaire.

7.3.1.6. Offered facilities
Respondents were asked which of the following office facilities they had access to: an own desk, a desk shared with others, an own computer, a shared computer, free access to a telephone, free printing, and none of the above. The ones that had access to one or more facilities were asked how satisfied they were with their office space.

7.3.1.7. Work pressure stress
Respondents were asked to rate their work pressure, and how often they felt stressed at work. Furthermore, the respondents who felt stressed "sometimes" or more often were asked to tick which of sixteen items made them stressed.

7.3.1.8. Post-PhD career
Respondents were asked whether they would like to continue working in academia/research after their PhD. The ones who would like to were asked how they rate their career prospects in this sector.

7.3.2. Survey methodology and description of respondents
The survey was sent to members of the Leiden PhD Association (LEO) and to the Leiden academic network of the 2012 LEO board. The survey was open for almost two months: from 23 November 2012 until 21 January 2013. The complete questionnaire can be found in appendix 6. A total of 218 responses from Leiden University PhD candidates was received, after removal of duplicates. Duplicates were removed by checking the IP addresses of the respondents and whether answers given by the same IP address were identical or very similar. The most complete responses were kept.[5] No precise response rate could be calculated, as recipients of the survey invitation were encouraged to forward the invitation to colleagues and friends who were also doing a PhD at Leiden University.

Two thirds of PhD candidates were employed at Leiden University, and thus characterized as internals (Table 1). PhD candidates from the sciences constitute the largest group among the respondents, followed by the humanities, social and behavioural sciences, law, and other fields. Almost half of the respondents were in the first two years of the PhD at the time of the survey. Finally, the ratio between males and females is almost one-to-one, as is the ratio between Dutch and non-Dutch respondents. Some of these background variables are correlated with each other (Table S1 in appendix 6). For example, the largest group of internal respondents is working in the science faculty. The opposite is true for the humanities faculty, with many

[5] Not all responses with identical IP addresses were removed. In our original dataset, we found IP addresses with up to five responses. When assessing the answers of identical IP addresses, we found that these were often very different. Hence, it is likely that multiple PhD candidates used the same computer to fill in the survey.

external PhD candidates working in this faculty. Furthermore, non-Dutch PhD candidates are more likely to be externals.

Table 1. Descriptive statistics survey sample

Variables	%		%
PhD characteristics			
Employment		*Year of PhD*	
Employed by Leiden University	69	First year	20
Not employed by Leiden University	31	Second year	24
		Third year	19
Faculty		Fourth year	18
Humanities	34	Fifth year	11
Law	8	Sixth year or beyond	7
Science	44		
Social and Behavioural Sciences	12		
Other	2		
Personal characteristics			
Gender		*Citizenship*	
Male	51	Dutch	53
Female	49	Non-Dutch	47

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

To determine whether specific groups of PhD candidates were overrepresented, or underrepresented, we performed a non-response analysis by type of employment contract and faculty. The ideal analysis would be to compare the percentage of internals and externals by faculty between the respondents and university totals. However, the university totals of internals (*AIO's*) are given in full-time equivalents, whereas those of externals are given in persons. Therefore, we calculated the share of PhD candidates by respondent or university group (Table S2). This analysis reveals a modest overrepresentation of humanities PhD candidates in our respondent set, and a modest underrepresentation of law PhD candidates.

7.4. Results

In this section, we describe the PhD candidates' research infrastructure and their satisfaction with it. Furthermore, we assess whether the various aspects of infrastructure are affected by the type of appointment of PhD candidates. We also describe the stress PhD candidates experience and what their career preferences are. The research infrastructure of PhD candidates consists of several aspects. In our study, we distinguish the financial situation, supervision, and (physical) facilities.

7.4.1. Financial situation

The first aspect of research infrastructure, and the main factor that separates internals and externals, is the mode of funding. Internals are paid by the university and are thus employees, whereas externals often are not. Hence, it makes sense for the source of funding to differ by type of employment. Indeed it does: internals are often funded through Leiden University or the Netherlands Organisation for Scientific Research (NWO), whereas externals are not. Externals, in turn, are more likely to be funded through a non-Dutch university, non-Dutch state authorities, or a non-Dutch private business. They also draw upon personal funds more, such as savings or funds from relatives or friends. Finally, they are more likely than internals to be funded through other employment next to the PhD position.

We assessed whether respondents have sufficient funding available for research (research material, research related training, and research trips), and compared internals and externals. Our results show that close to 90% of internals have sufficient funding for research available, compared to 30% of externals (Table 2; $p < 0.001$ in Mann-Whitney U test). Research funding for externals is often insufficient or completely absent. Hence, there is much more heterogeneity within the group of externals than in the group of internals, with the former being more likely to have insufficient research funding. This means, for example, that externals probably visit fewer conferences, which can be used to establish an academic network. Furthermore, the presentation of papers at conferences is shown to increase the visibility of these papers, especially if they were written by early career researchers (de Leon & McQuillin, 2015). These benefits are missed by PhD candidates who have insufficient finances to visit scientific conferences.

Table 2. Funding available for research

Funding for research	Internal	External	Total
		%	
Sufficient funding available	87	31	71
Funding available but not sufficient	11	38	19
No funding available at all	2	31	11

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

Furthermore, we determined whether the personal income of PhD candidates differs by type of appointment. Internals tend to have a higher income than externals (Table 3; $p < 0.001$ in Mann-Whitney U test). Almost all internals have a net income of at least 1,000 euros per month, with 60% having an income of more than 1,500 euros. Conversely, close to 40% of externals have less than 1,000 euros per month to spend. Again, there is much more heterogeneity in the group of externals than in the group of internals. Our findings are in line

with those of Sonneveld et al. (2010, p. 77) who found that *AIO's* have a (much) higher income than scholarship recipients.

Table 3. Monthly disposable income

Income	Internal	External	Total
		%	
Less than 500 euros	2	9	4
500-1000 euros	3	28	10
1000-1500 euros	34	40	36
More than 1500 euros	61	24	50

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

7.4.2. Supervision

The second aspect of research infrastructure we describe, is supervision. We compared the frequency of meetings with the supervisor between internals and externals, and their satisfaction with this frequency. Externals meet with their supervisors less often (Table 4). They are also less satisfied with this frequency, but this tendency is not statistically significant. These results slightly resemble but are subtly different from those of Heath (2002) and Harman (2003a) who both found that PhD students were more satisfied with the frequency of supervisory meetings when the frequency is higher. We also determined the overall satisfaction with supervision and compared it between the two groups. Two thirds of respondents were "satisfied" or "very satisfied" (Table 5). No meaningful differences in satisfaction were found between internals and externals ($p = 0.259$ in Mann-Whitney U test).

Table 4. Frequency of meetings with main supervisor and satisfaction with frequency

Frequency	Internal	External	Satisfaction	Internal	External
	%			%	
Daily	3	2	Far too high	0	2
Weekly	28	17	Too high	1	6
Once every two weeks	26	24	Exactly right	74	55
Monthly	20	17	Too low	22	26
Once every two months	15	15	Far too low	4	11
Once every six months	4	13	*p-value*	*0.260*	
None	1	4			
Other	4	9			
p-value	*0.030*				

N. B. Percentages may not add up to 100 due to rounding. P-values from Mann-Whitney U test; for test on frequency of meetings, the answers "other" were removed.

Table 5. Overall satisfaction with supervision

Overall satisfaction	Internal	External	Total
		%	
Very satisfied	28	23	26
Satisfied	43	42	43
Neither satisfied nor dissatisfied	19	19	19
Dissatisfied	7	11	9
Very dissatisfied	2	6	3

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

7.4.3. Facilities

A third aspect of research infrastructure concerns the facilities PhD candidates have at their disposal. For the office facilities mentioned above we compared the shares of internals and externals who have access to them. Furthermore, we determine how many PhD candidates have no such facilities at their disposal. Our comparison between internals and externals shows that externals less often have an own desk, an own computer, free printing, and free telephone facilities (Table S3). They much more often than internals have access to none of the listed facilities. However, the fact that they have fewer facilities might not be due to their type of appointment *per se*, but to other factors. For example, amongst external PhD candidates, the share of candidates from the humanities and the law faculty is much higher than amongst internals (Table S1). Hence, it might be the case that the former faculties offer fewer facilities to all PhD candidates, internal as well as external, than the science faculty. A similar argument could be made for nationality; in principle, Dutch PhD candidates are not remunerated through scholarships but through employment. Therefore, we performed a logistic regression on all facilities offered by type of appointment and the control variables faculty, year of PhD, gender, and nationality. This analysis shows that for all facilities to which internals had access more often than externals, the type of appointment independently affects whether an own desk and an own computer are offered (Table 6), as well as all other facilities to which internals had access more often than externals (Table S4).

Table 6. Logistic regression on availability of own desk and own computer by employment status, controlling for other variables

	Own desk		Own computer	
	B (S. E.)	p-value	B (S. E.)	p-value
Constant	0.77 (0.61)	0.202	0.49 (0.56)	0.384
Internal (dummy)	2.15 (0.50)	< 0.001***	1.82 (0.45)	< 0.001***
Faculty (ref. is humanities)				
Law	0.91 (0.88)	0.302	1.12 (0.84)	0.186
Science	0.88 (0.52)	0.091	0.52 (0.45)	0.247
Social and behavioural sciences	-0.63 (0.62)	0.311	-0.05 (0.57)	0.936
Year of PhD	-0.22 (0.14)	0.127	-0.08 (0.13)	0.529
Female (dummy)	-0.60 (0.45)	0.180	-0.62 (0.40)	0.124
Dutch (dummy)	0.06 (0.47)	0.900	-0.45 (0.43)	0.293
Cox & Snell R^2	*0.194*		*0.146*	

We also asked the respondents who have one or more of the listed facilities at their disposal how satisfied they are with these facilities. Externals not only have facilities at their disposal less often, they are also less satisfied with the offered office facilities (Table 7; $p < 0.001$ in Mann-Whitney U test). Please note that these are only the answers of the 75 per cent of externals who do have one or more facilities at their disposal; respondents who did not have any facilities were not asked the question how satisfied they are with the offered facilities (as they do not have them).

Table 7. Satisfaction with facilities

Satisfaction	Internals	Externals	Total
		%	
Very satisfied	43	39	42
Satisfied	51	36	47
Neither satisfied nor dissatisfied	5	16	8
Dissatisfied	1	2	2
Very dissatisfied	0	7	2

N. B. Question only asked to respondents who did not tick "none" when answering the question which facilities they have at their disposal. Percentages may not add up to 100 due to rounding.

Our results are in apparent contrast with de Goede et al.'s (2014) who did not find differences between the satisfaction of employed PhD candidates and PhD candidates on a scholarship, the main group of PhD candidates in our sample of externals. However, they did not assess the material aspects of research infrastructure (the financial situation and access to office facilities). It is in those aspects that we find large differences between the two groups. Furthermore, they also state in their report that they have probably "only reached scholarship PhD candidates who are visible to university administrations, whose daily work practice may hardly differ

from employed PhD candidates" (de Goede et al., 2014, p. 45; own translation). On the other hand, we contacted PhD candidates through an association of PhD candidates, allowing us to reach PhD candidates invisible to university administration. Our results are more similar to those of Neumann and Rodwell (2009), who found that part-time research students are less satisfied with research infrastructure (which includes "working space, technical support, computing facilities and necessary equipment, as well as financial support for research", with the difference that they compared full-time to part-time students, whereas we compare PhD candidates employed by the university to those who are not.

7.4.4. Pressure and stress

Respondents were asked how they rate their work pressure. Half indicated this pressure is "normal", four in ten said it is "high", and a mere four per cent said it is "too high" (Table 8). Though no statistically significant differences are observed between internals and externals (p = 0.497 in Mann-Whitney U test), in case of those experiencing a very high pressure, the difference between externals (8%) and internals (3%) is quite suggestive. In frequency of stress that PhD candidates experienced we *do* find statistically significant differences between internals and externals (Table 9; p = 0.024 in Mann-Whitney U test). Externals more often indicate they are "always" or "often" stressed. Other factors, such as year of PhD, faculty, gender, and nationality could also influence the experience of work pressure and stress. Therefore, a binary logistic regression including both type of appointment and these other factors was run on experiencing high pressure, and being stressed often.[6] Our results show that type of appointment indeed does not affect the rating of work pressure, but *does* have a significant effect on the frequency of stress: internals are less likely to experience stress often, also when controlling for these other factors (Table S5). However, it must be borne in mind that the explained variance is low (Cox & Snell R^2 = 0.096). This means that type of appointment only explains the frequency of stress to a small extent, but does affect it independently from the other factors commonly associated with stress that we measured. The perception of work pressure was also only explained by the included independent variables to a small extent (Cox & Snell R^2 = 0.109). However, an interesting finding is that *ceteris paribus*, women experience high work pressure more often than men, a finding similar to the effect found by Toews et al. (1997).

[6] Running ordinal regressions on pressure and stress with five answer categories resulted in too many empty cells. Therefore, answer categories were combined into dummies of "high pressure" (rating of pressure as "high" or "too high") and "often stressed" (rating frequency of stress as "often", "very often", or "always").

Table 8. Work pressure

Work pressure	Internal	External	Total
		%	
Too high	3	8	4
High	43	32	40
Normal	52	55	53
Low	2	6	3
Too low	0	0	0

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

Table 9. Frequency of stress

Frequency of stress	Internal	External	Total
		%	
Never	7	11	8
Sometimes	53	28	46
Often	23	30	25
Very often	14	17	15
Always	2	13	5

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

Our findings of type of appointment influencing frequency of stress but not work pressure would appear to contradict each other. However, a high work pressure does not have to lead to high stress levels. Out of the 74 respondents who reported "high" work pressure, one said they "never" feel stressed, and 27 said they only "sometimes" feel stress, which makes for a total of 38 per cent of respondents who are not often stressed while at the same time reporting high work pressure. The other way around is also true: a high frequency of stress is not always accompanied by high work pressure. Out of the 53 respondents who were "often" stressed, 15 reported "normal" or even "low" (in one case) work pressure.

The most important sources of stress for the respondents are pressure to publish, deadlines, difficulty of work, amount of work, contact with managers or supervisors, and interruptions during work (Table S6). The main non-work related stressor are drastic personal events. For internals, pressure to publish and teaching duties are sources of stress more often than for externals (Table S6). Logistic regression with type of appointment, faculty, gender, nationality and year of PhD as independent variables shows that type of appointment is only an independent predictor of stress due to teaching, not of stress due to publication pressure. For externals, contact with managers or supervisors, and with colleagues are stressors more often than for internals, but after controlling for the other variables in a logistic regression, type of appointment was found to have an independent effect only on stress due to managers or supervisors.

7.4.5. Post-PhD career

Respondents were asked what their plans for their post-PhD career are; whether they would like to work inside or outside academia/research. About sixty per cent would prefer to work in academia or (non-academic) research after the PhD; thirteen per cent would not. Another quarter does not know yet. This strong preference to work in academic or non-academic research was also found in a study among all PhD candidates in the Netherlands (de Goede et al., 2014). Studies from other countries have found an even stronger preference for research among postdoctoral researchers (Fitzenberg & Schulze, 2014; Puljak & Sharif, 2009). A greater share of externals would like to work in academia or research, and a greater share of internals do not know yet, but these differences are not statistically significant ($p = 0.078$ in Pearson's chi-squared test of independence).

Respondents who would like to work in academia or research were asked how they rate their career prospects in this sector. Many found them "difficult" or even "very difficult" (Table 10). Crosstabulation shows that internals rate the prospects as worse than externals, but this difference is not statistically significant ($p = 0.399$ in Mann-Whitney U test).

Table 10. Perception of career prospects

	Internal	External	Total
		%	
Very easy	0	13	4
Easy	7	3	5
Neither easy nor difficult	28	31	29
Difficult	57	38	51
Very difficult	8	15	11

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

7.5. Discussion and conclusions

Many countries have witnessed shifts in academic appointments such as a shift from many permanent positions for university researchers to a larger share of contingent, temporary positions, which has affected the employment conditions in academia (Schuster & Finkelstein, 2006, p 323-325). The Netherlands is no exception to this trend. Fitting with this trend of more contingent careers is the shift from employed to student PhD candidates, which has taken place in several countries. Although in the Netherlands, at the time of the survey, universities had to employ PhD candidates financed through their own funds, there were also many PhD candidates who were not employed by the university, such as scholarship PhD candidates and PhD candidates doing a PhD next to a main job. Our results show that

type of appointment does not significantly influence the immaterial infrastructure of PhD candidates (supervision), but does strongly negatively affect material infrastructure (financial situation and office facilities). Considering the fact that most of the externals in our sample are funded through scholarships and not through other employment, it is likely that these are PhD candidates who work full-time on their PhD. In this light, it is especially remarkable that many important aspects of research infrastructure are not available to so many of them.[7]

In addition, externals who do have access to at least some office facilities, are less satisfied with them. Economic psychology shows job satisfaction of individuals to be related to expectations (Poggi, 2010) and to be affected by comparisons to others (Clark & Oswald, 1996). Quite probably, the lower satisfaction of externals is at least partly due to the fact that they compare their situation to that of internals, which is objectively better. In this light, it would be interesting to study additional aspects of job satisfaction, such as with remuneration and embeddedness in the department.

Our results also show that externals are stressed at work more often than internals. An interesting follow-up question would be to see if their higher stress levels could be caused by the lesser availability of material infrastructure, or are caused by other factors. Another striking finding in our study was that female PhD candidates were more likely to report high work pressure than male PhD candidates. Again, a follow-up question that warrants further investigation but cannot be answered by a survey study like ours, is to investigate the reasons for the higher work pressure experienced by females.

Of course, our conclusions are based on data from a single university only. However, the PhD candidate population in Leiden does not differ from that in the other Dutch universities: everywhere a considerable share of PhD candidates is university employee but there are also many external PhD candidates. Local conditions for PhDs may vary somewhat because of policy differences, but our findings are quite comparable to what PhDs from other universities report in national meetings. Consequently, by and large our results are quite likely to represent the situation of PhD candidates in all Dutch universities.

[7] In 2015, two years after the LEO survey on which the findings of our paper are based, several questions especially directed at PhD candidates were included in the university's employee monitor. The results of this monitor show that satisfaction with office facilities did not differ between internal and external PhDs (Smeenk & Mariën, 2015), which suggests that office facilities have indeed improved for externals. However, no questions were included on the availability of office facilities, categories of internals and externals were slightly different and no distribution of the data was shown, making it difficult to compare results between our survey and the employee monitor.

In conclusion, on the whole, the surveyed PhD candidates are quite satisfied with their PhD experience. Strikingly, however, PhD candidates who are not employed by the university are at a disadvantaged position with respect to financial situation, offered facilities, and experienced work stress. Hence, type of appointment affects several aspects of the PhD. This shows that precarious working conditions influence the way PhD candidates conduct their research projects.

7.6. References

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