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Quantized careers : origins and consequences of the preponderance of temporary and junior jobs in academia

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CHAPTER 1

Introduction



1.1. Introduction

For countries' economic growth and prosperity, high-quality research and innovation are crucial (e.g., European Commission, 2014). To enable such research and innovation, the governments of several countries have explicitly stated their goals to attract students to science¹ (especially the STEM fields; Maltese, Melki, & Wiebke, 2014). However, during the past decades, opportunities to “move up the career ladder” in science have been increasingly characterized as scarce. The lack of career opportunities, the long spells of employment on temporary contracts, and the dependence on third party funding are seen as major problems in science in the editorials of *Science* and *Nature*, the two leading scientific journals (see *chapter 2* of this dissertation). Critique of the academic career system is not confined to scientific journals, but also appears in popular newspapers and magazines. For example, the final paragraph of a 2010 article in *The Economist* aptly titled “The disposable academic” says:

“Many of those who embark on a PhD are the smartest in their class and will have been the best at everything they have done. They will have amassed awards and prizes. As this year's new crop of graduate students bounce into their research, few will be willing to accept that the system they are entering could be designed for the benefit of others, that even hard work and brilliance may well not be enough to succeed, and that they would be better off doing something else. They might use their research skills to look harder at the lot of the disposable academic. Someone should write a thesis about that.” (“The disposable academic”, 2010)

This is that thesis.

The scientific literature on careers in academic research has focused on different aspects of careers, such as how women are in a disadvantaged position in science, the influence of (international) mobility, and the effects of different modes of research funding. However, one issue has been studied less, namely the career system as such and how it affects the attractiveness of the academic career: how are academic careers built up, what does the typical career ladder look like, which opportunities do those within the system have?

This dissertation will study the topic from various perspectives. First, it describes which issues can be identified in the career system and in academic careers in general. Second, it studies how the career system developed into the system that it is today. Third, the dissertation studies the effects of the academic career system on the attractiveness of an academic career by looking at how they affect job choice and job satisfaction of early career researchers.

¹ In the continental European tradition, throughout this dissertation we will use the term “science” to incorporate all fields, including mathematics, engineering and the humanities.

The title of this dissertation emphasizes that an academic career is not the traditional smooth and linear merit-based progression from student through a junior and subsequent intermediate position to a professorial chair. Instead, careers often consist of many small pieces, or quanta, that are not strongly related to each other and do not necessarily have a clear direction or common content. The uncertainty that in modern physics is the key connotation of the word “quantized”, is one of the core phenomena investigated in this dissertation.

1.2. How to define an academic career

Careers have been defined as “the evolving sequence of a person’s work experiences over time” (Arthur, Hall, & Lawrence, 1989, p. 8). Careers used to be linear paths of upward mobility in a single organization, in which career advancement was based on tenure: the time in the job (Baruch, 2004). However, since then “protean” (Hall, 1976, pp. 200-203; Hall, 1986, pp. 9-11) or “boundaryless” careers (Arthur & Rousseau, 1996) have emerged, in which control over the career has transferred from the employer to its employees, who develop themselves as they wish and change employers accordingly. With this development, career paths have become multidirectional, both in terms of vertical and horizontal mobility. This also has implications for how career success — “the accomplishment of desirable work-related outcomes at any point in a person’s work experiences over time” — should be measured (Arthur, Khapova, & Wilderom, 2005, p. 179). Arthur et al. (2005) distinguish subjective and objective career success. Subjective career success entails an individual’s own evaluation of his or her career and is dependent on which aspects of the career are important to that person. In contrast, objective career success is the success that is inferred by the outside world and usually relies on more or less observable attributes, such as rank, salary, number of promotions, etcetera.

Baruch and Hall (2004) argue that careers in academia have had “protean” or “boundaryless” features long before corporate careers attained those features. For example, universities have had relatively flat hierarchical structures compared to businesses and government, academics have enjoyed high levels of autonomy, and career advancement has long been determined by performance instead of time in position, unlike the situation in the corporate and government sector. Still, careers in academia have a feature foreign to protean or boundaryless careers: a rigid hierarchical structure of career ranks.

This hierarchical structure of career ranks differs by country (Baruch & Hall, 2004; Kreckel, Burkhardt, Lenhardt, Pasternack, & Stock, 2008), but typically the highest position is the (full) professorship. The lowest rank depends on whether a system regards those attempting to obtain a PhD degree as academics; if so, these PhD candidates usually make up the group

lowest in academic rank. The rigid career structure in academia makes it possible to measure objective career progression through ranks quite easily.

Naturally, from advancement through academic career ranks one cannot infer subjective career success in academia. And, as we shall see later, even though in many countries the academic career structure seems quite clear-cut, the archetypical picture of job titles with increasing rank unduly simplifies the academic career system.

1.3. International comparisons of academic career systems

As indicated above, academic career systems vary by country. To compare shares of female and male academics across ranks, the European Commission distinguishes four grades: “A: The single highest grade/post at which research is normally conducted; B: Researchers working in positions not as senior as top position (A) but more senior than newly qualified PhD holders (ISCED 6); C: The first grade/post into which a newly qualified PhD graduate would normally be recruited; D: Either postgraduate students not yet holding a PhD degree who are engaged as researchers, or researchers working in posts that do not normally require a PhD” (European Commission, 2006, p. 97).

Kreckel et al. (2008) used this classification to show that academic career systems differ heavily between the United States, Germany, France, Great Britain, the Netherlands, Sweden, Austria and Switzerland (Kreckel et al., 2008, p. 352). Among the most notable outcomes is that the share of academics in grade A differs, with United States and France having about a quarter of their academics in this category, whereas this share is only eight per cent for Germany. France, Austria and Switzerland have a large share of academics in the intermediate categories B and C.

This dissertation will focus on academic careers in Germany, the United States and the Netherlands; the choice for these countries will be elaborated upon in the section on the research questions of this dissertation. As background information, an overview of the corresponding ranks in these countries’ academic career structure is provided in Table 1. This shows that most positions in one country have an equivalent position in another country.

Table 1. Overview of academic career structure in Germany, the United States and the Netherlands

Grade	Germany	United States	The Netherlands
A	<i>W3 Professor</i> (full professor)	Full professor	<i>Hoogleraar</i> (full professor)
B	<i>W2 Professor</i> (extraordinary professor)	Associate professor	<i>Universitair hoofddocent</i> (associate professor)
C	<i>Juniorprofessor</i> (junior professor)	Assistant professor	<i>Universitair docent</i> (assistant professor)
D	<i>Wissenschaftlicher Mitarbeiter</i> (research affiliate)*	Postdoctoral researcher	Postdocs and other scientific staff
D [#]	<i>Wissenschaftliche Hilfskraft</i> (research assistant)	PhD student	<i>Assistent-in-opleiding</i> (AIO; PhD candidate)

Source: de Goede, Belder, & de Jonge, 2013; Kreckel et al., 2008; Statistisches Bundesamt, 2011. *Not only postdoctoral researchers can be given a position as *wissenschaftlicher Mitarbeiter*, but also PhD candidates. #Only the Dutch AIO is actually classified into grade D by the European Commission (2006), as German *wissenschaftliche Hilfskräfte* and U.S. PhD students are not counted as academic employees.

Please note that this picture omits several positions, and that the ranks do not correspond completely. For example, in the United States it is common for assistant professors to be appointed “on a tenure track”: the assistant professor is appointed for five to seven years, and is promoted to (tenured) associate professor if proven successful (Fruijtier & Brok, 2007). This implies one can only be appointed as an assistant professor for a limited amount of time. In contrast, in the Netherlands the majority of assistant professors are employed on a permanent contract, and as such can occupy this position until retirement. However, the share of assistant professors employed on a temporary contract is increasing (VSNU, 2015a). One of the reasons for this increase may be that with the growing internationalization of academic research, some universities in the Netherlands have also adopted a tenure track system for its assistant professors (de Goede, Belder, & de Jonge, 2013). This brings us to another issue: whether an academic position comes with tenure (or a permanent contract) or not. In Germany, full and extraordinary professors are usually employed on a permanent contract, although employment on a temporary (or: fixed-term) contract is also possible (Kreckel et al., 2008, p. 45). Junior professors are usually appointed on a temporary contract, as are research affiliates and assistants. In the United States, both full and associate professorships usually imply tenure. As indicated above, assistant professorships are generally tenure track positions. Postdoctoral researchers and PhD students are paid stipends from grants of the faculty member who is their supervisor, or are paid through fellowships (Stephan, 2012, p. 69). Hence, a position as a postdoc or PhD student at a U.S. university is fixed-term. Finally, in the Netherlands, full and associate professors are also generally employed on a permanent contract, whereas postdocs and PhD candidates are virtually always employed on a temporary one. As described above, the majority of assistant professors are employed on a permanent contract, but the last few years have seen a large increase in the share of assistant professors employed on a temporary contract.

In all three studied countries, scientists and other stakeholders have pointed out an increase in temporary contracts at the expense of permanent employment, e.g., in editorials of scientific journals and in general newspapers (“Indentured labour”, 2007; Kuiper, 2014; “Op de universiteit stikt het van de flexwerkers”, 2013; Piltz, 2015; Powell, 2015), which quite many see as an undesirable development. Indeed, age until tenure in the U.S. has increased (Schuster & Finkelstein, 2006, p. 182). Furthermore, in all countries the number of junior positions has increased more than the number of senior positions (Hill & Einaudi, 2010; Konsortium Bundesbericht Wissenschaftlicher Nachwuchs, 2013, p. 181; Schuster & Finkelstein, 2006: p. 46; VSNU, 2015b). This quantizes the careers of early career researchers: early career researchers are employed on short-term contracts, causing uncertainty and furthering the need to be almost constantly on the lookout for a next job in fierce competition for senior positions.

Such a structure with many junior positions and few senior positions has been compared to a pyramid scheme by Paula Stephan in her 2012 book *How Economics Shapes Science* (Stephan, 2012, pp. 70-71). Although the likening of the academic career structure to an immoral (and often illegal) money-making model seems too strong, such a structure could alter the employment relationship between employer and employee. As a result, the attractiveness of science as a career and the job satisfaction of those within the system may be affected.

1.4. Employment relationships

According to organizational psychology theory, several types of employment relationships exist. Tsui and Wang (2002, p. 78) define the employment relationship as “the formal and informal, the economic, social and psychological connection between an employee and his or her employer”. In the same book chapter, they give an overview of several approaches of employment relationship typologies. These typologies generally distinguish a job-focused from an organization-focused approach (as well as mixes of the two). The job-focused employment relationship is characterized by its short-term nature and limited investment from both parties, whereas the organization-focused approach has a long-term nature and much investment from both parties (e.g., by the employer investing in the broad skill development of its employees). Tsui and Wang (2002) argue that a job-focused employment is suitable when the employee is expected to perform specific duties (leading to a “quasi spot” situation), whereas the organization-focused approach is more suited to workers performing open-ended duties (leading to a “mutual investment” situation). Unbalanced situations can also occur, when a job-focused approach is used for workers performing open-ended duties (underinvestment situation) or when an organization-focused approach is used for workers performing specific duties (overinvestment situation). According to Thunnissen (2015, p.

183), talent management at Dutch universities can be characterized as an underinvestment approach, whereas an overinvestment or mutual investment approach would be more suitable for the human resource management of individuals with rare or special skills.

The existence of balanced and unbalanced employment relations is due to the psychological contract that is formed between employers and employees. Rousseau (1995, p. 9) defines the psychological contract as “individual beliefs, shaped by the organization, regarding terms of an exchange between individuals and their organization”. If one of the parties experiences a violation in the terms of the contract, it can lead to several consequences. One of these is an exit by the employee (Rousseau, 1995, p. 136), which tends to happen if the employment contract was job-focused. Another consequence is the voicing of complaints, which is likely if there is a positive relationship and channels to voice complaints exist (Rousseau, 1995, pp. 136-138). Still another consequence is silence, which is likely when there are no channels to voice complaints and exit is not an option (i.e., when there are no other job opportunities available). A final consequence is neglect, which includes both “passive negligence” and “active destruction” (Rousseau, 1995, p. 138). Neglect is most likely when there is a history of conflict and when there are no options to voice complaints.

1.5. Attractiveness of science as a career

Following the employment relationship theory, an underinvestment approach should lead to decreased attractiveness of academia as a sector of employment. However, whether career opportunities in academia and the likelihood of a tenured position influence the attractiveness of science as a career, is a debated issue. On the one hand, it is argued that despite poor career prospects, there is no shortage of talent in science, but rather a “war between talents”, in which there is an oversupply of talents in relation to the career opportunities available (van Arensbergen, 2014, p. 121). On the other hand, in the early 2000s both Huisman, de Weert and Bartelse (2002) and van Vucht Tijssen (2000) argued that dwindling career opportunities decrease the attractiveness of faculty positions. However, looking at studies on the career preferences of PhD students, the supposedly limited academic career opportunities have not affected the attractiveness of academic careers to a large extent. That is to say, although these studies have not correlated career opportunities with career preferences, most find that academia is the most attractive sector of employment (Fox & Stephan, 2001; Roach & Sauermann, 2010; Sauermann & Roach, 2012 for the U.S.; Bloch, Krogh Graversen, & Skovgaard Pedersen, 2015 for Denmark; Gemme & Gingras, 2012 for Québec; Conti & Visentin, 2015 for Sweden and Switzerland). Postdoctoral researchers exhibit an even stronger preference for employment in academia (Puljak & Sharif, 2009 for the U.S.; Fitzenberger & Schulze, 2014 for Germany; van der Weijden, Teelken, de Boer, & Drost, 2016 for the Netherlands).

That is not to say that non-academic sectors are not appealing to PhD students and postdoctoral researchers. Their appeal varies by field of PhD. For example, for U.S. chemistry PhD students working in industry is more appealing than for PhD students in other fields (Fox & Stephan, 2001; Sauermann & Roach, 2012). In Denmark, a relatively high share of PhDs from the medical and health sciences works in the public sector, as many of these PhDs work in hospitals or other medical organizations (Bloch et al., 2015).

According to the sociology of science, one of the purposes of doctoral education is the socialization of PhD students into the academic profession (Gardner, 2007; Larivière, 2012). Turner and Thompson (1993) describe doctoral education as “a lengthy period of adult socialization in cognitive skills, appropriate attitudes toward research and scholarship, and field-specific values” (p. 357). A wide range of activities are included, such as meetings with supervisors and peers, writing scientific works and publishing these. Studies into organizational socialization have shown that it increases organizational commitment and decreases turnover intention (i.e., the intention to leave a company or organization; Bigliardi, Petroni & Dormio, 2005; Vazifehdust & Khosrozadeh, 2014). Indeed, in 1965 Warren O. Hagstrom described how socialization “effectively isolates [graduate students] from competing vocational and intellectual interests and (...) [makes them] extremely dependent on [their] teachers” (Hagstrom, 1965, p. 9).

Hence, socialization plays an important role in shaping the career aspirations of young academics. Here, psychological contract theory linked to the process of socialization may be illuminating. Academia is said to offer a greater degree of independence and academic freedom, and researchers in academia value these attributes (Roach & Sauermann, 2010). In contrast, pecuniary rewards and other employment conditions are valued less by many academic researchers. Socialization into academia with its valuation of academic freedom and independence rather than employment conditions may make early career researchers accept relatively poor career prospects in academia more readily than they would otherwise. Said differently: the psychological contract between an early career researcher in academia and their employer may not include the expectation of job security, as the early career researchers have been socialized into expecting long periods of temporary employment. In this situation, unbalanced employment relationships need not lead to dissatisfaction, complains or neglect. This, however, does not mean that early career researchers will stop comparing career opportunities and look for a more advantageous employment relationship elsewhere. Then the perception of career opportunities may influence career preferences and the actual sector of employment. Whether it indeed does, and if so, to what extent, is a question not answered yet.

1.6. Job satisfaction of PhD graduates and academics

A subjective measure of career success that is used in several studies is job satisfaction (Arthur et al., 2005). Locke (1969, p. 316) defined it as “the pleasurable emotional state resulting from the appraisal of one’s job as achieving or facilitating the achievement of one’s job values”. In their theoretical discourse on the employment relationship, Tsui and Wang (2002, p. 107) proposed that the type of employment relationship influences (job) satisfaction. In this way, the underinvestment approach that universities employ in their talent management, which is characterized by a lack of opportunities for career advancement and job security, decreases employee well-being (Thunnissen, 2015, pp. 182-183).²

Academics tend to be quite satisfied with their job (e.g., Boyer, Altbach, & Whitelaw, 1994; Lacy & Sheehan, 1997). In an international survey among academics from fourteen countries, Boyer et al. (1994) found that these academics were satisfied with the intellectual aspects of their jobs, the relationship with their colleagues, and the courses they teach. They were less satisfied with their salary and with the way the university is led by top administrators. Lacy and Sheehan (1997) found that professors were most satisfied with the opportunity to pursue their own ideas, the courses they taught, the relationships with colleagues, and the job situation as a whole. These professors were (much) less satisfied with the way the institution is managed and with their prospects for promotion.

In addition, multiple studies on the job satisfaction of PhD graduates have been performed, in several countries (e.g., Bender & Heywood, 2006; Di Paolo, 2016; Kifle & Desta, 2012; Moguérou, 2002). In the U.S., PhDs in academic employment are more satisfied with their jobs than PhDs in non-academic employment (Bender & Heywood, 2006; Moguérou, 2002). Both studies also found female PhDs to be less satisfied than male PhDs. PhDs from Catalonia who work in non-academic sectors are less satisfied with job content, but more satisfied with their earnings than PhDs in academia (Di Paolo, 2016). These studies show that job satisfaction among academics and PhD graduates is multi-faceted with regards to both the job qualities they are satisfied with and the factors that influence satisfaction: academics and PhDs may be satisfied with their salary, but not with their colleagues, for example. And working outside academia may have a positive effect on satisfaction with salary, but have no effect at all on satisfaction with colleagues. This is important to bear in mind when studying the effect of employment conditions on job satisfaction.

² Please note that Thunnissen found that “[talented academics] want job security in terms of employability [...]: rather than employment, they want the certainty that they can continue to develop as an academic and pursue an academic career in which the abovementioned non-economic job orientations (meaningful, challenging work, autonomy, etc.) are key aspects [...]” (Thunnissen, 2015, p. 182).

1.7. Research questions

As announced in the introductory section, the aim of this dissertation is to study the academic career system by describing its development through time and study its effects on job choice and job satisfaction.

However, the policy field of academic careers is large and encompasses a wide range of topics. Therefore, first the field of academic career policy was mapped and its key issues identified. Accordingly, the first main research question of this dissertation is:

1. What are the key topics discussed in *Science* and *Nature* editorials relating to academic career policy?

In *Science*, the authors of these editorials are the editor-in-chief (a distinguished scientist usually at the final stages of their career) or guest writers, who are usually high level policymakers in the field of science. In *Nature*, the editorials are written more journalistically: they are written by (anonymous) editors of *Nature*, who are often PhD-holding science journalists whose goal is to spot breakthrough research and offer reflection on scientific developments and science policy (van Calmthout, 2016). Analyzing the editorials of *Science* and *Nature* therefore gives a good overview of the keys issues in academic career policy. The other studies in this dissertation go into three key issues identified by *Nature* and *Science* editorials: career conditions in science, the attractiveness of science as a career, and the role of gender in academic careers. The editorial analysis and other data available on academic career prospects tentatively sketch a picture in which career prospects have indeed worsened and temporary employment has increased. Since a more thorough historical analysis is lacking in the literature, the second main research question of this dissertation is:

2. Historically, how has the composition of academic positions changed in Germany and how has the span of publication careers of PhD recipients from the United States changed (both before and after the PhD)?

As described in the earlier section 1.3, the composition of academic staff in several countries has shifted from senior to more junior staff (e.g., Schuster & Finkelstein, 2006). However, most of the literature is restricted to the second half of the 20th century and the early 21st century, and does not take into account historical developments that led to the emergence of specific positions. Data on the extent of temporary employment are often lacking, too.

Therefore, *chapter 3* describes the development of the structure of academic careers in Germany from the 19th century to the present day. Germany was chosen as the country of study, as the concept of the research university originated there. The German data show large changes in the structure of academic careers over the past two centuries, with the last quarter of the 20th century showing vast increases in the number of (temporary) research affiliate positions. Thus it would be natural to presume that the pattern of publication careers has also changed. As stable jobs have given way to short-term jobs, and only a small share of academics in such short-term jobs will eventually land a stable job (e.g., Ioannidis, Boyack, & Klavans, 2014; Stephan, 2012, p. 170), the spell during which academics publish their work would seem likely to have shortened as well. However, whether this presumption is correct needs to be verified. We do so for the U.S., as the U.S. has been the dominant nation in science since the mid-20th century, the period for which publication careers can be most readily measured.

More specifically, *chapter 4* describes trends in the length of publication careers of U.S. PhD graduates since the 1950s. This is achieved by matching the names of a subset of PhDs (i.e., those with rare names) in astrophysics, chemistry, economics, genetics and psychology in the dissertation database ProQuest, to the database of scientific articles Web of Science. The ProQuest database is the highest quality database of doctoral dissertations, but high-quality coverage is limited to North America.

Finally, if career prospects have indeed worsened and employment conditions in academia have deteriorated, as much of the scientific literature on the topic suggests, it raises the question to what extent these issues do or do not affect those in the system. This leads to the third research question of this dissertation:

3. What are the effects of career prospects and employment conditions on early career researchers in the Netherlands?

This question focuses on the consequences of quantization for the researchers and on the effects of its associated uncertainty in the Netherlands, as high quality data collection on this topic was possible from our position. Moreover, the Netherlands has a standardized academic career system and quite uniform HRM policies in its universities (de Goede et al., 2013). The Netherlands also has the largest share of PhD graduates working outside higher education among the OECD countries (Auriol, Misu, & Freeman, 2013, p. 19), which means that there is a large diversity in the careers of early career researchers and probably also in their considerations when pursuing a career. Finally, and most importantly, Dutch universities uniformly produce good research – by most accounts, they are no elite universities but the research performed in all universities is of good quality. Therefore, by surveying a group of

recent PhDs from five Dutch universities encompassing all scientific disciplines, we are able to study the effects of career prospects and employment conditions in a representative group of PhDs from all Dutch universities. In contrast, if PhDs from the United States had been surveyed, the status and quality of the PhD-granting institutions would have varied much more if universities had been picked from the pool of all universities. More information could have been obtained on the consequences of quantization for PhDs from elite institutions, but also PhDs from institutions with much less status would have been studied, and this variability should have been taken into account. By surveying PhDs from Dutch universities, one obtains a better picture of the consequences of quantization for the group of good but perhaps not elite researchers – a group important for the knowledge economy (OECD, 1996).

The question is divided into sub-questions, by chapter. In section 1.5 we discussed that many factors influence the career preferences and actual employment of PhDs. However, whether their perception of career prospects is correlated with their sector of employment, is an unanswered question. This question is especially pressing in the case of recent PhD graduates, as they have changed jobs after completing their PhD.³ Therefore, the research question of *chapter 5* is:

a. How are career prospects in academia and other sectors perceived by recent PhDs from Dutch universities, and how is this perception related to their job choices?

Another key issue in academic careers are employment conditions. Temporary employment has long been prevalent in academia but is becoming increasingly common in other sectors, too. According to dual labor market theory, temporary jobs are “bad jobs” that are not only sub-par to permanent jobs with respect to employment conditions, but also have poorer job content. However, some subgroups, e.g., the young, and the highly educated, may be exempt from these negative effects. As recent PhDs are both highly educated and (often) young, they may be a case in point. On the other hand, postdoctoral researchers report high levels of career insecurity due to temporary employment (e.g., Höge, Brucculeri, & Iwanowa, 2012; van der Weijden et al., 2016). Almost by definition, though, postdoctoral researchers have a temporary contract and thus, such studies cannot determine the effect of temporary employment by comparison to a control group. To study the effect of temporary employment, we therefore included PhDs on several types of contracts in our study. *Chapter 6* assesses:

³ This is the case for most PhDs in the Netherlands. PhD candidates appointed by a university are employed on a fixed-term contract reserved for PhD candidates. Thereby, by definition they will have had to have changed jobs after PhD graduation. However, there is also a sizeable group of PhD candidates who are not appointed by a university: “external” PhD candidates. Among them are PhD candidates employed and paid by another organization. These PhD candidates may still have the same job after obtaining their PhD. Still, most PhD graduates will have changed jobs after obtaining the PhD.

b. What is the effect of temporary employment on the job satisfaction and personal lives of recent PhDs from Dutch universities?

Another issue in employment conditions concerns the type of appointment of PhD candidates. Among academics at U.S. universities, wage inequality was shown to decrease the job satisfaction of those earning below the median (Card, Mas, Moretti, & Saez, 2010). This raises the question what the effect of the labor market status of PhD candidates is on their PhD experience. In many countries PhD candidates are formally treated as students, but in the Netherlands, approximately half of the PhD candidates are employed by a university (European University Association, 2007, p. 29). Since the other half of PhD candidates in the Netherlands are *not* employed by a university, there is enough variation in labor market terms to analyze the effect of labor market status. Therefore, *chapter 7* investigates:

c. What is the effect of appointment type on the availability of research infrastructure, work pressure, stress, and career attitudes of PhD candidates at a Dutch university?

A third important issue is the mediating role of gender in the effect of career prospects and employment conditions on early career researchers. Many studies have looked into the role of gender *within* academia, for example in how it plays a role in job activities, academic promotion and scientific accomplishments (e.g., Bellas & Toutkoushian, 1999; Ceci & Williams, 2011; Kaminski & Geisler, 2012; Larivière, Vignola-Gagné, Villeneuve, Gélinas, & Gingras, 2011; Ward, 2001). In comparison, considerably less attention has been paid to gender differences within the group of all PhD graduates, including those *not* working in academia. This is regrettable, as it limits knowledge on gender differences within the highest educated group in society and may bias the picture. To fill this gap, *chapter 8* investigates:

d. What is the effect of gender on the type of employment, occupation, career perception and research performance of recent PhDs from Dutch universities?

Together, the answers to the research questions describe which issues are the most pressing in academic career policy, how the career system developed into the system that it is today, and what its effects are on publication careers, the job choice and job satisfaction of early career researchers.

1.8. References

- Arthur, M. B., Hall, D. T., & Lawrence, B. S. (1989). *Handbook of career theory*. Cambridge, United Kingdom: Cambridge University Press.
- Arthur, M. B., & Rousseau, D. M. (1996). *The boundaryless career: A new employment principle for a new organizational era*. Oxford, United Kingdom: Oxford University Press.
- Arthur, M. B., Khapova, S. N., & Wilderom, C. P. M. (2005). Career success in a boundaryless career world. *Journal of Organizational Behavior*, 26(2), 177-202. <http://dx.doi.org/10.1002/job.290>
- Auriol, L., Misu, M. & Freeman, R. A. (2013). *Careers of doctorate holders: Analysis of labour market and mobility indicators*. Paris, France: Organisation for Economic Co-operation and Development.
- Baruch, Y. (2004). Transforming careers: From linear to multidirectional career paths. *Career Development International*, 9(1), 58-73.
- Baruch, Y., & Hall, D. T. (2004). The academic career: A model for future careers in other sectors? *Journal of Vocational Behavior*, 64(2), 241-262. <http://dx.doi.org/10.1108/13620430410518147>
- Bellas, M. L., & Toutkoushian, R. K. (1999). Faculty time allocations and research productivity: Gender, race and family effects. *The Review of Higher Education*, 22(4), 367-390. <http://dx.doi.org/10.1353/rhe.1999.0014>
- Bender, K. A., & Heywood, J. S. (2006). Job satisfaction of the highly educated: The role of gender, academic tenure, and earnings. *Scottish Journal of Political Economy*, 53(2), 253-279. <http://dx.doi.org/10.1111/j.1467-9485.2006.00379.x>
- Bigliardi, B., Petroni, A., & Dormio, A. I. (2005). Organizational socialization, career aspirations and turnover intentions among design engineers. *Leadership & Organization Development Journal*, 26(6), 424-441. <http://dx.doi.org/10.1108/01437730510617645>
- Bloch, C., Krogh Graversen, E., & Skovgaard Pedersen, H. (2015). Researcher mobility and sector career choices among doctorate holders. *Research Evaluation*, 24(2), 171-80. <http://dx.doi.org/10.1093/reseval/rvv004>
- Boyer, E. L., Altbach, P. G., & Whitelaw, M. J. (1994). *The academic profession: An international perspective*. Stanford, CA: Carnegie Foundation for the Advancement of Teaching.
- Card, D., Mas, A., Moretti, E., & Saez, E. (2010). *Inequality at work: The effect of peer salaries on job satisfaction* (NBER Working Paper 16396). Cambridge, MA: National Bureau of Economic Research. Retrieved from <http://www.nber.org/papers/w16396.pdf>
- Ceci, S., & Williams, W. (2011). Understanding current causes of women's underrepresentation in science. *Proceedings of the National Academy of Science*, 108(8), 3157-3162. <http://dx.doi.org/10.1073/pnas.1014871108>
- Conti, A., & Visentin, F. (2015). A revealed preference analysis of PhD students' choices over employment outcomes. *Research Policy*, 44(10), 1931-1947. <http://dx.doi.org/10.1016/j.respol.2015.06.009>
- de Goede, M., Belder, R., & de Jonge, J. (2013). *Facts & figures: Academic careers in the Netherlands*. The Hague, the Netherlands: Rathenau Instituut.
- Di Paolo, A. (2016). (Endogenous) occupational choices and job satisfaction among recent Spanish PhD recipients. *International Journal of Manpower*, 37(3), 511-535. <http://dx.doi.org/10.1108/IJM-10-2014-0197>
- European Commission. (2006). *She figures 2006: Women and science statistics and indicators*. Luxembourg, Luxembourg: Office for Official Publications of the European Communities.
- European Commission. (2014). *Research and innovation as sources of renewed growth*. Brussels, Belgium: European Commission.
- European University Association. (2007). *Doctoral programmes in Europe's universities: Achievements and challenges*. Brussels, Belgium: European University Association.

- Fitzenberger, B., & Schulze, U. (2014). Up or out: Research incentives and career prospects of postdocs in Germany. *German Economic Review*, 15(2), 287-328. <http://dx.doi.org/10.1111/geer.12010>
- Fox, M. F., & Stephan, P. E. (2001). Careers of young scientists: Preferences, prospects and realities by gender and field. *Social Studies of Science*, 31(1), 109-122. <http://dx.doi.org/10.1177/030631201031001006>
- Fruijt, B., & Brok, W. (2007). *Tenure track een goed instrument voor talentmanagement? Inventarisatie van de risico's en kansen van 'tenure track' voor de werving, binding en loopbaanbegeleiding van wetenschappelijk talent op de Nederlandse universiteiten*. The Hague, the Netherlands: Vereniging van Nederlandse Universiteiten (VSNU).
- Gardner, S. K. (2007). "I heard it through the grapevine": Doctoral student socialization in chemistry and history. *Higher Education*, 54(5), 723-740. <http://dx.doi.org/10.1007/s10734-006-9020-x>
- Gemme, B., & Gingras, Y. (2012). Academic careers for graduate students: A strong attractor in a changed environment. *Higher Education*, 63(6), 667-683. <http://dx.doi.org/10.1007/s10734-011-9466-3>
- Hagstrom, W. O. (1965). *The scientific community*. New York, NY: Basic Books.
- Hall, D. T. (1976). *Careers in organizations*. Pacific Palisades, CA: Goodyear Publishing Company.
- Hall, D. T. (1986). Introduction: An overview of current career development theory, research, and practice. In R. A. Katzell (Ed.), *Frontiers of industrial and organizational psychology* (1-20). San Francisco, CA: Jossey-Bass.
- Hill, S., & Einaudi, P. (2010). Jump in fall 2008 enrollments of first-time, full-time S&E graduate students. *National Science Foundation InfoBrief* 10-320, June 2010. Arlington, VA: National Science Foundation, Division of Science Resources Statistics.
- Höge, T., Brucculeri, A., & Iwanova, A. N. (2012). Karriereunsicherheit, Zielkonflikte und Wohlbefinden bei Nachwuchswissenschaftlerinnen und -wissenschaftlern. *Zeitschrift für Arbeits- und Organisationspsychologie*, 56(4), 159-172. <http://dx.doi.org/10.1026/0932-4089/a000088>
- Huisman, J., de Weert, E., & Bartelse, J. (2002). Academic careers from a European perspective: The declining desirability of the faculty position. *Journal of Higher Education*, 73(1), 141-160. <http://dx.doi.org/10.1353/jhe.2002.0007>
- Indentured labour. (2007). *Nature*, 448(7156), 839-840. <http://dx.doi.org/10.1038/448839b>
- Ioannidis, J. P. A., Boyack, K. W., & Klavans, R. (2014). Estimates of the continuously publishing core in the scientific workforce. *PLoS ONE*, 9(7), e101698. <http://dx.doi.org/10.1371/journal.pone.0101698>
- Kaminski, D., & Geisler, C. (2012). Survival analysis of faculty in science and engineering by gender. *Science*, 335(6070), 864-866. <http://dx.doi.org/10.1126/science.1214844>
- Kifle, T., & Desta, I. H. (2012). Gender differences in domains of job satisfaction: Evidence from doctoral graduates from Australian universities. *Economic Analysis and Policy*, 42(3), 319-338. [http://dx.doi.org/10.1016/S0313-5926\(12\)50032-9](http://dx.doi.org/10.1016/S0313-5926(12)50032-9)
- Konsortium Bundesbericht Wissenschaftlicher Nachwuchs. (2013). *Bundesbericht Wissenschaftlicher Nachwuchs 2013: Statistische Daten und Forschungsbefunde zu Promovierenden und Promovierten in Deutschland*. Bielefeld, Germany: W. Bertelsmann Verlag.
- Kreckel, R., Burkhardt, A., Lenhardt, G., Pasternack, P., & Stock, M. (2008). *Zwischen Promotion und Professur: das wissenschaftliche Personal in Deutschland im Vergleich mit Frankreich, Großbritannien, USA, Schweden, den Niederlanden, Österreich und der Schweiz*. Leipzig, Germany: Akademische Verlagsanstalt.
- Kuiper, R. (2014, September 2). Zorg in de universitaire wereld: de wetenschapper als flexwerker. *NRC Handelsblad*.
- Lacy, F. J., & Sheehan, B. A. (1997). Job satisfaction among academic staff: An international perspective. *Higher Education*, 34(3), 305-322. <http://dx.doi.org/10.1023/A:1003019822147>
- Larivière, V. (2012). On the shoulders of students? The contribution of PhD students to the advancement of knowledge. *Scientometrics*, 90(2), 463-481. <http://dx.doi.org/10.1007/s11192-011-0495-6>

- Larivière, V., Vignola-Gagné, E., Villeneuve, C., Gélinas, P., & Gingras, Y. (2011). Sex differences in research funding, productivity and impact: an analysis of Québec university professors. *Scientometrics*, 87(3), 483-498. <http://dx.doi.org/10.1007/s11192-011-0369-y>
- Locke, E. A. (1969). What is job satisfaction? *Organizational Behavior and Human Performance*, 4(4), 309-336. [http://dx.doi.org/10.1016/0030-5073\(69\)90013-0](http://dx.doi.org/10.1016/0030-5073(69)90013-0)
- Maltese, A. V., Melki, C. S., & Wiebke, H. L. (2014). The nature of experiences responsible for the generation and maintenance of interest in STEM. *Science Education*, 98(6), 937-962. <http://dx.doi.org/10.1002/sce.21132>
- Moguéro, P. (2002). *Job satisfaction among US Ph.D. graduates: the effects of gender and employment sector*. Labor and Demography 0204002, EconWPA.
- Op de universiteit stikt het van de flexwerkers. (2013, September 20). *NRC Handelsblad*.
- Organisation for Economic Co-operation and Development (1996). *The knowledge-based economy*. Paris, France: OECD.
- Piltz, C. (2015, August 18). Wissenschaftliche Mitarbeiter: Nach zwölf Jahren kommt das Nichts. *Der Spiegel*.
- Powell, K. (2015). The future of the postdoc. *Nature*, 520(7546), 144-147. <http://dx.doi.org/10.1038/520144a>
- Puljak, L., & Sharif, W. D. (2009). Postdocs' perceptions of work environment and career prospects at a US academic institution. *Research Evaluation*, 18(5): 411-415. <http://dx.doi.org/10.3152/095820209X483064>
- Roach, M., & Sauermann, H. (2010). A taste for science? PhD scientists' academic orientation and self-selection into research careers in industry. *Research Policy*, 39(3), 422-434. <http://dx.doi.org/10.1016/j.respol.2010.01.004>
- Rousseau, D. M. (1995). *Psychological contracts in organizations*. Thousand Oaks, CA: SAGE Publications.
- Sauermann, H., & Roach, M. (2012). Science PhD career preferences: Levels, changes, and advisor encouragement. *PLoS ONE*, 7(5), e36307. <http://dx.doi.org/10.1371/journal.pone.0036307>
- Schuster, J. H., & Finkelstein, M. J. (2006). *The American faculty: The restructuring of academic work and careers*. Baltimore, MD: The Johns Hopkins University Press.
- Stephan, P. E. (2012). *How economics shapes science*. Cambridge, MA: Harvard University Press.
- The disposable academic. (2010, December 16). *The Economist*. Retrieved from <http://www.economist.com/node/17723223>
- Thunnissen, M. A. G. (2015). *Talent management in academia: An exploratory study in Dutch universities using a multi-dimensional approach* (Doctoral dissertation). Retrieved from Utrecht University Repository. (<http://dspace.library.uu.nl/handle/1874/303800>)
- Tsui, A. S., Pearce, J. L., Porter, L. W., & Tripoli, A. M. (1997). Alternative approaches to the employee-organization relationship: Does investment in employees pay off? *Academy of Management Journal*, 40(5), 1089-1121. <http://dx.doi.org/10.2307/256928>
- Tsui, A., & Wang, D. (2002). Employment relationships from the employer's perspective: current research and future directions. In C. L. Cooper, & I. T. Robertson (Eds.), *International Review of Industrial and Organizational Psychology* (77-114). Hoboken, NJ: John Wiley & Sons Ltd.
- Turner, C. S. V., & Thompson, J. R. (1993). Socializing women doctoral students: Minority and majority experiences. *The Review of Higher Education*, 16(3), 355-370.
- van Arensbergen, P. (2014). *Talent proof: Selection processes in research funding and careers* (Doctoral dissertation). Retrieved from Radboud Repository. (<http://hdl.handle.net/2066/130435>)
- van Calmthout, M. (2016, July 9). Het weekblad dat wetenschappelijke carrières kan breken: De power van Nature. *Volkskrant*. Retrieved from <http://www.volkskrant.nl/wetenschap/het-weekblad-dat-wetenschappelijke-carrieres-kan-breken~a4336129/>

- van der Weijden, I., Teelken, C., de Boer, M., & Drost, M. (2016). Career satisfaction of postdoctoral researchers in relation to their expectations for the future. *Higher Education*, 72(1), 25-40. <http://dx.doi.org/10.1007/s10734-015-9936-0>
- van Vucht Tijssen (2000). *Talent voor de toekomst, toekomst voor talent: Plan van aanpak voor het wetenschapspersoneelsbeleid*. The Hague, the Netherlands: Ministerie van Onderwijs, Cultuur & Wetenschap/Vereniging van Nederlandse Universiteiten.
- Vazifehdust, H., & Khosrozadeh, S. (2014). The effect of the organizational socialization on organizational commitment and turnover intention with regard to moderate effect of career aspirations intention. *Management Science Letters*, 4(2), 277-286. <http://dx.doi.org/10.5267/j.msl.2013.12.027>
- Vereniging van Nederlandse Universiteiten. (2015a). *Feiten & cijfers personeel: Verhouding vast en tijdelijk personeel*. Retrieved November 2, 2015, from http://www.vsnu.nl/f_c_verhouding_vast_tijdelijk.html
- Vereniging van Nederlandse Universiteiten. (2015b). *Feiten & cijfers personeel: Downloadbare tabellen personeel*. Retrieved November 2, 2015, from http://www.vsnu.nl/f_c_personeel_downloads.html
- Ward, M. E. (2001). Gender and promotion in the academic profession. *Scottish Journal of Political Economy*, 48(3), 283-302. <http://dx.doi.org/10.1111/1467-9485.00199>

