

The Future of PhD Holders

#1

THEMATIC
REPORT
June 2019

Employment status of PhD holders in the Federation Wallonia-Brussels



With the support of the





Observatory of Research and Scientific Careers - F.R.S.-FNRS

Thanks to funding from the Federation Wallonia-Brussels (FWB), the Observatory of Research and Scientific Careers was created in September 2018. Integrated in the F.R.S.-FNRS, this structure aims, among other things, to track and analyse the careers of researchers in the FWB through surveys and data cross-referencing. In collaboration with the six FWB universities, the Observatory is responsible for developing knowledge on the doctoral and postdoctoral process. It makes recommendations to facilitate the professional transition of PhD holders and optimise the doctoral process in order to meet the expectations of researchers and society. Particular attention is paid to the various obstacles to a scientific career: stereotypes and discrimination related to gender, constraints related to the requirement of international mobility, impact of the pressure to publish early in one's career, etc. The results of surveys and analyses are systematically published on the site: <http://www.observatoire.frs-fnrs.be>

The team of the Observatory of Research and Scientific Careers- F.R.S.-FNRS

Neda Bebiroglu, PhD
Scientific Consultant

Baptiste Dethier, PhD
Scientific Consultant

Christel Ameryckx, MA
Administrative Manager

To cite this report:

Bebiroglu, N., Dethier, B., & Ameryckx, C. (May, 2019). Employment status of PhD holders in the Federation Wallonia-Brussels. ORCS Thematic Report Series #1, Observatory of Research and Scientific Careers, Brussels, Belgium.

Corresponding author: neda.bebiroglu@frs-fnrs.be

Contact data: Observatory of Research and Scientific Careers- F.R.S.-FNRS

Rue d'Egmont 5, 1000 Brussels

02/504.93.69

www.observatoire.frs-fnrs.be



Executive Summary

The past few decades have witnessed a significant growth in the number of doctoral candidates as well as doctoral degrees awarded. For instance, the number of PhD holders in OECD countries increased from 158,000 in 2000 to 247,000 in 2012, an increase of 56% (OECD, 2014). Since this increase was not matched by an increase in the number of available permanent academic positions, many PhD holders either found themselves in increasingly longer periods of postdoctoral training or entered the non-academic labour market.

Comprehensive survey data for PhD holders are not systematically collected in the Federation Wallonia-Brussels. To address this gap, the Observatory of Research and Scientific Careers conducted a survey entitled the "Future of PhD Holders", specifically targeting the job transition of PhD holders from all six French-speaking universities of Belgium. 2,065 PhD holders completed this questionnaire. The primary aim of this report is to describe the employment status of PhD holders at the time of the survey.

- **New job after doctoral completion.** A large majority of PhD holders find a new job within four months of obtaining their doctoral degree. However, very few find their new job through professional career services that exist within universities such as career guidance services or outside universities such as aid in the creation and development of enterprises or public employment services (FOREM, ACTIRIS, VDAB).
- **Employment status.** PhD holders have a high rate of employment: a majority (79.6%) are employed full-time, 9.1% are employed part-time, and 7.2% are self-employed. These high employment rates, however, may mask relatively precarious employment conditions since only 60.7% of those employed have permanent contracts. Importantly, about half of those who are self-employed full-time choose to be self-employed because they cannot find a salaried position that is satisfying.
- **Sector of employment.** The university sector remains the main employment sector for PhD holders regardless of their research field. Other important sectors of employment are industry and the government/public sector. There are differences related to research field. Compared to other research fields, a higher proportion of PhD holders in Social Sciences and Humanities work at universities and a very small proportion in industry.
- **Unemployment rate.** The overall unemployment rate in our sample is 3.8%, which is lower than the national average in 2018 (6.2%) and comparable to international surveys on PhD holders.
- **Pursuing an academic career.** Those who completed their doctoral degree between 2016 and 2018 are less likely to pursue an academic career the first year after doctoral completion compared to PhD holders who completed their degree between 2012 and 2015. In addition, regardless of the year the doctorate is awarded, the proportion of PhD holders who pursue an academic career decreases over time. The two main reasons to pursue an academic career are a "passion for research" and the "creative and innovative nature of activities". The two main reasons not to pursue an academic career are "very few job offers or no job offers at all in the academic sector" and the "wish to do more applied work in the real world". 55.8% of those who did not pursue an academic career in 2018 said they would have liked to have an academic job if they had had the opportunity. This suggests that for a large majority the choice of a non-academic career is a forced choice or a plan B. In addition, mobility experiences after PhD, research field, number of publications, and the perceived positivity of the immediate work environment during the PhD training are all related to the probability of pursuing an academic career



two years after doctoral completion. PhD holders in Social Sciences and Humanities and Life and Health Sciences, compared to PhD holders in Exact and Natural Sciences, are more likely to pursue an academic career two years after doctoral completion.

- **Type of contract.** The type of contract PhD holders have depends on their sector of employment. Universities offer the highest rate of temporary contracts. In addition, those who work in education outside of higher education have the highest rate of interim contracts. Temporary and interim contracts are signed owing to a lack of opportunities rather than by personal choice. Seniority, having children, working in the private sector and having a doctoral dissertation that involves a collaboration with private or public sector entities are linked to the probability of having a permanent contract.
- **Number of contracts.** The average number of contracts PhD holders sign increases more steeply in the first three years following doctoral completion. We infer that the first three years after the doctoral degree is awarded are more unstable, with frequent job changes or multiple jobs combined simultaneously.

The results of our first thematic report highlight the importance of understanding the academic and non-academic career choices of PhD holders in the FWB and their employability. We will continue to publish similar reports based on an analysis of the data collected through the “Future of PhD Holders” survey.



1. INTRODUCTION

Since the development of a *knowledge economy*¹ in the 1960s, in all the major economies of the world, a priority for policy makers has been to support policies that increase investment in higher education, research, and technology (Powell & Snellman, 2004). Given that a knowledge economy requires a highly qualified labour force, the past few decades have witnessed a significant growth in the number of doctoral candidates as well as doctoral degrees awarded (Gokhberg, Shmatko, & Auriol, 2016). For instance, the number of PhD holders in OECD countries increased from 158,000 in 2000 to 247,000 in 2012, an increase of 56% (OECD, 2014).

When we look specifically at the number of doctoral degrees awarded between 2000 and 2016 in the Federation Wallonia-Brussels (FWB), we see a clear increase, from 568 doctoral degrees awarded in the academic year 2000-2001 to 900 doctoral degrees awarded in 2015-2016, an annual growth rate of 3.3% (Figure 1). However, as observed in many parts of the world, this increase in the number of PhD holders in the FWB was not matched by an increase in the number of available permanent academic positions. For instance, in the last five years the number of full-time permanent academic and scientific positions that were opened in all the French-speaking universities in Belgium ranged from 68.5 to 90.6, with an average of 80.9 positions per year² (Figure 2). Therefore, many PhD holders either found themselves in increasingly longer periods of postdoctoral training waiting mostly unsuccessfully for a tenured academic position or entered the non-academic labour market. This trend is repeated worldwide (Hayter & Parker, 2019; Teelken & van der Weijden, 2018).

¹ The idea that knowledge-intensive activities and technology production are the leading drivers of economic development.

² We received these data from administrations of the six FWB universities in February 2019 through personal communication.



Figure 1. Number of doctoral and master's degrees awarded by the universities in the FWB, academic year 2000-2016

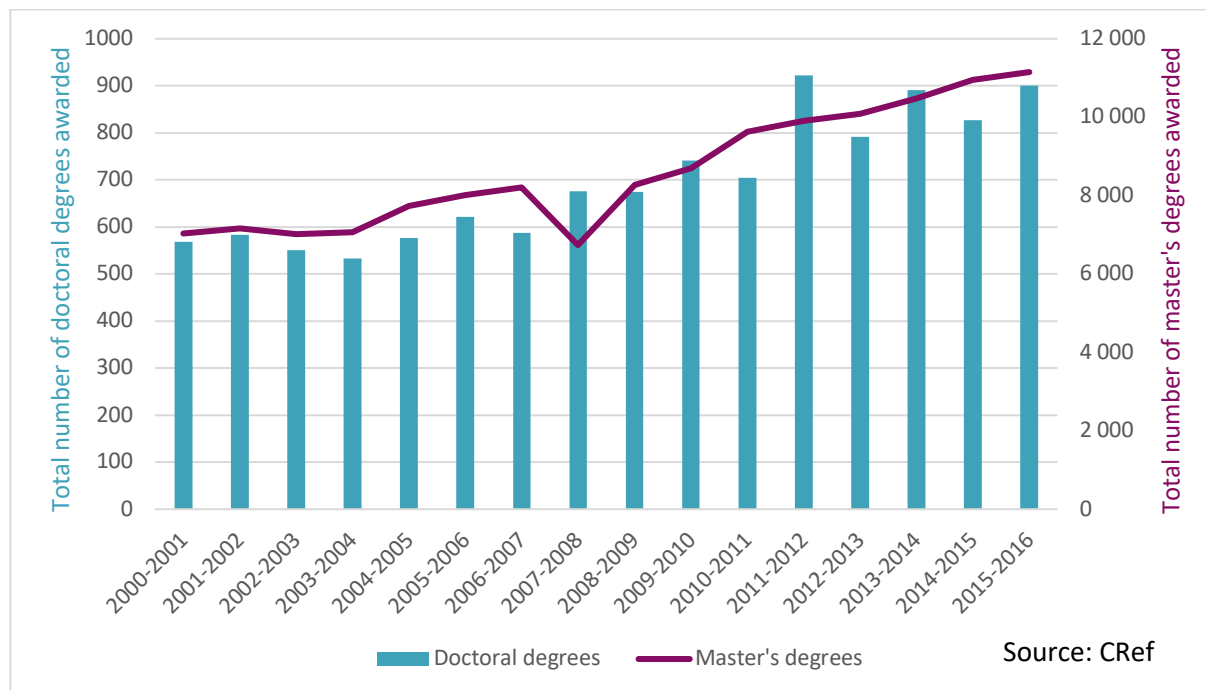
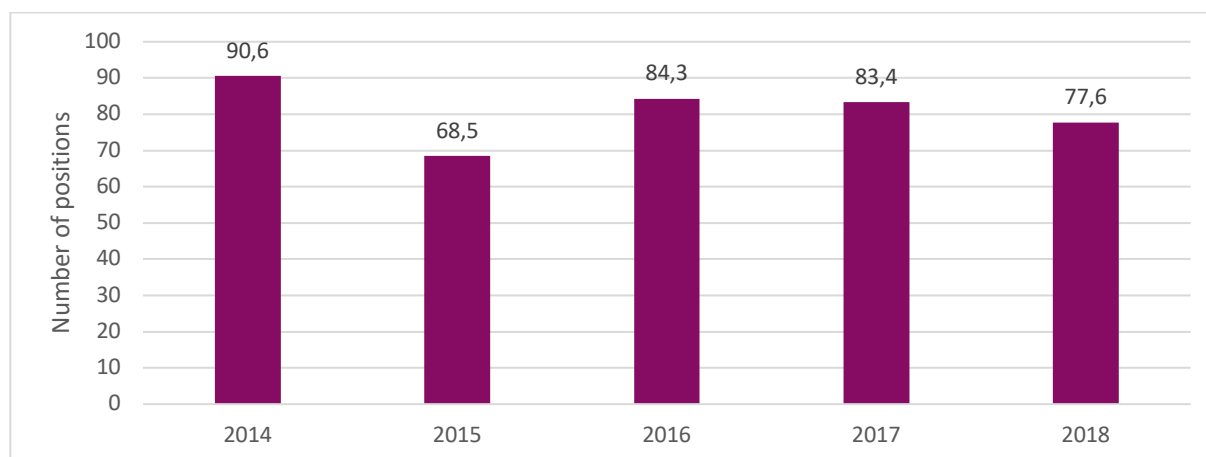


Figure 2. Estimation of available permanent academic and scientific positions in the FWB- Full-time equivalence, excluding administrative staff and researchers on permanent contracts granted by professors who have external budgets



Comprehensive survey data for PhD holders are not systematically collected in the FWB. To address this gap, the Observatory of Research and Scientific Careers conducted a survey entitled the “Future of PhD Holders” specifically targeting the job transition of PhD holders from all six French-speaking universities of Belgium. Our goal was to capture an informative snapshot of the employment status of PhD holders early in their career, coming from different research fields, working in a variety of different sectors, and with a range of professional experiences. Our survey included a high diversity of topics such as doctoral training experience, transition to employment, current career, job satisfaction, and mobility experiences.

Based on online dissertation databases of the FWB universities (e.g., BICTel), we generated a list of 4,918 doctoral dissertations that were successfully defended between



January 2012 and May 2018 from the six French-speaking universities³. We then identified 2,046 primary or secondary doctoral supervisors and asked them to transfer an invitation to their former doctoral students. The invitation to participate included a short description of the study, eligibility criteria for participation (i.e., to have completed a PhD between January 2012 and May 2018), and a hyperlink to the survey, which directed participants to SurveyGizmo, a secure online data collection software. Doctoral supervisors received two reminders to send the link to their former students and PhD holders received two reminders directly from their own universities. The survey was open from the 11th of December 2018 to the 31st of January 2019. Participation was voluntary and anonymous. All participants provided consent after receiving information about the study.

Participants' data were automatically downloaded into a database. Statistical analyses were conducted using IBM SPSS 24.0. Details about these analyses can be found in the Appendix.

The primary aim of this report is to describe the employment status of PhD holders at the time of the survey. We will first provide information about the characteristics of the sample who completed the "Future of PhD Holders" survey. We will then detail the professional status of PhD holders (new job after doctoral degree, number of contracts, employment status, unemployment rate, sector of employment, pursuing an academic career, and type of contract). We will finish this report by summarising the main conclusions.

³ This list was created from accessible data, the actual number of doctoral dissertations that were defended within this time frame in the FWB is probably higher.



2. SAMPLE CHARACTERISTICS

2,065 participants from all six French-speaking universities in Belgium completed the questionnaire. If we consider that all 4,918 of PhD holders identified received an invitation to participate in our survey, this equates to an overall response rate of 42.0%, which ranges from 26.1% to 51.3% depending on the university⁴. The dropout rate is only 5.2%, which indicates that 94.8 % of those who answered the first question went on to complete the questionnaire.

To ensure the validity of conclusions inferred from survey data, many researchers recommend including attention-check questions (e.g. Berinsky, Margolis, & Sances, 2014). Therefore, we inserted three questions in the survey to test participant attention. Ten participants failed all three attention-check questions and were not included in the final sample. Thus, the analysis of the current report is based on 2,055 participants (42.8% female, $n = 878$)⁵. Respondents had a mean age of 35.2 years ($SD = 6.3$) ranging from 26 to 68. The mean age at the beginning of PhD was 27.0 years ($SD = 5.6$) and at completion it was 32.1 years ($SD = 5.9$).

Although 85 nationalities were represented among PhD holders, most participants (64.9%, $n = 1,334$) were of Belgian nationality and indicated Belgium (75.3%, $n = 1,547$) as the country where they obtained their master's degree. 38.8% ($n = 710$) indicated that they were working outside of Belgium at the time of the survey (Figure 3)⁶. 65.6% of those working outside of Belgium were of foreign nationality. Among 1,118 PhD holders working in Belgium, 61.7% ($n = 690$) worked in Wallonia, 32.2% ($n = 360$) in Brussels and 6.1% ($n = 68$) in Flanders. Figure 4 demonstrates that a large majority of PhD holders of Belgian nationality choose Belgium as their country of work⁷.

⁴ This rate is just an estimation, however, since we cannot know the exact number of PhD holders contacted by their supervisors. If we consider that all PhD holders who completed their doctoral degree between January 2012 and May 2018 received an invitation to participate, this equates to an overall response rate of 35.0%.

⁵ The participants had the option of selecting "other" as their gender category. Participants who chose other ($n = 4$) were not included in statistical models where gender was used as a variable.

⁶ 1,828 out of the 2,055 people solicited answered the questions about mobility, which were situated at the end of the questionnaire.

⁷ In Figure 4, we only included countries that had minimum 10 PhD holders.



Figure 3. Country of work for PhD holders working outside of Belgium at the time of the survey (proportion logarithmic scale)

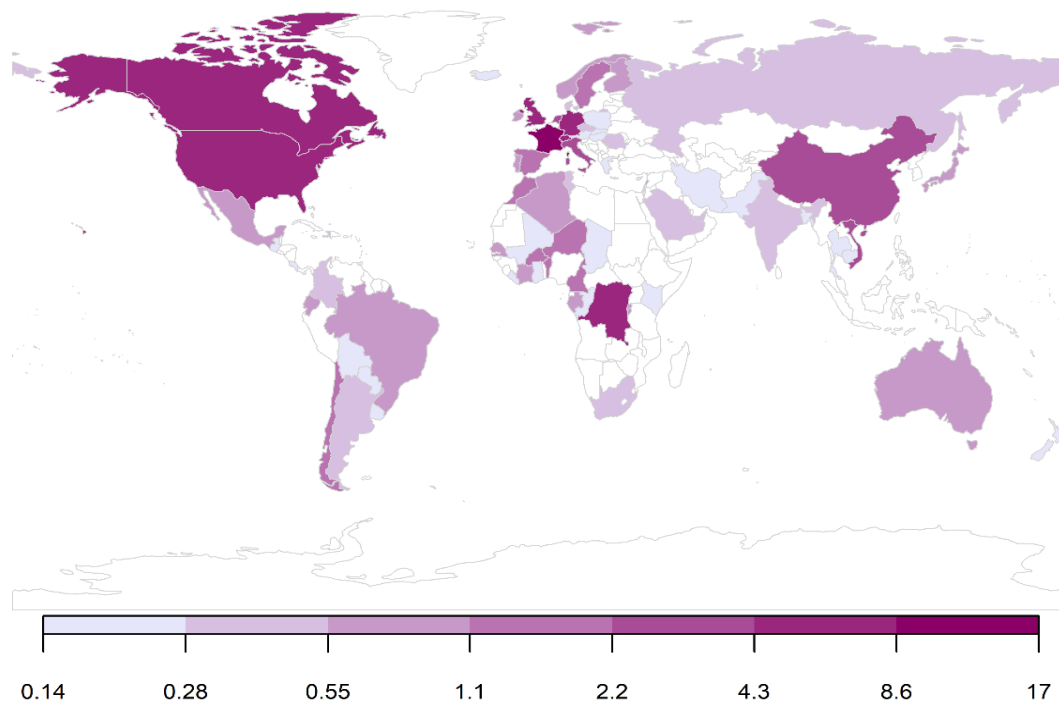
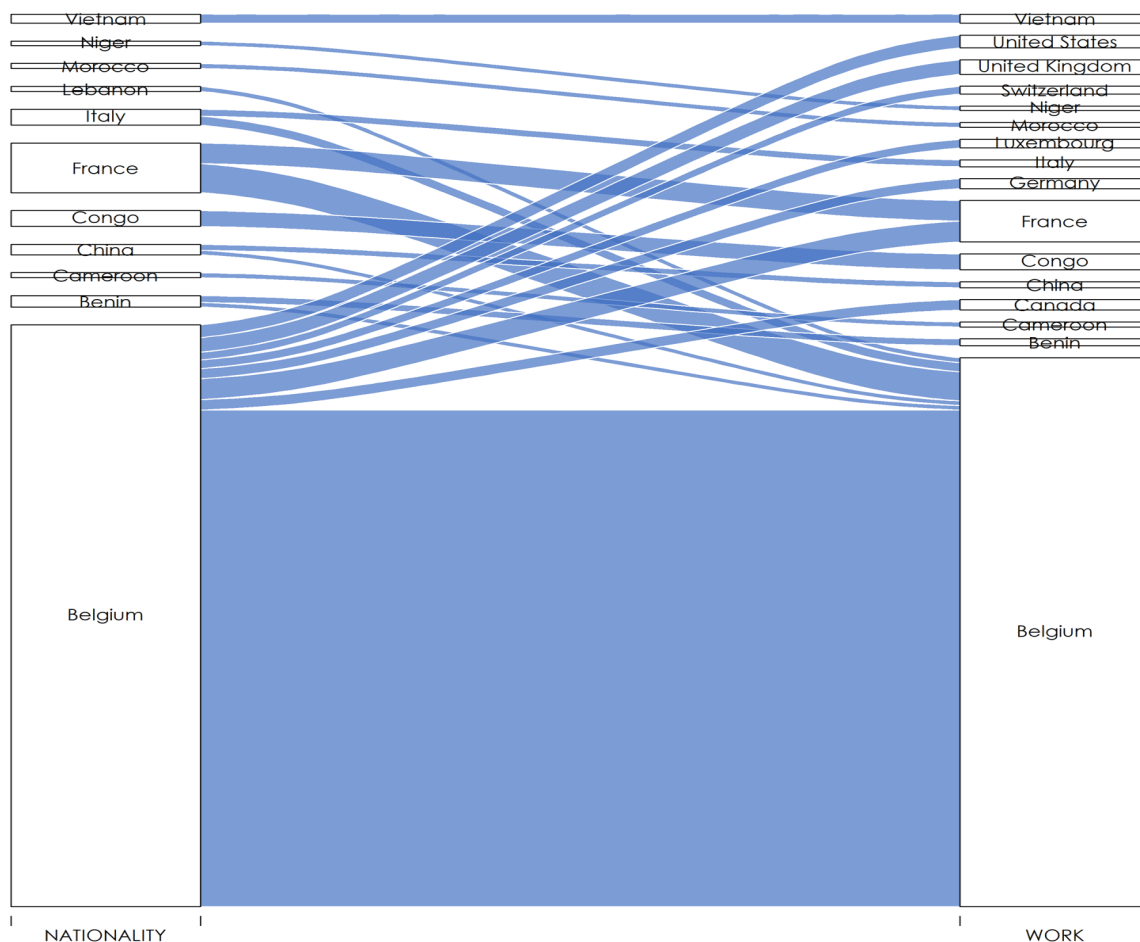


Figure 4. Flow between the nationality and the country of work of PhD holders at the time of the survey



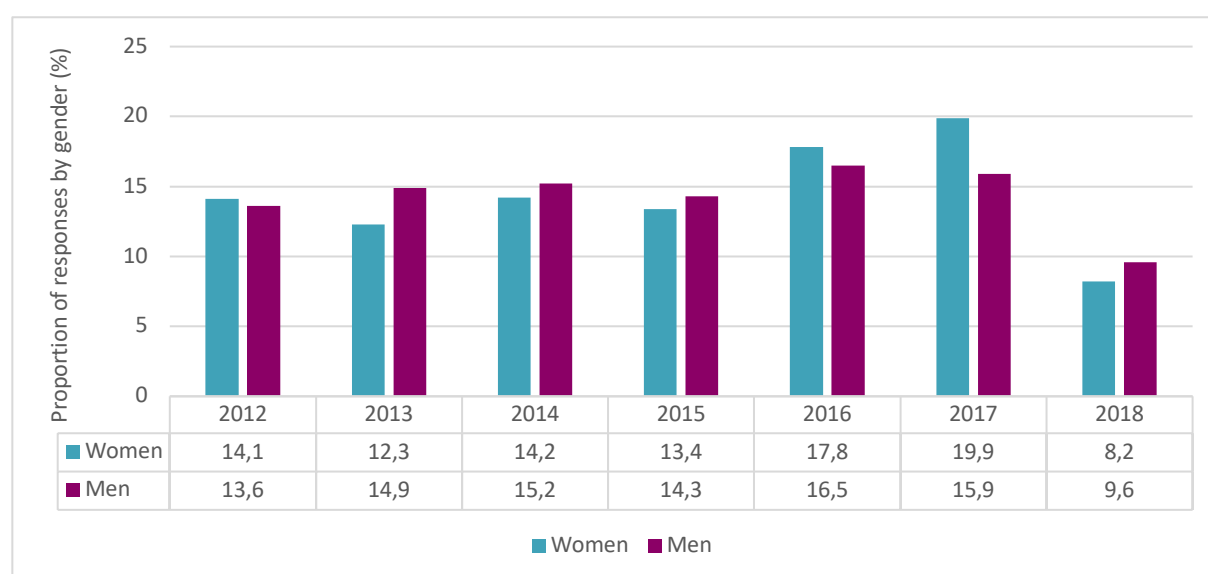


65.3% ($n = 1,342$, 42.9% female) were either married or legally cohabiting at the time of the survey. 52.1% ($n = 1,071$, 43.1% female) reported having children: 38.7% of respondents had only one child, 43.3% had two children and 18.0% had three or more.

On average, the length of doctoral completion was 5.1 years ($SD = 1.6$). The average length varied between research fields: 4.9 years ($SD = 0.4$) for Exact and Natural Sciences (ENS), 5.2 years ($SD = 0.8$) for Life and Health Sciences (LHS) and 5.3 years ($SD = 0.7$) for Social Sciences and Humanities (SSH).

We targeted researchers at an early stage in their career. Respondents had completed their doctoral degree in the last 3.1 years ($SD = 1.9$) (using 2018 as the reference year) and were almost equally distributed as to the year the doctoral degree was awarded (Figure 5).

Figure 5. Distribution of the sample by the year the doctoral degree was awarded



Most respondents (45.8%, $n = 941$) had their PhD in ENS, whereas 31.0% ($n = 638$) in SSH and 23.2% ($n = 476$) in LHS⁸. We see clear imbalances in the gender distribution of research fields (Figure 6). When we specifically look at the areas of study⁹, engineering sciences and technology has the highest gender imbalance, followed by psychology and educational sciences (Figure 7).

⁸With respect to the proportion of research fields observed in the population of doctorate graduates between January 2012 and September 2016, which equates to 50.6% of PhD holders in ENS, 29.3% in HSS, and 20.09% in LSH (CRef), in our sample, we have a lower representation of PhD holders in ENS and a higher representation of PhD holders in HSS and LSH.

⁹In order to categorise the areas of study we used « Décret de la Communauté française du 31 mars 2004 définissant l'enseignement supérieur, favorisant son intégration dans l'espace européen de l'enseignement supérieur et refinançant les universités » URL : https://www.gallilex.cfwb.be/document/pdf/28769_017.pdf



Figure 6. Gender distribution of the sample by research field

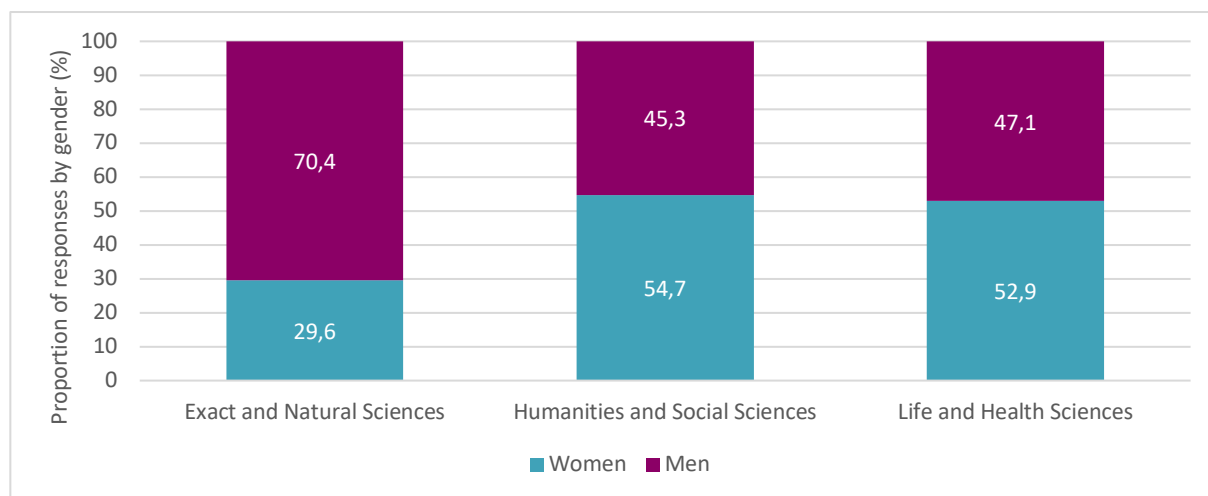
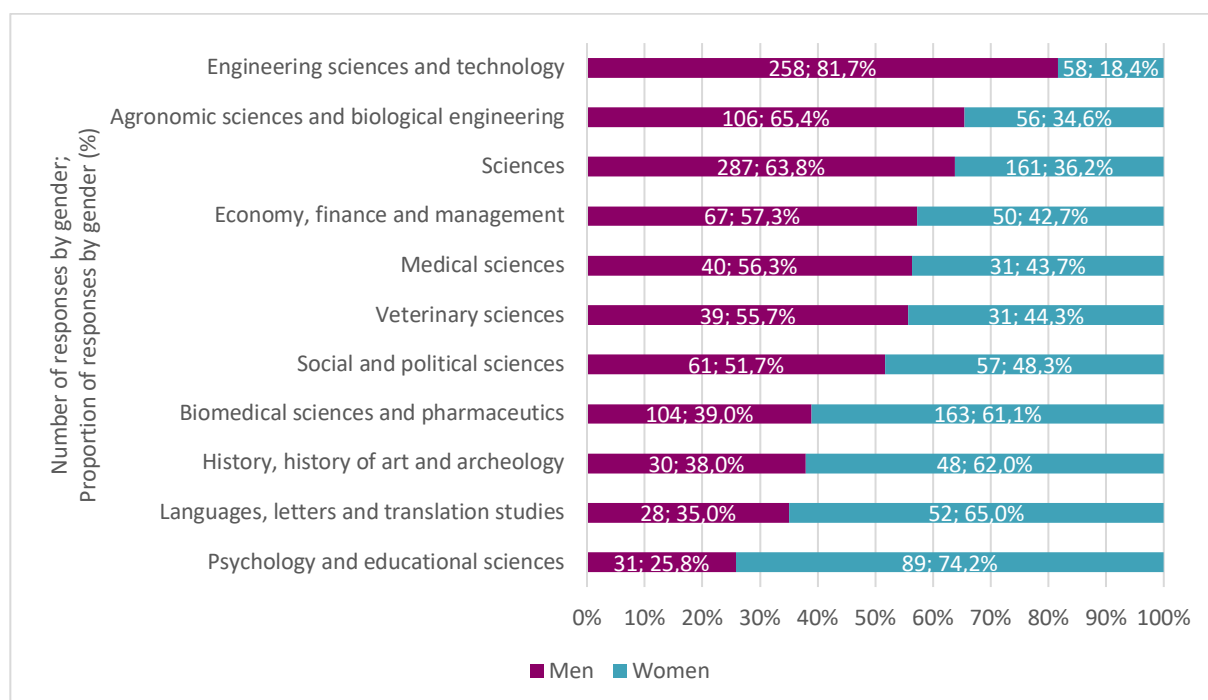


Figure 7. Gender distribution of the sample by the area of study



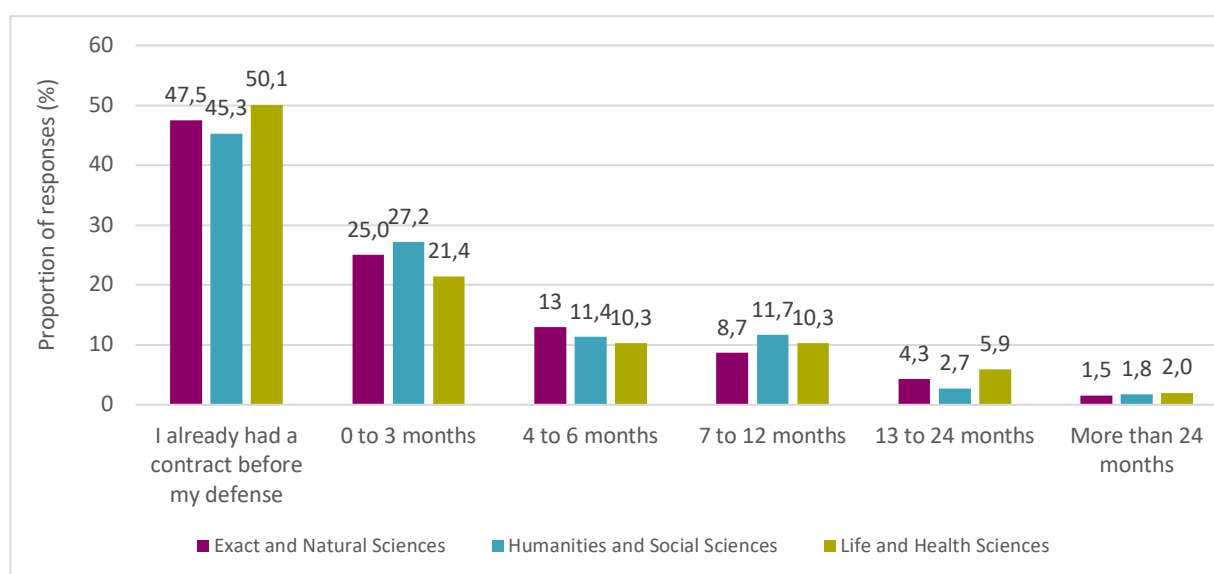


3. EMPLOYMENT STATUS OF PHD HOLDERS

3.1 New job after doctoral completion

We asked PhD holders who signed at least one contract how long it took them to find a job after they completed their doctorate. It would appear that finding a new job is fast for PhD holders since for 72.2% ($n = 1,317$) the job search lasted less than 4 months. Interestingly, almost half of the sample (47.4%, $n = 864$) had secured a contract before completing their degree. However, for 15.9% ($n = 289$), the job search lasted more than 7 months. The length of time it takes to find a new job after the doctoral degree does not significantly differ by research field (Figure 8).

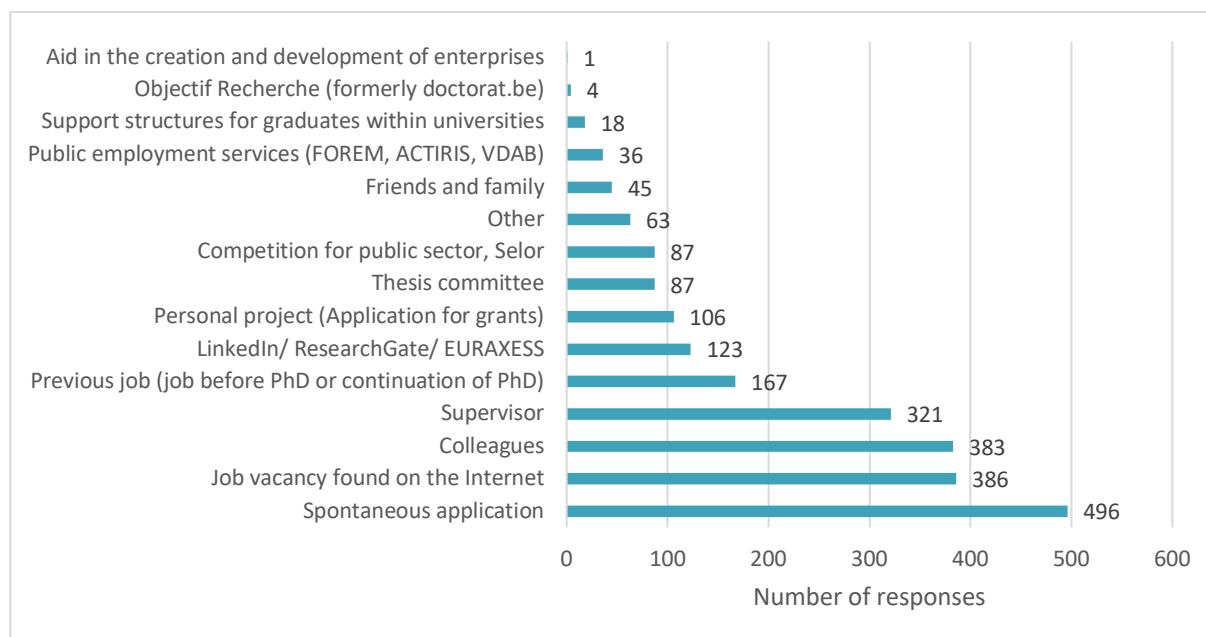
Figure 8. Length of time to find a new job after doctoral completion by research field



When we asked respondents how they found their new job, we see that to a large extent PhD holders rely on spontaneous applications and their colleagues, followed by job vacancies found on the Internet (Figure 9). 16.3% ($n = 321$) of PhD holders credit their supervisor with helping them secure a job after obtaining their doctoral degree. It seems that only a few PhD holders find their new job through professional services that exist within universities such as career guidance services, or outside universities such as services concerned with the creation and development of businesses and public employment, e.g., FOREM, ACTIRIS, VDAB. We cannot say whether this is because they do not use these services or because despite using them, they cannot get the specialised help they need to find a new job.



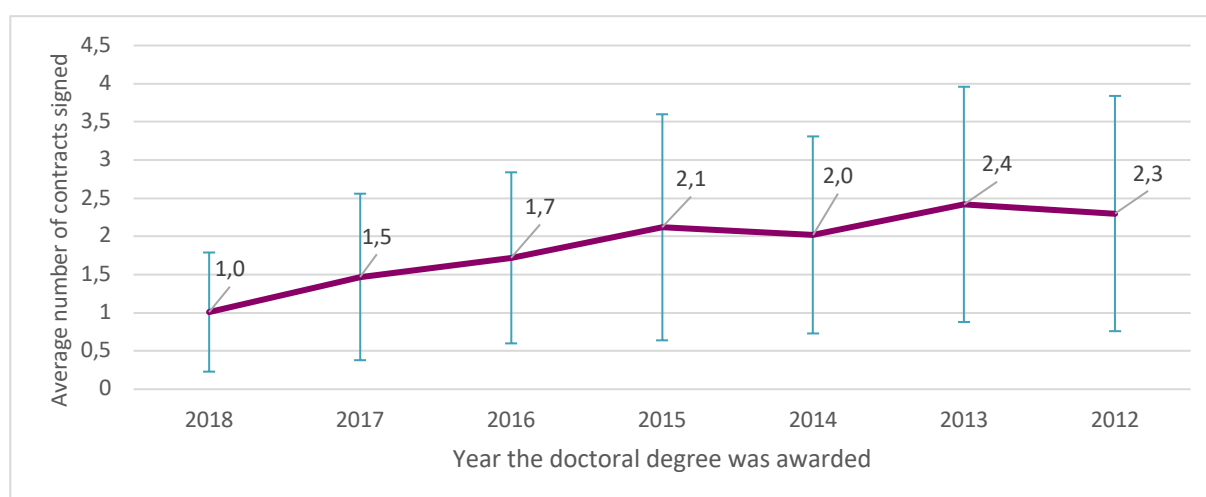
Figure 9. How did you find your new job?



3.2 Number of contracts

Looking at respondents' total number of contracts, we realise that the average number of contracts PhD holders sign increases more steeply in the first three years following doctoral completion (Figure 10). The increase is less pronounced after year four. This may indicate that the first three years after doctoral completion are more unstable, with frequent job changes or multiple jobs combined simultaneously. It is nevertheless important to keep in mind that there is variance between respondents, as indicated by the standard deviations in the graph.

Figure 10. Average number of contracts signed since doctoral completion. The error bar represents standard deviations.

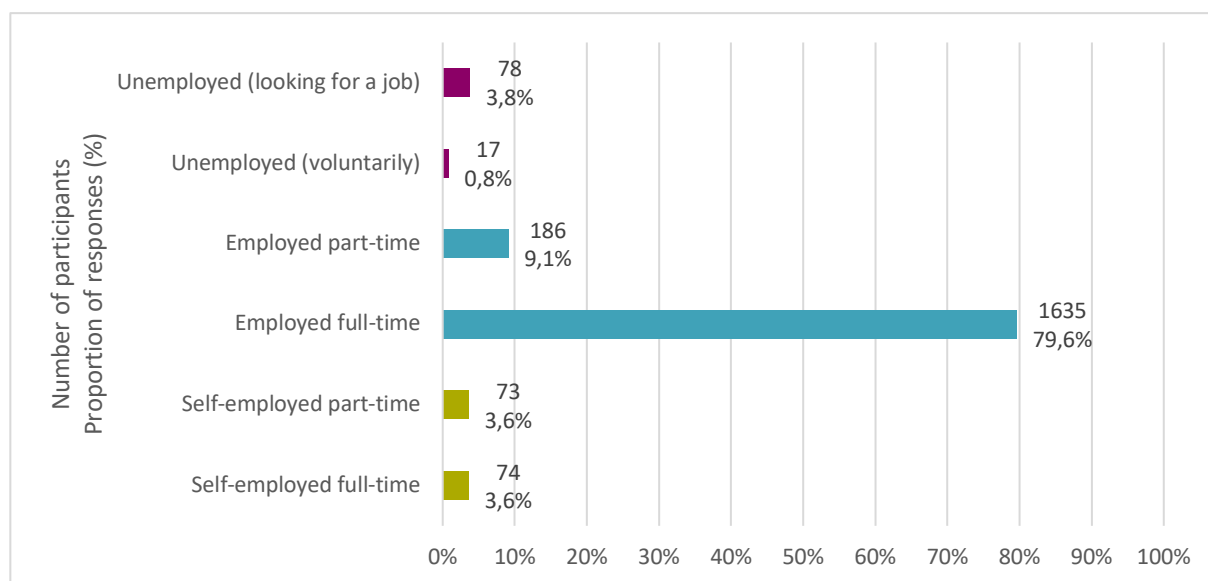




3.3 Employment status

Our findings point to high rates of employment of PhD holders in our sample at the time of the survey: a majority (79.6%) reported being employed full-time, 9.1% were employed part-time, and 7.2% were self-employed (Figure 11). 77.8% of those who were employed part-time worked 50% or more compared to a full-time position. For this question, PhD holders had the option of choosing more than one employment status. Of the 186 respondents who selected “employed part-time”, 30 were combining their part-time employment with being self-employed part-time and 9 with full-time. 28 respondents were employed full-time and simultaneously self-employed part-time. 13 people chose the category “Other”.

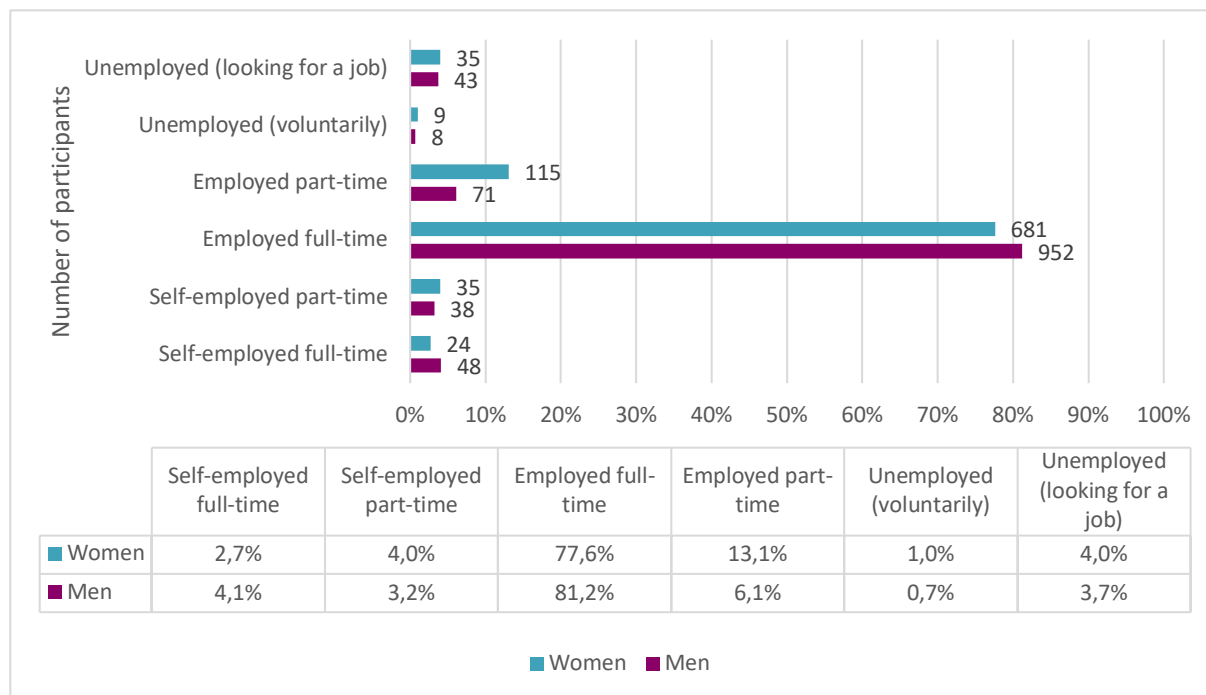
Figure 11. Employment status of PhD holders



When we look at the percentage of women who are employed full-time (Figure 12), we realise that the rate in our sample (77.6%) is higher than the national average of 55.8% (STATBEL, 2018). However, women in our sample, compared to men, are more likely to work part-time (Wald χ^2 (1) = 28.89, $p < .001$; OR = 2.34, [CI = 1.72-3.19]) and less likely to work full-time (Wald χ^2 (1) = 22.32, $p < .001$; OR = .52, [CI = .40-.68]).



Figure 12. Employment status of PhD holders by gender



We have a low percentage of self-employed workers in our sample. Importantly, when we asked the full-time self-employed why they chose to be self-employed, 47.1% answered that it was because they could not find a salaried position that was satisfying.

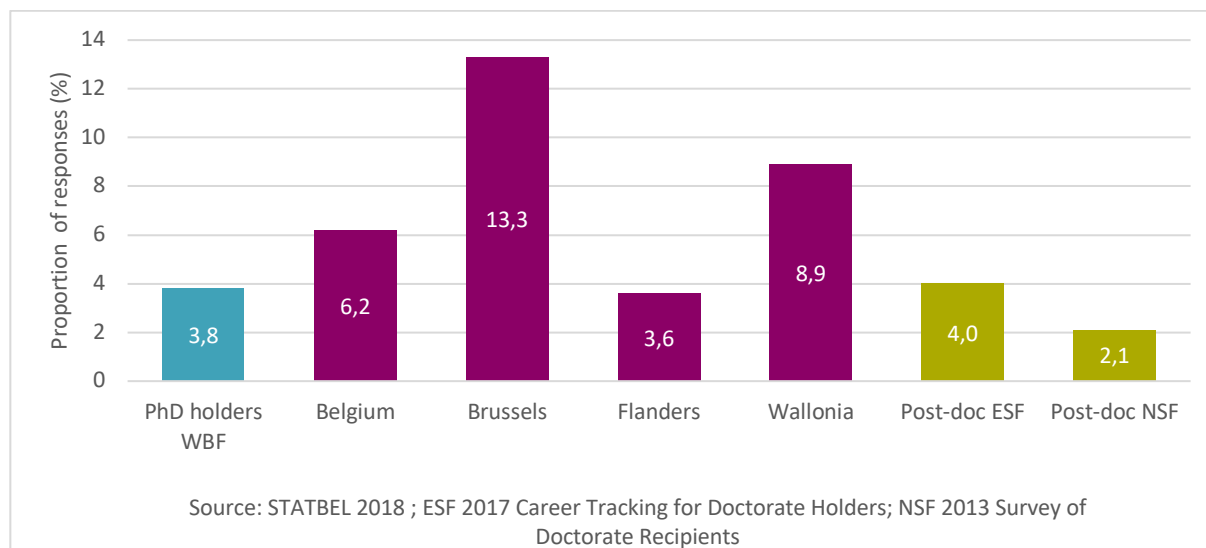
3.4 Unemployment rate

The overall unemployment rate in our sample is 3.8%, lower than the national unemployment rate in Belgium in 2018 (6.2%) (Figure 13). When we compare this rate to the rates observed among PhD holders in Europe and in the United States, we see that the unemployment rate in the FWB is comparable to other samples.

It is important to note that in addition to the 3.8% of respondents who were unemployed at the time of the survey, 17 people (0.8%) reporting being unemployed voluntarily.

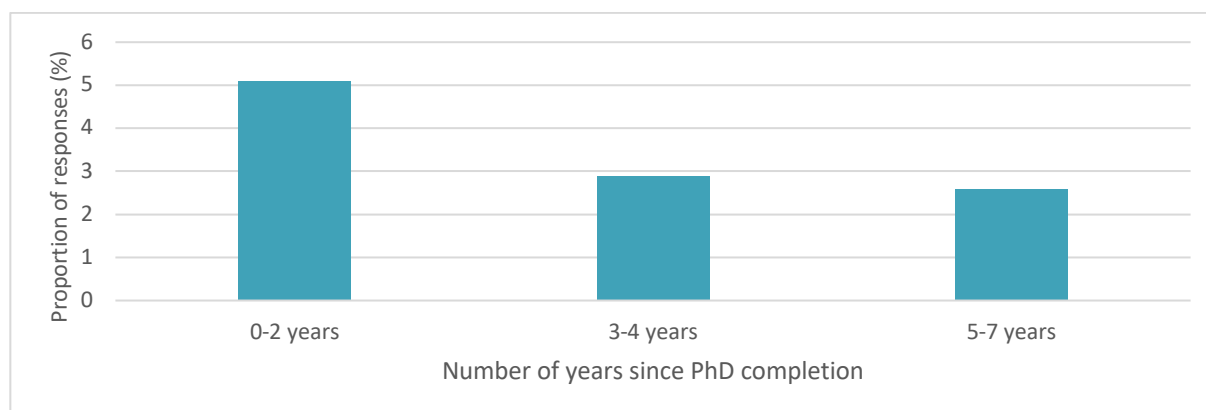


Figure 13. Unemployment rate of PhD holders in FWB compared to national and regional unemployment rate and unemployment rates of PhD holders in other countries



Although not significant, we observe a slight decrease in the unemployment rate of PhD holders as the number of years since doctoral completion increases (Figure 14). Since the sample size was too small, we did not run regression analysis on the unemployment rate.

Figure 14. Unemployment rate of PhD holders in FWB by the number of years since doctoral completion



3.5 Sector of employment

The university sector employs the highest number of PhD holders (44.4%, $n = 912$). For this question, PhD holders had the option of choosing more than one sector as their sector of employment. If we look at those who uniquely choose university as their sector of employment, the percentage goes down to 36.4%. Other sectors of employment by their order of importance include industry (14.5%, $n = 297$), the government/public sector (9.6%, $n = 197$), service (9.0%, $n = 184$), hospitals (5.8%, $n = 119$), higher education outside university (5.6%, $n = 115$), non-profit organisations (5.5%, $n = 113$), education outside of higher education (3.7%, $n = 76$), research institutes (2.6%, $n = 54$) and other sectors (5.4%, $n = 111$).

When we look at the sector of employment by research field, we see clear differences (Table 1). A large majority of those with a PhD in SSH work at universities. In addition, only 1.4% of PhD holders in SSH choose industry, a very small percentage compared to 21.0% of PhD holders in ENS and 18.9% in LHS.



Table 1. Sector of employment (total proportion) by research field

(%)	Education outside of HE	HE outside university	Gov/ Public	Hospital	Industry	Service	Non-profit	University	Research Institute
Overall	3,7	5,6	9,6	5,8	14,5	9,0	5,5	44,4	2,6
SSH	3,9	7,7	12,5	2,0	1,4	8,0	8,8	55,6	1,6
ENS	4,3	4,9	8,9	0,6	21,0	11,9	4,3	38,6	3,3
LHS	2,3	4,2	6,9	21,0	18,9	4,4	3,6	40,8	2,7

HE = Higher education

Figure 15 demonstrates the flow between research fields and the sectors of employment in frequencies. Even though the number of candidates is much higher than the number of permanent positions available in the university sector, PhD holders choose to stay in large numbers in this sector regardless of their field of research. In addition, while 55.6% of doctoral graduates in SSH (compared to 38.6% in ENS) work in the university sector, their representation in absolute terms is similar to the doctoral graduates in ENS.

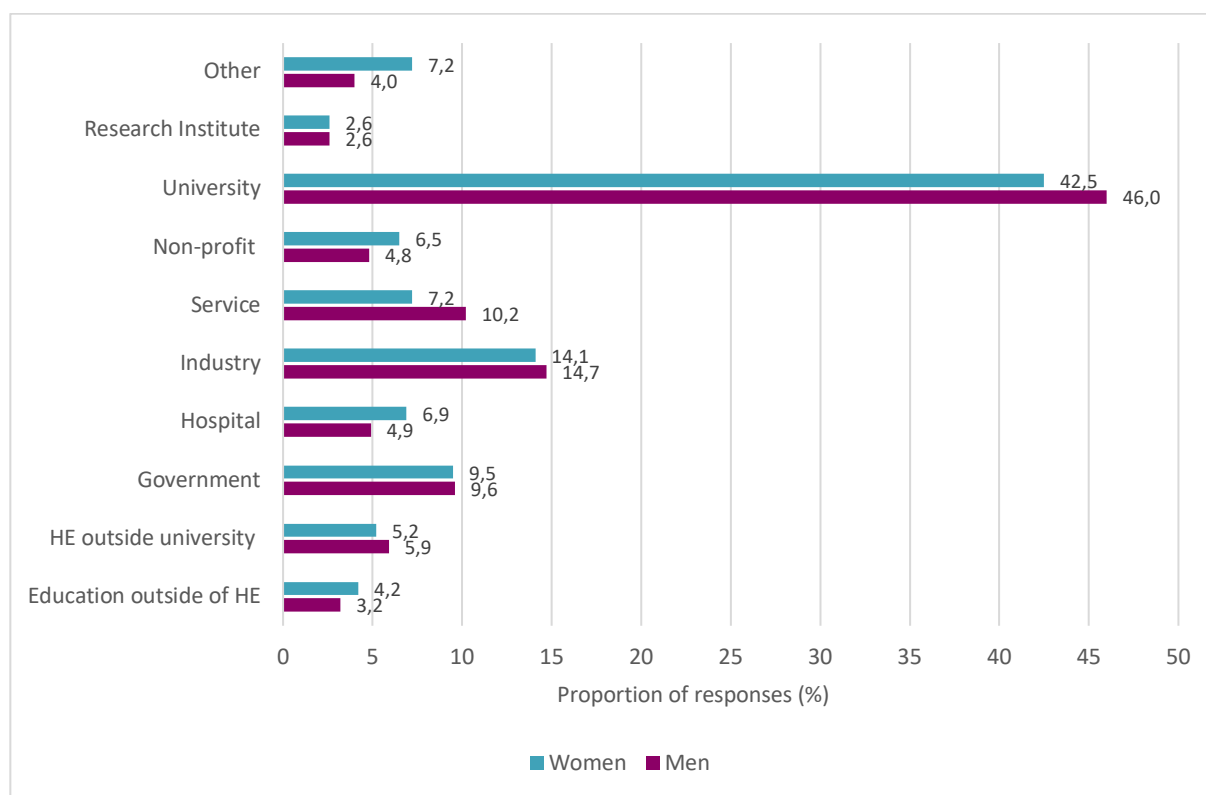
Figure 15. Flow between the fields of research and sectors of employment



When we look at the sector of employment by gender, we see differences for the university sector (Figure 16). Women are less likely to work in the university sector than men (Wald $\chi^2(1) = 4.74, p < .05; OR = .82, [CI = .68-.98]$).



Figure 16. Sector of employment by gender



HE = Higher education

3.6 Pursuing an academic career

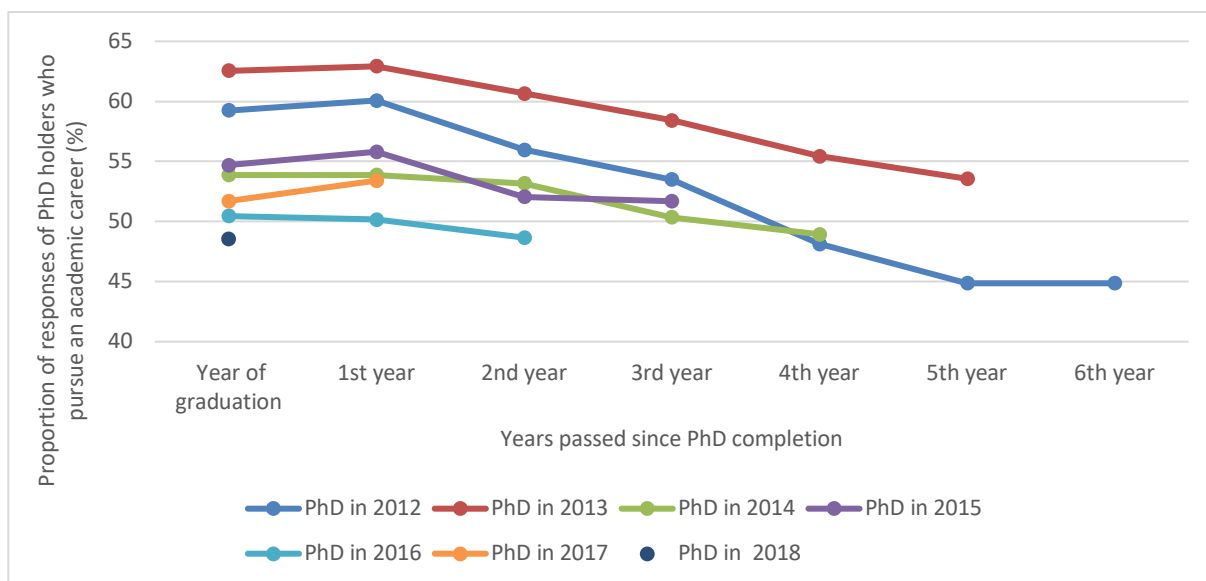
In the questionnaire, we asked PhD holders to indicate year by year whether or not they had pursued an academic career since their doctoral completion¹⁰. Looking at the number of PhD holders who said “yes”, we can discern two trends (Figure 17). Firstly, those who completed their doctoral degree between 2016 and 2018 are less likely to pursue an academic career the first year after doctoral completion than PhD holders who completed their degree between 2012 and 2015. For instance, 62.6% of respondents who completed their degree in 2013 pursued an academic career in their year of graduation, whereas only 48.6% of respondents who completed their degree in 2018 are pursuing an academic career. This may be due to the raising awareness among doctoral candidates of the lack of career opportunities in academia or a decline in attractiveness of academic careers.

Secondly, regardless of the year of doctoral completion, in each group, the proportion of PhD holders pursuing an academic career decreases over time. For instance, looking at PhD holders who completed their degree in 2012 (the blue line), the percentage goes down from 59.3% in the year of doctoral completion to 44.9% in year six. It is likely that regardless of the year the doctoral degree was awarded, those who cannot succeed in securing a permanent contract after years of postdoctoral work quit academia.

¹⁰ In the questionnaire, we did not provide a definition of “to pursue an academic career”.

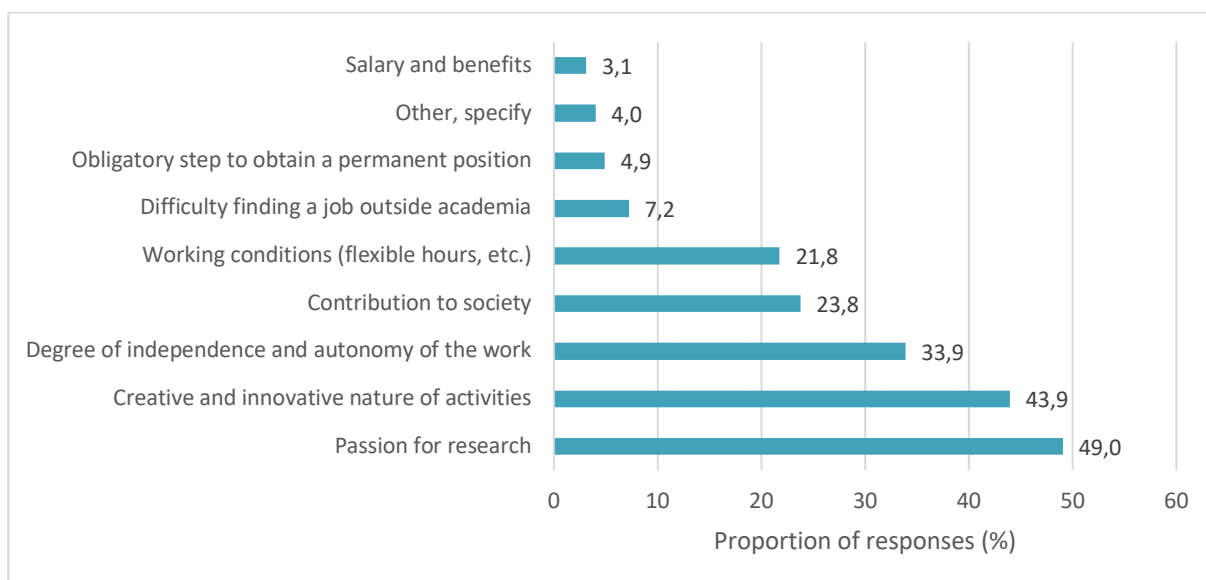


Figure 17. Have you pursued an academic career since your dissertation defense?



We asked those who pursued an academic career in 2018 ($n = 997$) to indicate two main reasons why they were pursuing an academic career. An important proportion stated that they were pursuing an academic career because of their passion for research (49.0%), the creative and innovative nature of the activities involved (43.9%), and the degree of independence and autonomy the career allowed (33.9%). The item that was least cited was salary and benefits (3.1%) (Figure 18). The most cited reason for the “other” category was passion for teaching ($n = 15$).

Figure 18. Main reasons to pursue an academic career

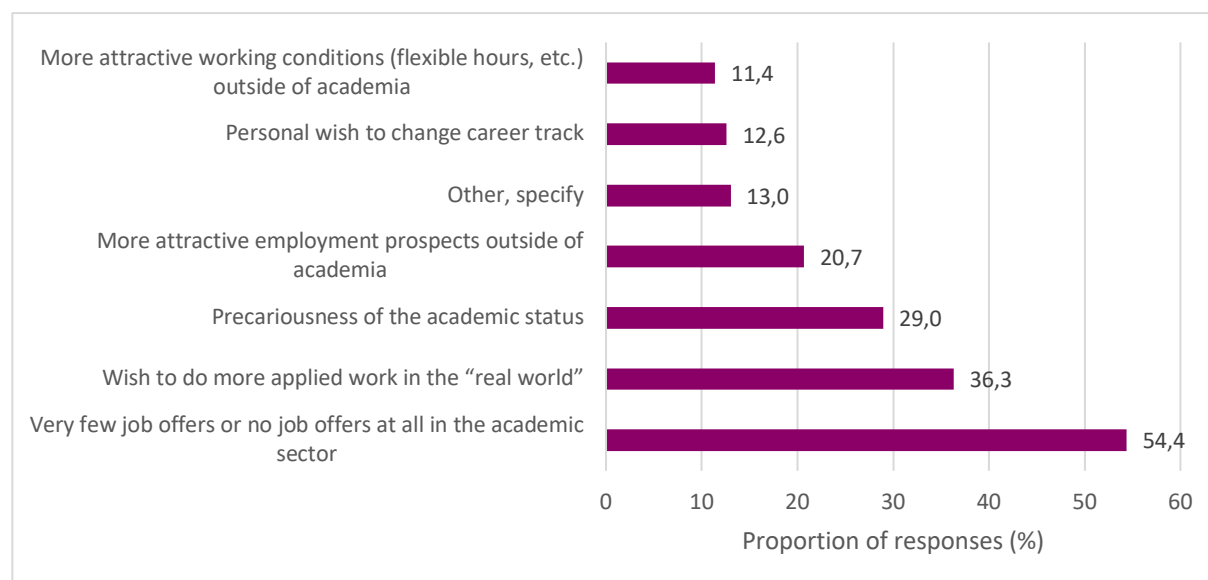


Similarly, we asked those who did **not** pursue an academic career in 2018 ($n = 991$) to indicate two main reasons why they were not pursuing an academic career. A significant proportion stated that they were not pursuing an academic career because of a lack of job offers (54.4%). Two other reasons included the desire to do more applied work in the “real world” (36.3%), and the precariousness of the academic status (29.0%) (Figure 18). The most cited reasons for the “other” category related to the working conditions of an academic



career: lack of compatibility with family life ($n = 12$), the pressure to publish ($n = 8$), mobility requirements ($n = 7$), and lack of team work ($n = 5$).

Figure 19. Main reasons not to pursue an academic career



Interestingly, we asked those who were not pursuing an academic career in 2018 whether or not they would have liked an academic job if they had had the opportunity, to which 55.8% answered “yes”.

The results of this section are a cause for concern since they may indicate that some highly qualified PhD holders who would like to pursue an academic career are forced to leave academia owing to the lack of opportunities and long-term career prospects. For a large majority of those who do not pursue an academic career, to leave academia is perceived as a forced-choice or a plan B.

Pursuing an academic career two years after doctoral completion. This model assessed the probability of pursuing an academic career two years after doctoral completion. Therefore, we did not include PhD holders who completed their degree in 2017 and 2018. We had 1,427 participants in total. In order to test whether or not gender, research field, and having children have a significant effect on the probability of pursuing an academic career two years after doctoral completion, we used logistic regression analysis. All the details of this regression analysis as well as the tables are presented in the Appendix. Since factors such as number of publications, mobility, supervisor satisfaction, and the immediate work environment during doctoral training may have an influence on doctoral students' career outcomes, we additionally included these factors in this model.

Mobility was measured by one item, “Did you work outside of the Federation Wallonia-Brussels for more than three months after getting your PhD?”, coded as 1 = yes and 0 = no. The number of publications was measured by one-item that was discrete, “To this day, how many scientific articles have you published in peer-reviewed journals as an author or co-author?”. The number of publications was categorised into “high/low” based on the median number of publications in each subdomain (refer to the Appendix for details). Supervisor satisfaction was measured by one item, “I was very satisfied by the supervision provided by my principle supervisor”, on a five-point Likert scale (1 = totally disagree to 5 = totally agree). The positive work environment during doctoral training was measured by taking the mean of four items: “During your PhD, in your immediate work environment (e.g., research



laboratory), how much have you felt the presence of...(a) kindness, (b) team spirit, (c) flexibility and adaptability, and (d) creativity". Respondents rated the presence of each characteristic on a five-point Likert scale (1 = not at all to 5 = very strongly).

Regression analysis demonstrated that when we include gender, research field, having children, number of publications, supervisor satisfaction and positive work environment in the model, controlling for other factors:

(1) those who publish more are more likely to pursue an academic career two years after doctoral completion compared to those who publish less [OR = 2.98, CI = 2.36-3.77];

(2) those who were in mobility after their PhD are 2.84 times more likely to pursue an academic career two years after doctoral completion compared to those who were not [CI = 2.24-3.59];

(3) those in SSH and in LHS are more likely to pursue an academic career two years after doctoral completion compared to those in ENS [OR = 2.35, CI = 1.77-3.11] for the former, [OR = 1.94, CI = 1.43-2.63], for the latter; and

(4) each 1-unit increase in the positivity of the work environment increases the odds of pursuing an academic career two years after doctoral completion by 1.32 times [CI = 1.10-1.59].

These results indicate that PhD holders who pursue an academic career two years after doctoral completion are more likely to be in mobility after obtaining their degree and have more publications. In general, PhD holders in SSH and LHS are more likely to pursue an academic career two years after doctoral completion. The results additionally highlight the importance of contextual factors such as the immediate work environment during doctoral training. The fact that those who perceive higher levels of kindness, team spirit, flexibility and creativity are more likely to pursue an academic career after obtaining their degree raises the question "how can we create a more positive work environment for doctoral candidates"?

Caution is necessary, however, in the interpretation of these results. Neither causality nor direction of effects (i.e., unidirectional or bidirectional) can be inferred from these data. For instance, it may be that those who publish more are more likely to pursue an academic career but it may also be that those who pursue an academic career publish more.

3.7 Type of contract

60.7% ($n = 1,098$) of those who were employed at the time of the survey had a permanent contract¹¹ whereas 37.1% ($n = 671$) had a temporary contract and 2.2% ($n = 40$) had an interim contract (Figure 20). Importantly, we asked those who had a temporary and an interim contract why they had decided to work on a temporary basis. A large majority of them (85.1% general; 87.9% of women) answered that it was because they could not find a permanent position that was satisfying. It would seem that temporary contracts are signed owing to a lack of opportunities rather than by personal choice. Figure 21 shows the distribution of different types of contracts by gender.

¹¹ We did not specially ask about the type of permanent contracts, i.e., contractual versus statutory.



Figure 20. Type of contract of PhD holders employed at the time of the survey

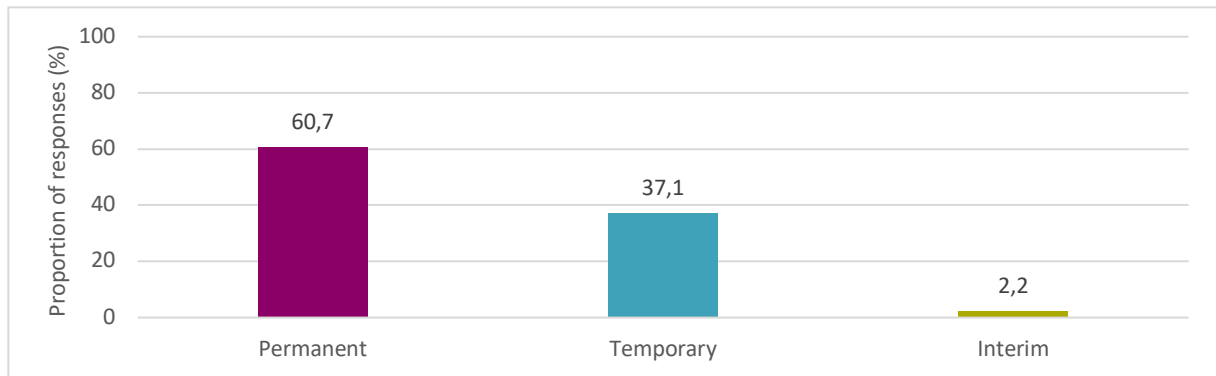
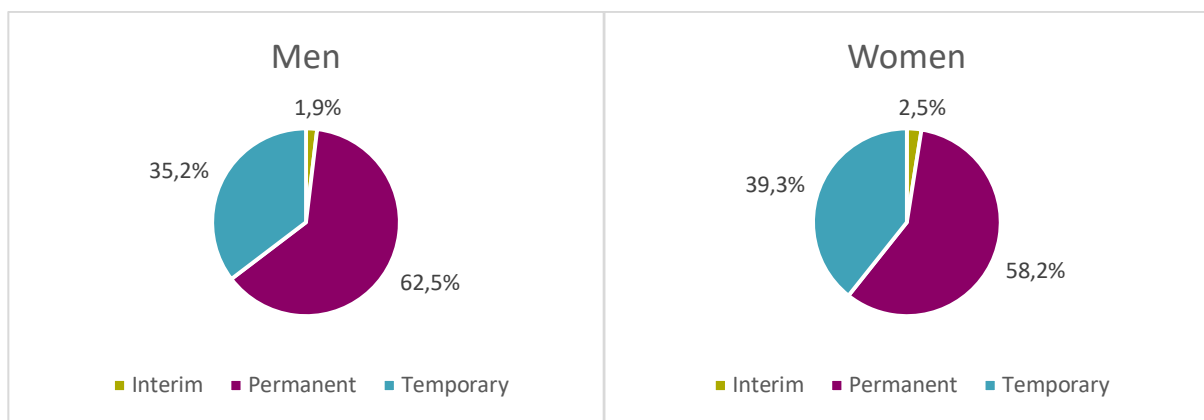
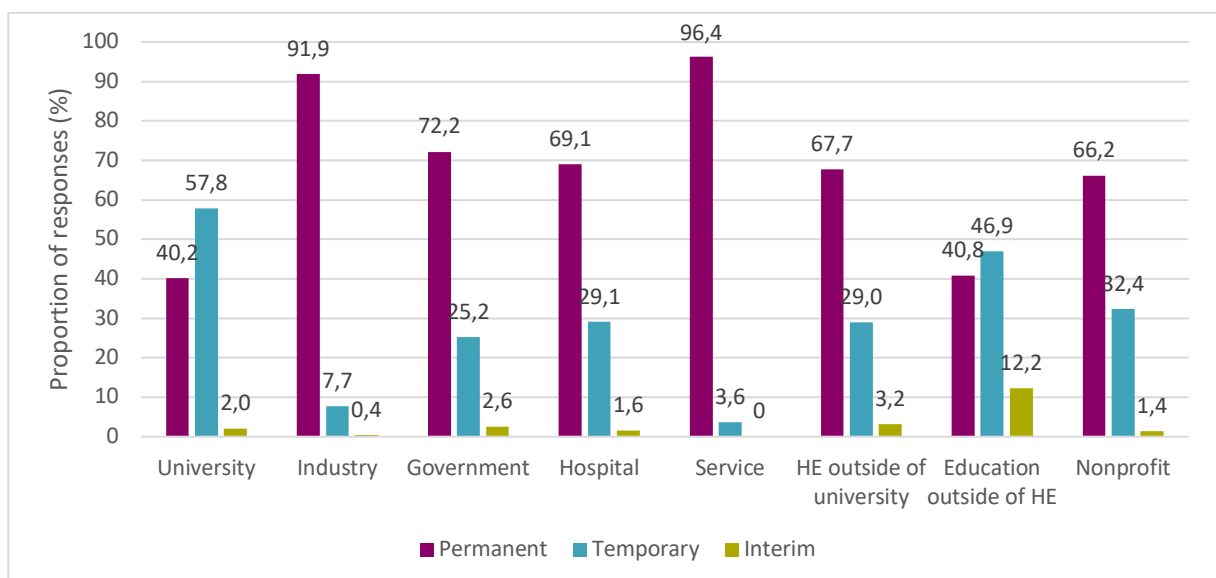


Figure 21. Type of contract of PhD holders employed at the time of the survey, by gender



When we look at the type of contract by sector of employment for those who chose only one sector of employment ($n = 1,566$), we see important differences. University is the sector that has the highest percentage of temporary contracts (57.8%, $n = 435$). Only 40.2% ($n = 303$) of those who work in universities have permanent contracts compared to 96.4% in service or 91.9% in industry (Figure 22). In addition, those who work in education outside of higher education have the highest rate of interim contracts (12.2%).

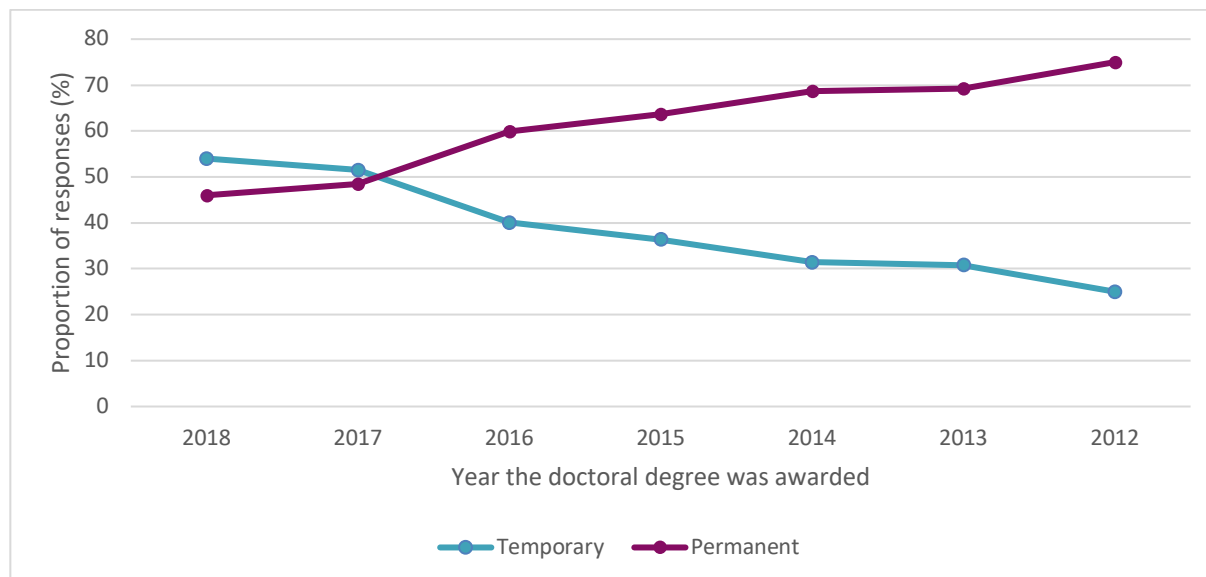
Figure 22. Type of contract by sector of employment





For those who are employed, we observe that while recent graduates are employed on fixed-term contracts, seniors are predominantly employed on permanent contracts (Figure 23).

Figure 23. Type of contract by year of doctoral completion for employed PhD holders



Having a permanent contract. This model evaluated the probability of having a permanent contract. We included only the participants who were employed full-time or part-time at the time of the survey ($n = 1,880$). In order to test whether or not gender, research field, and having children have a significant effect on the probability of having a permanent contract, we used logistic regression analysis. Since sector of employment (private vs. public), years since PhD, and previous collaboration experiences with private or public sector entities during doctoral training may have an influence on doctoral students' type of contract, we additionally included these factors in this model.

Collaboration was measured by one item, "Within the framework of a signed agreement, did your doctoral dissertation work involve a collaboration with private or public sector entities", coded as 1 = yes and 0 = no. All the details of this regression analysis as well as the tables are presented in the Appendix.

Regression analysis demonstrated that when we include gender, research field, having children, sector of employment, years since PhD, and previous collaboration with the public or private sector during doctoral training in the model, controlling for other factors:

- (1) those who work in the private sector are more likely to have a permanent contract [OR= 2.77, CI = 2.21-3.45];
- (2) those who have children are 2.37 times more likely to have a permanent contract [CI = 1.94-2.90];
- (3) each additional year since doctoral completion increases the odds of having a permanent contract by 1.23 times [CI = 1.17-1.30]; and
- (4) those whose dissertation work involved a collaboration are more likely to have a permanent contract [OR = 1.46, CI = 1.13-1.89].

As years of professional experience increase, the probability of having a permanent contract increases. Interestingly, having a permanent contract and having children are dependent. As was the case in the previous model, we cannot infer the directionality of



these effects (unidirectional or bidirectional). It may be that once they become parents, PhD holders need more stability and move into sectors that offer more permanent contracts. It may also be that PhD holders who have permanent contracts are more likely to feel in a position to have children. It would seem that the private sector offers more permanent contracts to PhD holders than the public sector does. In addition, an important factor linked to the probability of having a permanent contract is collaboration with private or public sector entities during the PhD training, which demonstrates the added-value of such collaborations for PhD holders.



4. CONCLUSION

The main objective of this report was to describe the employment status of doctoral graduates of the six French-speaking universities in Belgium. Findings suggest that PhD holders at the beginning of their careers have high levels of employment and that a large majority find a new job within four months of doctoral completion.

The findings also suggest, however, that regardless of their research field, an important proportion stay in the university sector and that a non-negligible proportion work under temporary contracts. Lack of career prospects and high levels of job insecurity during postdoctoral training put PhD holders in the FWB in a vulnerable position. Although, for the most part, these highly qualified people would like to pursue an academic career, they are forced to leave the university sector. With little experience outside of academia and little career guidance, doctorate holders must promote the skills they acquired during doctoral training to prospective employers in other sectors of employment, which do not necessarily recognise the added-value of their degree (De Grande, De Boyser, Vandeveldde, & Van Rossem, 2011; Van der Weijden, De Gelder, Teelken, & Thunnissen, 2017). Specialised and individualised career guidance during and after the PhD degree could provide the necessary support for them to prepare their transition. In addition to this individual guidance, global work on the promotion of the doctoral degree among potential employers, especially those beyond academia, is necessary to highlight the skills PhD holders acquire during their training and explain how these skills may be useful in a number of different sectors.

We will continue to publish similar reports on the results of the "Future of PhD Holders" survey, including a set of recommendations to improve the job transition of PhD holders. For our second thematic report, we will focus on the job satisfaction of PhD holders and the relationship between their level of education and their job.



5. REFERENCES

- Auriol, L., Felix, B., & Schaaper, M. (2010). *Mapping careers and mobility of doctorate holders: Draft Guidelines, Model Questionnaire and Indicators*—the OECD/UNESCO Institute for Statistics/EUROSTAT Careers of Doctorate Holders Project. Paris: OECD.
- Berinsky, A., Margolis, M., & Sances, M. (2014). Separating the shirkers from the workers? Making sure respondents pay attention on Internet surveys. *American Journal of Political Science*, 58, 739–53.
- Décret de la Communauté française du 31 mars 2004 définissant l'enseignement supérieur, favorisant son intégration dans l'espace européen de l'enseignement supérieur et finançant les universités. URL: https://www.gallilex.cfwb.be/document/pdf/28769_017.pdf.
- De Grande, H., De Boyser, K., Vandeveld, K. and Van Rossem, R. (2011). The skills mismatch: What doctoral candidates and employers consider important. *ECOOM Briefs*, Vol 2011, No. 4, pp 1-4.
- Gokhberg, L., Shmatko, N., & Auriol, L. (2016). Rethinking the Doctoral Degrees in the Changing Labor Market Context. In L. Gokhberg, N. Shmatko, & K. Auriol (Eds.), *The Science and Technology Labor Force* (pp. 1-7). Switzerland: Springer International.
- Hayter, C.S., & Parker M.A. (2019). Factors that influence the transition of university postdocs to non-academic scientific careers: An exploratory study. *Research Policy*, 48, 3, 556-570. DOI: <https://doi.org/10.1016/j.respol.2018.09.009>
- Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Multiple regression Applied multivariate research: Design and interpretation*. Thousand Oaks, California: Sage Publications.
- Paglis, L. L., Green, S. G., & Bauer, T. N. (2006). Does adviser mentoring add value? A longitudinal study of mentoring and doctoral student outcomes. *Research in Higher Education*, 47, 451– 476.
- Powell, W., & Snellman, K. (2004). The knowledge economy. *Annual Review of Sociology*, 30, 199-220.
- STATBEL (2018). *Taux d'emploi, taux de chômage, taux d'activité par sexe pour la Belgique et les régions, derniers 4 trimestres* : <https://statbel.fgov.be/fr/themes/emploi-formation/marche-du-travail/emploi-et-chomage#figures>
- STATBEL (2018). *Temps partiel parmi des salariés, selon le régime de temps partiel et le sexe* : <https://statbel.fgov.be/fr/themes/emploi-formation/marche-du-travail/le-travail-temps-partiel#figures>
- Teelken, C., & Van der Weijden, I. (2018). The employment situations and career prospects of postdoctoral researchers. *Employee Relations*, 40 (2), 396-411.
- Van der Weijden, I.C.M., De Gelder, E.J., Teelken, C., & Thunnissen, M. (2017). Which grass is greener? Personal stories from PhDs about their careers within and outside of academia. phdcentre.eu/en/practices/portraits



6. APPENDIX

The objective of this section is to detail the statistical analyses we ran to model the employment outcomes of PhD holders. In order to determine the probability of pursuing an academic career two years after doctoral completion and of having a permanent contract, we used logistic regressions.

6.1 Logistic Regressions

In a typical logistic regression, there is one dichotomous dependent variable, coded traditionally as 1 for the event occurring and 0 for the event not occurring. For instance, those who were identified as working with a permanent contract were coded as 1, and those who did not were coded as 0. The objective of this analysis is to determine the probability that a case will belong to the event category. Just as in linear regressions, we can include multiple predictor variables in our model. Statistical measures that are reported include:

- a. **Odds ratio.** The odds ratio (OR) is a statistical measure that compares whether the probability of an event occurring is the same for two groups. An odds ratio of 1 implies that the event is equally likely for both groups. Odds ratios greater than 1 suggest that PhD holders in a particular group (e.g., those with children) are more likely to be in the event category (e.g., have a permanent contract) compared to the other group (e.g., those without children). Odds ratios less than 1 suggest that PhD holders in a particular group are less likely to be in the event category compared to the other group. The confidence interval (CI) indicates 95% confidence interval for the OR.
- b. **Evaluation of the logistic model.** Logistic regression produces a number of tests to assess the validity of the model:
 - *Omnibus test of model coefficients:* This chi-square test evaluates whether the set of predictor variables improves the prediction of the dependent variable over the constant only model, which has no predictors.
 - *Cox and Snell and the Nagelkerke Pseudo R²:* They determine the goodness of fit of the model.
 - *Wald test:* This test measures the statistical significance of the unique contribution of each coefficient in the model.

6.2 Pursuing an academic career two years after doctoral completion

This model assessed the probability of pursuing an academic career two years after doctoral completion. Therefore, we did not include PhD holders who completed their degree in 2017 and 2018. We had 1,427 participants in total.

In this model, we included gender (female = 1), having children (yes = 1), research field, mobility (yes = 1), number of publications, supervisor satisfaction ($M = 3.83$, $SD = 1.15$), and the positive work environment ($M = 3.67$, $SD = .76$). Exact and Natural Sciences (ENS) was specified as the reference group thus comparing the likelihood of being employed at the university sector to Life and Health Sciences (LHS = 1) and Social Sciences and Humanities (SSH = 1). We only adjusted the full model, without interaction.

The number of publications was calculated based on the median of each subdomain based on the questions 23, 24, 25 of the survey (<http://www.observatoire-frs-fnrs.be/docs/survey.fr.final.pdf>). We coded those who had published higher than the median in each subdomain as a high-publication group (coded as 1) and at the median or lower as a low-publication group (coded as 0). For instance, the median for Cultures and Cultural



Production subdomain was 5 publications. We coded those who published 6 or more publications as a high-publication group and those who published 5 and less publications as a low-publication group. Similarly, the median for Computer Science and Informatics subdomain was 7 publications. We coded those who published 8 or more publications as a high-publication group and those who published 7 and less publications as a low-publication group.

Results indicated that the model provided a statistically significant improvement over the constant only model, $\chi^2(8) = 266.08, p < .001$. The goodness of fit as indicated by Nagelkerke pseudo R^2 was .23 (Cox and Snell = .17).

Table 2. Logistic regression analysis on the likelihood of PhD holders pursuing an academic career two years after doctoral completion

	B	S.E.	Wald	df	p-value	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Gender	-0,220	0,124	3,138	1	0,076	0,802	0,629	1,024
SSH vs ENS	0,854	0,143	35,538	1	0,000	2,349	1,774	3,109
LHS vs ENS	0,663	0,154	18,456	1	0,000	1,941	1,434	2,627
Children	0,053	0,120	0,193	1	0,661	1,054	0,833	1,333
High vs low publication	1,092	0,120	83,125	1	0,000	2,981	2,357	3,770
Mobility	1,042	0,120	75,431	1	0,000	2,836	2,241	3,588
Supervisor Satisfaction	0,093	0,060	2,423	1	0,120	1,098	0,976	1,234
Positive work environment	0,280	0,093	9,019	1	0,003	1,323	1,102	1,588
Constant	-3,656	0,392	87,196	1	0,000	0,026		

The significant variables are in bold.

6.3 Having a permanent contract

In this model, we only included participants who were employed part-time or full-time ($n = 1,880$). In order to determine the probability of being employed with a permanent contract, we included gender (female = 1), having children (yes = 1), research field (SSH, LHS), sector (private = 1), years since PhD, and collaboration (yes = 1) in our model. We only adjusted the full model, without interaction.

Results indicated that the model provided a statistically significant improvement over the constant only model, $\chi^2(7) = 255.37, p < .001$. The goodness of fit as indicated by Nagelkerke pseudo R^2 was .17 (Cox and Snell = .13).

Table 3. Logistic regression analysis on the likelihood of PhD holders having a permanent contract

	B	S.E.	Wald	df	p-value	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Gender	-0,185	0,105	3,130	1	0,077	0,831	0,677	1,020
SSH vs ENS	-0,128	0,122	1,097	1	0,295	0,880	0,693	1,118



LHS vs ENS	0,119	0,133	0,803	1	0,370	1,127	0,868	1,463
Children	0,863	0,103	70,047	1	0,000	2,370	1,937	2,901
Private vs Public	1,017	0,113	80,656	1	0,000	2,765	2,214	3,451
Years since PhD	0,209	0,027	59,461	1	0,000	1,232	1,169	1,299
Collaboration	0,380	0,131	8,396	1	0,004	1,463	1,131	1,891
Constant	-1,015	0,133	58,249	1	0,000	0,362		

The significant variables are in bold.



Acknowledgments

We would like to thank the participants of this study as well as the supervisors we solicited for their time and contribution. We would also like to thank the members of the Support Committee of the Observatory of Research and Scientific Careers and our colleagues, Juliane Farthouat and Audrey Ségerie, from the Analysis, Evaluation and Foresight Unit of the F.R.S.-FNRS, for their valuable support.

The writing of this report was supervised by Raphaël Beck, Head of the Analysis, Evaluation and Foresight Unit of the F.R.S.-FNRS and by Véronique Halloin, Secrétaire Générale of the F.R.S.-FNRS.

This report was produced with the support of the Federation Wallonia-Brussels.

