



WHAT KEEPS THEM INTERESTED? INFLUENCES ON THE STABILITY OF RESEARCH CAREER INTENTIONS IN THE COURSE OF ACADEMIC QUALIFICATION

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ABSTRACT

Aim/Purpose	While scientists play a crucial role within modern knowledge societies, the attractiveness of scientific careers in Germany is moderate due to career uncertainty and the limited perspectives of long-term retention in academia. This study identifies (intra-individual) changes in the career intentions of early career researchers. Furthermore, supporting factors for the stability of research career intentions are shown.
Background	Recent studies investigated early career researchers' career intentions and predictors for their development in cross-section. These studies determine influences of individual factors, such as interests or self-efficacy beliefs, and organizational aspects like working and doctoral training conditions. By contrast, there is little knowledge about intra-individual changes in career intentions in the course of academic qualification.
Methodology	Longitudinal data of 101 research associates at a German university were collected via survey questionnaires in 2016 and 2018. Descriptive analysis was used to investigate changes in career intentions in consideration of doctoral phases. Logistic regression was applied to predict the stability of research career intentions over time.
Contribution	So far, research investigated the career intentions of early career researchers in Germany solely in cross-section. The present paper contributes in two ways. Firstly, intra-individual changes in career intentions are identified from a longitudinal perspective. Secondly, the stability of research career intentions is explained, considering various individual and contextual factors based on the Social Cognitive Model of Career Choice.
Findings	Descriptive analyses illustrate the tendency of declining interest in scientific careers in the course of academic qualification. The stability of research ca-

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	reer intentions is predicted by changes in attractiveness ratings of a professorship and subjective assessments of research abilities relative to peers. Changes in academic self-efficacy beliefs have no significant effect.
Recommendations for Practitioners	Firstly, the attraction of and the path to a professorship must be structurally strengthened. Secondly, early career researchers should be supported in developing realistic assessments of their subjective research skills relative to peers. Mentoring in addition to academic supervision, mental support, or opportunities for peer counseling are expected to be valuable offers.
Recommendations for Researchers	Researchers seeking to explain the career intentions of early career researchers should be aware of their changeability. Hence, they should be investigated in extended longitudinal studies. Furthermore, impostor feelings as influencing factors on career intentions need further research.
Impact on Society	Research and knowledge are the basis for innovation and progress. In today's knowledge society, research is in direct competition with both other countries and the private sector. In order to attract the "brightest minds" for academia, universities and research institutes must gain a deeper understanding of factors influencing the stability of research career intentions.
Future Research	Future research should focus on specific instruments of promoting early career researchers and how they affect the development of realistic assessments of individual research skills. Moreover, international ECRs should be explicitly considered since a researchers' visa status potentially affects career prospects and individual career intentions.
Keywords	research career intention, early career researchers, stability of research career intentions, scientific career, impostor phenomenon

INTRODUCTION

Within current discussions on conditions, paths, and risks of scientific careers, career intentions of early career researchers (ECRs), i.e., doctoral candidates and postdocs (European Commission, 2011), are of particular interest. They can be considered as vocational aspirations or goals that persons pursue. From a psychological perspective, the individual career intention is a central component in career development as it determines further behavior and career trajectories (Evers & Sieverding, 2015; Sheeran, 2002). The development of individual career intentions is linked to a multitude of self-referential cognitive processes (Lent et al., 1994). However, careers eventually result from the interplay of individual and structural characteristics over time (Settersten & Gannon, 2005). Career intentions do not, therefore, solely depend on vocational interests and preferences, but also relate to a variety of external environmental conditions such as the labor market situation or family constraints.

The interest in ECRs' career intentions results from the observation of diverging developments in several Western countries (Auriol, 2010). On the one hand, scientists play a crucial role within modern knowledge societies as they are regarded as sources of knowledge creation, discovery, and innovation (Auriol, 2010; Shin et al., 2018). Thus, national policies to increase participation in higher education and the attractiveness of scientific careers have been common phenomena during the last fifteen years (Shin et al., 2018). Examples include movements towards structured doctoral programs, the implementation of job categories with increased autonomy such as junior professorships and junior research group leaders, and the expansion of tenure-track positions. On the other hand, ECRs come under increasing pressure to financially secure their research and occupational situation (Maher & Sureda Anfres, 2016). The growing importance of third-party research funding is accompanied by individual dependencies and an oversupply of PhDs and postdocs (Stephan, 2012). Different coun-

tries face a massive imbalance between the number of trained ECRs and vacant independent researcher positions (e.g., Consortium for the National Report on Junior Scholars, 2017; Fröllich et al., 2018; Heggeness et al., 2016). Two figures from the German case serve to exemplify the situation. In the period from 2009 to 2018, the number of German professorships rose from approximately 40,000 to approximately 48,000, i.e., by 20 percent. In the same period, the number of research associates increased by 32 percent (up to approximately 193,500) (Federal Statistical Office of Germany, 2019). This often leads to career uncertainty, a decreasing attractiveness of scientific careers (Huisman et al., 2002), and limited perspectives of long-term retention in the academic system. The estimated chances of achieving a professorship vary between 4% and 20%, depending on the subject group and the calculation basis used (Consortium for the National Report on Junior Scholars, 2017; Kremmkow, 2017; Schneiderberg, 2017). Actually, only 15 percent of all doctorate holders in Germany work within the sector of research and higher education teaching (Consortium for the National Report on Junior Scholars, 2017).

Given that doctoral candidates predominantly start their qualification for intrinsic reasons, such as the interest in scientific work or an academic career (Brailsford, 2010; Grotheer et al., 2012; Wiegrová, 2016), the present study seeks to investigate possible changes in ECRs' career intentions in the course of academic qualification at a large German university. Moreover, I aim to identify factors that promote the stability of research career intentions.

LITERATURE REVIEW

THEORETICAL FOUNDATION

Due to the variety of internal and external influences on the development of individual career intentions, the attempt to explain them and their changes over time set high demands on the theoretical approach used. In the past, the Theory of Planned Behavior (Ajzen, 1991) and the Social Cognitive Career Theory (Lent, 2013; Lent et al., 1994) were frequently used for studying the career intentions of ECRs (e.g., Berweger, 2008; Briedis et al., 2014; Evers & Sieverding, 2015; Hauss et al., 2015; Mozhova, 2018). Both approaches originate from social psychology and focus on human behavior. They share the consideration of competences as a central component and include other socio-cognitive determinants that influence the development of intentions and behavioral change. The Theory of Planned Behavior postulates influences of attitudes, subjective norms, and perceived behavioral control on intentions. However, the Social Cognitive Career Theory takes aspects of the personal background (e.g., subject) as well as contextual opportunity structures (e.g., perceived support regarding career planning) into account. Hence, the latter theory offers a high explanatory potential for investigating career intentions and the complexity of driving factors for the stability of research career intentions. Through three interlocking sub-models, the theoretical framework by Lent, Brown, and Hackett (1994) describes the following relations: (1) the emergence of (vocational) interests, (2) the goal setting and choice of career options, and (3) the performance and retention in a field of work.

As the present study focuses on career intentions, the Model of Career Choice is of particular interest. It is assumed that—under favorable conditions—vocational interests lead to occupational fields in which persons expect to carry out their individually preferred activities. Career-related interests promote the development of corresponding career intentions and indirectly prompt activities to achieve one's goals. Interests, as well as choice goals, result from specific self-efficacy beliefs and outcome expectations. It is conceivable that persons choose career goals that they believe they are capable of and successful in achieving and which are likely to have the desired outcomes (e.g., salary, work-life balance). The social-cognitive factors are, in turn, influenced by learning experiences. However, the Model of Career Choice also takes into account that career decisions can result from other necessities, for example, economic obligations, family constraints, or environmental factors as mechanisms of external selection. Therefore, it explicitly considers contextual influences that are proximal or distal factors in the development of career goals.

INDIVIDUAL INFLUENCES ON ECRs' CAREER INTENTIONS

Applying the Model of Career Choice (Lent et al., 1994) to the particular group of ECRs, the development of a research career intention is expected to be promoted by a keen interest in and positive experiences with scientific work, confidence in being able to carry out academic tasks, and the expectation of being able to achieve one's own life goals within a scientific career. At the same time, people with a high interest in job security are supposedly less willing to pursue a scientific career, due to its limited predictability in German academia (Consortium for the National Report on Junior Scholars, 2017).

Several studies investigated the influences of vocational interests on ECRs' career intentions. Analyzing the data of doctoral candidates in life sciences, Mozhova (2018) shows that scientific interest is an essential predictor for developing a research career intention. She supports the effect identified by Berweger (2008) in a group of scholars belonging to social sciences and humanities. Briedis and colleagues (2014), however, note that unambiguous directions of effect are difficult to determine since interests could also be formed based on specific career intentions. In contrast, the authors consider reasons for starting a doctorate as an alternative motivational factor on the individual level. Chance-reducing effects of leaving academia are reported for persons who started a doctorate as a prerequisite for the desired scientific career.

The influence of self-efficacy beliefs has been empirically proven. With higher academic self-efficacy beliefs, the probability for an intention to leave academia decreases (Adedokun et al., 2013; Berweger, 2008; Briedis et al., 2014; Epstein & Fischer, 2017; Gibbs et al., 2015; Mozhova, 2018). However, Jöstl et al. (2012) show that academic self-efficacy beliefs are not solely determined by beliefs about actual abilities. In contrast, they found that 82% of persons within a sample of Austrian doctoral candidates reported impostor feelings. The impostor phenomenon occurs when people who are objectively capable and skilled are bothered by contradictory sentiments and, therefore, afraid of "being unmasked" (Clance & Imes, 1978; Jöstl et al., 2012, p. 109). Impostor feelings (e.g., low self-esteem) are negatively related to the construct of academic self-efficacy and hence function as a psychological barrier for ECRs' scientific careers (Jöstl et al., 2012). In a recent study, Tao and Gloria (2019) confirmed prior findings. They demonstrate negative associations between impostor feelings and academic self-efficacy, the research-training environment, and persistence attitudes of female doctoral candidates in STEM fields. Neureiter and Traut-Mattausch (2016) report negative influences of impostor feelings on career planning and vocational aspirations in a sample of university students. Moreover, these feelings are negatively related to the individual motivation to take a leadership position in a sample of working professionals. As the results suggest that the impostor phenomenon is relevant to career development, it needs to be considered in further investigations on the career intentions of ECRs.

CONTEXTUAL INFLUENCES ON ECRs' CAREER INTENTIONS

A variety of contextual factors influencing the career intention of ECRs is conceivable. Proximal factors include aspects of supervision and integration. McAlpine et al. (2018) find that intentions to remain in or leave academia are affected by the interaction of supervision and community support. Other scholars identify positive influences of network integration (Jaksztat et al., 2017) and further conditions of doctoral training and education (e.g., institutional affiliation or formalization of supervision; Hauss et al., 2015) on developing research career intentions. Additionally, several recent studies point to the importance of the prevailing working conditions in the European scientific systems and job (dis)satisfaction. Persons with low job satisfaction and low perceived support in the work environment are less likely to pursue a scientific career (Aarnikoivu et al., 2019; Dorenkamp & Weiß, 2018; McConnell et al., 2018; van der Weijden et al., 2016). Besides, perceived opportunities on the labor market could play a role in the development of the individual career intention, although some studies could not detect such an influence (Briedis et al., 2014; Roach & Sauermann, 2017; Sauermann & Roach, 2016). It would be comprehensible that the situation of an oversupply of ECRs in

various countries or subjects (Heggeness et al., 2016; Stephan, 2012) would lead to a shift away from research career intentions. Long-term developments of research funding and labor markets are not foreseeable, as they are subject to fluctuations or economic cycles. ECRs who have completed their studies or PhDs may have decided on career paths that are no longer viable in the current situation (Blume-Kohout & Clack, 2013). Due to the scarcity of academic positions, growing competition, and prevailing working conditions for ECRs, an increase in the awareness of career prospects in academia could result in a decline of persons striving for a scientific career. In this regard, a distal influence factor is the field of study. In reference to ECRs from the humanities and social sciences, there is a reduced chance for a research career intention for doctoral candidates belonging to the life sciences, natural sciences, or engineering sciences (Haus et al., 2015). This finding implies unequally attractive options on the non-scientific labor market. However, in some subject groups, doctoral candidates are predominantly trained for the non-university labor market. Concerning the whereabouts of PhDs, this applies explicitly to STEM ECRs (Flöther, 2017).

CHANGES IN ECRS' CAREER INTENTIONS IN THE COURSE OF ACADEMIC QUALIFICATION

However, according to the Model of Career Choice, the development of a career intention is not a one-time, static event. Instead, it is a dynamic process that can evolve over a period of time. Lent (2013) regards “career selection as an unfolding process with multiple influences and choice points” (p. 123). Therefore, longitudinal studies are necessary to analyze intra-individual changes in the career intentions of ECRs. To the best of my knowledge, there is only a small number of such studies, all referring to the U.S. academic system (Gibbs et al., 2015; Roach & Sauermann, 2017; Sauermann & Roach, 2012). Sauermann and Roach (2012) ascertain a decrease in the average attractiveness of faculty positions from the early to the late phase of the doctorate. The doctoral period could affect career intentions as a situational characteristic. Doctoral students start their qualification predominantly out of intrinsic motivation, such as the interest in scientific work or an academic career, among other factors (Brailsford, 2010; Grotheer et al., 2012; Wiegerová, 2016). This could explain a higher proportion of people striving for a scientific career in the early phase of their doctorate. In the course of the qualification, they experience everyday research life, the challenging requirements, and pressures that arise through doctoral education. This could temporarily be frustrating and affect the individual career intention. On the other hand, the effect could decrease during the closing phase of the doctorate, if one has found a way of coping. Gibbs et al. (2015) looked at the interest in research faculty careers over an extended period, from the beginning of the doctorate through PhD completion to the postdoc phase of biomedical researchers. The authors found a significant decline in the interest in such careers in the course of academic qualification. Furthermore, they investigated influences on the remaining interest in a research faculty career in the postdoc period. Under consideration of multiple significant factors like advisor's commitment to career support, research self-efficacy, and productivity, the high interest in a faculty career at the time of PhD completion appear to be the strongest predictor. The findings are confirmed by Roach and Sauermann (2017). They demonstrate that a particular group of STEM ECRs shifted their career preferences over time towards fields of work outside academia. These changes in preferences are not driven by perceptions of career prospects or conditions in the scientific labor market. By contrast, they are attributed to subjective assessments of individual research skills compared to peers and declining interests in activity-specific characteristics of faculty careers (Roach & Sauermann, 2017).

RESEARCH GAP AND RESEARCH QUESTIONS

The current state of research lacks longitudinal studies on ECRs' career intentions in German-speaking countries. Recent literature does not inform us about the prevalence of intra-individual changes, and it is unclear to what extent the findings from the U.S. are related to the scientific system in that country. Therefore, investigations in other national contexts appear to be necessary and valuable. Ad-

ditionally, the question of driving factors for the stability of research career intentions remains unanswered. While the development of research career intentions has been explained in cross-section, factors for their stability have not been examined. Furthermore, previous studies generally distinguished between doctoral candidates and postdocs, not acknowledging that the doctoral period could affect career intentions as a situational characteristic. Individual and environmental aspects may be subject to change, as well. In this way, modifications in variables could also affect changes in career intentions. This implies that at different points in time, varying factors can be decisive for the development of or change in career intentions. Knowledge of factors promoting the stability of research career intentions can be particularly valuable for universities in order to retain the brightest and most capable minds. Taken together, this paper aims to answer the following research questions:

- (1) Which factors influence the development of a research career intention of doctoral candidates?
- (2) To what extent do ECRs change their career intentions in the course of academic qualification phases?
- (3) Which factors promote the stability of research career intentions over time?

RESEARCH METHODOLOGY

The empirical data set results from a campus-wide survey of research associates at a large German university. The project was commissioned by the university's Executive Board and pursued two equally important goals: The first was to generate empirical data for further evidence-based organizational development. Second, the study tries to contribute to the research gap of ECRs' career development. A longitudinal study design with two waves of data collection was implemented. The first wave was undertaken in 2016 (T1). The second one was conducted in 2018 (T2). Both surveys were primarily addressed to research associates at the university, i.e., doctoral candidates as well as postdocs who have permanent or fixed-term employment at the university. As this population can be contacted best via e-mail, web-based surveys with automatic filtering were conducted to achieve a response rate as high as possible, while guaranteeing anonymous and brief participation for the respondents.

SURVEY QUESTIONNAIRE

According to the Model of Career Choice (Lent et al., 1994), a comprehensive survey instrument was developed. ECRs' career intentions represent the core component of career goals. Interests were operationalized as vocational interests and as motives for starting a doctorate. Indicators of objective academic performance and subjective abilities relate to the model component of learning experiences. Furthermore, academic self-efficacy beliefs were considered. Contextual factors and opportunity structures such as the attractiveness of a professorship and the perceived career prospects of obtaining the position, perceived support in the work environment, and general job satisfaction were considered. Finally, personal characteristics were included in the questionnaire. To ensure the quality of the questionnaire, I followed up on existing instruments and used widely established items.

ECRs' career intentions. At both times of measurement, the respondents' career intentions were measured in two ways: First, the participants were asked which career options are generally considered in regard to the individual's professional future. Second, it was directly assessed which working field is preferred. To answer both questions, the respondents could choose between twelve options, e.g., "Working in research and/or teaching at a university," "Working in science/academic management," or "Mainly work in the third (non-profit) sector that is only remotely related to research." The direct survey of the preferred working field allows a distinction to be made between the intention to enter a career in academia (i.e., working at a university, a university of applied sciences, at a non-university research institute, or freelance research work) and the intention to aspire to a career outside academia. Persons who were generally considering several career options but had not chosen a preferred working field were coded as undecided.

Vocational interests. Vocational interests were operationalized as the importance of several professional and life goals. Taken from *WiNbus*, a set of 20 items by Jaksztat et al. (2010) was used. The respondents were asked “How important are the following career and life goals for you personally?” (e.g., “instructing and leading others”) on a 5-point Likert scale ranging from 1 = *not important at all* to 5 = *very important*. The final item set reflects six dimensions of goals. The scales regarding career orientation, creativity/ scientific orientation, as well as vocational security are used in the present study. Reliability coefficients are reported in Table 1. For scales consisting of more than two items, Cronbach’s α was calculated. In case of two-item scales, Eisinga et al. (2013) recommend reporting the less biased Spearman-Brown coefficient. The reliability coefficients vary in the range of acceptable and respectable. Differences in the mean values of scale calculated at the individual level illustrate changes in interests over time.

Table 1. Reliability of scales regarding the dimensions of professional and life goals

SCALE	N _{ITEM}	T1			T2		
		N	α	r _{SB}	N	α	r _{SB}
Career orientation	7	100	.84		98	.85	
Creativity/ scientific orientation	4	101	.66		98	.66	
Vocational security	2	101		.75	101		.86

Reasons for starting the doctorate. In terms of assessing the doctoral motives, various statements known from the German Doctoral Candidates and Doctorate Holders Study *ProFile* (Institute for Research Information and Quality Assurance, 2015) were used. Amongst others, doctoral candidates were asked “Please think back to when you were deciding to start a doctorate. To what extent did the following reasons play a role in your decision? The doctorate is a prerequisite for my intended scientific career.” on a 5-point Likert scale ranging from 1 = *not at all true* to 5 = *completely true*.

Objective academic performance. The respondents were asked how many scientific publications they had already authored. By offering a variety of publication forms, it should be ensured that the assessment fits different subject groups. As a standard form, the publishing experience regarding peer-reviewed articles (dichotomized; 0 = no) is used in the analyses.

Subjective academic abilities. On the one hand, academic self-efficacy beliefs were measured with a slightly modified version of the scale by Berweger (2008). The final scale consists of seven statement items regarding the conviction to carry out academic activities (e.g., “I feel like I am able to regularly publish in scientific journals” or “I feel like I am able to successfully apply for third-party funding”). The respondents’ answers range on a 5-point Likert scale from 1 = *strongly disagree* to 3 = *moderately agree* to 5 = *strongly agree*. Cronbachs alpha equals to $\alpha_{T1} = .85$ and $\alpha_{T2} = .87$ for the first and second points in time, respectively, indicating a respectable internal consistency. On the other hand, to obtain more general information regarding subjective abilities and to ensure comparability of the results, the survey question “How would you rate your research ability relative to your peers in your specific field of study?” by Roach and Sauermann (2017) was added at the second point of measurement. The respondents’ answers range from 1 = *very low* to 5 = *moderate* to 10 = *very high*.

Attractiveness of a professorship. As a coherent indicator for the intention to enter a scientific career, the attractiveness of a professorship was assessed at both points of measurement. Resulting from the evaluative character of the initial project, the item wording was “To what extent are the following career options at the [name of university] personally appealing to you? Professorship?” Due to the request for questionnaire harmonization with a cooperation partner joining the survey in 2018, there was an adaptation of the answer scale between the two points of measurement. While the respondents were forced to decide on a 4-point Likert scale in the first survey, the answers within the second

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survey range on a 5-point Likert scale from 1 = *not appealing at all* to 3 = *moderately appealing* to 5 = *very appealing*. Employing linear transformation, the first survey data were converted to the 5-point scale to enable combined data analysis. Intra-individual differences in the rating of the extent of appeal indicate changes in the attractiveness of this position over time.

Perceived chances of obtaining a professorship. The respondents' perceptions of career prospects were assessed regarding the probability of obtaining a professorship. In the first survey, they were measured with the modified question "How do you rate the current chances for people with your qualifications to get the following employment positions or career options? Professorship?" from the German *WiNbus* study (Jaksztat et al., 2010). Respondents reported the estimated chances on a scale ranging from 0% to 100%. Due to a possible compound of general perceptions of career prospects and the self-evaluation of one's own qualifications, the item was replaced by the slightly modified question "What do you think is the probability that a doctorate / PhD in your field can find the following positions after graduation?" by Roach and Sauermann (2017). There was no change in the answer scale.

Perceived support in the work environment. Taken from *WiNbus*, a slightly modified nine-item scale by Jaksztat et al. (2012) was used. The respondents were asked "To what extent do you agree with the following statements?" (e.g., "In my work environment there are people, who help me to plan my career.") on a 5-point Likert scale ranging from 1 = *strongly disagree* to 3 = *moderately agree* to 5 = *strongly agree*. Cronbachs alpha equals to $\alpha_{T1} = .90$ and $\alpha_{T2} = .92$ for the first and second points in time, respectively, indicating a respectable internal consistency.

General job satisfaction. The general job satisfaction was measured with the help of the three-item short scale (Jaksztat et al., 2010), used at both points of measurement. As the item wording was "Please consider your current job situation. To what extent do you agree with the following statements?" (e.g., "All in all, I am satisfied with my job situation."), the answer scale ranged from 1 = *strongly disagree* to 3 = *moderately agree* to 5 = *strongly agree*. Cronbachs alpha is equal to $\alpha_{T1} = .72$ and $\alpha_{T2} = .67$ for the first and second points in time.

Personal characteristics. In order to control for effects of personal characteristics, different standard variables such as gender (dichotomized; 0 = male), nationality (grouped; 1 = German, 2 = other European countries, 3 = non-European countries), the qualification level (dichotomized; 0 = doctoral candidate), the doctoral phase (1 = phase of orientation and finding of topic, 2 = research phase, 3 = closing phase) and subject group (1 = natural sciences, mathematics and computer sciences, 2 = social sciences, 3 = humanities and cultural sciences, 4 = other) are included. As these characteristics can change over time, the most current information of time point T2 is used in longitudinal analyses.

SAMPLE AND SELECTION BIAS

To answer the above-mentioned research questions, solely longitudinal data were used in the present study. Due to common fixed-term employment contracts and employee turnover, a reduced number of persons could take part in both waves of data collection. Furthermore, excluded from the final analyses were permanently employed persons with no desire for a career change, as well as cases with missing data on the particular important career intention variables.

In conclusion, longitudinal data of $N = 101$ persons are available. The characteristics of the participants are provided in Table 2. The sample included 52.5% females and 64.4% doctoral candidates (T1). The mean age of the respondents at T1 was 32.3 years ($SD = 5.9$). Regarding these characteristics, the sample reflected the corresponding population of T1 in an adequate manner. The vast majority of the participants are of German nationality. Moreover, the representativeness in terms of career-relevant aspects, particularly career intentions, must be considered. In comparison to the full sample of T1 ($N = 721$), the longitudinal sample deviated slightly. It has to be noted that there is an overstated share of respondents striving for a career in academia (66.3% vs. 60.1%) while undecided persons are underrepresented in the sample (6.9% vs. 14.5%).

Due to data protection regulations and the lack of administrative data concerning the individual terminations of employment, an analysis of the drop-out rate from T1 to T2 is not possible. The self-reported information of the employment end did not seem to be a reliable calculation basis as they do not consider follow-up employment contracts.

Table 2. Descriptive characteristics of the participants at T1

VARIABLE	N	DESCRIPTION
Gender	99	Male = 47.5%; female = 52.5%
Age	100	Mean age: 32.3 years; SD = 5.9
Nationality	100	German = 87.0%; other European countries = 9.0%; non-European countries = 4.0%
Formal qualification	101	Doctoral candidates = 64.4%; postdocs = 35.4%
Subject group	101	Natural sciences, mathematics and computer sciences = 35.6%; social sciences = 32.7%; humanities and cultural sciences = 17.8%; other = 13.9%

DATA ANALYSIS

The data analysis was carried out in three steps. First, I examined the respondents' generally considered and preferred career intentions at T1 and T2 within the longitudinal data set.

Second, I focused on explaining the initial emergence of a research career intention. The initial intention refers to the career intention in the early phases of the academic qualification. For that reason, the sample was temporarily reduced to the subgroup of doctoral candidates actively working on their PhD theses. To start with, the possible correlation between career intentions and the phase of doctoral qualification was examined. Then, I used a logistic regression analysis (Best & Wolf, 2010) to jointly investigate potential influences on the initial emergence of a research career intention. The dependent variable was the group variable (0 = aspiring to a career outside academia; 1 = research career intention). Metric predictors were standardized to a mean of 0 and a standard deviation of 1. Due to small and unequal group sizes, a logistic regression using the standard maximum-likelihood-based estimates did not suit the data (Eid et al., 2017). Instead, I conducted a logistic regression analysis with penalized maximum-likelihood estimation (PMLE) proposed by Firth (1993), using Stata version 14 and the *firthlogit*-command (Coveney, 2008). The PMLE approach provides two major advantages. On the one hand, it is useful to reduce bias due to small sample sizes. On the other hand, it always leads to finite estimates of regression parameters, even in case of rare events and separation problems. Simulation studies indicate that Firth's logistic regression surpasses exact logistic regressions, which can only consider a small number of (in the best case dichotomous) covariates and are computationally intensive, or the correction method by King and Zeng (2001), which tends to over-correct (Heinze & Puhr 2010; Leitgöb, 2013).

Third, possible changes regarding the career intentions were examined on individual level. In this way, the following two groups of interest were identified: (1) persons with a stable intention to enter a scientific career and (2) research associates who sought a scientific career at T1 but shifted their intention towards a career outside academia. After defining these two groups, I tested whether the groups differed significantly in respect of performance and research abilities, academic self-efficacy beliefs, interests, perceptions of career prospects, and the attractiveness of a professorship. Independent sample t-tests were conducted. In case of violated data requirements for t-tests (such as homogeneity of variances), I switched to the Mann-Whitney U test as the nonparametric equivalent. Generally, the effect strength coefficient Cohens *d* was calculated, which is characterized by its ro-

bustness against unequal group sizes. Finally, I used Firth’s logistic regression analysis to jointly investigate potential influences on the stability of research career intentions. The dependent variable was the group variable (0 = shift of career intention; 1 = remaining research career intention). Again, metric predictors were standardized to a mean of 0 and a standard deviation of 1.

RESULTS

INITIAL DEVELOPMENT OF RESEARCH CAREER INTENTIONS

Considering only doctoral candidates (N = 65), a descriptive analysis of the career intentions at T1 reveals that 52.3% of the respondents aspire to a career in research and higher education teaching. While 9.2% of the doctoral candidates were undecided at the time of the survey, every fourth respondent strives for a career outside academia. This calculated distribution is in line with the German state of research (e.g., Briedis et al., 2014; Hauss et al., 2015; Krempkow & Winde, 2019). A closer look is taken at the qualification phase as it could affect career intentions as a situational characteristic and lead to a temporary loss of interest in a scientific career. The descriptive results point in this direction. The proportion of doctoral candidates aspiring to a scientific career varies depending on the doctoral period. With special consideration of the small number of cases, a recognizably lower proportion of doctoral candidates in the research phase exhibits a research career intention than at the beginning or end of the qualification (see Table 3). A chi-square test confirms the presumed relationship between the career intention and the qualification phase ($\chi^2(4) = 9.76, p < .05$, Cramer’s V = .28). However, the effect strength coefficient indicates a weak correlation, and the analysis does not allow for causal conclusions.

Table 3. Research career intentions depending on the doctoral phase

DOCTORAL PHASE	N	in %
Phase of orientation and finding of topic (N = 21)	13	61.9
Research phase (N = 30)	10	33.3
Closing phase (N = 11)	9	81.8

As progress within the qualification is accompanied by developments in several individual characteristics, a more complex investigation of influences on the emergence of (initial) research career intentions is necessary. During doctoral qualification and training, the candidates not only acquire experience in scientific work and receive professional feedback that can affect their self-efficacy beliefs, they also gain insights into academia as a working field. Therefore, I examined to what extent the doctoral phase contributes to the intention of a scientific career, with the inclusion of theory-driven predictors. The results of the conducted Firth’s logistic regression analysis on the emergence of a research career intention are presented in Table 4. Unstandardized logit coefficients (b) with standard errors (S.E.) as well as odds ratios (OR) are reported.

In Model 1, there is an influence of the closing phase of the doctoral qualification, in reference to persons belonging to the research phase. The chance of aspiring to a scientific career increases if persons are already in the final phase of their doctorate. This finding supports the hypothesis of a “bathtub curve” of research career intentions due to the doctoral phase. However, the effect disappears in Model 2, which additionally contains variables of interests and motivation, objective performance and self-efficacy beliefs, perspective-related and situational characteristics, as well as the control variables gender and subject group membership. The inclusion of the predictors leads to an improvement in the model fit. The Akaike Information Criterion (AIC) of 54.43 is well below the value from Model 1 and the pseudo-R² estimates according to Cox & Snell and Nagelkerke amount to .39 and

.66, respectively. The considered variables, therefore, appear to have high explanatory merit. Interestingly, there is only one significant effect of the attractiveness of a professorship. It records an odds ratio of 5.26 indicating that when holding all the other predictors constant, a one standard deviation higher rating of the attractiveness of a professorship is associated with a 5.3 times higher chance of a research career intention. Regarding the subject group membership, a person belonging to the group of heterogeneous other subjects is less likely to aspire to a career in research and higher education teaching than a person from the group of natural sciences, mathematics and computer science. The doctoral phase, interests and motivation, the objective performance and academic self-efficacy, as well as job satisfaction and perceived support do not affect the dependent variable.

Table 4. Firth's logistic regression analysis on the (initial) development of a research career intention

PREDICTORS	MODEL 1			MODEL 2		
	<i>b</i>	<i>S.E.</i>	OR	<i>b</i>	<i>S.E.</i>	OR
Constant	-.32	.41	.73	2.41	2.78	11.13
Phase of doctoral qualification						
Research phase (ref)						
Phase of orientation and finding of topic	.83	.61	2.30	1.49	1.21	4.44
Closing phase	1.55†	.83	4.70†	-1.28	1.48	.28
Interests and motivation						
Career orientation				-.84	.63	.43
Creativity / scientific orientation				.84	.56	2.32
Vocational security				-.26	.39	.77
Doctorate as prerequisite for planned research career				-.08	.41	.92
Objective performance and self-efficacy beliefs						
Publishing experience regarding peer-reviewed arti-				-.08	1.15	.92
Academic self-efficacy beliefs				1.16	.99	3.19
Perspective-related and situational characteris-						
Perceived chances of obtaining a professorship				-.07	.39	.93
Attractiveness of professorship				1.66*	.84	5.26*
General job satisfaction				-.40	.60	.67
Perceived support in work environment				-.04	.48	.96
Controls						
Gender (male = 0)				.80	.83	2.23
Subject group: Natural sciences, mathematics, com-						
puter science (ref)						
Social sciences				-1.34	1.07	.26
Humanities and cultural sciences				-3.11	2.21	.04
Other				-3.78†	2.09	.02†
Pseudo-R² (Nagelkerke)		.11			.66	
Pseudo-R² (Cox & Snell)		.08			.39	
AIC		69.84			54.43	

Annotations: N = 53; *b* = unstandardized logit coefficient, *S.E.* = standard error, OR = odds ratios; † = $p \leq 0.1$, * = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$.

DESCRIPTIVE ANALYSES ON CHANGES IN RESEARCH CAREER INTENTIONS

To analyze changes and the stability of research career intentions, I rely on longitudinal data of the whole sample of the surveyed ECRs. The descriptive results regarding the career intentions at T1 and T2 reflect vocational aspirations in cross-section. Therefore, they can indicate the attractiveness of different fields of work at the two points in time as well as potential changes regarding the percentage of persons striving for a career in academia. The analysis confirms the assumption of intra-individual changes over time. At T1, 66% of the 101 research associates aspire to a career in academia. In total, the proportion drops to 55% at T2. Over the course of time, 20 of the persons who were initially interested in a scientific career change their intention, while the remaining 47 people still pursue it. Nine persons from the group, who intended to enter a career outside academia at T1, reorient themselves towards the scientific career (Figure 1). Overall, the analysis illustrates the tendency of a declining interest in academic careers. Hence, the findings are congruent with recent empirical results (Gibbs et al., 2015; Roach & Sauermann, 2017).

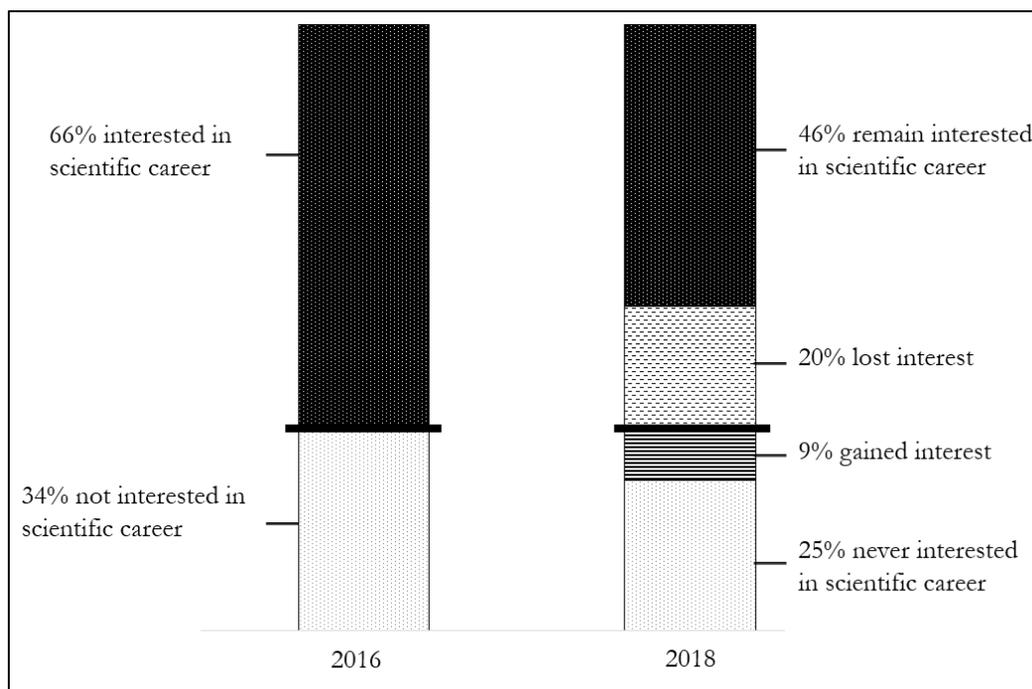


Figure 1. Changes in research career intentions in the course of academic qualification (N = 101; illustration following Roach & Sauermann, 2017, p. 6)

In the following, persons with a remaining research career intention and persons who lost this interest over time are of particular interest. The question of group differences seems to be obvious. In fact, the two groups do not differ remarkably regarding the average number of publications nor the average extent of academic self-efficacy beliefs at T2. Although a Mann-Whitney test suggests that the rating of subjective research abilities is significantly higher in the group of persons with a stable research career intention (Mdn = 8) than for persons with a change in the career intention (Mdn = 7), $U = 268.00$, $p = .006$, $d = .69$. Cohen's d represents a medium to large effect, indicating a substantial difference. Furthermore, the analyses echo former results regarding the attractiveness and expected chances of obtaining a professorship (Roach & Sauermann, 2017). The estimated probabilities of achieving the academic target position are generally rated low in both groups ($M < 25\%$), but still positive in comparison to calculated chances (Consortium for the National Report on Junior Scholars, 2017; Krempkow, 2017; Schneijderberg, 2017). They do not seem to affect the average attractiveness of a professorship in the group of persons striving for a scientific career. A Mann-Whitney test shows a significantly higher rating (Mdn = 5) than for persons who realign in terms of their career

intention (Mdn = 2), $U = 204.00$, $p = .000$, $d = .93$. Cohen's d represents a large effect. The identified disparity leads to the question of possible group differences in the aversion of vocational risks. The descriptive analysis shows that vocational security is essential to people in both groups ($M > 4.3$). Furthermore, the group averages remain stable over time. In contrast, the two groups differ in their creativity/ scientific orientation. While the average, individual importance of creative science-related tasks remains at a stable level within the group of persons with a remaining research career intention (Mdn = 4), a Mann-Whitney test indicates that it is significantly lower in the group of persons with a shifted career intention at T2 (Mdn = 4), $U = 316.50$, $p = .034$, $d = .53$.

While the findings on group differences already provide indications of possibly relevant characteristics for the stability of the research career intention, it has to be stressed that they do not imply causality. On the one hand, it is conceivable that people whose interest in creative science-related tasks decreases may shift their career intentions as a result. On the other hand, a shifted career intention may lead to changes in vocational interests or the rating of the attractiveness of a professorship.

LOGISTIC REGRESSION ANALYSIS ON THE STABILITY OF RESEARCH CAREER INTENTIONS

By means of a regression analysis, I aimed to draw inferences about the impact of the theoretically and/or empirically relevant factors on the stability of research career intentions over time. The results of the Firth's logistic regression model, including changes in interests, subjective abilities, perspective-related characteristics as well as control variables, are shown in Table 5. Unstandardized logit coefficients (b) with standard errors (S.E.) as well as odds ratios (OR) are reported.

The analysis reveals significant positive influences of only two predictors, namely the subjective research abilities at T2 and the change in the rated attractiveness of a professorship. When holding all the other predictors constant, a one standard deviation higher change in the attractiveness of a professorship is associated with a 3.0 times higher chance of a continuing research career intention. The rating of the subjective research abilities similarly affects the outcome variable. In consideration of the small sample size, the effects can be interpreted as meaningful. Changes in interests, academic self-efficacy beliefs, job satisfaction, and perceived support do not significantly influence the stability of research career intentions. Furthermore, there are no effects of perceived chances of obtaining a professorship or control variables. The pseudo- R^2 , according to Nagelkerke and Cox & Snell, amount to .48 and .26, respectively.

Table 5. Firth's logistic regression analysis on the stability of research career intentions

PREDICTORS	<i>b</i>	<i>S.E.</i>	OR
Constant	1.51†	.88	4.53†
Changes in interests			
Change in science orientation/creativity	.09	.38	1.09
Change in vocational security	.39	.32	1.48
Subjective abilities			
Subjective research abilities (T2)	1.02*	.45	2.77*
Change in academic self-efficacy beliefs	-.38	.38	.68
Perspective-related and situational characteristics			
Perceived chances of obtaining a professorship	.06	.63	1.06
Change in attractiveness of professorship	1.09*	.45	2.97*
Change in general job satisfaction	.41	.58	1.51
Change in perceived support in work environment	-.26	.37	.77

PREDICTORS	<i>b</i>	<i>S.E.</i>	OR
Controls			
Gender (male = 0)	-.01	.87	.99
Formal qualification (doctoral candidates = 0)	-.57	.89	.57
Subject group: Natural sciences, mathematics, computer science (ref)			
Social sciences	-.24	.94	.79
Humanities and cultural sciences	-.29	.88	.75
Other	-.12	1.20	.89
Pseudo-R² (Nagelkerke)	.48		
Pseudo-R² (Cox & Snell)	.26		
AIC	57.59		

Annotations: N = 61; b = unstandardized logit coefficient, S.E. = standard error, OR = odds ratios; † = p ≤ 0.1, * = p ≤ 0.05, ** = p ≤ 0.01, *** = p ≤ 0.001.

DISCUSSION

The investigation of factors influencing the development of a research career intention among doctoral candidates leads to the conclusion that it is significantly favored by a higher assessment of the attractiveness of a professorship. Although this finding is plausible, it is not possible to conclude clear directions of impact. According to the Model of Career Choice (Lent et al., 1994), the postulated effect only works in one direction. However, Briedis et al. (2014) already referred to the possibility of reciprocal relations between career intentions and other model components. It is conceivable that a research career intention also promotes the attractiveness of the target position. The effect of the subject group membership is in line with prior expectations. It can be seen that individuals within the group of heterogeneous other subjects, compared to those in the reference group of natural sciences, mathematics, and computer science, have a reduced chance of aspiring to a scientific career. This finding can be explained by the composition of the group, including economists, lawyers, and veterinarians, who have numerous career options outside academia. Interestingly, no significant influences of academic self-efficacy beliefs and the interest in scientific work have been shown, which had explanatory potential in previous studies. However, it must be emphasized that an intention to enter a career outside academia does not necessarily imply that one wants to leave the academic profession. Dorenkamp and Weiß (2018) explicitly differ between organizational and professional turnover. For instance, working in research and development within the private sector can also require a strong interest in scientific work and self-efficacy beliefs. In such a case, the occupational transition into the private sector would correspond to an organizational, but not a professional turnover. The further descriptive analyses confirm previous findings regarding intra-individual changes of career intentions and a declining interest in academic careers over the considered period of time (Gibbs et al., 2015; Roach & Sauer mann, 2017; Sauer mann & Roach, 2012). As scholars have already discussed, the observed changes in the career intentions may result from a higher awareness of job requirements, chances, and career paths in- and outside of academia. It is also conceivable that ECRs develop a higher sensitivity for individual interests and strengths, resulting in a shift of their personal career intention. Findings from the conducted multivariate analysis support the latter assumption, as perceived chances of obtaining a professorship have no significant influence on the development of initial research career intentions or their stability. However, it is questionable whether ECRs are capable of realistically anticipating the conditions in the scientific labor market. The longitudinal analysis reveals a significant effect of the assessment of subjective research abilities, while changes in the domain-specific self-efficacy do not influence the stability of the intention to enter a career in academia. Therefore, it is the comparison within the peer group that has an impact. This finding is supported by the fact that persons with a shifted or continuing research career intention do not differ significantly in terms of objective performance or academic self-efficacy beliefs. The impostor phenomenon may appear at this point. In recent studies, Chakraverty (2020) and Cisco (2020) both identify

comparing oneself to others as a major issue resulting from impostor experiences. Doctoral candidates with feelings of impostorism are prone to compare themselves unfavorably with their peers. At worst, this may lead to an irrational depreciation of self-esteem and the conviction that one does not deserve a scientific career, concluding in a shifted career intention. In the long run, there is the question of whether the “brightest minds” will remain in academia or those with high activity-related self-esteem. Furthermore, the analysis also shows that the change in the attractiveness rating of the professorship affects the stability of the outcome variable. Again, it is not possible to conclude a clear direction of impact. Overall, few predictors have been proven to affect the development and the stability of research career intentions.

LIMITATIONS

It has to be mentioned that the analyses are based on a small sample at one German university, so the results may not be generalizable. Nevertheless, there is no apparent reason to assume that ECRs at the considered organization differ systematically from scientists at other German universities. It should also be noted that harmonization processes have led to modifications in the survey instrument between T1 and T2. Therefore, changes over time could not be taken into account for all variables.

IMPLICATIONS OF THE STUDY

The study comprises implications for future research, policy, and the promotion of ECRs at universities. The proof of the tendency of declining interest in scientific careers, combined with the importance of the attractiveness of the professorship for remaining interested in a research career, implies a need for structural changes. The attractiveness of scientific target positions and, in particular, the path to a professorship, must be strengthened. The creation of distinct career stages in German academia could improve the predictability of scientific careers. At the same time, it could enhance transparency and meet the need for security expressed by ECRs.

Within qualification phases at universities, ECRs should be supported in developing realistic assessments of their subjective research skills relative to their peers. In addition to feedback within regular academic supervision, other sources could be valuable. Mentoring, offers regarding mental support, or opportunities for peer counseling are expected to be beneficial. Hence, the expansion of such services could be an approach for organizational support in regard to fulfilling the aim of keeping the “brightest minds” in academia.

Future research should focus on specific instruments of promoting ECRs and how they affect the development of realistic assessments of individual research skills. Moreover, future studies should highlight the issue of a researcher’s visa status. Since nationality and visa regulations are accompanied by work permit constraints, these potentially affect individual career intentions and career development. In comparison to German nationals, international ECRs, especially non-European citizens, may face different job opportunities and research career prospects in their home countries. The group of international ECRs should be explicitly considered in the context of career intentions and career development.

CONCLUSION

This study contributes to the understanding of the career intentions of ECRs in Germany. I documented (longitudinal) changes in the career intentions in the course of academic qualification, indicating the tendency of a declining interest in scientific careers over time. Besides, I was able to highlight the attractiveness of the professorship and the subjective research skills relative to peers as key factors influencing the stability of a research career intention. These findings are essential for policy as well as practitioners at universities in order to improve the appeal and conditions of scientific ca-

reers in German academia. Further research is needed in different fields: I want to encourage researchers to verify the findings using other longitudinal data sets. Moreover, impostor feelings and a researcher's visa status as influencing factors on career intentions need to be investigated. Future research should also focus on specific instruments of promoting ECRs and how they affect the development of realistic assessments of subjective research skills relative to peers.

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DECLARATION OF INTEREST STATEMENT

No potential conflict of interest was reported by the author.

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BIOGRAPHY



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