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Individual and Contextual Influences on the Start-up Inclination of Women Academics

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Although in recent years there has been an increasing interest in studies of academic entrepreneurship, only a few studies investigating the start-up inclination of women working in academia have been reported. This paper investigates intention formation, person input, and contextual factors as predictors for the start-up inclination of academic women at German universities based on the Social Cognitive Career Theory (SCCT). We employ multinomial logistic regression in a sequential analysis. Our data refers to the sample from the "Institut für Mittelstandsforschung" "IfM" Bonn, Germany. Thus, we conduct a secondary analysis. The sample size considered for academic women is 2,340. Person input shows mixed effects on the start-up inclination. Contextual factors; however, exert a positive impact on having a start-up idea among academic females in Germany. Intention formation has a positive influence on having a concrete and non-concrete start-up idea. Our paper intends to fill the research gap by adding to the available models explaining individual and contextual factors that influence having a start-up idea a SCCT-based model that explains the start-up inclination of women working in academia.

Keywords: entrepreneurial career choices, academic entrepreneurs, female academic entrepreneurship, individual influences, contextual influences

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INTRODUCTION

Over the past two decades, there has been sustained research activity in predicting the entrepreneurial behavior (EB) of students, academics, and researchers (e.g., Krueger et al., 2000; Audet, 2004; Moriano et al., 2012). This is mainly because the commercialization of research is seen as an important driver of transfer from research to society; thus, consequently affecting societal development and contributing to significant innovation (Grimaldi et al., 2011; Iffländer et al., 2018). While numerous studies have examined academic entrepreneurial behavior (e.g., Krabel and Müller, 2009; Haeussler and Colyvas, 2011; Fritsch and Krabel, 2012; Grimm and Jaenicke, 2012; Perkmann et al., 2013; Kolb and Wagner, 2015; Piontek and Wyrwich, 2017; Lehmann and Stockinger, 2019; Goethner and Wyrwick, 2020; Greven et al., 2020; Dohse et al., 2021), the research on the entrepreneurial behavior of female scientists has received limited attention in the literature. The data on academic entrepreneurship of female scientists are scarce (Iffländer et al., 2018), suggesting that, among the academic entrepreneurs, women are still a minority based on studies of the Organisation for Economic Cooperation and Development (OECD) countries (Rosa and Dawson, 2006; Polkowska, 2013; Best et al., 2016; Lawton-Smith et al., 2017). As the available differentiated statistics on women in entrepreneurship are scarce (Iffländer et al., 2018), we did not confine ourselves to research-driven entrepreneurship. Instead, we studied the overall academic

entrepreneurship of female scientists, especially the start-up inclination of women working in academia that also has an economic, technological, and social impact.

As the individual and contextual influences of the start-up inclination of female scientists are still under-researched despite the low percentage of academic female entrepreneurs in the OECD countries, we investigated these influences for Germany in a secondary analysis based on data collected by the institute of Small and Medium-sized Enterprises (SME) research in Bonn (Institute für Mittelstandsforschung "IfM"). The core objective of this study was to assess how individual and structural factors relate to the start-up inclination of women academics working at German universities. Two core questions guided the research pursuit:

(1) What individual and contextual factors predict the start-up inclination of women academics working in German universities?
(2) How can we model the individual and contextual influences on the start-up inclination of women academics working in academia?

To improve the rate of business founding out of the university, it would be beneficial to understand what individual and contextual factors influence the start-up inclination of women academics. This study strives to contribute to the empirical foundation of customizing the initiatives to promote entrepreneurship of women academics based on evidence. This paper is one of its kind relating to the influences of entrepreneurial activities of female academics working at universities in Germany. The study advances the current research in two ways: firstly, gaining insights into the influencing factors of the start-up inclination of female academics at universities in Germany; and secondly, from the empirically identified impact factors, deriving valid pedagogical implications.

Goel and Grimpe (2012) differentiated the entrepreneurial activities between research-driven and overall academic entrepreneurship. Depending on the type of organization, studies also refer to the empirical activities at universities, universities of applied sciences, and research organizations. The current study focused on the start-up inclination of the overall academic entrepreneurial activities at universities, including German universities of applied sciences.

The work in this arena generally encompasses the predictors of academic entrepreneurship independently of gender (e.g., Fritsch and Krabel, 2012; Obschonka et al., 2012; Perkmann et al., 2013; Kolb and Wagner, 2015; Hossinger et al., 2020; Neves and Brito, 2020; Dohse et al., 2021). However, some attempts have been made to address this issue.

One of the rare studies running regressions for the sample of female researchers at a non-profit research organization compared to the male sample to explain the entrepreneurial propensity for both genders was conducted by Goel et al. (2015). They found the female sample comparable to the male researchers of a non-profit German research institution and that age has a slightly negative impact and German citizenship has a strongly negative impact, while industrial experience has a positive medium effect on academic entrepreneurship of females (Goel et al., 2015). The negative impact of the doctoral degree is conversely related to the influence of the males insignificantly. The perception of increased reputation from academic entrepreneurship raises the entrepreneurial probability of female academics similar to the male counterpart (Goel et al., 2015). The inclination towards free accessibility of one's own research results has no significant impact on the academic entrepreneurship of females, while for male academics it has a negative impact (Goel et al., 2015). Patenting is significant for the male, but insignificant for the academic female (Goel et al., 2015). Ebersberger and Pirhofer (2011) explored the effects of gender and supplementary management education on the willingness of academics to start up a company. Based on a survey of academics, they found that controlling of academic achievement, field of science, and perceived hampering of female academics show a significantly lower propensity to have a high willingness to start up a company. Supplementary management education does not in general have a significant effect on the willingness to start up, but for academic females, supplementary management education somehow exerts a significantly positive effect almost offsetting the gender effect. A tabular summary of the predictors of women's academic entrepreneurship is presented in **Supplementary Table SA1**.

As for the academic research field, there are some fields of science, such as Education, Social Sciences, and Humanities (Bielby and Baron 1986; Polkowska, 2013), that offer less commercialization-opportunities compared to science-related disciplines such as Biotechnology, Mathematics, Physics, and Chemistry (Polkowska, 2013; Politis et al., 2014). However, as for the commercialization-friendly disciplines, there are differences in terms of gender balance: according to Abreu and Grinevich (2017), the rates of female academics in the commercialization-friendly disciplines are lower compared to those of men (Rosa and Dawson, 2006). Politis et al. (2014) found that the technology sector increases the likelihood of a female-led incubator project (Politis et al., 2014). For example, they found that women are more likely to become incubator entrepreneurs in Information and Communications Technology (ICT) than in Life Sciences (Politis et al., 2014). Goel et al. (2015) found that Biology or Medicine has a medium positive effect on academic entrepreneurship, while the effect of Chemistry, Physics, or Technics is not that significant.

Summarizing these studies, it can be concluded that management education, human capital, and the disciplines of Biology, Medicine, and ICT, while German nationality, and age have a negative effect on entrepreneurship.

To the best of our knowledge, no previous research has investigated the individual and contextual influences on the start-up inclination of women academics working at German universities based on a theoretical foundation. This study aims to fill this research gap.

Despite the success of the studies addressing the issues of female gender (e.g., Krabel and Müller, 2009; Aldridge and Audretsch, 2011; Ebersberg and Pirhofer, 2011; Alshumaimri

et al., 2012; Bijedic et al., 2014; Politis et al., 2014; Goel et al., 2015; Abreu and Grinevich, 2017; Dohse et al., 2021) in certain aspects, the literature still lacks the theory to account for why relatively few women scientists working in academia are becoming entrepreneurs. In general, several theories have been applied to explain entrepreneurial behavior. The introduction of the *Social Cognitive Career Theory* (SCCT) developed by Robert W. Lent, Steven D. Brown, and Gail Hackett in 1994 is expected to contribute to the understanding of both the effects of the personal and contextual factors on the interests, intentions, and behavior of the career development (Liguori, 2012). Lent et al. (1994) based their theory on Bandura's general social cognitive theory. The SCCT model is an integration of the models to explain career-related interest development, choice-making, and performance. According to Lent et al. (1994), career interest is predicted by cognitive-related factors such as self-efficacy, outcome expectations, and goals/intentions. Goals are defined as the commitment to show a specific behavior. Self-efficacy is "people's judgments of their capabilities to organize and execute courses of actions required to attain designated types of performance" ("I know I can do it") (Bandura, 1986, p. 391). Outcome expectation is understood as one's belief about the consequences of performing specific behaviors. Self-efficacy and outcome expectations are influenced by learning experiences. For the last predicted variable, they propose that the learning experience is predicted by both, personal input variables such as gender, predispositions, ethnicity, and disability/health status, and background/context variables such as family and parent influences. The choice goals and proximal contextual factors impact the choice-making that predicts performance. The study conducted by Liguori (2012) extended the SCCI into entrepreneurship research and showed that the use of the SCCT is an appropriate model for explaining entrepreneurial intention. To explain the entrepreneurial career choice of academics, we refer to the SCCT-core model of choice-making. Due to data limitations, we will focus on the personal input, the contextual factors, and the intentions to explain the choice actions.

Our objective is to identify the predictors of the start-up inclination of female academics working at German universities. Our research question is as follows: What are the predictors of the entrepreneurial choice of female academics working at universities in Germany?

Based on the presented empirical studies and our theoretical framework, we hypothesize that:

(1) The personal input factors, including very good/good assessment of professional prospects regarding self-employment, second job as self-employed/freelancer besides being academic at the university, inventions made, management function, and Non-German nationality are positively associated with the realization of the intention to become an entrepreneur.

According to Lent et al. (1994), the person input affects through domain-specific self-efficacy and outcome expectations the intentions. As we consider the assessment of professional prospects regarding self-employment a generalized cross-domain cognition not related to a specific object, we assign it to the personal input: besides the traits, the socio-demographic factors, as well as cross-domain cognitions, constitute the person input (Liguori, 2012). Goel et al. (2015) found that being of German nationality has a negative impact on the entrepreneurial propensity, while industrial experience (Hossinger et al., 2020) and inventions (Neves and Brito, 2020) have a positive influence.

(2) The personal input factor of the research fields of informatics, medicine, and health management is positively associated with the realization of the intention to become an entrepreneur.

Studies have shown that women academics are more likely to become entrepreneurs in ICT (Politis et al., 2014), as well as in Biology, and Medicine (Goel et al., 2015), while the influence of Chemistry, Physics, or Technics is comparatively non-significant (Goel et al., 2015) and the influence of Life Sciences is even negative (Politis et al., 2014).

(3) The contextual factors including self-employment of the parents and self-employment of the partners are positively related to the realization of the intention to become an entrepreneur.

Bijedic et al. (2014) studied German female and male academics and observed that personal factors such as having entrepreneurial parents or an entrepreneurial partner exert a positive influence on entrepreneurial activities. Entrepreneurial parents, as well as partners, have a role model function.

(4) The intention formation of becoming an entrepreneur is positively related to the realization of the intention to become an entrepreneur.

A meta-analysis of more than a hundred studies revealed an average correlation of 0.46 for intentions and behavior (Kim and Hunter, 1993; Audet, 2004). In a similar meta-analysis of the findings of 185 studies carried out up to 1997, Armitage and Conner (2001) found a mean correlation of 0.47 between intention and behavior. In another meta-analysis (Sheeran, 2002), a mean correlation of 0.53 was found between intention and action. However, the actions analyzed were different from the act of launching a business.

METHODS

The institute of Small and Medium-sized Enterprises (SME) research in Bonn (Institute für Mittelstandsforschung "IfM") focuses on the development of medium-sized companies. IfM is a research institute that is funded by the federal ministry of Economics and Energy. It is concerned with presenting quantitative information about SEM and publishing statistics about Start-ups and company closures.

This study is a secondary analysis of the survey data collected for a study conducted in 2013 in which the potential drivers of entrepreneurship among academics in Germany were investigated (Bijedic et al., 2014; Hochschulbefragung des IfM Bonn). The IfM Bonn contacted 73 randomly chosen universities in the fields of business and economics, health and social affairs, social sciences, and Science, Technology, Engineering, and Mathematics (STEM) (Schlömer-Laufen and Schneck, 2020). Since this study focuses on academic entrepreneurship for females in Germany, the empirical analysis is based on the IfM data. To examine the factors that have an impact on having a start-up idea, 12 variables for our multinomial logit estimates are included. These 12 variables refer to person input, contextual factors, and intention formation as our independent variables and the intention initiation or realization as our dependent variable. The questions and items of the survey conducted by Bijedic et al. (2014) are as follows:

The Intention Initiation or Realization

The variable intention initiation or realization is the dependent variable which is measured through inclination to found a company which is a three categorical variable divided into 0 = "no", "no concrete start-up idea at all"; 1 = "founding idea exists, but no activities realized yet to implement the idea", and 2 = "founding idea exists and at least one activity to implement the idea was realized" (Bijedic et al., 2014).

Person Input

Person input was measured through a field of research, including 8 variables (Mathematics, Informatics, Natural science, Economics, Architecture, Medicine/Health management, Music, Design/Art studies, *etc.*), second job including "yes and employed in the private sector," "yes and employed in the public sector," "yes and self-employed/freelancer," "others," and "no", and assessment of professional prospects regarding self-employment measured on a 5 Likert scale ranging from "very bad" to "very good" and "do not know". In addition, nationality (German/Non-German), management function, and invention made, with "yes" and "no"-answers, are included to measure person input (Bijedic et al., 2014).

Contextual Factors

Context/background input is measured through the self-employment of the parents and of the partners with a yes or no and does not know the self-employment of the parents (Bijedic et al., 2014).

Intention Formation

Intention formation is measured through the professional planning for the next 2 years to be self-employed with the 2 variables of full time or part-time and through the probability to be self-employed in the next 2 years, measured on a 5 point Likert scale ranging from "very unlikely" to "very likely" and "do not know" (Bijedic et al., 2014).

The sample consisted of females who participated in the IfM Bonn survey in 2013. Referring to the sample recruited by Bijedic et al. (2014) from 175 universities, including universities of applied sciences in Germany, 73 universities were selected randomly with 36.918 identified scientists in the fields of Business and Economics, Health and Social Affairs, Social Sciences, and STEM (Bijedic et al., 2014; Schlömer-Laufen and Schneck, 2020). Ten thousand one-hundred and ninety-nine scientists took part in the survey in 2013. In sum, 5,992 usable questionnaires were available, and cases of those who refused to answer or engaged in self-employment were excluded. We only focus on the academic women and not on the whole sample of the original study done by IfM. The sample size considered for academic women is 2,340.

The sample descriptive statistics for the variables of interest are shown in **Supplementary Table SA2**. To measure the person input, contextual factors, and intention formation, 12 variables are also presented in **Supplementary Table SA2**.

On one hand, the correlation between intention initiation, personal input, and intention formation shows a negative but weak significant value. On the other hand, the correlation between intention formation, person input, and contextual factors shows a positive but weak correlation, as shown in **Supplementary Table SA2**.

Among the academic females, the lowest percentage has a start-up and concrete idea, a higher percentage has a start-up idea but not concrete, and the highest percentage has no start-up idea at all, as shown in **Supplementary Table SA3**.

RESULTS

We employed sequential logistic regression analysis to explore the impact of contextual factors, intention formation, and person input on the start-up inclination measured by having a concrete and non-concrete start-up idea among academic females in German universities (**Supplementary Table SA4**). The multinomial logistic regression shows the impact of our independent variables on the different responses of having a start-up idea. We present three models in this study, starting with the impact of distal contextual factors on having a start-up idea in model 1 (**Supplementary Table SA4**) followed by model 2 (**Supplementary Table SA4**), including intention formation and contextual factors, and lastly, model 3 (**Supplementary Table SA4**) adding person input to the existing variables.

Distal contextual factors show a positive and significant impact on having a concrete start-up idea and even a start-up idea that is not concrete. This impact is found in the case of having parents and partners who are self-employed, such that a one-point increase in having a self-employed parent increases the multinomial log-odds of having a concrete start-up idea up to 0.582 (the estimated multinomial log-odds values are significant at 1% significance level). A one-point increase in having a self-employed partner increases both the multinomial log-odds of having a concrete start-up idea up to 0.667 and having a start-up that is not concrete up to 0.323 (the estimated multinomial log-odds values are significant at 1 and 5% significance levels). These results are significant, however, in model 1 (**Supplementary Table SA4**) only.

Intention formation has a positive and significant impact on having a concrete start-up idea. This is clear in the professional planning in the next 2 years to be self-employed for full time. It indicates that respondents who are very likely to have professional planning in the next 2 years to be self-employed for full-time are most likely to have a concrete start-up idea. Thus, a one-point increase for having a very likely professional planning in the next 2 years to be self-employed for full time increases the multinomial log-odds of having a concrete start-up idea up to 1.471 and 1.244 in models 2 and 3 (**Supplementary Table SA4**), respectively (the estimated multinomial log-odds are significant at 1 and 5% significance levels). The higher the likelihood of having professional planning in the next 2 years to be self-employed for part-time, the higher the likelihood of having a concrete and non-concrete start-up idea (models 2 and 3, **Supplementary Table SA4**). Contrary to that, regardless of the likelihood, the probability to be self-employed in the next 2 years has the same effect on having a start-up idea, both for concrete and non-concrete ideas. Therefore, the probability of being self-employed in the next 2 years exhibits a positive and significant impact on the multinomial log-odds of having concrete and not concrete start-up ideas (model 2 and 3, **Supplementary Table SA4**).

Person input shows a positive significant impact on having concrete and non-concrete start-up ideas, such that, the fields of research, music, design and art studies have a positive significant impact on having a start-up idea but not on having a concrete one. It shows that a one-point increase for having music, design, and art studies as a field of research, the multinomial log-odds of having a non-concrete start-up idea increase up to 1.258 (the estimated multinomial log-odds are significant at 5% significance level) (model 3, **Supplementary Table SA4**). Having a second job has only a positive significant impact on having a non-concrete start-up idea if the respondent is an employee in public service. Therefore, for every one-point increase of having a second job in the public service, the multinomial log-odds value of having a start-up idea, although not a concrete one, is 0.919 (the estimated multinomial log-odds values are significant at the 1% significance level) (model 3). Furthermore, being self-employed/freelancer as a second job has a positive significant impact on having a concrete start-up idea. Accordingly, a one-point increase for having the second job as a self-employed or a freelancer increases the multinomial log-odds of having a concrete start-up idea with 0.798 (the estimated multinomial log-odds are significant at the 1% significance level) (model 3, **Supplementary Table SA4**).

In addition to that, respondents who have other second jobs are more likely to have a non-concrete start-up idea. Thus, increasing the probability of having any other second job with one point, increases the multinomial log-odds up to 0.554 (the estimated multinomial log-odds are significant at a 5% significance level) (model 3, **Supplementary Table SA4**). Furthermore, having a bad, neutral, good, and very good assessment of professional prospects regarding self-employment contributes to having a start-up idea; however, not a concrete one. Our model shows that for every one-point increase in the likelihood regarding the assessment of professional prospects of self-employment, the multinomial log-odds of having a bad, neutral, good, and a very good assessment increase up to 0.734, 1.293, 1.490, and 1.423, respectively (the estimated multinomial log-odds are significant at 1 and 5% significance levels) (model 3, **Supplementary Table SA4**).

Lastly, person input has a positive significant impact on having a non-concrete start-up idea, if the respondent has a management function. Therefore, for each one-point increase in having a management function, the multinomial log-odds increase up to 0.570 (the estimated multinomial log-odds are significant at a 5% significance level) (model 3, **Supplementary Table SA4**).

DISCUSSION

The study contributes to the research of influencing factors of the start-up inclination of women working in academia. To predict the inclination of women academics working at German universities, based on SCCT, we referred to data of the IfM Bonn and employed sequential logistic regression analysis to investigate the influence of person input, contextual factors, and intention formation. The developed model for all predictors (model 3) shows an acceptable model accuracy with a pseudo R^2 of 0.27: 27% of the variation of the start-up idea of women academics at German universities is explained by the person input, the contextual factors, and the intention formation. In sum, the study supported generally the hypotheses derived from SCCT; however, the results show mixed evidence for the hypothesized variables depending on the degree of concreteness of the start-up idea.

In terms of person input, contrary to our hypothesis, only the research fields of Music, Design, and Art studies show a positive significant impact on having a start-up idea, but not on having a concrete one. Regarding the second job besides being academic at the university, our results provide support to the hypothesis related to the positive impact of having a second job as a self-employed/freelancer. In addition to that predictor, both being an employee in public service and having any other second job also exert an influence on having a non-concrete idea. The study supports the hypothesis that the good and very good assessments of professional prospects regarding self-employment have an impact on the start-up idea, even though these do not have a significant impact on the concrete idea.

As hypothesized, the management function significantly interacts with having a non-concrete start-up idea. However, concerning nationality and invention, our hypotheses could not be confirmed. Regarding the contextual factors, our hypotheses could only be confirmed in the model that includes the distal contextual factors: this model shows that the presence of parents and partners who are self-employed affects the start-up idea of women academics at German universities positively. Finally, our results show that, as hypothesized, intention formation exerts a positive influence on having a concrete start-up idea. A very likely professional planning for the next 2 years to be self-employed in both, full-time and part-time, has a positive influence on having a concrete start-up idea, and also on having a non-concrete idea for the part-time prospects.

Although some hypotheses of the person input, such as the research field, are not supported, they lead to the surprising results that the research fields of Music, Design, and Art studies, as well as a second job in public service and other sectors besides being academic at the university, increase the probability of having a start-up idea. This may be due to the following facts: 1) the research fields of Music, Design, and Art studies are commercialization-friendly disciplines (Abreu and Grinevich, 2017) although not dominated by male students; and 2) a second job may contribute to a broader set of competencies that characterize entrepreneurs. With this study, we could add to the available models explaining entrepreneurship a SCCT-based model that focusses on the women working in academia. In light with previous research, results of the current study show surprising differences in effects of the SCCT-based impact factors depending on the degree of the concretization of the start-up idea. Compared to the SCCT, the current model expands the understanding of entrepreneurship by differentiating the degree of the concretization of the start-up idea. The findings contribute to the literature of entrepreneurship education and shed light on personal and contextual factors that differentially impact the variance of the start-up inclination of women working in academia in Germany. It would be interesting to add economic factors to the distal context factors to investigate the transferability of the model to other ecosystems of the world. Our findings have several interesting pedagogical implications for overcoming gender disparities in academic entrepreneurship. The study provides insight into two new target groups of entrepreneurial training. Women working in academia in research fields, for example, Music, Design, and Art studies, as well as those females in academia having a second job, are identified as target groups of entrepreneurial training and education programs at universities. Moreover, identifying women academics planning to be self-employed in the next few years and supporting them to concretize or finalize start-up ideas at the university could contribute to overcoming gender disparities.

Finally, the study has two main limitations: it is based on IfM data from 2013 that is not considered up to date anymore; besides, the IfM does not provide information on all relevant constructs of SCCT. Thus, further research is warranted to investigate the core constructs of the SCCT to explain the entrepreneurial activities of women academics.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: https://www.ifm-bonn.org.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.799361/full#supplementary-material

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