

Koenings, Fabian; Haussen, Tina; Toepfer, Stefan; Uebelmesser, Silke

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Coming to stay or to go? Stay intention and involved uncertainty of international students

Fabian Koenings¹  | Tina Haussen¹ | Stefan Toepfer¹ |
Silke Uebelmesser^{1,2} 

¹Friedrich Schiller University Jena, Faculty of Economics and Business Administration, Jena, Germany

²CESifo, Munich, Germany

Correspondence

Fabian Koenings, Friedrich Schiller University Jena, Faculty of Economics and Business Administration, Carl-Zeiss-Str. 3, 07743 Jena, Germany.

Email: fabian.koenings@uni-jena.de

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Abstract

Countries compete for young talents to alleviate skilled-labor shortage. International students, who stay after graduation, allow host countries to overcome this challenge. This study investigates the factors associated with international students' intention to stay or to go after graduation from a host country's perspective. In contrast to the literature, this analysis employs survey data collected from first-semester students. This assures that the analysis is not distorted by attrition. Furthermore, it allows policymakers to address those students who would be no longer around later in the absence of any policy measure. At the same time, it requires to deal with uncertainty as the actual migration decision will be later. This study introduces a set of uncertainty models to the migration context. The results show that, next to career opportunities and a stay in the host country before the studies, being enrolled in a Bachelor program instead of a Master program is significantly associated with the intention to stay. The findings are largely robust to different approaches accounting for the uncertainty involved. Further, Master students are found to be significantly more uncertain than Bachelor students.

KEYWORDS

international students, labor shortage, stay intention, uncertainty

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1 | INTRODUCTION

The shift in the importance of production factors, from physical to human capital, is one important reason for competition for skilled talents to increase a country's productivity and prosperity (Reiner, 2010). When endogenous potentials, that is, skilled labor within a country, are scarce, countries search for exogenous potentials, that is, skilled labor from abroad. Universities can play an important role in this international competition as they attract highly talented young individuals from around the globe and provide them with the possibility to build up human capital (Glaeser et al., 2001). International students, however, will only directly contribute to the economic development of the host country if they decide to stay and become part of the host country's labor force after their studies (Hooijen et al., 2017).¹ In this paper, we focus on the perspective of the host country and examine the factors associated with the stated intention of international students to stay or to go after graduation, while explicitly considering the uncertainty of this future decision.

The related literature on that topic can broadly be divided into theoretical studies that model the migration intention and actual decision, respectively, and empirical studies dealing with students' intentions to stay or to go after graduation. With respect to the actual migration decision the standard human capital model of migration predicts that migration occurs whenever expected lifetime earnings in a foreign country exceed expected lifetime earnings in the current country of residence (De Haas & Fokkema, 2011; Sjaastad, 1962).² Given the large number of possible destinations after graduation, it is difficult to collect data on actual (non-)migration. Therefore, this study investigates the intention to stay in the host country after graduation. According to the theory of planned behavior, the intention for a particular action is (almost always) a necessary precondition for a behavior (Ajzen, 1991). When analyzing a behavior that lies in the future, such as permanently migrating after graduation, intentions to engage in such a behavior are a meaningful proxy for the actual decision (Burda et al., 1998; Manski, 1990; Papapanagos & Sanfey, 2001; Uebelmesser, 2006).

Empirical analyses on migration intentions either focus on the determinants of the intention to stay in the host country and to join its labor force or the intention to return to the corresponding home country. Kruanak and Ruangkanjanases (2014), for example, survey international students during their studies and investigate their intention to stay in Thailand after graduation. The authors illustrate that the level of social support and career opportunities are significant determinants of whether international students want to stay in the host country. Lin and Kingminghae (2017), also employing survey data collected during the studies, solely focus on one determinant of international students' intention to stay in China—the role of intimate relationships, such as a marriage or a romantic relationship. They outline that intimate relationships indeed are a pull factor across borders, with their strength differing by gender. Hooijen et al. (2017) asked students in their final phase of studies about their intention to stay within the Euregio Meuse-Rhine after graduation. The authors find that, among others, individual characteristics, the perception of career opportunities, and having social ties within the region are significantly associated with the intention to stay. Cheung and Xu (2015) as well as Soon (2010) analyze, in turn, the return intentions of international university students after completing their studies. Cheung and Xu (2015) use a survey of Chinese citizens studying in the United States and identify job opportunities in the home country and family ties to be the strongest predictors of return intentions. Soon (2010) investigates the intentions of international students who graduated at two universities in New Zealand. The analysis reveals that, for example, a longer stay duration in New Zealand significantly decreases the intention to return.

¹We abstract from benefits for the host country which could realize while students are still in the course of their studies or when they leave after graduation (see, e.g., Pan, 2013 on the general enhancement of international political and diplomatic relations through international students and Murat, 2014 on effects on trade relations).

²In the case of highly skilled individuals, however, personal characteristics, such as individual preferences, are more important for the initial decision to emigrate as well as for the decision to return than monetary gains (Gibson & McKenzie, 2011).

Yet, when surveying international students' intention (but not their actual decision) to stay or to migrate after graduation, that is, at some point in time in the future, the survey response is characterized by uncertainty.³ To account for this, Soon (2010) distinguishes between a definite return, possible return, possible no return, and definite no return. The results show, among others, that studying commerce instead of science is significantly associated with being uncertain. Similarly, Hooijen et al. (2017) consider the uncertainty involved in students' intention to stay. They separately analyze certain stayers, certain leavers, and uncertain students. Comparing the uncertain students with those who are certain to leave, reveals that Master students compared with Bachelor students are more likely to be uncertain.

One common feature of all these studies is that the students' intentions to stay or to go are surveyed at the middle or the end of their studies. However, this approach misses all students who leave the university before. Let us take Germany as an example. On average, between 29% and 45% of international students do not graduate from institutions of higher education for various reasons (Heublein & Schmelzer, 2018). The attrition rate is especially high over the first semesters (German Federal Statistical Office, 2019b). Given this observation, factors driving the intention to stay may differ considerably for the initial sample of international students as compared with the later reduced one. The identification of the factors that determine the intention to stay or to go at the beginning of the studies has the advantage to allow policymakers to address those international students who would be no longer around at a later stage in the absence of any policy measure. In addition, this provides policymakers more generally with more time to target policy measures at international students according to their intention.

In the present paper, we analyze the factors that are associated with the intention to stay or to go after graduation of international students of a medium-sized university in Germany. In this context, Germany provides an interesting basis for research for several reasons: It is not only the sixth-largest destination country for international students (OECD, 2018), but also ranks fourth in an attractiveness analysis for students among OECD countries (Tuccio, 2019). At the same time, like many other European countries, Germany is confronted with an aging population (Deschermeier, 2017; Plötzsch & Röger, 2015) and a declining labor supply (Fuchs et al., 2017) while demand for skilled labor is high (Maier et al., 2015). The successful integration of international students helps to address this shortage.

Our study distinguishes itself from related empirical papers mainly through two key points. First, and most importantly, we survey international students at the beginning of their studies and not at the end, so that our results are not distorted by the attrition that occurs during the course of the studies. This allows evaluating factors that are of importance for the initial sample of international students. To account for the larger uncertainty associated with a decision in the more distant future, we, second, borrow several model specifications on how to combine information on the willingness to pay and involved uncertainty in the context of contingent valuation (Martínez-Españeira & Lyssenko, 2012) and apply them to the migration context. This is our conceptual innovation. It enables us to derive factors that shape the intention to stay with certainty and hence are the most likely drivers of an actual staying decision later on. At the same time, we provide insights about the group of uncertain students. Those students have already decided once in favor of the host country; understanding better who they are and how important specific factors of the host country are for their staying decision allows policymakers for more targeted policy measures. The results of our analyses show that, next to career opportunities and a stay in the host country before the studies, being enrolled in a Bachelor program instead of a Master program is significantly associated with the intention to stay. This also holds in the presence of lower economic growth in the students' home country. Our main findings are largely robust to different approaches accounting for the uncertainty

³Sometimes the terms uncertainty and risk are used interchangeably even though they are two distinct concepts (Knight, 1921). The expressed intention about an action lying several years in the future mainly involves uncertainty as uncertainty is primarily rooted in imperfect knowledge or the unpredictability of the future. In contrast, the literature refers to risk once particular outcome possibilities regarding an event in the future are known. Naturally, uncertainty and risk overlap to a certain extent (Williams & Baláz, 2012, p. 176).

involved. Having been to Germany before enrolling at the German university and having a German partner is accompanied by a higher intention to stay with certainty. Further, Master students do not only exhibit a lower intention to stay, but they are also significantly more uncertain. An important aspect in this context from a policy perspective is the role played by career opportunities as this opens up the scope for measures to foster the contact to the labor market already during the studies.

This paper is structured as follows: In Section 2, we present the data set. Section 3 focuses on determinants of the intention to stay without taking uncertainty into account. It presents our empirical strategy and estimation results. Different approaches on how to take the uncertainty involved into account are conducted and discussed in Section 4. A concluding Section 5 summarizes our findings.

2 | DATA

To test which factors are significantly associated with the intention to stay in Germany after graduation, we use survey data of international students at the beginning of their studies at a university in East-Germany, where demographic change and skilled-labor shortage are prevalent challenges (Burstedde et al., 2017). The university under study is a medium-sized university among the full-fledged universities in Germany. For an investigation of international students, the university is well suited as the share of foreign students over all students (12.57%) is very close to the median share (12.63%) of all German universities in 2016 (own calculations based on data from the German Federal Statistical Office, 2017). This also holds for the consecutive years.⁴

On the basis of a questionnaire, students were asked, among others, to provide information on individual characteristics, their study program, the intention to stay in Germany after graduation and the reasons for this intention as well as the uncertainty involved. The questionnaire was available in both German and English.

The survey was conducted from mid-October until the end of November in 2016, 2017, and 2018, which constitutes the beginning of the respective academic years. Hence, international students completed the survey within the early weeks of their arrival at their study location in Germany. The intention to stay in Germany is, therefore, in most cases, not yet affected by a long experience of residing in Germany. In contrast to the literature, the sample comprises all international first-semester students (however excluding guest and short-term students).

There exists a large difference in size between the sample of international students at the beginning of their studies and at the middle or toward the end of it. Around 70,000 international students began their studies in the winter semester 2016/2017 at a German university, for example. Between the first and the second semester and between the second and the third semester the drop-out rates were 22% and 23%, respectively. An additional 8% dropped out between the third and the fourth semester. Overall these numbers correspond to an attrition of 45% (around 32,000 international students) between the first and the fourth semester (German Federal Statistical Office, 2019b).⁵ Additionally, the composition of the groups of students in the first and the fourth semester differs. Our data on a small number of international students who are already in the last year of their study programs shows that significantly more international male students drop out during their studies. Students enrolled in a Bachelor program instead of a Master program and those with rather limited German-language proficiency are also slightly more likely to leave the university without a degree. All in all, conducting the survey at the beginning of the studies and not at the end allows for an analysis of a different, and in particular, larger sample of skilled international students who might ultimately decide on staying in Germany after graduation if addressed by appropriate policy measures.

It is important to note that the literature on the causes for the attrition of international students in Germany is scarce. Furthermore, Neugebauer et al. (2019), who analyze the literature on drop-out rates in Germany, point out

⁴See Koenings et al. (2020) for a study on the importance of rankings for international and domestic students based on a related data set.

⁵It should be noted that also German students drop out in large numbers. Among Bachelor students, 28% leave the university before graduating. Among Master students, the drop-out rate amounts to 19% (Heublein & Schmelzer, 2018).

that most of the literature merely studies correlations and does not take into account the point in time of dropping out. Pineda (2018), conducting a qualitative study on international students in Germany, shows that for some students, it is a mixture of, among others, adaptability problems and emotional drain which makes them drop out (push factor), while other students leave the university before graduating to start working once they are offered a job (pull factor).⁶ Important in the context of this study, the variety of reasons does not point toward a biased selection, for example, related to ability levels.

For our analysis, all students were surveyed by means of a paper-and-pencil questionnaire to guarantee a high response rate. Overall, 265 (2016), 244 (2017), and 274 (2018) questionnaires were completed, which corresponds to response rates of 56% (2016), 45% (2017), and 53% (2018), respectively, of all newly enrolled international students at the university excluding guest and short-term students. To arrive at a relatively homogeneous sample of international students, those who only participate in language courses, or with a Bachelor degree from Germany are dropped as well as Ph.D. students. Even though the analysis of those groups might be insightful (see, e.g., the analysis for Ph.D. students by Hooijen et al., 2017 or Soon, 2010), the group sizes are too small to draw rigorous inference. Our final sample comprises 578 international students. Table A1 in Appendix A compares the sample used in this study to a sample of all first-year international students of the university and the corresponding universe of international students in Germany. Whereas our sample is fairly representative in regard to all international students at the university, there are some differences relative to the group of international students in Germany. Compared with international students in Germany, Europeans⁷ and engineering students are under-represented in our sample, while females, Asians, and Master students are overrepresented.

To identify international students' intention to stay in Germany, we use the survey responses to the question: "From your current point of view, where will you most likely reside after graduating from this university?" The respondents could choose from four answers: (1) in Thuringia, (2) in Germany (somewhere), (3) in my home country, and (4) in a third country. Given the aim of our paper of examining international students' intentions to stay in Germany, the answers are transformed into a binary variable taking the value of one if the respondent plans to stay in Thuringia or Germany and zero otherwise. From the 578 international students, 320 students have the intention to stay in Germany.

In line with the literature, this study investigates five factors in the analysis of the determinants of the intention to stay in or to leave Germany after graduation: individual characteristics, study characteristics, reasons to migrate, already existing social ties in Germany, and macro-economic conditions in the origin country.

The factor 'individual characteristics' encompasses students' gender, age, patience, and risk-lovingness.⁸ Since risk-loving and patient individuals are more likely to migrate (see, e.g., Gibson & McKenzie, 2011 or Roca Paz & Uebelmesser, 2019), these characteristics may play a role in the intention to stay or to leave Germany after graduation. We additionally include information on the type of the relationship of the respondents. Having a partner residing in a particular country can work as a pull factor to migrate to that country (Lin & Kingminghae, 2017). While a German partner is expected to increase the likelihood to stay in Germany, the opposite pertains when the partner resides in a foreign country. Furthermore, feeling welcome in Germany is included as it is expected to be positively associated with stating the intention to stay.⁹

The 'study characteristics' factor includes information on the field of study as well as the type of degree students are enrolled in. With respect to the intention to stay after graduation, Hooijen et al. (2017) find, for

⁶It should be noted, however, that Germany grants every international student who successfully graduates in Germany an 18-month visa to find a job within the study field (SVR, 2019). This can be seen as a strong incentive for students coming from outside the European Union to not drop out lightly and forgo this facilitated labor market access.

⁷Students were grouped into origin regions on the basis of their country of birth. In few cases, when no country of birth was indicated, students' citizenship was used to determine their region of origin.

⁸Patience and risk-lovingness are self-reported on an 11-point Likert-type scale ranging from 0 (risk-averse/very impatient) to 10 (risk-loving/very patient). For simplicity, the answers have been deflated to binary variables with the value of one if the level is seven or higher.

⁹Feeling welcome is a binary variable. Respondents indicated on a five-point Likert-type scale whether they 'strongly disagree' (1) or 'strongly agree' (5) to feeling welcome in Germany. The binary variable takes a value of one if respondents either answered with four or five and a value of zero otherwise.

example, that students enrolled in a Master program are more likely to state the intention to stay than students in a Bachelor program.¹⁰ The authors also show that students studying law and medicine/health exhibit a significantly higher intention to stay compared with students studying social sciences.

The 'reasons to migrate' factor tests, among others, whether having a German scholarship or a scholarship from another country is significantly associated with the intention to stay or to go. A scholarship from a particular country may tie students more closely to that country. Furthermore, as the human capital model of migration builds on the idea that migration is partially driven by better career opportunities in a foreign country, we include the importance of students' own and their partner's career opportunities as part of the 'reasons to migrate' factor. Kruanak and Ruangkanjanases (2014) find that international students with a strong focus on career opportunities have a higher intention to stay in Thailand. Analyzing return intentions, De Haas and Fokkema (2011) find that the most important reasons to return are family-related and work-related reasons. Accordingly, we additionally include an indicator for the importance of the proximity to partner/family and an administrative reason (visa regulations). Both are expected to be negatively correlated with the intention to stay in Germany.

'Social ties in Germany' comprise an indicator on whether the respondent has visited Germany before enrolling at the German university as well as an indicator for German-language proficiency.¹¹ Moreover, this factor includes a variable about German friends.¹² Haug (2008) and De Haas and Fokkema (2011) have shown that having social ties in the destination country drives migration into that country or the intention to stay within that country.

Since the standard human capital model of migration predicts that individuals migrate whenever they expect a net economic gain through migration, we include 'macro-economic conditions' as a further factor in the analysis. Those macro-economic conditions of the origin countries are observed in the year before the beginning of the studies in Germany. To control for the economic prosperity of the origin country and, hence, for possible economic gains through migration to Germany, we test whether gross domestic product (GDP) per capita and the annual growth rate of GDP per capita taken from World Bank (2019) are associated with the intention to stay.¹³ We expect that having a less prosperous origin country or an origin country where the economy faces an economic downturn is associated with a higher intention to stay in Germany.

Table 1 displays descriptive statistics on these factors separately for intended leavers and stayers. A close look reveals similarities between the two groups, for example, the share of those studying economics, business or law and the degree of risk-lovingness, but also important differences. For instance, leavers show a higher degree of patience, they are more often Master students and follow a study program of humanities. They are also more likely to come from a country with a higher per capita growth rate. Stayers on the contrary more often have a German partner and follow a Bachelor program. They also have been in Germany before with a higher probability. Interestingly, there are no pronounced differences as far as possible reasons to migrate are concerned. For a comprehensive understanding of the factors associated with the intention of international students to stay or to go after graduation, a more thorough empirical analysis is thus needed.

¹⁰In Germany there are still some fields of study which are not yet divided into a Bachelor and Master degree, for example, medicine. Medical students and those who did not state their degree are grouped into the "Others/No Information" category.

¹¹Having answered the questionnaire in German instead of English is employed as a proxy for German-language proficiency. Having chosen to answer the questionnaire in German instead of English highly correlates (correlation coefficient of 0.66) with the self-assessed German-language skills on a five-point Likert-type scale.

¹²Many German friends are a binary variable. Respondents indicated on a five-point Likert-type scale whether they 'strongly disagree' (1) or 'strongly agree' (5) to having many German friends. The binary variable takes a value of one if respondents either answered with four or five and a value of zero otherwise.

¹³We also estimate models that include additional indicators for the macro-economic condition of a country (e.g., Freedom House Democracy Scale, Transparency International's (Public Sector) Corruption Perception Index and United Nations' Human Development Index). Since all additional macro-economic variables highly correlate with GDP per capita, they are not part of the final model.



TABLE 1 Descriptive statistics by intended stayers and leavers

	Stayers		Leavers	
	Mean	SD	Mean	SD
<i>Individual characteristics</i>				
Male	0.422	0.495	0.349	0.478
Age	24.409	4.036	23.849	3.079
Patience	0.594	0.492	0.702	0.458
Risk-loving	0.503	0.501	0.465	0.500
Feeling welcome in Germany	0.756	0.430	0.829	0.377
<i>Type of relationship</i>				
No partner (R)	0.772	0.420	0.853	0.355
Non-German partner	0.072	0.259	0.074	0.262
German partner	0.156	0.364	0.074	0.262
<i>Study characteristics</i>				
<i>Type of degree</i>				
Bachelor (R)	0.253	0.435	0.112	0.316
Master	0.591	0.492	0.775	0.418
Others/no information	0.156	0.364	0.112	0.316
<i>Field of study</i>				
Social sciences (R)	0.084	0.278	0.093	0.291
Humanities	0.156	0.364	0.236	0.426
Economics/business/law	0.175	0.381	0.178	0.384
Medicine	0.075	0.264	0.027	0.163
Natural sciences	0.372	0.484	0.337	0.474
Engineering	0.050	0.218	0.008	0.088
No information	0.087	0.283	0.120	0.326
<i>Reasons to migrate</i>				
Scholarship from Germany	0.287	0.453	0.233	0.423
Scholarship from another country	0.166	0.372	0.143	0.351
Proximity to family/partner	0.544	0.499	0.632	0.483
Own/partner's career chances	0.897	0.305	0.845	0.363
Administrative reason	0.453	0.499	0.434	0.497
<i>Social ties in Germany</i>				
In Germany before	0.603	0.490	0.415	0.494
German questionnaire	0.525	0.500	0.473	0.500
Many German friends	0.197	0.398	0.120	0.326
<i>Macro-economic conditions</i>				
GDP p.c. (constant 2010 thousand-US\$)	10.123	12.251	10.085	13.489
GDP p.c. growth (%)	2.717	3.521	4.153	2.968
Observations	320		258	

Notes: (R) indicates the reference category in regressions. Macro-economic conditions relate to students' citizenship/ country of birth and are observed 1 year before the beginning of studies in Germany.

Abbreviation: GDP, gross domestic product.

3 | DETERMINANTS OF THE INTENTION TO STAY

3.1 | Estimation strategy

We run a binary choice model to estimate which factors are significantly associated with the international students' intention to stay. Given the individual intention to stay int_i for individual $i = 1, \dots, N$ and the latent propensity to stay int_i^* , the model is formulated as follows:

$$int_i = \begin{cases} 1 & \text{for } int_i^* > 0, \\ 0 & \text{for } int_i^* \leq 0, \end{cases} \text{ where } int_i^* = \beta'X_i \text{ and} \quad (1)$$

$$\beta'X_i = \beta_0 + \beta_1'Individual_i + \beta_2'Study_i + \beta_3'Reason_i + \beta_4'Social_i + \beta_5'Macro_i + \beta_6d_{2017} + \beta_7d_{2018} + \varepsilon_i$$

with $Individual_i$ capturing 'individual characteristics,' $Study_i$ 'study characteristics,' $Reason_i$ 'reasons to migrate,' $Social_i$ 'social ties in Germany' and $Macro_i$ 'macro-economic conditions' of the origin countries. d_{2017} and d_{2018} are the binary indicators for the respective years to control for cohort differences. ε_i is the idiosyncratic error term of international student i . The corresponding model's likelihood function is given by

$$L = \prod_{i=1}^N F(\beta'X_i)^{int_i} [1 - F(\beta'X_i)]^{1-int_i}. \quad (2)$$

For the following estimations, a cumulative normal distribution for F , that is, a standard probit model framework, is chosen. We report average marginal effects, where marginal effects for dummy variables are calculated as discrete changes from the respective base level.

3.2 | Results

Table 2 displays the estimation results when the different factors are stepwise included. We focus on interpreting the results of the full model only as the results are similar across all specifications. As to the 'individual characteristics,' we do not find a significant association with gender which is a rather common finding (see, e.g., Hooijen et al., 2017; Soon, 2010; Waldorf, 1995). Age, however, turns out slightly significant. While this is in line with Hooijen et al. (2017) who also find that the intention to stay significantly increases with age, Soon (2010) does not find this association between the two variables. Patient international students are less likely to stay in Germany. In contrast to our hypotheses derived above, neither risk-lovingness nor feeling welcome is significantly associated with the intention to stay. As expected, having a German partner is associated with a 14.6-percentage point higher propensity to stay compared with having no partner.

Being enrolled in a Master program is associated with a 23.3-percentage point lower probability to exhibit an intention to stay in Germany compared with a Bachelor program.¹⁴ This result might be driven by the fact that a Bachelor program has a longer duration than a Master program¹⁵ and, hence, Bachelor students anticipate that they will more likely integrate in the host country (De Haas & Fokkema, 2011; Waldorf, 1995). On the contrary, a Master program not only has a shorter duration; at the same time, Master students have already spent a longer period outside Germany and likely built up social ties there. These ties might act as a pull factor to leave Germany after graduation. Some might also argue that Bachelor students want to stay in Germany only to acquire an

¹⁴A separate analysis for German-language Master and English-language Master programs shows that they do not differ significantly.

¹⁵The standard curricula in Germany for Bachelor programs take 3 years and for Master programs 2 years.



TABLE 2 Determinants of the intention to stay (stepwise inclusion)

	(1)	(2)	(3)	(4)	(5)
<i>Individual characteristics</i>					
Male	0.086** (0.042)	0.045 (0.042)	0.043 (0.042)	0.054 (0.041)	0.042 (0.041)
Age	0.006 (0.006)	0.012** (0.006)	0.013** (0.006)	0.012* (0.006)	0.010* (0.006)
Patience	-0.140*** (0.043)	-0.133*** (0.042)	-0.124*** (0.042)	-0.099** (0.042)	-0.096** (0.042)
Risk-loving	0.063 (0.042)	0.067 (0.042)	0.056 (0.042)	0.049 (0.042)	0.045 (0.042)
Feeling welcome in Germany	-0.094* (0.050)	-0.062 (0.050)	-0.063 (0.049)	-0.071 (0.049)	-0.065 (0.048)
<i>Type of relationship</i>					
Non-German partner	-0.012 (0.082)	0.010 (0.082)	0.001 (0.079)	-0.015 (0.078)	-0.014 (0.077)
German partner	0.191*** (0.061)	0.154** (0.061)	0.171*** (0.061)	0.142** (0.061)	0.146** (0.062)
<i>Study characteristics</i>					
<i>Type of degree</i>					
Master		-0.260*** (0.050)	-0.260*** (0.050)	-0.247*** (0.053)	-0.233*** (0.053)
Others/no information		-0.094 (0.074)	-0.080 (0.073)	-0.066 (0.073)	-0.060 (0.072)
<i>Field of study</i>					
Humanities		0.022 (0.081)	0.035 (0.080)	0.042 (0.080)	0.056 (0.076)
Economics/business/law		0.120 (0.083)	0.118 (0.081)	0.155* (0.081)	0.141* (0.080)
Medicine		0.269** (0.112)	0.258** (0.112)	0.203* (0.112)	0.164 (0.119)
Natural sciences		0.148** (0.075)	0.139* (0.075)	0.183** (0.075)	0.176** (0.075)
Engineering		0.368*** (0.119)	0.363*** (0.120)	0.377*** (0.120)	0.341*** (0.128)
No information		-0.031 (0.094)	-0.020 (0.093)	0.033 (0.092)	0.037 (0.091)
<i>Reasons to migrate</i>					
Scholarship from Germany			0.062 (0.050)	0.060 (0.049)	0.038 (0.049)
Scholarship from another country			-0.018 (0.061)	-0.024 (0.060)	0.003 (0.059)
Proximity to family/partner			-0.123*** (0.041)	-0.136*** (0.041)	-0.131*** (0.040)
Own/partner's career chances			0.127** (0.061)	0.118* (0.060)	0.120** (0.059)
Administrative reason			0.032 (0.040)	0.037 (0.040)	0.033 (0.040)

(Continues)

TABLE 2 (Continued)

	(1)	(2)	(3)	(4)	(5)
<i>Social ties in Germany</i>					
In Germany before				0.162*** (0.041)	0.143*** (0.043)
German questionnaire				-0.003 (0.053)	0.011 (0.053)
Many German friends				0.058 (0.054)	0.071 (0.053)
<i>Macro-economic conditions</i>					
GDP p.c.					-0.002 (0.002)
GDP p.c. growth					-0.020*** (0.006)
Observations	578	578	578	578	578
Pseudo-R ²	0.038	0.094	0.110	0.133	0.146
AIC	782.657	753.918	751.114	739.240	732.770

Notes: Dependent variable is the intention to stay. Table displays average marginal effects resulting from probit model estimation. Standard errors in parentheses: * $p < 0.10$; ** $p < 0.05$, *** $p < 0.01$. Regressions include a 2017 and a 2018 dummy. Reference category for type of degree is Bachelor degree, for field of degree is Bachelor degree, for field of study social sciences and for type of relationship no partner.

Abbreviations: AIC, akaike information criterion; GDP, gross domestic product.

additional degree and do not seek to become part of the German labor market. The longer study period in the host country which this implies, however, would on its own increase the likelihood that they ultimately stay (De Haas & Fokkema, 2011; Waldorf, 1995). Additionally, an analysis on a reduced sample of international students for which it is possible to control for the intention to apply for a subsequent degree shows that the large and highly significant Master effect is robust to this concern. The result that the intention to stay is significantly lower for Master students compared with Bachelor students is in contrast to most of the literature. For example, Esser and Gillissen (2014), evaluating international students at German universities during the winter term 2013/14 via an online survey, find that Bachelor students have similar staying intentions as Master students. Furthermore, analyzing the intention to stay within the region, Hooijen et al. (2017) also find that Bachelor students are less likely to stay. Abstracting from the fact that the regions investigated are different, two possible reasons might drive the difference in the results between the results by Hooijen et al. (2017) and ours. First, Hooijen et al. (2017) focus on students in the final phase of their studies, while we investigate them when enrolling at the university. Second, we ask international students only, while Hooijen et al. (2017) take all students into account.

Furthermore, Table 2 shows that international students enrolled in economics/business/law, natural sciences, and engineering exhibit on average a higher intention to stay in Germany than international students studying social sciences. This result partially mirrors the result of the analysis by Hooijen et al. (2017). Additionally, Soon (2010) finds that students enrolled in more capital-dependent disciplines, such as science, compared with humanities exhibit a higher intention to stay.

The different origins of funding do not play a significant role in explaining the intention to stay or to go. However, the proximity to one's family or partner as well as own or partner's career chances do. Students who value own or partner's career chances highly are more likely to state their intention to stay in Germany after graduation. In contrast, those students for whom the proximity to their family or partner is important are less likely to have the intention to stay in Germany after graduation. Having been in Germany before studying is associated with a 14.3-percentage point higher intention to stay in Germany. This implies a better-informed decision on studying in Germany. The result shows that these better-informed students, who decided to return to study in Germany, are, on average, also more likely to stay in Germany after graduation.

Surprisingly and in contrast to previous studies, a higher German-language proficiency, that is, choosing the German over the English questionnaire, does not play a role for the intention to stay.¹⁶ This result might be rooted in the fact that students are surveyed shortly after their arrival in Germany and might not yet know how important German-language skills on the German labor market are leading to an insignificant association between the intention to stay and German-language proficiency. With respect to macro-economic conditions, the results show that, as expected, international students from countries with unfavorable economic situations are more likely to state the intention to stay in Germany after graduation.¹⁷

3.3 | Extensions

The determinants of the stated intention to stay identified in Section 3.2 might vary for different subgroups of international students as, among others, their prospects after graduation are different. While we have observed that,

¹⁶While there are a substantial number of international Bachelor students who choose to fill out the German questionnaire, there is no multicollinearity between German questionnaire and Bachelor degree. No significant relationship between stating the intention to stay and language proficiency can be found without controlling for the type of degree. In addition, an analysis of a smaller number of observations employing self-rated German skills instead of the language of the questionnaire does not alter the results compared with those shown in Table 2.

¹⁷Through the inclusion of GDP variables we automatically control for differences between origin regions. We also run regressions separately for EU and non-EU countries given the different rules guiding immigration to Germany. The results were qualitatively similar, which might be due to the preferential rules guiding access to the German labor market for international graduates from German universities—see above, that is, an 18-month visa if graduation was successful.

for example, Master students are less likely to stay in the host country after graduation than Bachelor students, the relevant factors might not be the same. The decision to stay or to go is closely related to the prospects of entering the host country's labor market. While the jobs available to students with a Bachelor and a Master degree are different, also the options outside the labor market vary. Bachelor students might continue their studies with a Master degree and Master students might seek to obtain a doctoral degree. Furthermore, as stated already above, the duration of Bachelor and Master programs differ. To investigate this possible heterogeneity we estimate Equation (1) for Bachelor and Master students separately.

The results on the determinants of the stated intention to stay are displayed separately for Bachelor and Master students in columns (1) and (2) of Table 3, respectively. Despite many similarities, differences between Bachelor and Master students particularly show up in two areas: One area is linked to personal relationships. For Master students, having a German partner is an important factor. As Bachelor students are on average younger than Master students, it is not surprising that this is not yet equally relevant for them. The other area concerns labor market considerations, which are more visible for Master students. This refers to their career concerns, but also the role played by the economic situation in their home countries. In addition, the positive association of having been in Germany before can be seen in this context as this means more information about the host country also related to the labor market. The relationship between study fields and the stated intention to stay differs as well between Bachelor and Master students. While Bachelor students from the field of economics/business/law have the highest likelihood to stay, this holds for Master students studying engineering. An interesting avenue for future research is to disentangle whether this difference stems from the selection into the study fields or is due to the study fields because of different labor market opportunities for Bachelor and Master students in Germany and outside Germany.

In a last extension, we assure that scholarship regulations, such as a requirement to return to the home country after graduation, do not affect the analysis. To do so we limit the analysis to students who do not indicate a scholarship as main or additional funding source, that is, students who self-fund their studies. The results do not change for this subgroup compared with the full sample.¹⁸

The additional analyses on the determinants of the stated intention to stay show that there are differences as well as similarities for Bachelor and Master students. While the smaller sample size for Bachelor students should be noted, the analysis on the Master sample closely mirrors the results obtained in Section 3.2 (see Table 2). This also holds if we restrict the sample to those who self-fund their studies.

4 | DETERMINANTS OF THE INTENTION TO STAY TAKING UNCERTAINTY INTO ACCOUNT

As our data on the intention to stay or to go is collected at the beginning of the respective study program, the actual behavior lies at least 2–3 years in the future. Hence, the stated intention involves a high degree of uncertainty. To assure that the identified determinants are not distorted by the uncertainty involved, in the following, special attention is placed on uncertainty.

4.1 | The role of uncertainty

Since an intention always involves some uncertainty, we are not the first to take uncertainty into account in the migration context. Previous studies mainly used a reply-option 'not sure' to the question on the intention to stay or

¹⁸The small sample of Bachelor students does not allow similar subsample-analysis.



TABLE 3 Determinants of the intention to stay (extensions)

	(1)		(2)		(3)	
	Bachelor		Master		Master Self-funded	
<i>Individual characteristics</i>						
Male	0.090	(0.090)	0.020	(0.050)	0.014	(0.061)
Age	0.008	(0.013)	0.008	(0.008)	0.014	(0.009)
Patience	-0.020	(0.092)	-0.148***	(0.052)	-0.157***	(0.060)
Risk-loving	0.112	(0.091)	0.026	(0.051)	0.024	(0.062)
Feeling welcome in Germany	-0.137	(0.102)	0.018	(0.062)	0.022	(0.073)
<i>Type of relationship</i>						
Non-German partner	-0.057	(0.179)	0.005	(0.089)	-0.021	(0.107)
German partner	0.010	(0.135)	0.230***	(0.077)	0.306***	(0.088)
<i>Study characteristics</i>						
<i>Field of study</i>						
Humanities	0.215*	(0.116)	-0.075	(0.104)	-0.100	(0.118)
Economics/business/law	0.437***	(0.148)	-0.020	(0.114)	-0.030	(0.129)
Medicine	-0.020	(0.293)	-0.166	(0.223)		
Natural sciences	0.181*	(0.105)	0.054	(0.111)	0.021	(0.128)
Engineering	0.222	(0.188)	0.370**	(0.161)	0.313	(0.195)
No information	0.074	(0.138)	-0.026	(0.138)	-0.088	(0.160)
<i>Reasons to migrate</i>						
Scholarship from Germany	0.080	(0.112)	0.042	(0.058)		
Scholarship from another country	-0.007	(0.123)	0.086	(0.075)		
Proximity to family/partner	-0.156*	(0.094)	-0.148***	(0.050)	-0.168***	(0.060)
Own/partner's career chances	0.056	(0.135)	0.257***	(0.079)	0.252**	(0.098)
Administrative reason	-0.080	(0.085)	0.054	(0.049)	0.040	(0.058)
<i>Social ties in Germany</i>						
In Germany before	0.011	(0.097)	0.163***	(0.051)	0.109*	(0.062)
German questionnaire	-0.076	(0.125)	-0.027	(0.071)	0.010	(0.087)
Many German friends	0.186*	(0.104)	0.039	(0.071)	0.052	(0.084)
<i>Macro-economic conditions</i>						
GDP p.c.	-0.004	(0.004)	-0.001	(0.002)	-0.001	(0.002)
GDP p.c. growth	-0.016	(0.016)	-0.021***	(0.008)	-0.024**	(0.010)
Observations		110		389		268
Pseudo-R ²		0.219		0.159		0.187
AIC		149.173		503.025		344.213

Notes: Dependent variable is the intention to stay. Table displays average marginal effects resulting from probit model estimation. Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Regressions include a 2017 and a 2018 dummy. Reference category for field of study is social sciences and for type of relationship no partner. There are only two Master students who self-fund their medicine studies; both have the intention to leave.

Abbreviations: AIC, akaike information criterion; GDP, gross domestic product.

to go and grouped students into a stayer category, a leaver category, and an uncertain category. The analyses of those categories show that the uncertainty involved differs significantly across study fields (Soon, 2010), types of degree (Hooijen et al., 2017), levels of sociocultural integration as well as language proficiency (De Haas & Fokkema, 2011). For example, Master students are found to be more uncertain than Bachelor students (Hooijen

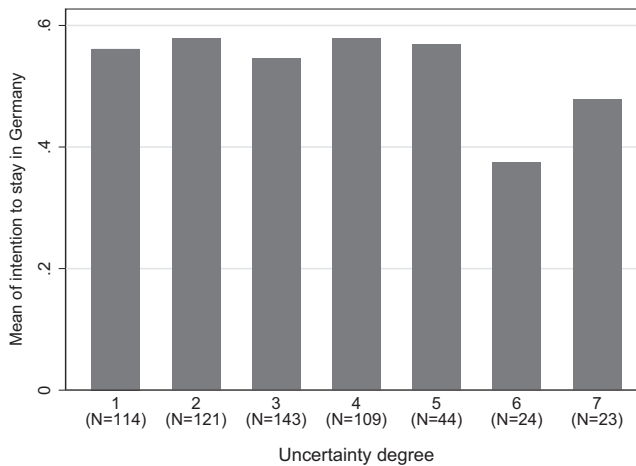


FIGURE 1 Mean of intention to stay over uncertainty. *Note:* The number of observations indicates the number of individuals in the sample for each uncertainty degree

et al., 2017) and immigrant groups with a higher sociocultural integration are less likely to be uncertain (De Haas & Fokkema, 2011). Compared with these studies, however, we are the first who make use of a follow-up question to the question about the intention to stay: “How certain are you about this choice?”, which allows answers on a seven-point Likert-type scale from (1) ‘very certain’ to (7) ‘not certain at all.’ This provides us with the possibility to distinguish more precisely between different levels of uncertainty.

Plotting the mean of the intention to stay over the seven uncertainty levels gives a first impression of the role of uncertainty in our sample. Figure 1 suggests that the relationship between the stated intention to stay and the uncertainty involved is of a non-linear nature. A linear relationship could be a linear decrease in the intention to stay with higher uncertainty, for example. In this case, the interpretation would be straightforward as the intention to stay with certainty would likely mirror the results from Table 2. Employing a more rigorous econometric approach would most likely not be necessary. The same would hold if Figure 1 pointed toward a uniform distribution.

4.2 | Estimation strategies

In a first step, we replicate the analyses of the stay intention and involved uncertainty employed in the previous literature (uncertainty models I) and in a second step, we run several further models taking the whole range of uncertainty levels into account (uncertainty models II). Our second step follows the approach by Martínez-Españeira and Lyssenko (2012), who analyze the uncertainty involved when studying the willingness to pay for a whale conversation program.

For the uncertainty models I, we divide the sample into certain stayers, certain leavers, and uncertain students. All respondents are considered as uncertain students if they indicate an uncertainty level of five or higher. The remaining students are grouped into certain stayers or certain leavers according to whether they intend to stay in Germany or not. For those different groups we conduct pairwise probit models similar to the specification outlined in Section 3.1. By doing so, we partially replicate the small literature on migration intention which takes uncertainty into account (De Haas & Fokkema, 2011; Hooijen et al., 2017; Soon, 2010).

For the uncertainty models II, we take the whole range of uncertainties (1–7) into account and test in detail how the importance of different factors for the intention to stay varies with uncertainty. There are several ways of how to proceed (Martínez-Espiñeira & Lyssenko, 2012). Overall, we employ five different uncertainty models to investigate the relationship between the intention to stay, the whole range of the involved uncertainties and the factors under study. Important to note is that so far there is no theoretical argumentation from which one could identify one model to be superior over another model (Martínez-Espiñeira & Lyssenko, 2012, p. 132).

One of the most straightforward models is to include uncertainty as a further covariate in the model laid out in Equation (1) (Model 1). For the next model, we recode the answers to the uncertainty question and construct a variable *sure* which takes on values ranging from 1/7 “very uncertain” to 7/7 “very certain.” To put more emphasis on those respondents who are more certain, the estimation of Equation (1) is weighted by the *sure* variable (Model 2). To put even more emphasis on the certain respondents, we follow Martínez-Espiñeira and Lyssenko (2012) who suggest to weight the estimation equation (1) by a $sure^2$ variable (Model 3). A different way to take uncertainty into account is to calculate a new variable *certain-intention* such that

$$certain-intention = \begin{cases} 0.5 + \frac{sure}{2} & \text{if i has the intention to stay,} \\ 0.5 - \frac{sure}{2} & \text{if i has the intention to leave (Model 4).} \end{cases} \quad (3)$$

This new variable takes a value of one if the respondent wants to stay in Germany and is very certain about it. On the contrary, *certain-intention* is zero if the respondent is very certain to leave after graduation. Values close to 0.5 indicate an uncertain individual.¹⁹ Following the strategy by Martínez-Espiñeira and Lyssenko (2012), we employ as the last uncertainty model the model suggested by Li and Mattsson (1995; Model 5). This model uses weights and employs a recoded dependent variable such that, for example, a relatively uncertain individual with an intention to stay becomes a relatively certain individual without an intention to stay and vice versa. In detail, the weighting variable is the *sure* variable as long as the value of *sure* is larger than 0.5. If *sure* is smaller than 0.5 the weighting variable is $1 - sure$. The dependent variable is one if the respondent is willing to stay with certainty ($sure > 0.5$) or willing to leave with uncertainty ($sure < 0.5$). In all other cases the dependent variable is zero. Hence, stating the intention to stay or to leave with full certainty, for example, results in the dichotomous-choice model weighted by the *sure* variable (Model 2).²⁰

4.3 | Results

First, we investigate the estimation results for the uncertainty models I. The results of the pairwise comparisons between certain stayers, certain leavers, and uncertain students are displayed in Table 4. Column (1) compares certain stayers and certain leavers (reference category) and, hence, abstracts from uncertain students. The results in column (1) show that the same factors are of relevance for students' stated intention to stay or to go as when uncertainty is not specifically controlled for (Table 2). This provides an initial indication that our analysis does not seem to be distorted by uncertain individuals.

Column (2) of Table 4 displays the estimation results for the comparison between certain stayers and uncertain students (reference category). This allows us to see which factors are significantly associated with the intention to stay with certainty compared with the factors which are relevant for those who are uncertain to stay

¹⁹As for the last approach the dependent variable is of a continuous nature, an ordinary least-squares method to estimate the relationships of interest is employed here.

²⁰Martínez-Espiñeira and Lyssenko (2012) also employ asymmetric uncertainty models when investigating the relationship between willingness to pay and involved uncertainty in the context of contingent valuation which is not appropriate for our analysis.

TABLE 4 Uncertainty models I: Comparing certain stayers, certain leavers, and uncertain students

	(1)		(2)	
	Certain stayers/certain leavers (ref.)		Certain stayers/uncer. students (ref.)	
<i>Individual characteristics</i>				
Male	0.039	(0.044)	0.027	(0.047)
Age	0.010	(0.006)	0.009	(0.007)
Patience	-0.096**	(0.045)	-0.026	(0.048)
Risk-loving	0.028	(0.045)	-0.020	(0.049)
Feeling welcome in Germany	-0.085	(0.053)	0.025	(0.052)
Type of relationship				
Non-German partner	0.003	(0.082)	-0.008	(0.094)
German partner	0.143**	(0.066)	0.162***	(0.054)
<i>Study characteristics</i>				
Type of degree				
Master	-0.230***	(0.057)	-0.124**	(0.058)
Others/No information	-0.046	(0.076)	0.015	(0.071)
Field of study				
Humanities	0.039	(0.082)	-0.022	(0.091)
Economics/business/law	0.123	(0.089)	-0.102	(0.095)
Medicine	0.150	(0.127)	0.060	(0.127)
Natural sciences	0.161*	(0.083)	-0.003	(0.087)
Engineering	0.305**	(0.132)	0.126	(0.117)
No information	0.019	(0.098)	0.003	(0.107)
<i>Reasons to migrate</i>				
Scholarship from Germany	0.038	(0.054)	0.020	(0.056)
Scholarship from another country	-0.024	(0.062)	0.141*	(0.077)
Proximity to family/partner	-0.117***	(0.043)	-0.093*	(0.049)
Own/partner's career chances	0.119*	(0.065)	0.167**	(0.070)
Administrative reason	0.031	(0.044)	0.040	(0.046)
<i>Social ties in Germany</i>				
In Germany before	0.166***	(0.046)	0.054	(0.051)
German questionnaire	-0.016	(0.058)	0.027	(0.059)
Many German friends	0.061	(0.058)	0.065	(0.062)
<i>Macro-economic conditions</i>				
GDP p.c.	-0.002	(0.002)	-0.005**	(0.002)
GDP p.c. growth	-0.025***	(0.007)	-0.001	(0.007)
Observations		487		366
Pseudo-R ²		0.170		0.114
AIC		607.813		417.914

Notes: Table displays average marginal effects resulting from probit model estimation. Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Regressions include a 2017 and a 2018 dummy. Reference category for type of degree is Bachelor degree. Reference category for field of study is social sciences. Reference category for type of relationship is no partner.

Abbreviations: AIC, akaike information criterion; GDP, gross domestic product.

or to go. The results show that some factors significantly distinguish those groups from one another. For example, Master students compared with Bachelor students are more likely to be uncertain than certain to stay. Unsurprisingly, having a German partner instead of no partner is accompanied by a higher intention to stay with certainty. However, having been in Germany before the beginning of the study program is not differently associated with stating an intention to stay for the two groups. In addition, those for whom own and partner's career chances are of importance more likely state an intention to stay with certainty.

The results displayed in Table 4 are only partially in line with the findings by Hooijen et al. (2017) who also employ groupwise comparisons. While Hooijen et al. (2017) find that the likelihood to be uncertain increases with age, age does not play a significant role in our results. In turn, their finding that Master students are more likely to be uncertain is mirrored by our results.

Our results in Table 4 are, however, sensitive to the way how the group of uncertain students is defined. Therefore, for a more comprehensive analysis we take the whole range of uncertainty levels into account. The results of the uncertainty models based on Martínez-Españeira and Lyssenko (2012) are displayed in Table 5 (uncertainty models II). With minor exceptions, all five models show qualitatively very similar results and, hence, give a relatively robust picture of the determinants of the intention to stay or to go that are not distorted by uncertain individuals. These qualitative results are also very close to the baseline results (Table 2, column 5) and the results from the analysis of certain individuals (Table 4, column 1).

Including uncertainty as a further covariate to explain the intention to stay (Model 1) does not change the qualitative results and only marginally increases the explanatory power of the model compared with the baseline model where uncertainty is not taken into account. The second model and the third model put more emphasis on those respondents who are more certain in their intention compared with those who are not. Except for own and partner's career chances, which is not always significantly associated with the intention to stay, the qualitative results are very much in line with the baseline model. However, their size varies across the different models and thereby gives an indication about the uncertainty involved in this context. The average marginal effect for having a German partner, for example, increases by two percentage points (from 14.2 to 16.2 percentage points) with the weight that is put on the certain individuals indicating that having a German partner is associated with certainty. The same line of argumentation holds true for the average marginal effect for having been in Germany before. This is different from the results in Table 4, column (2), and points toward shortcomings of choosing an arbitrary threshold for separating uncertain from certain students. Own and partner's career chances are not significantly associated with the intention to stay when more emphasis is put on certain students (Model 3) indicating that those for whom career chances are of importance are generally more certain, either to stay or to go. This result is in line with the observations in Table 4, columns (1) and (2).

The qualitative results also largely stay the same compared with the baseline model when considering Models 4 and 5. Except for being patient and own and partner's career chances the same factors are significantly associated with the intention to stay. In comparison to the previous Models 1–3, these models, however, change the size of the marginal effects by a larger extent.

The similarity in terms of significance of the calculated effects in Tables 5 and 2 shows that our analysis in the first place did not suffer from a bias introduced by uncertain students.²¹ The exception is the only marginal importance of career opportunities and of being patient when taking uncertainty into account. This reveals that these factors might not be important when distinguishing between the intention to stay and to go with certainty but might play a more important role for those students who are uncertain. However, we find that the employed uncertainty models exhibit different magnitudes for the estimated marginal effects indicating that the choice of the uncertainty model is crucial when effect sizes matter. Therefore, we conclude, analogously to Martínez-Españeira

²¹The qualitative results also stay the same when estimating models based on Model 1 and additionally including an interaction between uncertainty and each covariate.

TABLE 5 Uncertainty models II: Determinants of the intention to stay taking all uncertainty levels into account

	Model 1 covariate	Model 2 sure	Model 3 sure ²	Model 4 certain-intention	Model 5 recoding
Uncertainty	-0.016 (0.012)				
<i>Individual characteristics</i>					
Male	0.042 (0.041)	0.068 (0.043)	0.093** (0.046)	0.050 (0.032)	0.046 (0.043)
Age	0.010 (0.006)	0.008 (0.007)	0.006 (0.007)	0.007 (0.004)	0.006 (0.007)
Patience	-0.098** (0.042)	-0.095** (0.044)	-0.094** (0.047)	-0.060* (0.032)	-0.035 (0.045)
Risk-loving	0.047 (0.042)	0.043 (0.043)	0.049 (0.046)	0.025 (0.032)	-0.007 (0.044)
Feeling welcome in Germany	-0.073 (0.048)	-0.071 (0.048)	-0.080 (0.052)	-0.047 (0.036)	-0.094* (0.049)
<i>Type of relationship</i>					
Non-German partner	-0.014 (0.077)	-0.012 (0.082)	-0.012 (0.088)	-0.006 (0.058)	-0.006 (0.082)
German partner	0.142** (0.063)	0.151** (0.066)	0.162** (0.069)	0.123** (0.050)	0.136** (0.068)
<i>Study characteristics</i>					
Type of degree					
Master	-0.231*** (0.053)	-0.231*** (0.056)	-0.227*** (0.060)	-0.173*** (0.043)	-0.188*** (0.056)
Others/no information	-0.056 (0.072)	-0.061 (0.075)	-0.062 (0.080)	-0.045 (0.059)	-0.025 (0.075)
Field of study	Yes	Yes	Yes	Yes	Yes
<i>Reasons to migrate</i>					
Scholarship from Germany	0.038 (0.049)	0.028 (0.052)	0.014 (0.055)	0.031 (0.038)	0.045 (0.052)
Scholarship from another country	-0.005 (0.060)	-0.007 (0.062)	0.004 (0.067)	0.004 (0.046)	-0.018 (0.062)
Proximity to family/partner	-0.130*** (0.040)	-0.123*** (0.043)	-0.119*** (0.045)	-0.092*** (0.032)	-0.080* (0.043)
Own/partner's career chances	0.121** (0.059)	0.113** (0.057)	0.089 (0.062)	0.078* (0.046)	0.081 (0.060)
Administrative reason	0.031 (0.040)	0.036 (0.042)	0.043 (0.045)	0.034 (0.031)	0.030 (0.042)
<i>Social ties in Germany</i>					
In Germany before	0.142*** (0.043)	0.155*** (0.043)	0.165*** (0.046)	0.114*** (0.034)	0.148*** (0.044)
German questionnaire	0.009 (0.053)	0.004 (0.052)	0.010 (0.056)	0.004 (0.040)	-0.018 (0.053)
Many German friends	0.066 (0.053)	0.065 (0.055)	0.058 (0.058)	0.063 (0.041)	0.051 (0.054)
<i>Macro-economic conditions</i>					
GDP p.c.	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.001)	-0.002 (0.002)



TABLE 5 (Continued)

	Model 1 covariate	Model 2 sure	Model 3 sure ²	Model 4 certain-intention	Model 5 recoding
GDP p.c. growth	-0.021*** (0.006)	-0.023*** (0.007)	-0.024*** (0.008)	-0.014*** (0.005)	-0.019*** (0.007)
Observations	578	578	578	578	578
(Pseudo-)R ²	0.148	0.158	0.164	0.179	0.109
AIC	733.003	529.274	423.085	435.571	597.630

Notes: Table displays average marginal effects resulting from probit model estimations when controlling for uncertainty by a covariate (Model 1), by weighting with *sure* (Model 2), or *sure*² (Model 3). Model 4 displays coefficients resulting from an ordinary least-squares estimation when having *certain-intention* as dependent variable. Model 5 displays average marginal effects resulting from probit model estimation when calculating the dependent variable and weights according to Li and Mattsson (1995). Standard errors in parentheses: **p* < 0.10, ***p* < 0.05, ****p* < 0.01. Regressions include a 2017 and a 2018 dummy. Reference category for type of degree is Bachelor degree, and for type of relationship no partner. Abbreviations: AIC:akaike information criterion; GDP, gross domestic product.

and Lyssenko (2012), that it is open for further research to investigate empirically and/or theoretically which model is the most appropriate to take uncertainty in the migration context into account.

5 | CONCLUSION

When endogenous potentials within a country are not sufficient to maintain or increase a country's productivity, international students staying in the country after graduation are one source of exogenous potential to maintain or increase productivity, to overcome demographic challenge and skilled-labor shortage, and finally to survive in the global competition for talent.

This study employs survey data to analyze determinants of international students' intention to stay in Germany after graduation. By surveying students at the beginning of their studies we overcome problems faced by studies which use surveys conducted at the middle or toward the end of the studies when a non-negligible part of international students has already dropped out. Surveying students at an earlier point in time allows identifying factors which make it more likely for students to leave during their studies or after graduation. This provides policymakers with more time to appropriately target those international students who would have left at a later stage in the absence of any policy. But at the same time it involves a higher degree of uncertainty. For this reason, this study applies several models to take uncertainty into account to assure that the results on the importance of specific factors for the intention to stay are not distorted by uncertain students. This is our conceptual innovation.

All models reveal a significant difference between Master and Bachelor students with Bachelor students being more likely to state the intention to stay. Analyzing the determinants for Bachelor and Master students separately shows similarities; differences concern the larger role of personal relationships and labor market considerations for Master students' intentions. When the involved uncertainty is explicitly accounted for, the analysis shows that having been in Germany before and having a German partner are significantly associated with the intention to stay with certainty. Furthermore, the importance of career chances distinguishes certain students from uncertain students. In addition, we find that Master students not only exhibit a lower intention to stay but are also more uncertain in their intention. This confirms earlier findings by Hooijen et al. (2017).

For host countries confronted with skilled-labor shortage and demographic change, some recommendations can be derived relative to all students and, in particular, to the group of uncertain students. First, the results indicate that promoting visits to the host country by students before the beginning of their studies might be beneficial in alleviating the existing challenges and allowing for well-informed study choices. Additionally, the findings show that especially Master students and students who state that career chances are not of importance constitute possible target groups for policymakers as they are significantly more uncertain. Providing those students with information on the labor market over the course of their studies might be an effective way to decrease students' uncertainty and encourage (some of) them to stay. More career counseling, for example, could help making them aware of the possibilities of working in the host country after graduation and of important complementary qualifications, such as language skills, which students do not seem to focus on so much. Naturally, a host country might also gain through international students who do not stay after graduation, for example, by increased trade. However, international students should not leave the host country due to a lack of information as this might lead to inefficient labor market outcomes if good matches between skill supply and demand do not realize.

This study has outlined several approaches on how to take uncertainty into account when analyzing the intention to stay or to go after graduation. Overall, and in line with the results of Martínez-Espiñeira and Lyssenko (2012) in the contingent valuation context, we find that the employed uncertainty models which take the whole range of uncertainty levels into account lead to somewhat different results. While this study provides researchers

with a set of uncertainty models to employ in the context of migration, it is open for further research to investigate empirically and/or theoretically which model is the most appropriate given a specific context.

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ORCID

Fabian Koenigs  <http://orcid.org/0000-0003-3193-4941>

Silke Uebelmesser  <https://orcid.org/0000-0001-5889-9061>

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APPENDIX A

See Table A1.

TABLE A1 Descriptive statistics (shares): International students in the first semester (for winter semesters 2016/17, 2017/18, and 2018/19)

	(1) Sample	(2) University	(3) Germany
Male	0.389	0.417	0.493
Age	23 (median)	23 (median)	n.a.
Field of study*			
Social sciences	0.098	0.086	0.085
Humanities	0.214	0.230	0.217
Economics/business/law	0.197	0.229	0.190
Medicine	0.060	0.085	0.041
Natural science	0.397	0.335	0.140
Engineering	0.035	0.036	0.307
Origin region			
Europe	0.318	0.286	0.486
America	0.057	0.063	0.088
Africa	0.083	0.076	0.062
Asia	0.542	0.572	0.223
Australia	0.000	0.002	0.004
Type of degree			
Bachelor	0.190	0.250	0.329
Master	0.673	0.646	0.346
Others/no information	0.137	0.104	0.326
Observations	578	1536	216,007

Notes: Shares of overall observations are displayed. * Does not contain a 'No information' category.22We abstract from this category in this descriptive comparison, as we assume no systematic bias between the missing information of the field of study and the variables of interest. In the regressions, this category is included. The number of observations in column (1) refers to the full sample used in this paper. The number of observations in column (2) contains all international students except guest students. Column (3) contains the number of all international students enrolled at universities in Germany. Sources: Friedrich Schiller University Jena (2016), Friedrich Schiller University Jena (2017), Friedrich Schiller University Jena (2018), German Federal Statistical Office (2017), German Federal Statistical Office (2018), and German Federal Statistical Office (2019a). Own computations.