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Which Factors Drive Major Change and University Dropout? An Analysis on International Degree-Seeking Students at German Universities

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ABSTRACT

Germany is a non-English speaking country with a large and growing number of incoming international degree-seeking students. However, their estimated dropout rates are high. This study aims to investigate whether specific challenges faced by international students (e.g., social and academic integration, language learning, financial situation, residence-permit related regulations) are associated with major change and university dropout. The discrete-time competing risk analyses of the first three semesters of an online panel survey of international students in Germany (International Student Survey; N = 3,660) show that satisfaction with the degree program's content decreases the risk of major change and university dropout. Moreover, the nationality and the associated temporary or permanent residence permit are considered in the students' educational decisions. Based on the results, we recommend improving the match between students' interest and their fields of study. Measures to prevent international students from dropping out must thus begin before they start their studies.

Keywords: degree mobility, higher education, international students, major change, student satisfaction, university dropout, university persistence

INTRODUCTION

The number of internationally mobile students in tertiary education has increased substantially worldwide (DAAD & DZHW, 2022). The non-English-speaking country with the highest number of incoming students worldwide is Germany, where eleven percent of all students in higher education are degree-seeking students from abroad (DAAD & DZHW, 2022). Most international degree-seeking students – that means students with a foreign nationality who have completed secondary education abroad and migrated to Germany to seek a degree – are enrolled in a master’s program and in the field of engineering, followed by legal, economic, or social sciences and mathematics or natural sciences (DAAD & DZHW, 2022). However, an estimated 41 percent of the international bachelor’s and 28 percent of the master’s students leave German universities without obtaining a first degree. Among German students, the dropout rate is lower, with 28 percent for bachelor’s and 21 percent for master’s students (DAAD & DZHW, 2022).

The high dropout rates are concerning: First, studying abroad is an educational investment with high personal costs (Lörz, Netz, & Quast, 2016). International degree-seeking students in Germany must prove a recognized university entrance qualification (e.g., from a school abroad or by passing preparatory courses) and language certificates. They must obtain a visa and residence permit as a third-country (non-EU/EFTA) student (e.g., by opening a blocked bank account worth 11,208 euros and proving health insurance) and leave family, partner, and friends in the country of origin. Second, university dropout and major changes produce societal and individual costs: The internal rate of return to a dropout is negative compared to graduates, based on gross earnings, disposable income, and net fiscal contribution (Pfeiffer & Stichnoth, 2021). Changing the major leads to a delay in the study progress (Thies, 2023).

The high dropout rates may result from the specific characteristics and challenges unique to international students, such as social and academic integration in a new cultural environment, language learning, or legal regulations regarding the residence permit (Pineda et al., 2022). However, no previous empirical study has explored the individual determinants of international students’ dropout in non-English speaking countries in the European context. Moreover, no study has jointly analyzed the mechanisms of international students’ major change and dropout behavior.

This study aims to fill this research gap by investigating whether and how social and academic integration, language skills, financial situation, pre-entry and institutional characteristics are associated with major change and university dropout for international degree-seeking students in Germany. We perform subgroup analyses by type of degree and chosen field of study to determine whether some groups are more affected by certain determinants than others. Bachelor’s and master’s students differ in their previous study experiences and their expected study duration. Science, technology, engineering, and mathematics (STEM) majors are characterized by a higher proportion of men among students and a higher time expenditure on courses and self-study than non-STEM majors

(Apolinarski & Brandt, 2018). We apply discrete-time competing risk event history analyses using an online panel survey of international students who started their studies in the winter semester of 2017/18 (International Student Survey).

THEORETICAL BACKGROUND

Economic and sociological approaches provide a clear framework and jointly provide a holistic explanation of students' educational decisions (Aina, Baici, Casalone, & Pastore, 2022; Beekhoven, de Jong, & van Hout, 2002; Lörz et al., 2016; Müller & Klein, 2023; Salisbury, Umbach, Paulsen, & Pascarella, 2009). Economic approaches draw on the rational choice or human capital theory and view education as an investment that an individual rationally decides upon after considering monetary and non-monetary costs and benefits of the optional career choices (Becker, 1962; Breen & Goldthorpe, 1997). Educational decisions are made under uncertainty as a sequential choice (Aina et al., 2022; Salisbury et al., 2009). Before starting the study program, the educational path with the best cost-benefit ratio is chosen. The intention or decision to study abroad is a selective process and is influenced by socio-demographic characteristics and social, financial, cultural, and human capital (Entrich & Fujihara, 2022; Lörz et al., 2016; Netz, Klasik, Entrich, & Barker, 2021; Salisbury et al., 2009). After starting their studies, students receive more detailed information about the study programs' content, their learning effort, or career prospects. They re-evaluate the costs and benefits and decide to continue or drop out of their studies. Economic approaches explain educational decisions therein – while sociological approaches explain higher education dropout and root educational choices in the institutional context of the university (Aina et al., 2022; Müller & Klein, 2023; Salisbury et al., 2009). Numerous sociological study success models relate different explaining factors to university dropout (Heublein, 2014; Metzner & Bean, 1987; Spady, 1971; Tinto, 1993). According to Tinto (1993), pre-enrollment characteristics, such as family background, skills, and prior schooling, affect institutional experiences (academic performance; faculty-, staff-, and peer-group interactions; extracurricular activities). Institutional experiences lead to academic and social integration and influence the decision to leave. Other student success models (Heublein, 2014; Metzner & Bean, 1987; Spady, 1971) add determinants of university dropout, such as the study motivation (e.g., identification with the major, expected benefit of studies), psychological and physical resources, study conditions, study satisfaction, environmental conditions (e.g., financing, family responsibilities) and available career alternatives (e.g., employment, vocational training). Economic and sociological approaches are not mutually exclusive: Tinto (1975) notes that students drop out when they assume that other career alternatives will yield greater benefits than costs over time.

Previous research is characterized by different definitions of university dropout (Behr, Giese, Tegui Kamdjou, & Theune, 2020b; Tieben, 2020). Following Tieben (2020), we understand university dropout as a sequential process: First, students decide to leave the initially chosen program. Second, they decide between staying in German higher education and transferring to an

alternative major (major change) – or leaving German higher education altogether (system departure, here: university dropout). Major change and university dropout are two alternative responses to problems with the study situation (Astorne-Figari & Speer, 2019). It is recommended to take the differences between these processes into consideration because the reasons for and, consequently, the effects of different factors on major change and dropout may differ (Behr et al., 2020b). Therefore, they are often analyzed as competing outcomes (Clerici, Giraldo, & Meggiolaro, 2014; Meggiolaro, Giraldo, & Clerici, 2017). In this paper, we will interpret the events of major change or university dropout as two different rational decisions made in the university environment in response to struggles – after considering the subjective expected costs and benefits of alternative educational choices.

LITERATURE REVIEW

Recent literature reviews have summarized the most important determinants of native students' dropout and major change (Aina et al., 2022; Behr et al., 2020b). Few empirical studies on university dropout have focused on international students in the United States (García, Garza, & Yeaton-Hromada, 2019; Kommers & Pham, 2016; Mamiseishvili, 2012). These studies are hardly generalizable to Germany due to the different higher education systems (e.g., many German universities do not charge tuition fees, study programs are offered in German or English). Previous studies in the German context focus on the determinants of international students' dropout intentions (Thies & Falk, 2021; Yildirim, Zimmermann, & Jonkmann, 2021; Zimmermann et al., 2021). Dropout intentions correlate with dropout (Bean, 1982) but may not necessarily lead to an actual dropout decision. In the following review, we draw on these studies and derive theoretical considerations concerning factors relating to university dropout and major change among international students.

Time-Varying Attributes of the Study Progress

Social integration. García et al. (2019) find that with increasing social, academic, and socio-academic integration, the sense of belonging increases, and college withdrawal of international students decreases. Integration in non-academic areas (e.g., participation in school clubs and sports) decreases persistence. In contrast, integration in academic areas (e.g., in study groups, meetings, and interactions with faculty members) increases the persistence of international students (Mamiseishvili, 2012). Studies on international students in the German context show that getting along with fellow students and teachers and feeling a sense of belonging to the university is related to lower dropout intentions (Thies & Falk, 2021; Yildirim et al., 2021). Drawing on the sociological and economic considerations, feeling integrated among students and teachers increases the non-monetary costs of major change or dropout. By terminating their studies, students would risk losing valuable contacts and a supportive and

enjoyable environment. We expect that getting along with fellow students and teachers decreases the risk of major change and dropout.

Academic integration. Students who are more satisfied with and interested in their studies and whose expectations for their studies are met are less likely to drop out or switch majors in Germany (Behr, Giese, Tegum Kamdjou, & Theune, 2020a, 2020c, 2021; Meyer, Leuze, & Strauss, 2022). Studies on international students in the United States have identified the college grade point average (GPA) as a positive predictor of student persistence (Kommers & Pham, 2016; Mamiseishvili, 2012). Among German international students, frequently indicated reasons for dropout were a lack of motivation for studies (e.g., the study program does not meet the expectations, loss of interest in the major) and performance problems (Pineda et al., 2022). International students with higher study-related self-efficacy and higher general satisfaction with their studies have lower dropout intentions (Thies & Falk, 2021; Zimmermann et al., 2021). The results align with the sociological and economic approaches: Low-performing students with little study-related interest must overcome greater efforts to pass exams and thus have higher non-monetary costs of studying. We expect that a higher academic self-concept and a higher satisfaction with the contents of studies decrease the risk of major change and university dropout.

Language skills. Studies on international students in the United States and the United Kingdom showed that higher scores in language tests positively correlated with students' university GPA (Ginther & Yan, 2018; Hu & Trenkic, 2021) and negatively with the number of failed modules (Daller, Müller, & Wang-Taylor, 2021). Thies and Falk (2021) found that better daily life language skills relate to lower dropout intentions for international bachelor's students in Germany. From the sociological and economic considerations, we derive that a better proficiency in the degree-programs' language requires less investment to keep up with studies. This should lead to lower non-monetary costs of studying and a lower major change and dropout risk. A better proficiency in daily life communication should ease everyday life (e.g., communication with administration, authorities, and employers) and reduce the aim of return migration, resulting in a lower dropout risk.

Financial situation. The primary source of funding for international students is financial support from parents – but this declines throughout their studies in favor of increasing student employment (Pineda et al., 2022). A difficult financial situation was the second most frequently cited reason for university dropout (Pineda et al., 2022). According to economic approaches, students in a good financial situation can afford a major change. They can cover the resulting costs of extending their studies (Thies, 2023). At the same time, they may not be tempted to drop out of university to cover their living expenses (e.g., through gainful employment). We expect that a good financial situation results in a higher major change and a lower dropout risk.

Time-Constant Pre-entry Attributes and Study Characteristics

Further pre-entry characteristics are assumed to correlate with the time-varying characteristics and explain variation in dropout and major change risks: Better school grade averages are related to lower dropout risks for native (Behr et al., 2020a, 2020c) and lower dropout intentions for international students (Thies & Falk, 2021). Students in German-taught programs may have more alternative German-taught programs to transfer to and thus be more likely to transfer: Three percent of all bachelor's and 15 percent of all master's programs are taught in English (Pineda et al., 2022). Previous statistics further showed that bachelor's students, students from research-oriented universities, and students in mathematics, natural sciences, humanities, and engineering have higher dropout and major change rates compared to master's students, students from universities of applied sciences and in other fields of study, respectively (Behr et al., 2020a; German Federal Statistical Office, 2022; Heublein, Hutzsch, & Schmelzer, 2022). In addition, international female students in Germany have a lower dropout intention than their male peers (Thies & Falk, 2021; Zimmermann et al., 2021).

Moreover, differences concerning residence regulations for students from EU/EFTA and third (non-EU/EFTA) countries must be considered (Residence Act, s. 16b): Students with an EU/EFTA nationality can enter Germany without a visa and stay in Germany without a residence permit. Students from third (non-EU or EFTA) countries enter Germany with a visa (granted under specific conditions, e.g., admission to a university, language skills, financial means) and then apply for a residence permit for the purpose of studying (other residence permits are possible, e.g., for humanitarian or family reasons). With a student residence permit, a major change is allowed until the end of the third semester and must be reported to the Foreigners' Registration Office. After the third semester, a change is only possible with justification. The student residence permit expires with a university dropout. International students from third countries have to leave Germany or change to a residence permit for another purpose, e.g., for vocational training or family reasons (Residence Act, s. 16b). The university application process also differs by nationality. Third-country students often do not get their university entrance qualifications recognized. To gain access to German universities, they must attend a one-year preparatory course ("Studienkolleg") and pass an assessment test ("Feststellungsprüfung") or have to pass through a study entry phase at the universities. Third-country students may favor a major change over a dropout due to their temporary residence permit and the time-consuming application procedure. We will check for this relationship by including a variable on the type of residence permit (e.g., temporary vs. permanent).

METHOD

Data and Sample

We use data from the International Student Survey, a panel study of students who have gained their university entrance qualification abroad or at a German

preparatory course, have a non-German nationality, started their tertiary studies in the winter semester of 2017/18, and aim to complete a master's or bachelor's degree in Germany (for more information on the survey, see Falk & Thies, 2022). For the survey, we cooperated with 125 research-oriented universities and universities of applied sciences in Germany. The universities forwarded the link to the survey via e-mail to their international first-year students, of whom 4,751 registered (about 14 percent of the international students). At the end of every semester and until their sixth semester, the registered students received a link via e-mail to participate in the online questionnaire. Students reporting a dropout or graduation were not invited in the subsequent waves, as the questionnaire could not cover alternative career paths (e.g., in the labor market).

We analyze the determinants of university dropout or major change within the first three semesters of study to create comparable conditions for students with different degree types and regions of origin: The study duration for bachelor's and master's students differ (standard duration: six semesters vs. four semesters, respectively), but should be comparable in the first three semesters, where graduations are unlikely. Third-country students with a residence permit for study purposes can often only change their major until the end of the third semester. The person-period dataset includes a record for each of the three semesters in which students are at risk for an event. We exclude student semesters after the students have experienced an event (a major change or university dropout) or censoring. Censoring occurs if students do not experience an outcome of interest because the observation period ends (third semester) or if students do not respond to the questionnaire anymore (panel dropout). If students have not participated in the second or third wave (wave non-response), we insert the last given information for the relevant time-varying variable. Because we anticipated wave non-response, we allowed students to back-report a major change or dropout date for previous semesters in each wave. We use the information given in waves 4 to 6 on major change and university dropout on back-reported events for waves 1 to 3. We used the information on the first reported event if a student reported multiple major changes. Our sample includes students who completed the first questionnaire ($N = 3,828$). We exclude students with missing values on relevant variables in the first semester, with diverse or unknown gender, a missing university type, an unknown type of residence permit, and students with early graduation. Students reporting a graduation in the first, second, or third semester could be enrolled in a 2-semester master's or a 4-semester bachelor's program, which is rare in Germany. The final sample entails 1,488 bachelor's and 2,172 master's students ($N = 3,660$).

Variables

The dependent variable compares students who have been enrolled in their chosen degree program since the winter semester of 2017/18 with university dropouts and major changers. University dropouts have dropped out of their degree program in Germany or have switched from a higher education institution in Germany to a foreign institution where they are continuing their studies. Major

changers are enrolled in Germany and have reported a change in their study program since the start of the winter semester of 2017/2018. This category includes students who have simultaneously experienced a change in the degree type or the university. Table 1 describes the independent variables included in the models.

Table 1: Variable Description

Variable(s)	Description
Attributes of the study progress (time-varying)	
Social integration: students and teachers	<p>A continuous index variable, adapted from NEPS (2018), based on the mean value of four items (<i>1 = does not apply at all to 5 = fully applies</i>):</p> <ul style="list-style-type: none"> • I feel accepted by [the teaching staff / my fellow students]. • I get on well with [the teaching staff / my fellow students] in my degree program. • Most of [the teaching staff / my fellow students] treat me fairly. • [The teaching staff / my fellow students] are interested in what I have to say.
Academic self-concept	<p>A continuous index variable, developed by Dickhäuser, Schöne, Spinath, and Stiensmeier-Pelster (2002), based on the mean value of three items (1–5):</p> <ul style="list-style-type: none"> • For me, learning new things as part of my studies is... (<i>difficult – easier compared to my fellow students</i>) • My study-related skills are... (<i>limited – well-developed compared to my fellow students</i>) • For me, tasks within the framework of my degree program are... (<i>difficult – easier compared to my fellow students</i>)
Satisfaction with degree program	<p>A continuous index variable, developed by Westermann, Heise, Spies, and Trautwein (1996), based on the mean value of three items (<i>1 = strongly disagree to 5 = strongly agree</i>):</p> <ul style="list-style-type: none"> • I really enjoy what I’m studying. • Overall, I am satisfied with my current degree program. • I find my degree program really interesting.
Language skills: studies, daily life	<p>An ordinal variable indicating sufficient language skills (<i>1 = strongly disagree to 5 = strongly agree</i>):</p> <ul style="list-style-type: none"> • My language skills are sufficient to cope with my [academic studies / everyday communication].
Financial situation	<p>An ordinal variable on adaptation to financing academic studies and life in Germany, finding appropriate jobs, combining paid employment and academic studies (<i>1 = very difficult to 5 = very easy</i>)</p>

Pre-entry attributes, study characteristics (time-constant)

School GPA	An ordinal variable measuring the achieved average grade in the university entrance qualification. The grade was retransferred to the German grade system and z-standardized by the destination where it was gained (abroad or at a German higher education preparatory course). Students were categorized into lower, middle and upper performing thirds and students with missing values. The missing values are due to students with no information or implausible information (average grade outside range of the grading system).
Study language	A dichotomous variable ($0 = \textit{English, or other}; 1 = \textit{German}$)
Degree type	A dichotomous variable ($0 = \textit{bachelor}; 1 = \textit{master}$)
University type	A dichotomous variable ($0 = \textit{research-oriented university}; 1 = \textit{university of applied sciences}$)
Field of study	A nominal variable ($0 = \textit{mathematics, natural sciences, engineering (STEM)}; 1 = \textit{humanities (non-STEM)}; 2 = \textit{legal, economic and social sciences (non-STEM)}; 3 = \textit{other}$)
Female	A dichotomous variable ($0 = \textit{male}; 1 = \textit{female}$)
Third-country nationality	A dichotomous variable ($0 = \textit{EU/EFTA nationality}; 1 = \textit{non-EU/EFTA nationality}$).
Residence permit	A dichotomous variable ($0 = \textit{permanent}; 1 = \textit{temporary}$)

Analytical Procedure

We perform discrete-time competing risk event history analyses, a methodology typically applied in studies on student persistence (Clerici et al., 2014; Meggiolaro et al., 2017; Scott & Kennedy, 2005):

$$\log \left[\frac{h_{i,j}(t)}{h_{i,0}(t)} \right] = \sum_1^3 \alpha_{t,j} + X_i \beta_j + Z_{i,t} \delta_j \quad \text{for } i = 1, \dots, N, t = 1, \dots, 3 \text{ and } j = 1, 2$$

The central idea of the model is to follow students over university semesters until they experience a major change or dropout, assuming that only one event can occur and that the students are no longer at risk afterward. The model estimates the logistic transformation of the outcome-specific hazard ratio $\left[\frac{h_{i,j}(t)}{h_{i,0}(t)} \right]$, which is the risk of an event j ($j = 1$: major change; $j = 2$: university dropout) to happen at a discrete time point t to an individual i , with respect to the probability

of an individual i experiencing no event at time t ($j = 0$: continued enrolment in a chosen degree program). The model assumes that the non-outcome ($j = 0$) for an individual i has happened at every period before t and the individual has not been censored before t . $\alpha_{t,j}$ is the baseline hazard common to all individuals, specified by including semester dummies. Furthermore, the model includes the vectors of the coefficients estimated from the time-varying ($Z_{i,t}\delta_j$) and time-constant ($X_i\beta_j$) variables. We run a multinomial logistic regression in STATA (15) with the exponentiated form of the coefficients, also known as relative risk ratios or odds. We have found no evidence of multicollinearity by checking the variance inflation factor.

RESULTS

Descriptive Analysis

Students who have not reported a dropout or major change within the first three semesters and are still studying feel significantly more integrated with regard to other students in their first semester (3.95 on a scale of one to five) as compared to major changers (3.54) and dropouts (3.69; Table 2). Moreover, students who are still studying after three semesters feel more integrated with regard to their teachers, have a higher academic self-concept and are more interested in the content of their studies than major changers and dropouts. Of the students that have not experienced an event, 62 percent are enrolled in a master's program. Among the major changers and dropouts, 38 percent are enrolled in a master's program, respectively, indicating a lower major change and dropout risk among master's students. Mathematics, natural sciences, and engineering students are less likely, and humanities students are more likely to change their major. Students from third countries change their major more often but drop out less often.

Multivariate Analysis

According to the results displayed in Model 1 in Table 3, feeling integrated into the student community does not significantly affect the risk of major change and university dropout for international students – when controlling for other covariates. However, a one-unit increase in the rating of feeling accepted and recognized by teachers reduce the odds of major change by 22 percent ($=100*[0.78-1]$). The subgroup analyses show that the effect is only significant for master's students (Figure 1).

Table 2: Descriptive Statistics Based on First Semester

Variables	Total	Subgroup outcomes		
		Still studying	Major change	Dropout
Attributes of the study progress	<i>M</i>	<i>M</i>	<i>M (t-test)</i>	<i>M (t-test)</i>
Social integration students	3.91	3.95	3.54***	3.69**
Social integration teachers	3.97	4.01	3.64***	3.81*
Academic self-concept	3.13	3.14	3.00**	2.82***
Satisfaction with study content	4.02	4.07	3.60***	3.48***
Language skills studies	4.19	4.22	3.96***	4.18
Language skills daily	4.01	4.00	4.10	4.19
Financial situation	2.64	2.66	2.54	2.45
Pre-entry attributes, study characteristics	%	%	% (chi ² -test)	% (chi ² -test)
School GPA				
Lower third	0.26	0.26	0.32	0.37
Middle third	0.27	0.27	0.24	0.23
Upper third	0.26	0.27	0.22	0.18
No information	0.21	0.20	0.21	0.22
German study language	0.51	0.49	0.71***	0.63*
Master	0.59	0.62	0.38***	0.38***
Field of study			***	
Mathematics, natural sciences, engineering	0.57	0.58	0.47	0.55
Humanities	0.10	0.09	0.17	0.08
Legal, economic and social sciences	0.28	0.28	0.29	0.27
Other	0.06	0.06	0.06	0.10
University: applied sciences	0.24	0.23	0.29	0.27
Female	0.45	0.44	0.53**	0.55*
Third Country (non-EU/EFTA)	0.83	0.83	0.88*	0.59***
Number of students	3,660	3,302	280	78

Note. International Student Survey, wave 1 – wave 3; Continuous variables: mean (*M*) and t-test of major change or dropout vs. still studying; Categorical variables: Frequencies (%) and chi²-test of major change or dropout vs. still studying. *** p < 0.001, ** p < 0.01, * p < 0.05

Table 3: Determinants of a Major Change or a University Dropout (OR)

Variables	Model 1		Model 2	
	Major change	Dropout	Major change	Dropout
Attributes of the study progress				
Social integration students	0.97	0.98	0.97	0.98
Social integration teachers	0.78*	1.14	0.78*	1.13
Academic self-concept	1.27**	0.78	1.27**	0.77
Satisfaction study content	0.55***	0.37***	0.55***	0.37***
Language skills studies	1.06	1.23	1.06	1.22
Language skills daily	1.10	1.16	1.11	1.15
Financial situation	0.97	0.84	0.97	0.83
Pre-entry attributes, study characteristics				
School GPA (Ref.: Lower third)				
Middle third	0.72*	0.58	0.71*	0.57
Upper third	0.69*	0.48*	0.69*	0.48*
No information	0.85	0.92	0.84	0.92
German study language (Ref.: English, other)	1.57*	0.90	1.55*	0.91
Master	0.47***	0.47*	0.46***	0.48*
Field of study (Ref.: Mathematics, natural sciences, engineering)				
Humanities	2.49***	0.55	2.46***	0.57
Legal, economic and social sciences	1.21	0.69	1.21	0.70
Other majors or unclear	1.56	1.52	1.55	1.55
University: applied sciences	1.13	1.01	1.13	1.04
Female (Ref.: Male)	1.16	1.31	1.17	1.29
Third-country nationality (Ref.: EU/EFTA)	2.24***	0.34***	1.46	0.70
Temporary residence permit (Ref.: permanent)			1.65	0.42*
Semester (Ref.: 1)				
2	0.64***	1.50	0.64***	1.50
3	0.21***	1.35	0.21***	1.36
Constant	0.19**	0.57	0.17**	0.67
Pseudo R ²	0.12		0.12	
Number of students (n)	3,660		3,660	
Number of student-semester (N)	9,790		9,790	

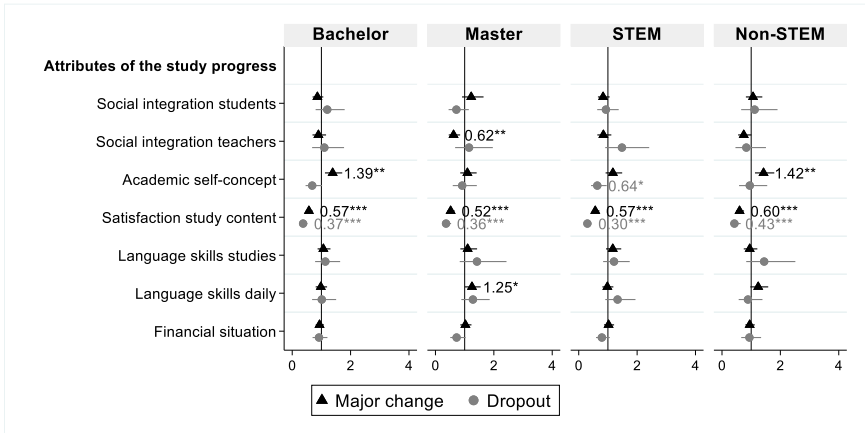
Note. International Student Survey; wave 1 – wave 3; *** p < 0.001, ** p < 0.01, * p < 0.05; OR = Odds Ratios; Regression diagnostics: We have checked and found no indication of multicollinearity.

Contrary to our expectations, students with a higher academic self-concept are more prone to major changes and not significantly more likely to drop out (Table 3, Model 1). In-depth analyses showed an initial lower dropout risk for students with a higher academic self-concept ($p < 0.05$). However, the effect becomes non-significant when controlling for satisfaction with studies. The positive effect on major changes is prevalent among bachelor's students and students in the humanities, social-, legal-, and economic sciences (non-STEM; Figure 1). The results align with studies finding a lower risk of withdrawal and a higher risk of major change for students with a higher study-related self-concept (Fellenberg & Hannover, 2006) or with better school grades (Meggiolaro et al., 2017; Meyer et al., 2022). High-performing students may be more sensitive, motivated, and able to change (e.g., in terms of admission requirements) (Aina et al., 2022; Meyer et al., 2022). Moreover, Figure 1 shows that students with a higher academic self-concept in mathematics, natural sciences, or engineering (STEM) have a lower risk of dropping out of studies, even after controlling for confounding variables. STEM students in Germany face high performance requirements and usually spend more time in class or studying than students in the humanities, economics, social or legal sciences (non-STEM) (Federal Ministry of Education and Research, 2017). Across all student groups and in line with our expectations, we find that students who are satisfied with their current study program have a lower risk of changing their major and dropping out of their university in Germany.

Model 1 in Table 3 shows that better language skills and the financial situation do not significantly affect major change or dropout risk when controlling for several other variables. However, the odds for students in German-taught programs to change their major are 1,57 times that of students with another instructional language (English, other).

Concerning the control variables, we find that entering the university with an average school GPA in the upper-performance third relates to a lower risk of major change and dropout than students in the lower-performance third (Table 3, Model 1). In line with previous findings (Heublein et al., 2022), master's students are less likely to drop out than bachelor's students. Humanity students are more likely to experience a major change than STEM students. Students from the humanities spend less time in class (Apolinarski & Brandt, 2018) and study in less occupational-specific fields marked by greater uncertainty about labor market prospects. They may strive to change to more challenging and promising majors concerning the labor market situation. Gender and university type are not related to student persistence net of other factors.

Finally, while third-country nationals tend to change majors more often, their odds of dropout are 66 percent ($=100*[0.34-1]$) lower compared to students from EU or EFTA states (Table 3, Model 1). When controlling for the type of residence permit (Table 3, Model 2), the effects of the nationality found in Model 1 diminish and are reduced in size. Students with a temporary residence permit have a higher risk of changing their major ($p < 0.1$) and a lower risk ($p < 0.05$) of dropping out than students with a permanent residence permit.



Note. International Student Survey; wave 1 – wave 3; coefficient plot with 95% confidence intervals; *** p < 0.001, ** p < 0.01, * p < 0.05; OR = Odds Ratios; n(Bachelor) = 1,488; n(Master) = 2,172; n(STEM) = 2,083; n(non-STEM) = 1,363; Models control for all variables included in Table 2, Model 1.

Figure 1: Determinants by Degree Type and Field of Study (OR)

Critical Reflection

To reduce the likelihood of panel non-response, we applied several measures during the field phase, for example, multiple modes of contact, a generous incentive concept, or a follow-up survey among panel non-respondents (Falk & Thies, 2022). After the data collection, we assessed whether there is a correlation between dropout and major-change intention and wave non-response (Falk & Thies, 2022). Students who reported major-change intentions were less likely to respond to the second questionnaire. Intending to drop out related to a lower probability of students of responding to the third questionnaire. However, no group continuously displayed high non-response rates in every wave (Falk & Thies, 2022). In our sample of 3,660 students, 12.4 percent did not respond to the second or third questionnaire. Our longitudinal discrete-time model uses the panel dropouts' information until they have answered their last questionnaire.

Due to the limited number of major changes and university dropouts in our sample, which may result from panel dropout, we have estimated parsimonious models. We encourage future researchers to examine the effect of the following student characteristics, which are central to educational research. (1) Social origin: Previous studies showed that international students with academically educated parents have lower dropout intentions due to their, on average, better school grades, higher parental aspirations, and other related determinants (Thies & Falk, 2021). (2) Labor market prospects: Students indicated in open-ended responses to the International Student Survey that anticipated poor labor market

prospects caused their major change. (3) Recognition of degrees: Some students experienced a delayed recognition of courses or degrees from abroad, which caused a later change to their desired major.

DISCUSSION

University dropout and major change are long-term, sequential, and multicausal processes during studies (Aina et al., 2022; Behr et al., 2020a, 2020b, 2020c, 2021; Pineda et al., 2022). Often, not one factor alone is responsible for major change or dropout, but several factors accumulate simultaneously or sequentially. Some factors are more decisive than others. This study sought to identify which factors are critical for major change and dropout decisions of international students.

Combining sociological and economic approaches and drawing on the results of previous studies (García et al., 2019; Mamiseishvili, 2012; Thies & Falk, 2021; Yildirim et al., 2021), we argue that better social integration is related to a lower major change or dropout risk, as the non-monetary benefits of completing a degree increase. Even though integration into the group of fellow students is related to lower dropout intentions for international students in Germany (Thies & Falk, 2021), it is not decisive for major change and dropout when controlling for several other variables. However, in line with a study on international students in the United States (Mamiseishvili, 2012), we find that social integration in academic areas (e.g., feeling accepted and recognized by teachers) reduces the odds of major change.

We consider factors related to academic integration (e.g., study motivation, study interest, study satisfaction, and ability) and their interrelation as crucial for international students' persistence. By combining the sociological and economic approaches, we have argued that a high interest in and a good performance during studies are associated with a lower major change or dropout risk, as the non-monetary benefits of completing studies increase. Studies from the United States have identified the college GPA as a positive predictor of student persistence (Kommers & Pham, 2016; Mamiseishvili, 2012). German studies showed that international students with higher self-efficacy, better initial school grades (Thies & Falk, 2021), and higher study satisfaction (Zimmermann et al., 2021) have lower dropout intentions. This study showed in accordance that interest and joy in studying the chosen field reduce the risk of major change and university dropout. STEM students with a higher academic self-concept have a lower dropout risk. Related to ability is a better school performance, which reduces the risk of major change and dropout for international students.

Based on economic approaches, we have argued that a good financial situation is related to a higher major change and a lower dropout risk as the monetary costs of studying decrease. Financial problems were the second most important reason for dropping out (Pineda et al., 2022). Economic and sociological considerations suggest that better study-related language skills should relate to a lower major change and dropout risk. Better daily life language skills should relate to a lower dropout risk. The non-monetary costs of studying

are reduced, as students need to invest less to keep up with studies or daily life challenges. According to previous studies, better language skills relate to lower dropout intentions of international bachelor's students (Thies & Falk, 2021). However, the financial situation and language skills are not crucial for the major change and dropout risk, net of other factors. Admission to a degree program in Germany requires a minimum language level of B2 or C1, depending on the university. Moreover, international students from third countries must deposit money in a blocked bank account and provide proof of health insurance. When the required language level for studying is met, and a financial cushion exists, language and financial difficulties may not be so severe that they directly affect major change or university dropout.

We conclude that international students are not so different from German students in their dropout and major change behavior. Among German students, the school grade point average, study satisfaction, academic self-concept, and self-assessments are crucial in the dropout process (Behr et al., 2020a, 2020c, 2021). However, language skills, student integration, or the financial situation may influence the satisfaction with studies or other factors of student success (e.g., grades) and may have an indirect effect on university dropout. Zimmermann et al. (2021) have shown that the sociocultural adaptation (e.g., coping with language, financial situation, housing, friends, and values) in the first semester is positively related to satisfaction with studies in the second semester, which is in turn positively associated with the dropout intention of international students in the third semester. Moreover, the language of the degree program receives weight in the considerations, as students in German-taught programs are more likely to change. A possible reason may be that students in German-taught programs face more alternative German-taught programs than students in English-taught programs – and simply have more options to change. Finally, students from third countries tend to have a higher risk of a major change but a lower risk of dropout than students with an EU/EFTA nationality. This is explained by the fact that EU/EFTA students can reside in Germany permanently. In contrast, third-country students often have a temporary student residence permit which expires with a university dropout. The opposing effects underline the different mechanisms that can lead to dropout and major change and the need to consider them as competing risks.

Based on the results, we recommend improving the match between interests and the chosen study program. Before applying for a specific program, international students should be able to contact student counseling services. Moreover, international students should find adequate (online) opportunities to inform themselves about study programs and vocational training in German and English. Providing information only in German increases the risk that they will misunderstand the content of their study program or will not be sufficiently informed. Moreover, universities could require students to inform themselves about a specific study program's content and labor market opportunities by introducing mandatory admission requirements (e.g., motivation letters and self-assessment tests). Finally, self-assessment tests are an appropriate tool for valid study choices. They allow students to formulate their expectations and reflect on

the extent to which they are met within their study programs. The purpose of the tests is to inform students and provide realistic expectations regarding the requirements of the field of study.

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