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The agony of university choice: Broaden horizons, expand participation?

Reinhard A. Weisser

Department of Economics, Nottingham Trent University, Nottingham, UK

ABSTRACT

This study investigates how personality and individual experiences influence decision-making processes during the transition into Higher Education (HE). It offers insights into application choices, where applicants employ different quantitative hedging strategies against non-admission. These strategies are assessed by the number of applications but also the search radius, leading to an alternative's inclusion into the application set. An empirical analysis of the usually unobserved application stage shows how these hedging strategies depend on applicants' perceptions of psychic costs and their socio-demographic backgrounds. This heterogeneity may explain varying participation rates for different subpopulations in a country with a large HE sector, such as Germany. An essential finding points to the relevance of earlier mobility experiences during adolescence, which may act as facilitators of subsequent student mobility. Providing adolescents with a stimulating mobility experience before they consider transitioning to university could thus be an avenue to increase participation chances of potentially disadvantaged groups.

Introduction

Participation in higher education (HE) has been expanding in many countries over the last decade (OECD, 2020). Despite this, and depending on school leavers' socio-demographic backgrounds, participation in HE varies considerably (Greenback, 2007; Griga & Hadjar, 2014). Successful completion of a university degree, in turn, opens new career paths and leads to labour market gains, such as graduate wage premiums (Knapp et al., 2013; Lemistre & Moreau, 2009).

Individual participation in HE is the outcome of two distinct decision-making processes: The applicant's decision to apply and the universities' decision to grant admission. The details of the admission process cannot be influenced by applicants. It is uncertain whether they will obtain admission at their preferred institution or whether they may fail to secure admission at any institution at all. At the application stage, however, prospective students can hedge against non-admission: They could apply at institutions with lower entry restrictions. Beyond this qualitative strategy, applicants could opt for a quantitative hedging strategy by applying to more institutions.

Increasing the number of applications is not a mere numbers game. When applicants form their application set, they also decide where to apply. The more institutions an applicant wishes to include into their application set, the further they must look. How far they are willing to look depends on how far they are willing to move. The wider a prospective student's search radius, i.e. the more mobile they are, the better their participation chances in HE.

The phenomenon of student mobility is a frequently discussed topic (cf., Montgomery, 2002; Skinner, 2018). Enrolment likelihood declines substantially with increasing distance to an institution (Alm & Winters, 2009; Gibbons & Vignoles, 2012). This effect is rooted in distance-dependent *monetary* and *psychic costs*, originating from social and place attachment (Schwartz, 1973). Other geography-related determinants of university choice relate to location-specific returns, e.g. by gaining access to favourable economic conditions (Dotti et al., 2013; McHugh & Morgan, 1984) or amenities (Cooke & Boyle, 2011; Mixon & Hsing, 1994).

Both costs and returns to mobility are a matter of subjective perception, shaped by individual traits and experiences. This explains why personality traits, e.g. openness and extraversion, are important determinants of geographic mobility (Canache et al., 2013; Jokela, 2009). Risk-seeking individuals are also more likely to migrate (Bauernschuster et al., 2014; Jaeger et al., 2010). Concomitantly, realised or expected returns to mobility are valued differently because time preferences vary across individuals (Frederick et al., 2002; Van Dalen & Henkens, 2012).

Another aspect of university choice, especially in the Anglo-American realm, is institutional quality. Some students migrate to attend highly ranked institutions, others due to availability of admission (Cooke & Boyle, 2011; Mixon & Hsing, 1994). There is also evidence of students choosing study places mostly based on availability and costs (Faggian & McCann, 2006) or programme diversity (Sá et al., 2004). This stresses the importance of general opportunities for participation within applicants' decision-making processes.

A lot is known about how socio-demographic and geographic factors impact final enrolment decisions. Yet little research investigates how differences in personality and earlier experiences affect the application process.

Contributing to the literature on university choice and participation in HE, this paper aims at closing this gap by investigating the occurrence of quantitative hedging strategies. This is an important extension as it helps to understand differences in participation outcomes, emerging from the application stage. Eventually, this allows deriving more specific recommendations on how to boost participation in HE for individuals from various backgrounds.

This research draws on a unique survey providing detailed information on choices and preferences within the application process of prospective economics students in Germany. Based on information on considered alternatives during the application stage, this study examines whether applicants employ quantitative hedging strategies. The emergence of such a strategy is investigated in two dimensions: One addresses the *size* of the application set, i.e. the *number* of applications. The other accounts for an applicant's *mobility inclination* by examining in what *radius* the considered alternatives are relative to an applicant's domicile. The latter is also a determinant of the former – you cannot increase the size of an application set without increasing the radius in which you are willing to look for alternatives.

To test hypotheses regarding the influence of individual traits and experiences, I resort to a personality-augmented model of quantitative hedging strategies. Within this model, the Big-Five personality traits, risk attitude, and time preferences are the core personality-related variables.[1] Additional factors are individual adjustment capability and social preferences, which are expected to affect the perception of psychic costs. Complementing the investigation of students' mobility inclination, the analysis integrates previous mobility experiences, which may lead to the development of resilience and broaden applicants' horizons in a geographic sense.

In the next section, I introduce the features relevant for decision-makers at the application stage in the context of the German HE system, and this study's dataset. In the subsequent section, I empirically investigate the determinants of hedging strategies. Based on identified impediments to broadened hedging strategies, a policy recommendation section discusses potentially effective and viable measures to boost participation opportunities in HE already at the application stage. The last section concludes.

The application stage within the German higher education sector: Data and description

Context of the application process

In the context of the German HE sector, the most comprehensive choice set for prospective students consists of 399 officially recognised institutions (HRK, 2015).[2] For an assessment in the context of geographic mobility, the maximum number of alternative destinations can be narrowed down to 164 cities hosting at least one university offering a full-time bachelor programme in a relevant discipline. For most programmes, prospective students apply directly to their universities of choice. There is no limit on the number of applications per applicant and applicants are not required to rank universities according to their preferences. Furthermore, there are neither application fees nor tuition fees at public German universities, which constitute the majority of HE institutions.

Admissions are usually subject to university or department regulations.[3] The necessary general admission criterion is the so-called university entrance certificate (UEC), comparable to A-levels, which is awarded at the end of upper secondary schooling. Though there may exist additional subject-specific requirements, admission to most undergraduate study programmes, including economics and business programmes, is primarily based on the average UEC grade. Better grades imply a higher admission likelihood.[4] Whilst applicants may infer something about their admission chances based on previous years' entry tariffs, unknown university-specific application and admission numbers during the application phase introduce substantial uncertainty.

Introduction to the data source

The underlying data source is a cross-sectional survey on 'Mobility, Expectations, Self-Assessment and Risk Attitude of Students' (MESARAS; Weisser, 2016a). The survey design allows the identification of previous residential or other relevant locations via postal

codes. Furthermore, the survey also elicits the three preferred alternatives at the application stage and the three preferred alternatives remaining after the completion of the admission process.

The survey's target group consisted of university students enrolled in an undergraduate economics or business programme in the first semester at one of seven universities in Germany. These seven public universities reflect the German HE sector in terms of size (ranging from 5,000 to 44,000 students), variety of offered curricula, cities (rural, urban and metropolitan) and states (East and West Germany) they are located in.

The reason for choosing this target group was twofold: First, for most beginning students the choice of a study place is the first autonomous mobility-related decision, highly indicative of their preferences. Earlier mobility experiences may have resulted mainly from parental decisions. Second, focusing on a specific family of programmes,[5] represented at virtually every university, ensures that students truly had a choice. This is important since it allows prospective students to employ quantitative hedging strategies. Moreover, curricula in these programmes have a high degree of overlap.[6]

The sample has been restricted to include domestic students who commenced their university life and hence just chose a university within the preceding weeks.[7] Such a restriction mitigates recall errors.

To ensure a high degree of representativeness, the self-administered survey was integrated into orientation weeks or the first month's lectures. Across all participating departments, the overall response rate amounts to 68.3% for all first-semester students enrolled in a business or economics programme. Using administrative enrolment data, the sample's representativeness could be established for important characteristics, such as age, gender, study programme and previous scholastic achievement (Weisser, 2016b). Respondents can thus be assumed to be representative of young adults who transitioned into tertiary education.[8]

Overview of students' application sets

Approximately one-fifth of respondents did not apply any quantitative hedging strategy: They had an application set consisting of a sole alternative and were thus at a very high risk of non-admission. Fifty-five per cent of all individuals sent out at least three additional applications (Figure 1).[9]

The geographic aspect of the application set, i.e. its radius, is evaluated based on the distance between an individual's origin (postal code area where someone graduated from school) and a selected alternative. This simple geographic distance measure has a drawback: A higher value does not necessarily imply that an applicant is more willing to move – it might simply be due to someone living in a rural area and hence the closest university was more distant.

To address this, I introduce the concept of *excess mobility*, defined as the difference between the distance to a considered alternative and the distance to the nearest university offering an economics programme. The main analysis will focus on the average excess distance of all stated alternatives in the application set and reflects by how much a person was willing to move, on average, beyond the closest possible destination.
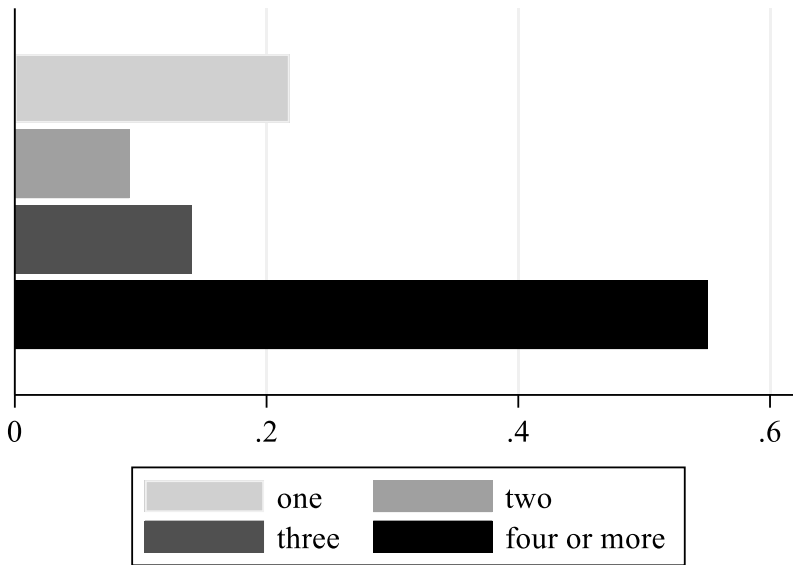
Figure 1. Size of the application set.

Typically, as indicated by the minimum excess distance, the closest alternative in the application set was 42.7 km farther away than the nearest potential study location (Table 1). More than one fourth selected the closest possible alternative into their application set. All excess mobility measures indicate a strong preference for closer alternatives and thus restricted levels of quantitative hedging.[10]

Figure 2 reveals notable differences between individuals scoring high and low on various personality traits. Individuals expressing a high willingness to take risks display a higher level of excess mobility. Mobility inclination at the application stage is also much larger for the most patient, open, and adaptable individuals. The reverse is true for those attributing a high level of importance to proximity to family.

Analysis of quantitative hedging within the application process

Empirical setup

All analyses build upon the personality-augmented model of quantitative hedging strategies, specifying the application set's optimal size and radius (cf., online Appendix). Whilst the differing concepts of the dependent variables require the application of alternative estimation methods, all specifications draw on a common set of explanatory variables.

Table 1. Search radius in the application set.

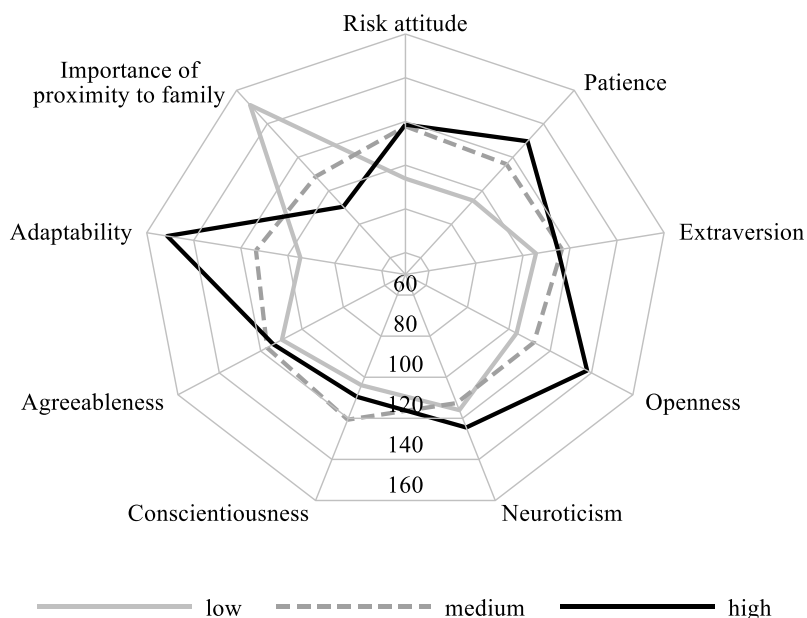| excess distance	mean	percentiles				
		10th	25th	50th	75th	90th
MIN	42.72	0.0	0.0	13.6	53.8	126.1
AVG	100.36	0.0	28.0	73.7	147.3	230.5
MAX	168.93	0.0	46.7	121.9	265.9	399.3

Note: The sample size is 1,710.

Figure 2. Average excess mobility in the application set.

Note: 'Medium' refers to respondents scoring within one standard deviation around the mean; 'high' ('low') comprises those more than one standard deviation above (below) the mean.

The main explanatory variables are personality-related traits, comprising the *Big-Five personality traits* (openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism). Additionally, *risk attitude* and *time preferences* are included, measured as willingness to take risks and as willingness to bear present costs for future benefits (labelled patience). The set of personality-related factors is complemented by a measure of *adaptability* and the *importance of proximity to reference persons*. Personality-related traits enter the models in a standardised form, indicating one of three classifications: those scoring distinctly below the sample average, the reference group of average-type individuals, and those scoring at least one standard deviation above the average. This allows detecting non-linear links between individual traits and hedging strategies.

Previous mobility experiences indicate whether an applicant has been exposed to residential mobility during school, participated in a short-term (school) exchange programme or has a longer stay abroad. Former episodes of mobility are not only highly indicative of future mobility (Huber & Nowotny, 2013) but they may be both outcome and influential factor in the formation of a student migrant personality.

Socio-demographic characteristics, such as gender, age, a vocational training dummy, and an ability measure (average grade of the university entrance certificate) enter as control variables.[11] Further controls are relationship status and whether someone originates from a household with at least one parent holding a university degree (labelled academic household). The latter reflects aspects of intergenerational educational mobility and is a proxy for socioeconomic status.

Following the migration literature (cf., Biagi et al., 2011; Clark & Cosgrove, 1991), the selected *origin-specific control variables* account for fundamentally differing geographic starting points in terms of economic opportunities and amenities: individuals originating from amenity-rich conurbations, typically offering accessible educational opportunities, may not gain much by increasing the geographic dimension of their application set.[12]

Determinants of the application set's size

The application set's size is analysed based on two different measures: A count measure reflects the number of reported applications, which is right censored at four alternatives. This measure is transformed into a binary measure, set to one if more than one application was reported, and zero otherwise. Using logistic regression, this measure allows to investigate the emergence of *basic hedging* and an evaluation of the outcomes' robustness with respect to the recording threshold.

Though this approach yields valuable insights concerning the general hedging aspect, it discards some of the information contained in the underlying count measure. There might be a qualitative difference whether someone considers two, three, and four or more alternatives (*refined hedging*). This is investigated applying two estimation techniques suitable for this type of variable: (i) Ordered Logit estimations, where the application set's size is represented as a categorical variable; (ii) censored Poisson regression, treating the number of additional hedging applications as count data and accounting for censoring at four or more alternatives.

Results for the ordered and count measures (Table 2) support the findings for the binary measure with respect to patience. As indicated by the odds ratio (OR), the odds of having a larger application set are 0.638 times smaller for the least patient decision-makers compared to their peers of average patience. Similarly, derived incidence rate ratios (IRR) in the censored Poisson model indicate that if an individual was the least patient, their incidence rate of hedging applications changes by a factor of 0.802. This is equivalent to a decrease of 19.8% in the expected count of such applications.

In addition to patience, the Big-Five trait extraversion displays explanatory power: Least extraverted individuals have 0.65 times smaller odds of sending out additional applications. In terms of incidence rates of hedging applications, these individuals have an approximately 18% lower expected incidence rate than the reference group. Since the dependent variables in the ordinal and count approaches account for refined hedging strategies, these findings indicate that least extraverted individuals perceive their returns to a larger application set as not as positive as their peers in the reference group.

Interestingly, individuals with a stay abroad form distinctly larger application sets. They do not simply engage in basic hedging, i.e. have one hedging application, but create much larger application sets with additional hedging applications.

The relevance of geography: The application set's radius

Subsequent analyses draw upon the concept of *excess mobility*, which evaluates alternatives' distance relative to the closest potential study destination. To account for the dependent variable's skewness, and frequent occurrences of zero distances, results are

Table 2. Determinants of the application set's size.

size concept		binary		ordered/count			
		OR	s.e.	OR	s.e.	IRR	s.e.
Personality							
risk attitude	low	1.050	(0.201)	1.008	(0.145)	1.016	(0.066)
	high	0.798	(0.124)	0.870	(0.109)	0.936	(0.053)
patience	low	0.550***	(0.085)	0.638***	(0.083)	0.802***	(0.051)
	high	1.281	(0.242)	1.192	(0.163)	1.094	(0.065)
extraversion	low	0.793	(0.147)	0.651***	(0.097)	0.820***	(0.060)
	high	0.969	(0.156)	1.051	(0.134)	1.032	(0.058)
neuroticism	low	0.851	(0.169)	0.838	(0.130)	0.919	(0.066)
	high	0.859	(0.154)	1.132	(0.163)	1.065	(0.067)
openness	low	0.899	(0.144)	0.952	(0.120)	0.978	(0.056)
	high	0.967	(0.166)	1.060	(0.142)	1.022	(0.061)
conscientiousness	low	0.981	(0.155)	0.968	(0.123)	0.979	(0.056)
	high	0.917	(0.160)	0.848	(0.109)	0.926	(0.055)
agreeableness	low	0.996	(0.158)	0.999	(0.125)	0.995	(0.057)
	high	1.071	(0.186)	0.903	(0.120)	0.957	(0.057)
adaptability	low	0.673***	(0.103)	0.824	(0.101)	0.917	(0.053)
	high	1.066	(0.212)	0.988	(0.154)	0.989	(0.068)
importance of proximity (family)	low	0.889	(0.140)	0.937	(0.116)	0.976	(0.054)
	high	1.065	(0.193)	0.980	(0.129)	0.985	(0.061)
Previous mobility experiences							
residential move		0.825	(0.119)	0.914	(0.108)	0.961	(0.052)
exchange part.		1.039	(0.147)	1.101	(0.120)	1.048	(0.050)
stay abroad		1.510**	(0.271)	1.469***	(0.197)	1.178***	(0.067)
Socio-demographics							
gender (female)		1.179	(0.166)	1.118	(0.122)	1.050	(0.052)
age		0.825***	(0.040)	0.858***	(0.032)	0.929***	(0.017)
acad. household		1.205	(0.158)	1.156	(0.117)	1.060	(0.048)
UEC grade		0.807*	(0.100)	0.905	(0.089)	0.957	(0.042)
vocational training		1.522*	(0.373)	1.318	(0.247)	1.135	(0.100)
partnership		0.990	(0.128)	0.868	(0.087)	0.937	(0.043)
observations		1713		1713		1713	
estimation method		LOGIT		Ordered LOGIT		Censored POISSON	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Note: Robust standard errors implemented. All specifications contain origin controls.

derived from a generalised linear model (GLM). The derived average marginal effects (AME) point to several robust and significant findings (at the 5% significance level) for personality-related factors.

The least patient individuals applied on average (Table 3, AVG model) at locations 16.7 km closer to their origin. Most adaptable individuals and those featuring least (most) pronounced preferences for proximity to their family select, on average, alternatives that are 21.4 to 21.9 km further away (13.9 km closer).

Focusing on the most distant alternatives in the application set (MAX model), the same set of significant factors emerges. Yet average marginal effects are typically 50% to 250% larger in absolute size. Concerning the selection of the closest alternative (MIN model), indicative of a lower bound mobility inclination, two noteworthy differences emerge: patience displays no explanatory power. At the same time, the least agreeable individuals select 9 km closer alternatives. Since this personality measure loads heavily on individual levels of trust, this implies that individuals who do not easily trust refrain from applying at more distant institutions.

Table 3. Determinants of the application set's radius.

distance concept		MIN AME	MIN s.e.	AVG AME	AVG s.e.	MAX AME	MAX s.e.
Personality							
risk attitude	low	−7.418	(4.775)	−11.045	(6.894)	−9.861	(11.708)
	high	2.159	(4.705)	−0.452	(5.659)	2.954	(9.249)
patience	low	−0.211	(4.442)	−16.684***	(5.569)	−37.455***	(8.894)
	high	5.254	(5.019)	13.210*	(6.940)	23.292**	(11.705)
extraversion	low	−5.558	(5.412)	−13.603*	(7.071)	−22.190*	(11.887)
	high	−4.856	(4.130)	−8.598	(5.597)	−11.721	(9.201)
neuroticism	low	−1.850	(5.052)	−0.066	(7.138)	−2.593	(11.570)
	high	5.341	(4.974)	9.441	(6.779)	11.364	(11.181)
openness	low	−6.874	(3.903)	−7.744	(5.522)	−12.978	(9.404)
	high	1.336	(4.647)	9.278	(6.452)	20.189*	(10.835)
conscientiousness	low	−0.316	(4.411)	1.788	(5.792)	4.677	(9.893)
	high	−6.062	(4.543)	−8.527	(6.031)	−13.588	(9.925)
agreeableness	low	−9.019**	(3.812)	−6.730	(5.650)	−5.820	(9.705)
	high	−7.006*	(4.114)	−2.674	(6.049)	3.238	(10.331)
adaptability	low	−3.577	(4.034)	−7.685	(5.612)	−12.389	(9.708)
	high	15.797**	(6.174)	21.906***	(7.683)	27.872**	(11.761)
importance of proximity (family)	low	14.903***	(4.865)	21.377***	(6.085)	29.419***	(9.599)
	high	−7.147*	(4.242)	−13.917**	(5.819)	−18.827*	(10.193)
Previous mobility experiences							
residential move		11.003**	(4.546)	15.526***	(5.963)	18.052*	(9.445)
exchange part.		11.246***	(4.040)	19.721***	(5.184)	26.812***	(8.515)
stay abroad		22.496***	(5.218)	44.404***	(6.392)	63.168***	(9.994)
Socio-demographics							
gender (female)		−1.173	(3.804)	−5.280	(4.920)	−7.462	(8.305)
age		2.771**	(1.345)	0.438	(1.808)	−2.908	(2.989)
acad. household		1.941	(3.569)	13.264***	(4.624)	28.217***	(7.753)
UEC grade		0.466	(3.408)	−2.809	(4.228)	−8.110	(6.919)
vocational training		−6.997	(5.829)	−3.159	(8.415)	6.089	(14.829)
partnership		−1.930	(3.505)	−11.818**	(4.600)	−21.100***	(7.626)
observations		1710		1710		1710	
mean (dep. var.)		42.71		100.34		168.93	

*** p < 0.01, ** p < 0.05, * p < 0.1

Note: Robust standard errors implemented. All specifications contain origin controls. Reported results are average marginal effects from GLM estimations (Gamma, with log-link).

As stipulated by the underlying personality-augmented model of quantitative hedging, measures related to perceived psychic costs (e.g. adaptability, preference for proximity to reference persons, and previous mobility experiences) play a much more important role for the application set's radius than its size. Empirical evidence suggests that individuals expect already at the application stage a harder time handling new experiences and reconnecting if they leave their familiar environment.

Effect comparison

Before deriving policy recommendations, it is worthwhile to identify those factors consistently influencing the formation of the application set. This allows a more targeted approach to strengthening participation in HE for various sub-groups.

Table 4 provides an overview of effects across quantitative hedging dimensions, including a comparison of origin-specific effects.[13] Reported effects are represented by arrows, where ↑ (↓) represents a significant positive (negative) effect.

Table 4. Effect patterns.

		Size			Radius		
		binary	ordered / count		MIN	AVG	MAX
Personality							
risk attitude	low						
	high						
patience	low	⬇	⬇	⬇		⬇	⬇
	high					⇧	⬆
extraversion	low		⬇	⬇		↓	↓
	high						↑
neuroticism	low						
	high						
openness	low						
	high						
conscientiousness	low						
	high						
agreeableness	low				⇩		
	high						
adaptability	low	⬇					
	high				⬆	⬆	⇧
importance of proximity (family)	low				⬆	⬆	⬆
	high					⇩	↓
Previous mobility experiences							
residential move					⬆	⬆	⇧
exchange participation					⬆	⬆	⬆
stay abroad		⇧	⬆	⬆	⬆	⬆	⬆
Socio-demographics							
gender							
age		⬇	⬇	⬇	⇧		
academic household						⬆	⬆
UEC grade		↓					
vocational training		↑					
partnership						⇩	⬇
Origin conditions							
students (per 1000 inh.)		⇩	↓	↓			
5-year GDP change						⇧	↑
5-year unempl. rate change		↑	⇧	⇧	↓		⬆
population density (log)		⬇	⬇	⇩	⬇	⬇	⬇
recr. area (per capita, log)		⬇	⬇	⬇	⬇	⬇	⬇

⬇⬆: p < 0.01, ⇩⇧: p < 0.05, ↓↑: p < 0.10

Note: Inference is based on robust standard errors. ↑ (↓) represents a significant positive (negative) coefficient estimate (or derived effect type).

Contrasting the two dimensions of the personality-augmented model of quantitative hedging, four **personality-related factors** stand out:

Patience - Whilst least patient individuals have smaller application sets, indicating that maximising their chances of getting into university is of lower importance to them, highly

patient individuals do not symmetrically adjust the size of their application set. Whereas least patient decision-makers tend to select, on average, closer alternatives into their application set, most patient decision-makers choose alternatives that are farther away.

Extraversion - Least extraverted individuals select a smaller number of alternatives into their application sets. At the same time, there is evidence they anticipate higher potential (psychic) costs associated with studying at more distant institutions, and thus they select alternatives closer to their origin.

Adaptability - Those expressing the highest levels of adaptability to new circumstances feature an application set characterised by geographically more dispersed alternatives. A symmetrical effect for least adjustable individuals is only documented for the binary model. Adaptability may play a role regarding the emergence of basic hedging, i.e. having one additional hedging application, but not when it comes to consequently minimising this risk by sending out a larger number of applications.

*Proximity to reference person*s - Placing higher importance on proximity to family does not impact the application set's size. It is, however, an important factor concerning understanding where prospective students apply.

Previous mobility experiences, possibly reflecting higher levels of resilience or self-reliance, tend to increase both the application set's size and radius. Participation in a short-term school exchange programme matters only for the latter. A prolonged stay abroad has approximately twice the effect on the search radius than participation in a short-term exchange programme.

With respect to **socio-demographic factors**, age plays a major role in the application set's size. Older individuals, with fewer years left to reap returns to studying, send out fewer applications. Individuals from an academic household select alternatives into their application set that are farther away. This points to the existence of intergenerational transmission of mobility preferences. Being in a relationship makes the selected alternatives more clustered around the origin. Furthermore, there is some evidence that applicants with weaker scholastic achievement may be at risk of refraining from any hedging applications.

The local environment applicants are confronted with, i.e. **origin conditions**, influences hedging strategies too. If employment perspectives are deteriorating, participation in HE to enter the white-collar labour market becomes more attractive. This explains the positive relationship between unemployment growth and a larger application set. The number and the distance of considered alternatives, in turn, are smaller for individuals residing in more densely populated or more amenity-rich districts (measured as recreational area per capita). This reflects a preference for the current centre of one's life, characterised by a certain degree of urbanisation and recreational value. If staying in such an environment yields non-monetary returns, increasing the application set by applying to a larger number of distant universities would not be optimal.

Policy recommendations to broaden participation in HE

In the following, I will present a set of policy recommendations to strengthen participation rates amongst those groups most at risk of non-admission due to a limited application set.

The previous effect comparison (cf., Table 4) highlighted the relevance of personality traits impacting on individually perceived costs of migration. Whilst any policy aimed at lowering these costs would be a promising measure to enlarge the (geographic) application set, this can or should only be done indirectly. Based on previous findings, three potential types of intervention emerge:

(I) *Facilitation of mobility experiences* – Depending on pre-existing accessibility or participation before the application stage, this may benefit various potentially disadvantaged groups.
(II) *Targeted application support* – Individuals with specific socio-demographic or personality characteristics could be offered further advice during the application process.
(III) *Localised recruitment campaigns* – This may accommodate regional differences in opportunities, which can impact the attractiveness of taking up studies in the first place.

Policy I: Facilitation of mobility experiences

To identify the beneficiaries of this policy more precisely, the analysis differentiates between individuals depending on whether they originate from one of the following potentially disadvantaged groups: non-academic households (57.3%), migration background (9.9%) or low status in society (26.5%).[14]

Insignificant overall effects (Table 5) indicate that the size of the application set does not differ between applicants from potentially disadvantaged groups and other applicants. However, applicants from non-academic households with stay abroad experience are 11.7 percentage points more likely to employ quantitative hedging than those without. In the overall sample, this experience's effect amounts to only 6.6 percentage points.

Individuals with a migration background, who participated in an exchange programme, display a 15.4 percentage point higher hedging probability than those lacking this experience. There is no such effect in the overall sample – only applicants with a migration background benefit.

Table 5. Predicted differential hedging effects for various groups.

	Size				Radius			
	Group effect		Overall effect		Group effect		Overall effect	
Group: Non-academic household			−0.029	(0.020)			−13.78***	(4.53)
exchange part.	−0.016	(0.029)	0.005	(0.022)	9.85	(6.62)	20.32***	(5.11)
stay abroad	0.117***	(0.032)	0.066***	(0.024)	44.08***	(8.77)	45.15***	(6.52)
Group: Migration background			−0.020	(0.040)			−15.05*	(8.14)
exchange part.	0.154**	(0.067)	0.007	(0.022)	21.63	(15.48)	19.72***	(5.17)
stay abroad	0.013	(0.094)	0.060***	(0.024)	25.24	(18.18)	44.05***	(6.39)
Group: Low social status			−0.034	(0.023)			−12.44**	(4.99)
exchange part.	0.025	(0.043)	0.007	(0.022)	−0.78	(9.79)	18.59***	(5.11)
stay abroad	0.070	(0.052)	0.060**	(0.025)	42.10***	(12.68)	42.82***	(6.46)

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$
Note: Sample size varies between 1,691 and 1,713. Displayed average marginal effects originate from logit or GLM estimations with the full set of control variables used in the main specification.

There are overall differences for the application set's radius: Applicants from non-academic households have an application radius diminished by 13.8 km. If such an applicant has a stay abroad experience, their average application radius increases by 44 km. This is a considerable effect, given this group's average 93 km search radius.

For those with a migration background or low social status, the overall effect is a reduction in the average search radius between 12.4 and 15 km. Only for the latter emerges a beneficial effect of previous mobility experiences: Applicants reporting low social status, and a previous stay abroad, increase their search radius by 42.1 km.

Having a broadened geographic horizon, i.e. having experienced and lived in different places, strengthens participation chances in HE considerably. This also pertains to applicants from potentially disadvantaged groups.

To increase participation in HE amongst these groups, a mobility bursary may be a suitable policy measure. The ensuing rising accessibility of short-term mobility experiences may indirectly shape a mobility-enhancing personality, which produces numerically and geographically broadened application sets. Assuming improved participation chances in HE translate into higher average earnings, the associated increase in tax revenues may allow the recovery of previous expenditures for the mobility bursary.

As a complementary approach, facilitating mobility during studying, universities could offer a semester travel allowance. This measure could benefit applicants and universities alike: supporting travel, and thus alleviating the (psychic) costs of being away from reference persons, may directly increase the application set's radius. Universities, on the other hand, can use this policy to showcase their commitment to facilitate students' transition into an unfamiliar environment. Such a well-being supporting measure may not only strengthen recruitment but possibly also lower the pressure on universities' social services. Thus, the financial impact on universities would be moderate.

Policy II: Targeted application support

In addition to indirect mobility enhancing interventions, application support may positively influence hedging strategies during the application process. This support should be targeted at individuals featuring specific immutable traits, which adversely impact the size and the geographic dimension of their application sets. The identification of potential beneficiaries of direct support should be based on *critical observable socio-demographic characteristics*, such as age, originating from a non-academic household, and scholastic achievement.

Guidance counsellors at school, who are in regular contact with prospective students during the application phase, can encourage at-risk applicants to send out more applications and consider a wider search radius. These counsellors, in conjunction with involved teachers, could also identify at-risk applicants based on *observable levels of patience and extraversion*. To achieve the desired goal of increasing the participation of at-risk applicants, an update of guidelines for guidance counsellors may be a cost-effective implementation.

In HE systems with a centralised application system, targeted reminders or additional information on the benefits of application hedging could be provided to candidates, based on previously elicited applicant information. The integration of a short personality assessment questionnaire into the centralised application system could enable targeted support based on *critical personality traits*, such as patience and extraversion.

Policy III: Localised recruitment campaigns

HE institutions or an umbrella organisation may run localised recruitment campaigns. Campaigns to encourage quantitative hedging would vary across municipalities, which differ in terms of *critical origin-specific conditions*: Since application sets are smaller for applicants from areas with a higher population or student density, and those displaying higher recreational values, campaigns should focus on larger conurbations with universities and relatively higher living standards.[15] In localities where general employment conditions have improved, i.e. a direct labour market entry has become a more accessible alternative to studying, recruitment campaigns may help to increase application sets' size. Concerning increasing application sets in a geographical sense, campaigns would have to be funnelled in metropolitan areas with high amenity values, or those exhibiting an economic decline in the recent past.

The precise nature of these localised recruitment campaigns would plausibly depend on the available budget.[16] Poster campaigns may be more costly but offer a high degree of visibility during application periods. Enrolled students from a respective area could act as 'application ambassadors' in local schools. Their insights may be particularly encouraging for prospective applicants. Whilst the level of visibility would be lower, this could be a cost-effective approach where a small number of application ambassadors may cover most schools of a metropolitan area in a short amount of time.

Conclusions

By investigating determinants of university choices at the application stage, this study offers empirical evidence on the relevance of applicants' personalities and experiences for educational outcomes. The focus rests on usually unobserved traits, which may restrict prospective students' application sets severely. Such restrictions can be of numerical or geographical nature: Smaller application sets, indicative of less pronounced hedging against the risk of non-admission, have the potential to limit applicants' chances of participation in Higher Education (HE). Geographic restrictions, however, may additionally lead to a suboptimal enrolment choice if the most suitable alternative was beyond an applicant's search radius. Ultimately, this research fosters our understanding of who is at risk of limiting their HE participation and success chances.

An essential result highlights the importance of subjective valuations of returns to education: least patient individuals form distinctly smaller application sets and display a smaller search radius. They are most at risk of not securing university admission, due to an increased risk of collapsing application sets, or attaining a suboptimal match.

Psychic costs, related to social and place attachment, are revealed as a dominant factor within the university choice process. Individual traits affecting the perception of these costs, such as extraversion or adaptability to new circumstances, are consistently related to the size of the application set and the search radius.

An important finding pertains to the relevance of previous mobility experiences: individuals with previous experience abroad are much more likely to exhibit a broadened search horizon. Typically, longer stays abroad translate into stronger effects than participation in a short-term exchange programme. Such experiences help applicants to employ a more refined hedging strategy.

Based on this study's empirical findings, three distinct avenues to improve individual HE participation and success chances have been identified: facilitating or financially supporting mobility experiences, i.e. broadening the horizon of school leavers, could lower the perceived costs of selecting a geographically and numerically wider set of alternatives. Such measures can be very effective for applicants from non-academic households or those with a migration background.

Targeted application support and advice during the application process for specific at-risk individuals is another cost-effective approach to increase participation. This could take place at school, aided by guidance counsellors, or via technical solutions during the online application process.

Lastly, localised recruitment campaigns, such as poster campaigns or application ambassadors in schools, can promote broader application hedging strategies when local conditions lower the perceived value of studying due to available outside options.

One potential limitation of this study is its focus on hedging strategies within a sample of successful applicants. However, with 22% of respondents not applying any quantitative hedging strategy, results are based on a sample with a substantial share of applicants at a very high risk of being unsuccessful. Moreover, since this study also integrates typically unobserved application alternatives, derived results are informative regarding determinants mitigating the risk of non-admission in a broader population.

Another caveat of this study is a potentially limited external validity, i.e. with respect to HE systems featuring a centralised clearing where applicants are restricted to a small number of applications. Despite this, the study's essential findings concerning applicants' search radius still apply. Irrespective of these limitations, the derived policy recommendations would be applicable in most established HE systems.

Eventually, this study demonstrates how nuanced and targeted approaches, reaching out to individuals before or during the application phase, could expand HE participation chances substantially.

Notes

1. Big-Five personality traits (cf., McCrae & Costa, 2004) comprise the traits openness, conscientiousness, extraversion, agreeableness, and neuroticism. These traits, long established in the psychological literature, have been elicited using a short inventory (Rammstedt & John, 2007), which has been validated in a student sample.
2. The German HE sector is characterised by few entries (and no exits) of HE providers over two decades, and a dominance of public institutions. 92.6% of the 2.6 million undergraduate and postgraduate students (Destatis, 2014) were enrolled at 238 public universities in 2013/2014. Average enrolment for 121 private institutions (1,424) and 40 church-related institutions (809) is distinctly below the average of public universities (10,228). A small share has been enrolled in so-called duale programmes, combining studies and paid work.
3. Study places in medicine and pharmacy are subject to a centralised system.
4. Applicants can accumulate so-called waiting semesters: For each additional semester passed since finishing school (and not already being enrolled in another programme) an applicant's chance of admission increases despite not meeting the minimum UEC grade requirement. The lower the grade, the more waiting semesters would be required.

5. Included programmes are business administration, economics, economics and business administration, engineering economics and business informatics. Business Studies and Economics and Business programmes were the most frequently chosen programmes within the population of beginning students in 2013 (Destatis, 2014).

6. Curricula comprise basic micro- and macro-economics, statistics, and business-related courses, e.g. accounting or investment.

7. Descriptive statistics for the sample of 1,713 respondents are provided in Table A.1 (online Appendix).

8. Using national enrolment statistics (Destatis, 2014) and population data (Middendorff et al., 2013; Scheller et al., 2013), the sample's representativeness regarding the overall population of beginning students has been established for age, UEC grade, completed vocational training, available budget, and enrolment at the preferred university.

9. The overall pattern is comparable to Galotti and Mark (1994), reporting an average number of considered US colleges of 4.2 for female and 4.7 for male high school leavers. In the UK's centralised application system, the share of UK applicants with less than four alternatives fluctuates around 20% (UCAS, 2021). The strong relation between number of applications and admission success is also evident in the UK data: In 2013, those with one or two applications had an admission chance of ca. 62%, those with three or four applications a 67–69% chance, and those with five applications had a success chance of 82%.

10. This strong preference of staying close to one's domicile can also be observed for enrolment choices: 47.3% enrolled at the closest university for which they obtained admission.

11. The latter is an essential control variable as high performing school leavers tend to be aware of more alternatives (Niu & Tienda, 2008).

12. Included are five-year GDP and unemployment rate changes, population (log) and student density, and an amenity measure (log of per capita recreational area). All are obtained from the INKAR online database (BBSR, 2014) and measured at the district level. These ca. 400 districts in Germany are part of the administrative nomenclature.

13. Further comparisons are based on Table A.2 and Table A.3 (online Appendix).

14. Non-academic household is defined as not having at least one parent with university degree. Migration background is inferred based on having a second mother tongue or been born abroad. Low societal status is assumed if a respondent rated their status on a 7-point scale at four or below. Group-specific effects are derived from estimations comprising interaction effects.

15. These localities offer relatively high outside options as an alternative to studying, thus securing a study place may be perceived as less beneficial.

16. Localised interventions could also be implemented as targeted application support, based on recorded postal codes.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributor

Reinhard A. Weisser is a Lecturer in Economics at Nottingham Trent University. His main research interests include contemporary aspects of international migration and student mobility. To showcase the importance of geography for human decision-making, his research places a special emphasis on spatial analyses, using Geographic Information Systems data.

ORCID

Reinhard A. Weisser 🆔 http://orcid.org/0000-0002-1717-5697

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