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University student decisions and mobility under uncertainty in the peripheral region of Sardinia

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ABSTRACT

This paper investigates the influence of a shock and associated uncertainty in the context of higher education in a peripheral region, offering a novel perspective. By using an integrated methodology, based on multivariate Biplot and Combination of Uniform and Shifted Binomial (CUB) models, the study explores how an exogenous event, such as the COVID-19 pandemic, has affected students' decision-making processes regarding their higher education choices and mobility preferences amid uncertainty. The empirical application employs online survey data from a representative sample of university students in Sardinia (Italy). Its geographical isolation from the mainland provides a controlled environment to address the effect of the shock on higher education. Findings indicate that bachelor's students are greater risk takers and prefer blended learning, while master's students focus on personal and career goals. Missed migrants, who would have studied outside the region if not for COVID-19, prioritise educational quality and economic returns. Although the shock affected both stayers and missed migrants similarly, it did not fundamentally shift mobility motivations.

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1. Introduction

The COVID-19 pandemic has altered individuals' well-being, behaviour and choices in an unprecedented way, affecting the daily lives of individuals and organisations worldwide (Clarke, 2025; Jung et al., 2021; McGrath, 2024; Mok et al., 2021), especially those living in peripheral areas (Devlin et al., 2025). There is agreement among researchers that this event is not the last global shock (Elfirdoussi et al., 2020; Looi, 2023). Uncertainty about future challenges is increasing across all sectors, particularly in Higher Education, which has been recognised as one of the many activities strongly affected (Ertingfeld, 2021; Jung et al., 2021; Tamrat, 2021).

The extant literature mainly focuses on the short-run impact of the pandemic on higher education, investigating the shift to online teaching and research activities, its immediate effects on students' performance and progression and, especially, international student mobility (Abakumova et al., 2020; Agasisti & Soncin, 2021; de Boer, 2021; Cairns & França, 2022; Pokhrel & Chhetri, 2021). Yet, despite this growing body of evidence, the behavioural implications of the shock remain insufficiently explored. From the extant literature, three main gaps emerge. First, the medium and long-run impacts of the pandemic have been largely overlooked (Ertingfeld, 2021; García-González et al., 2022; Jung et al., 2021; McGrath, 2024). There is still limited evidence on whether a systemic shock reconfigures motivations and enrolment decisions in a higher education context. Second, most studies focus on a single specific factor related to student decisions, with limited integration between enrolment motivation and mobility choice, which are mainly treated as separate factors. As a consequence, the interdependence between educational progression, career expectations and spatial mobility under conditions of uncertainty remains under-theorised at the micro level. Third, studies investigating student mobility mainly focus on international contexts. In contrast, attention to domestic mobility at the

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European level is scarce, especially in peripheral regions, where student mobility is a valuable driver of economic development. Addressing these gaps is particularly relevant from a regional perspective. Shocks may alter the geography of human capital formation, influencing spatial dynamics and reshaping mobility patterns, especially in contexts where educational alternatives are more constrained (de Boer, 2026).

In light of these research gaps, this paper investigates student behaviour in the post-pandemic period, addressing two critical aspects. Specifically, the study examines the implications of the shock on student decision-making and enrolment processes regarding two key outcomes. The research objectives it addresses are the following: 1) the choice between pursuing a bachelor's degree and progressing to a master's degree after the bachelor's graduation; 2) mobility decisions about the selection of study locations.

Methodologically, an integrated approach captures both the structural relationships among student motivations and the stochastic features of their ordinal responses. Specifically, a non-parametric biplot provides a visual and exploratory representation of multivariate associations, allowing one to detect latent patterns and clusters in a high-dimensional space, an approach still rarely applied in higher education or human capital research (Gabriel, 1971; Gabriel & Odoroff, 1990). However, visual inspection alone cannot disentangle genuine preferences from response uncertainty. For this reason, this exploratory analysis is integrated with the Combination of Uniform and Shifted Binomial (CUB; Piccolo, 2003) model, which formally separates the 'feeling' component from the 'uncertainty' component in ordinal data (D'Elia & Piccolo, 2005). The combined use of these methods allows one to identify latent cognitive structures while quantifying the degree of indecision associated with shock-induced uncertainty, thereby offering a more comprehensive interpretation of student behaviour and choices.

The testing empirical ground is the insular region of Sardinia (Italy) and the University of Sassari (north-east), founded in the second half of the sixteenth century. This peripheral island represents a context characterised by structural mobility constraints, limited substitution alternatives and strong dependence on local educational supply. Hence, it provides a particularly suitable case study for exploring how an exogenous shock interacts with pre-existing constraints that are likely to differ from those in more central and interconnected national areas (Biagi et al., 2021). By focusing on a relatively self-contained regional system, the analysis contributes to understanding how shocks may influence educational choices and mobility patterns in peripheral higher education contexts.

The analysis focuses on ad hoc survey data collected in the academic year 2021–2022 from a representative sample of second-year university students. These students had enrolled in their first year of bachelor's, master's, or single-cycle master's degree programmes in 2020–2021, during the peak of the COVID-19 pandemic.

Overall, this paper extends current debates on regional human capital dynamics in the aftermath of a global disruption. It contributes to this strand of the literature in several ways. It integrates enrolment and mobility as interdependent decisions shaped by uncertainty within a unified behavioural framework. It provides micro-level evidence from a peripheral European region, and applies a combined methodological approach capable of disentangling preferences from uncertainty in the aftermath of a systemic shock. Besides, it offers original empirical evidence on student motivations and differentiated behavioural responses across student groups and educational levels. In this regard, this research advances understanding of how shocks may reshape educational choices and spatial mobility patterns under conditions of socio-economic uncertainty and labour-market positioning, in territorially constrained contexts.

The paper is structured as follows. Section 2 summarises the literature on motivations for university enrolment and on student mobility. Section 3 presents the two methods employed, specifically the multivariate biplot (Section 3.1) and the CUB model (Section 3.2), while Section 3.3 describes the survey design and data collection process. Section 4 provides contextual background, highlighting enrolment data at the University of Sassari in comparison with trends in other Italian universities. Section 5 discusses the main results, while Section 6 offers concluding remarks.

2. Literature review

The literature section comprises two parts, aligned with the research questions addressed. The first focuses on the motivations that drive students to enrol in university and on the effects of the pandemic on study plans and career prospects. The second part reviews the macro-level studies investigating the determinants of student mobility and how COVID-19 altered their propensity to move.

2.1. Motivations to enrol at university and the effect of COVID-19

Students and potential students act as rational agents when deciding whether to enrol in a university for the first time or to continue their studies in higher education, guided by a rational investment decision criterion (Corazzini et al., 1972; Peter & Zambre, 2017). Hence, their decision is based on a rational assessment, which involves a comparison between potential future benefits, which are influenced by individual characteristics and personal perceptions, and associated costs, such as tuition fees and the expenses of studying away from their place of residence, whether nationally or abroad (Johnson & Muse, 2012; Peter & Zambre, 2017). Côté and Levine (1997) identified five categories of motivations for students to enrol in a university: i) ‘careerism-materialism’, focused on future career development, personal success, job satisfaction and wage return; ii) ‘personal-intellectual development’, relating to human capital development and the acquisition of new knowledge and skills; iii) ‘humanitarian’, where the decision to enrol in university is driven by the will to contribute to creating a better society and improving human conditions; iv) ‘expectation driven’, referring to cases where students decide to attend university to please families and friends; v) ‘default’, where students enrol because they did not find a better alternative. Similarly, Balloo et al. (2017) indicated that securing a promising job position, enhancing quality of life and human capital development are relevant reasons for deciding to study. Gorgodze et al. (2020) confirmed previous findings showing that the main reasons for attending university are improving future job prospects and earnings, human capital development and improving initial socio-economic conditions.

However, the pandemic and the future uncertainty may have altered both the motivations for enrolling in university and, especially, the career prospects in the labour market (Aucejo et al., 2020; Borisova & Vasilieva, 2020; Hickey et al., 2021; ILO, 2020; Jemini-Gashi & Kadriu, 2022; Spronken-Smith et al., 2023). In this regard, a study by Aucejo et al. (2020) at Arizona State University clearly shows not only that the pandemic affected students’ performance by delaying graduation or leading to withdrawals, but also negatively altered expectations about future labour market opportunities. More specifically, 20% reported a decrease in perceived job-finding probability and future salary, with an expected salary at 35 years old approximately 2.5% lower (Aucejo et al., 2020). Similar results were found by Farcnik et al. (2022) in a study conducted in Slovenia. The authors, surveying 471 students, found that 47.7% of their sample changed or adjusted their study plans due to the spread of the pandemic. Specifically, students enrolled in forestry, fishing, agriculture and veterinary science and those enrolled in engineering, construction and manufacturing were more likely to change (Farcnik et al., 2022). Besides, the authors find that a vast majority of students (82%) considered prolonging their studies, while approximately 7% considered changing their study plan or dropping out of the university (Farcnik et al., 2022). Similarly, Panina et al. (2020), based on an online survey of 437 students, showed that some students revised their expectations and attitudes towards their future careers and professional education to improve their digital skills and adapt to remote work. In the United Kingdom, Montacute and Holt-White (2020) report that 19% of university applicants changed their plans due to the pandemic. Some students opted to take a gap year, while others altered their educational pathways. Most notably, almost half of the applicants perceived COVID-19 as negatively affecting their chances of admission to their first-choice university.

Despite the extensive literature on students’ motivations to enrol in higher education, existing studies predominantly reflect pre-pandemic conditions or focus on immediate academic adjustments during COVID-19. Emerging evidence highlights shifts in expectations, study plans and perceived labour-market opportunities. Yet, there is limited systematic analysis of how the pandemic has reshaped the underlying motivational structures driving enrolment in higher education and how these changes affect the spatial allocation of human capital across regions. Addressing this gap is essential to understanding how shocks influence educational investment decisions within territorially differentiated contexts and to inform stakeholders seeking to respond effectively to evolving student motivations, particularly in peripheral and structurally constrained regional systems.

2.2. Determinants of university student mobility and the pandemic impact

With the increasing development of the knowledge economy, in which talent represents a valuable source of growth, national and/or international student mobility has become a debated issue among scholars and

policymakers (Beine et al., 2014; de Boer, 2026; Leoni, 2022; Wei, 2013). Internal students' mobility in Italy has attracted the attention of several scholars as a potential tool to address the well-known north–south and centre-periphery divide that characterises Italy and many other European countries (Biagi et al., 2024; Dotti et al., 2014). The quality of the university is one of the most frequently cited determinants of students' mobility. In this regard, Ciriaci (2014) showed that university characteristics, such as quality, as measured by the Italian Ministry of University and Research (MUR) rating and institutional size, affect student flows. Similarly, De Angelis et al. (2017), using data from the National Research Quality Assessment (so-called VQR) 2004–2010, found that higher research and teaching quality increase universities' attractiveness. As further examples, Bratti and Verzillo (2019) measured university quality with two indicators: a composite measure based on different bibliometric sources and the university quality ranking developed by Censis in collaboration with the Italian newspaper *La Repubblica*. Unlike Ciriaci (2014) and De Angelis et al. (2017), the authors found that while university quality is an important indicator, it is not the primary driver of student mobility, as students tend to prioritise the distance to their home region.

Taking into account university and regional characteristics, Bruno and Genovese (2012) included university prestige and the related regional socio-economic status in a gravity model. Furthermore, within a Broadly-Terry model, Giambona et al. (2017) assessed the territorial attractiveness of fifty geographical areas where universities are located. The authors found that attractiveness levels depend on the number of services provided and local socio-economic factors. Ballarino et al. (2022) examined the role of geographical distance and show that Italian students' mobility is only partially driven by socio-economic disparities, while the spatial distribution of universities plays a key role in shaping short-distance mobility. However, during the pandemic (national and international), student mobility was precluded, and students had to participate in online learning activities, exams and thesis defences due to lockdowns (Mok et al., 2021; Wang, 2022).

The extant literature on the topic has mainly focused on international student mobility. In Europe, Cairns and França (2022) found that the number of Erasmus+ students at Portuguese public universities decreased significantly during the pandemic. Similar results were also found in Spain, especially at three universities in Madrid, where study participation in international mobility dropped by 62.7% (Di Pietro & Perez-Encinas, 2025) and in Germany, where the number of international student exchanges decreased by 54% (Kercher, 2021). Similar results were also found in the UK by Di Pietro (2023), and in Hong Kong and Mainland China (Mok et al., 2021).

Years after the start of the pandemic, the factors influencing the 'post-pandemic' student mobility remain uncertain. Future unpredictability limited available information, and individual characteristics, such as attitudes toward risk, will be central to predicting student mobility decisions. Additionally, besides traditional selection criteria such as university quality, reputation, the attractiveness of specific destinations and local job market conditions, contingent factors may affect students' choices, such as the option of blended or online teaching. However, the existing literature on the effects of distance learning on students shows mixed results. While some studies report appreciation for online learning (e.g., Iglesias-Pradas et al., 2021), others highlight negative findings (e.g., Daniels et al., 2021).

Further relevant gaps remain in the literature. First, most studies examining the effects of the pandemic primarily focus on international mobility, paying comparatively less attention to domestic mobility within European countries. Second, existing research mainly focuses on Anglophone countries (the United States, the UK and Canada) or Asian contexts. To the best of the authors' knowledge, little is known about how shocks affect mobility choices in structurally peripheral and insular regions, where geographical constraints and limited alternatives may either amplify or mitigate behavioural responses. To address these gaps, integrated methodologies can guide the uncovering of complex individual behaviours under uncertainty.

3. Methods and data

The nature of the empirical data, based on ordinal survey responses, requires quantitative approaches capable of capturing both structural associations among motivations and the uncertainty embedded in individual choices. The multivariate biplot is used to explore and visualise latent relationships among students' motivations, attitudes and intended choices, thereby addressing the research objectives from an exploratory to a structural perspective.

However, since students' decisions, such as whether to continue to a master's degree or to relocate, are expressed through ordinal scales and may reflect varying degrees of indecision, a modelling approach is also required. The CUB model complements the exploratory analysis by decomposing each ordinal response into a systematic '*feeling*' component and a stochastic '*uncertainty*' component. These two combined methods jointly analyse the cognitive structure underlying students' preferences and the degree of decisional uncertainty associated with their choices. This explorative-to-quantify approach identifies which motivational dimensions are associated with stronger preferences and which are associated with higher indecision during the pandemic.

3.1. Multivariate biplot

The non-parametric biplot (Gabriel, 1971; Gabriel & Odoroff, 1990), despite its potential to offer key insights into complex behaviours, is hardly employed in analysing human capital formation and accumulation (Fahrurrazi et al., 2021; Gómez Marcos et al., 2022; Villacís-Macías et al., 2025). Theoretically, as reported in Equation (1), Y represents the standardised data. A biplot breaks up this matrix into a portion associated with a clustering of N decision-making units (i.e., rows of Y , marked by points; in this case, the survey respondents) and a portion associated with K variables (i.e., columns of Y , marked by arrows; in this case, the items from the questionnaire).

$$Y \approx (N_2 \cdot \Lambda_2^\alpha)(K_2 \cdot \Lambda_2^{1-\alpha}) \quad (1)$$

In Equation (1), $(N_2 \cdot \Lambda_2^\alpha)$ includes the plotting coordinates corresponding to rows/observations, while $(K_2 \cdot \Lambda_2^{1-\alpha})$ consists of the plotting coordinates for the arrows/items. Alpha (α) can take values from zero to one. To combine these dimensions, several approximation methods can be employed. This study adopts an intermediate solution, opting for the Half Joint (HJ) approximation. This method achieves an optimal quality representation for N points and K arrows (Torres-Salinas et al., 2013).

The biplot addresses the impact of the pandemic on the decision to pursue higher education studies (Research Objective 1 (RO1)). A scatterplot reveals multivariate relationships and hidden patterns within complex empirical data. The biplot graph has three distinctive elements. The Cartesian axes correspond to the dimensions (or factors) extracted via a standard principal component analysis (PCA). The two principal dimensions typically capture most of the data variation (Gallego-Álvarez et al., 2013; 2015). The arrows symbolise the variables, and their lengths reflect the contribution to the overall data variation (the longer the arrow, the greater the extracted variance, and vice versa). The direction of the arrow represents the covariance relationship and structure with other variables. Arrows with similar and nearly parallel directions show high correlation or similarity. (Almost) perpendicular arrows represent orthogonality or independence, while negative correlation is indicated by arrows pointing in opposite directions (i.e., the dotted arrows). The points represent the decision-making units (i.e., respondents). The proximity of points to a particular arrow denotes similarity and indicates a strong association and impact. Conversely, points that deviate from the arrows indicate unique values, representing distinct behaviours.

3.2. CUB model

The Combination of a Uniform and a Shifted Binomial (CUB) distribution model, developed by Piccolo (2003), allows for distinguishing the impacts of endogenous behaviours, item specifications and exogenous conditions on individual ratings, evaluations and preference data. CUB models are particularly useful for analysing ordinal data as they identify respondent indecision in their responses and the attractiveness of the item (D'Elia & Piccolo, 2005). The attractiveness of the item is primarily characterised as '*feeling*', which is associated with the respondent's comprehension of the question, taking into account their knowledge and experience, and this interpretation varies across topics.

The CUB approach considers the final response a combination of *feeling* and *uncertainty*. Formally, for categories $y = 1, 2, \dots, m$, with $m > 3$, available to the respondent, the response Y is a random variable with a probability mass distribution (Piccolo, 2003):

$$P(Y = y) = \pi \left[\binom{m-1}{y-1} (1-\xi)^{y-1} \xi^{m-y} \right] + (1-\pi) \frac{1}{m}, \quad y = 1, 2, \dots, m \quad (2)$$

The shape of the model probability distribution varies according to the parameter $\xi \in [0, 1]$ and $\pi \in (0, 1]$. The first parameter ξ identifies the *feeling*, that is, the respondent's agreement with the item. When $\xi \rightarrow 0$, the respondent states the highest agreement with the item, while when $\xi \rightarrow 1$, the respondent has the lowest agreement. It implies that $1 - \xi$ is the measure of the feeling that takes a value of zero for no *feeling* and the value of one for a complete agreement. The parameter π characterises the *uncertainty*, and when $\pi \rightarrow 0$, the CUB model shifts to a discrete Uniform distribution, and the respondent's choice is uncertain; when $\pi \rightarrow 1$ the CUB goes for a shifted Binomial distribution, with almost no doubts in the response. Thus, $1 - \pi$ measures *uncertainty*: values near 1 indicate maximum *uncertainty*, while values near zero indicate *no uncertainty*. *Feeling* and *uncertainty* are latent components that reflect the stochastic choice mechanism underlying the actual individual perception of an item and the hesitation in selecting a rate among the available range, respectively (Iannarino and Piccolo, 2011). The *feeling* displays the level of agreement with the items in question; the *uncertainty* reflects respondents' limited information, questionnaire-related issues, wording, comprehension of the question and hesitation. To mitigate the central tendency bias commonly observed in Likert scales, where respondents tend to select answers in the middle of the scale and avoid the extremes, a *shelter* effect (δ) corresponding to the median Likert scale value is introduced.

The CUB results address mobility decisions regarding the selection of study locations (Research Objective 2 (RO2)). 'Feeling' and 'uncertainty' are reported on a scale from 0 (lowest level) to 1 (highest level). Likelihood-based information criteria, such as the Akaike information criterion (AIC) and the Bayesian information criterion (BIC), are commonly used to assess the model fit. Additionally, to evaluate the goodness of fit of CUB, Piccolo and d'Elia (2008) and Corduas et al. (2009) propose a normalised index of dissimilarity (Diss) that ranges from 0 (perfect fit) to 1 (worst fit). The R package CUB allows calculating all parameters using maximum likelihood methods by implementing an extended version of the Expectation-Maximisation (EM) algorithm. The CUB function also returns Bozdogan's Information Complexity Measure (ICOMP), with lower ICOMP values indicating better model fit.

3.3. The survey

The empirical data were collected in the academic year 2021–2022 through a survey administered to second-year students at the University of Sassari (Italy). These students had enrolled in their first year of bachelor's, master's, or single-cycle master's degree programmes in 2020–2021, during the peak of the COVID-19 pandemic. The survey was conducted via a direct online link shared through popular social platforms, including WhatsApp, Instagram and Facebook groups associated with different university departments. The Lime Survey platform, a web application for survey management, was utilised to administer a semi-structured questionnaire comprising 55 questions, categorised into six groups. The first group of questions gathers information about the respondent's study programme, while the second group focuses on factors affecting their university choice. The third group captures details about the student's residence and mobility. The fourth group explores students' future expectations and choices. Finally, the fifth group identifies the respondent's characteristics.

The questions were designed to maximise the generalisability of the collected data. Most questions are closed-ended, while a few are open-ended and include textual or numerical responses, aiming to enhance and personalise the primary single-answer questions. Matrix questions were also utilised, with rows representing sub-questions and columns representing five-point Likert-scale preference levels from 1 (lowest level of agreement) to 5 (highest level of agreement). A total of 241 questionnaires were received, including 132 complete and 104 partial questionnaires. In the academic year 2020–2021, the cohort approximated 2370 students. With an initial target sample size of 93 units, calculated to yield a 5.98% margin of error and a 95% confidence interval, 132 fully completed surveys can be considered statistically representative of the cohort under analysis.

4. Contextualisation: trend and dynamics

The University of Sassari, located in the Sardinia region (Figure 1), has around 12,000 students, more than 600 professors and researchers working across eleven departments, and offers 63 study courses and 10 PhD courses. Like all the other traditional universities, Sassari was also affected by the COVID-19 pandemic.



Figure 1. University of Sassari location.

Source: authors' elaboration.

From a policy perspective, during the pandemic, the University of Sassari adopted a structured and progressive approach to ensure academic continuity while complying with national public health regulations. As early as March 2020, in the same week as the national lockdown and campus closure, all lectures, examinations and graduation sessions were shifted entirely online through Rectoral and departmental decrees, ensuring the continuation of the academic year despite the suspension of in-person activities.

In January 2022, due to the spread of other COVID-19 variants, the Rector temporarily suspended in-person teaching and exams, replacing them with online learning for the entire month.¹ Departmental resolutions further specified that all lessons scheduled until mid-February 2022 would continue online. Remote examinations were also regulated by detailed technical guidelines requiring real-time audio-visual interaction, student identification, multi-member examination committees, and safeguards to ensure transparency and academic integrity. From 2023 onwards, in-person teaching was reinstated as the default mode of delivery, with distance learning permitted only in exceptional, formally authorised cases, supported by specific safety and infrastructure protocols.

To contextualise this research setting within the Italian higher education (HE) system, [Figure 2](#) explores long-run enrolment trends in the presence of major systemic shocks, providing a descriptive benchmark for understanding territorial dynamics and mobility patterns.

The Great Recession is associated with a contraction phase, evident in the years characterised by the real economic downturn (2012–2015), with a more pronounced decline in peripheral institutions such as the Southern University and the University of Sassari, thereby reflecting amplified territorial inequalities. In contrast, the COVID-19 pandemic (academic year (a.y.) 2020–2021 to a.y. 2021–2022) coincides with a remarkable enrolment increase around 2020, especially in Sassari, mirroring the pattern observed among small-sized universities and at the national level. This pattern suggests a countercyclical response in which higher education served as a temporary shelter during periods of labour-market uncertainty,

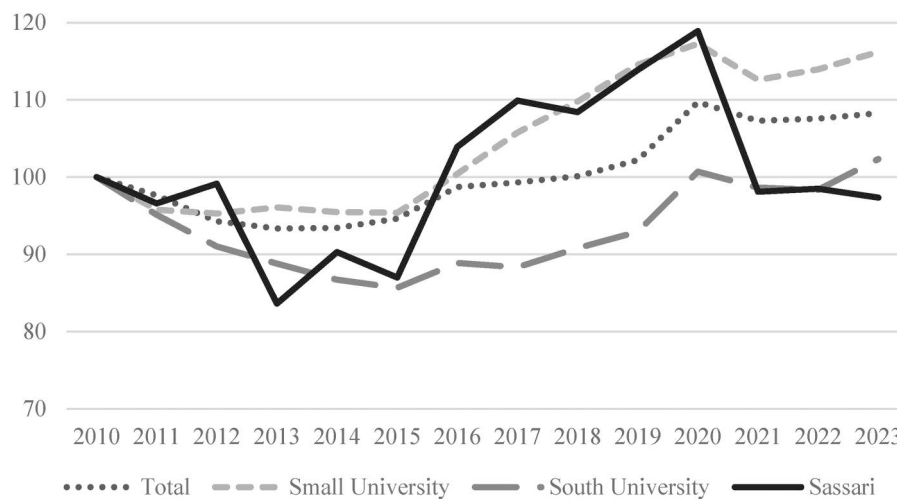


Figure 2. Students' enrolment: national level, small university, southern university and the University of Sassari (a.y. 2010/2011 to a.y. 2023/2024).

Source: authors' elaboration.

reinforced by the expansion of online teaching, backed by almost real-time management risk protocols, as previously addressed. However, unlike the small-sized university, Sassari experienced a post-pandemic enrolment decline (a.y. 2022–2023 to a.y. 2023–2024), along with the peripheral university in the south of the country. These findings provide preliminary evidence that, in the short run, shocks may exert either positive or negative effects, but stronger and more volatile effects in peripheral areas. At the same time, long-run trajectories seem anchored to structural territorial characteristics and pre-existing mobility patterns (see also Appendix A1 in the online supplemental data for more details on the dynamics).

5. Results

5.1. Biplot

To explore whether and how the pandemic influenced students' decisions to continue higher education, the biplot uncovers latent motivational structures (Figure 3). Based on the survey's first section, the analysis considers responses to the question 'Did the pandemic influence the decision to continue higher education studies?' Students are grouped according to their responses and, within each group, further distinguished by employment status (non-working students – A and B; working students – C and D): those who acknowledged the influence of the pandemic (sub-figures A and C) and those who would have chosen to study regardless of the pandemic (sub-figures B and D). This distinction allows for a more comprehensive assessment of how perceived shock exposure and labour-market attachment interact in shaping motivations. Overall, bachelor's students (BA = bachelor students, represented by circles) exhibit a higher propensity for risk-taking than master's students (MA = master students, represented by triangles), as indicated by their alignment with the risk-taking vector (see sub-figures A and B). This pattern is consistent with the established finding that younger individuals are more prone to risk-taking than older cohorts, a relationship widely documented to decline monotonically with age. However, individual behaviour may also be shaped by personality traits, contextual conditions and cultural factors (Mata et al., 2016).

Additionally, BAs prefer blended courses over MAs (see the arrow in the upper right quadrant in sub-figure A and the lower right quadrant in sub-figure B). This finding aligns with the fact that younger individuals are more willing to attend online courses, as they are more familiar with information and communication technologies (ICT). Studies conducted during the COVID-19 pandemic show that undergraduates were intrinsically and extrinsically autonomously committed to their studies through online learning facilities and motivated by their aspirations rather than by compelling rules (Rahiem, 2021). Yet, as Cofini et al. (2022) showed, e-learning satisfaction during the COVID-19 pandemic is related to the type of courses

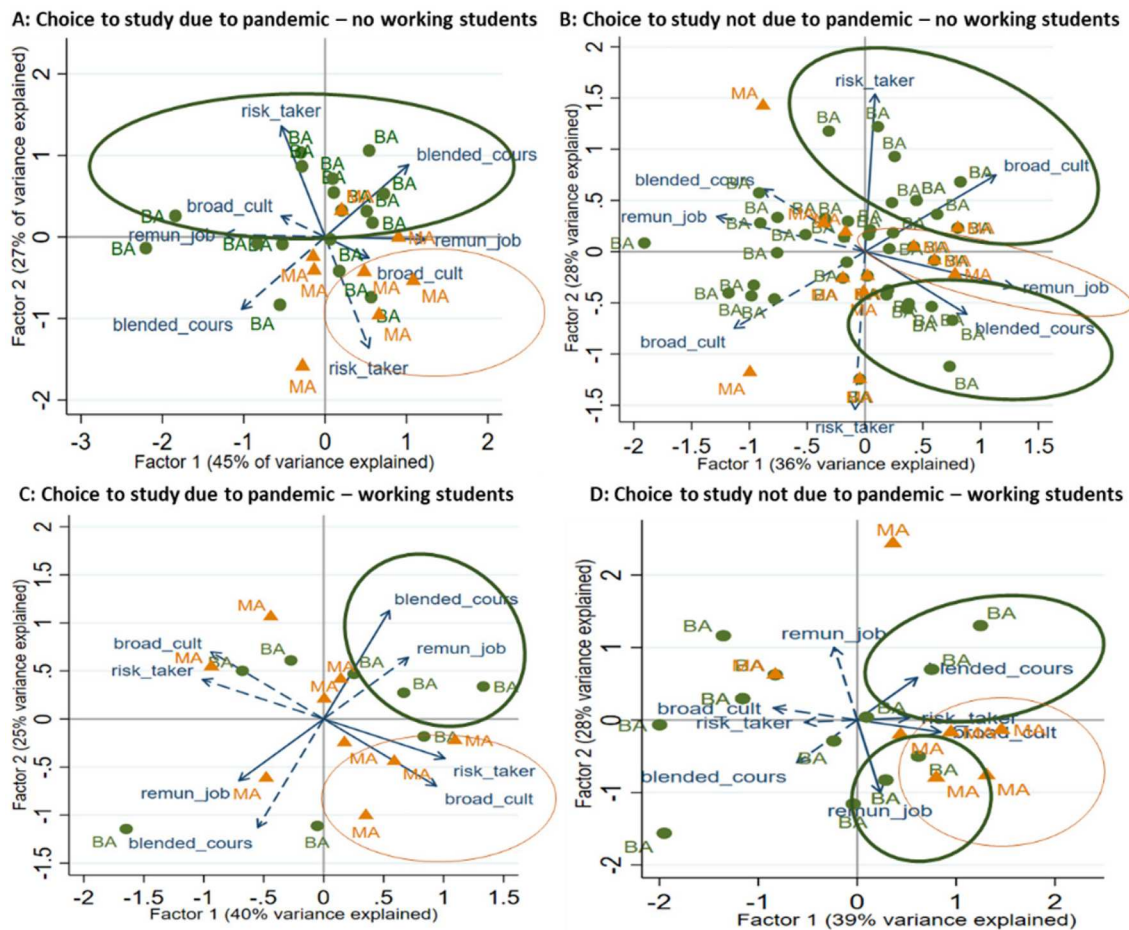


Figure 3. Did the pandemic influence the decision to continue higher education studies? (R01).

Note: BA = bachelor students (circles); MA = master students (triangles).

Source: authors' elaboration.

attended and psychological conditions. For example, medical students and those affected by stress were more satisfied with online learning activities.

As a further outcome, MA students, more than BA students, appear to pursue higher education primarily to enhance their knowledge and improve their employment prospects (see the arrow in the lower-right quadrant in sub-figures A and B). This result aligns with Mendick and Peters (2023), who argued that the progression from bachelor's to master's programmes is influenced by students' aspirations to enhance job-market opportunities and contribute to the national and global knowledge economy.

A distinct pattern emerges concerning non-working students (sub-figures A and B) and working students (sub-figures C and D). Interestingly, working MA students who claimed to have continued their studies due to the pandemic exhibit a higher inclination towards risk-taking than BA students, with one of the primary motivations being a desire to broaden their cultural horizons. By contrast, working students who chose a master's programme despite the pandemic crisis were mainly driven by broadening their culture and only to a certain extent by the expectation of more remunerative job opportunities. These outcomes are consistent with Mendick and Peters (2023).

Overall, the empirical results from this exploratory analysis show that some motivations and attitudes tend to be similar across the pandemic, such as risk-taking and blended courses for the BA cluster. Moreover, specific motivations exhibit altered effects because of the pandemic, such as the desire to broaden one's cultural horizons. In particular, this motivation appears more strongly associated with MA students when their decision is framed as pandemic-induced, whereas for BA students it emerges more clearly among those who report having chosen their studies independently of the shock.

5.2. CUB

While the biplot provides an exploratory representation of the latent motivational structures underlying students' responses, a CUB identifies the intensity of preferences from the degree of uncertainty embedded in ordinal evaluations. Hence, the CUB model is applied to the survey question: 'On a scale of 1–5, how important do you consider the following factors in choosing the university you are studying at?' Figure 4 presents the factors influencing university choice and mobility. Specifically, the items considered are course *quality*, course *location*, *blended* teaching modality, *pandemic* and *economic* factors. 'Feeling' and 'uncertainty', respectively, are reported on a scale from 0 to 1, where 0 represents the lowest level and 1 the highest. Location, quality and blended teaching show the highest *feeling*, followed by *economic* opportunities and the *pandemic*. Besides, teaching modality, the pandemic situation and economic drivers display the highest level of uncertainty, suggesting that these factors are characterised by greater ambiguity or instability in students' evaluations.

As a further disaggregation, Figure 5 displays the group of students who would have applied to the local university regardless of the pandemic (i.e., 'stayers'). Besides, Figure 6 represents those who selected the local university solely because of the pandemic (i.e., 'missed migrants'). By comparing these two figures, it becomes evident that the missed migrants exhibit no uncertainty about the quality and economic opportunities as the primary factors influencing their degree of agreement (*feeling*). Although the *pandemic*

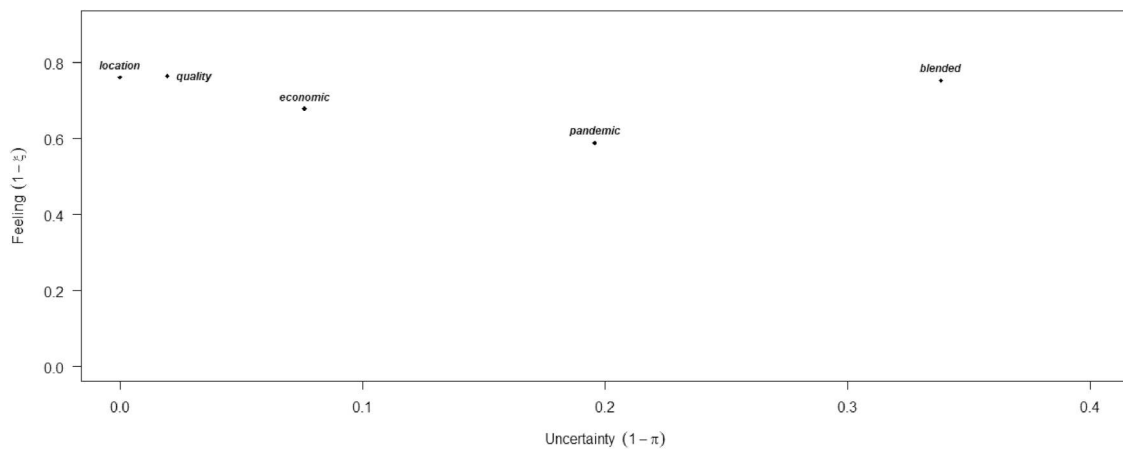


Figure 4. 'On a scale of 1–5, how important do you consider the following factors in choosing the university you are studying at?' All sample (RO2).

Source: authors' elaboration.

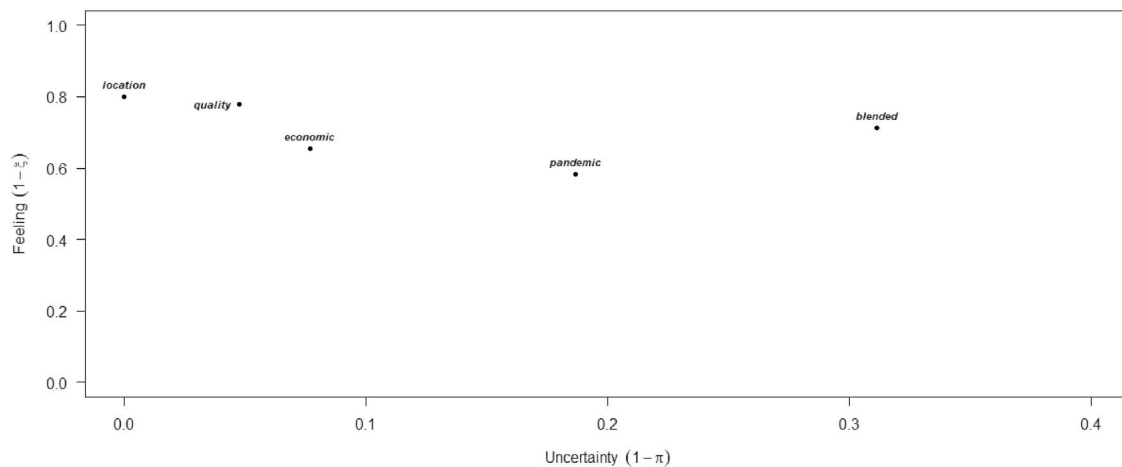


Figure 5. 'On a scale of 1–5, how important do you consider the following factors to be in choosing the university you are studying at?' Stayers (RO2).

Source: authors' elaboration.

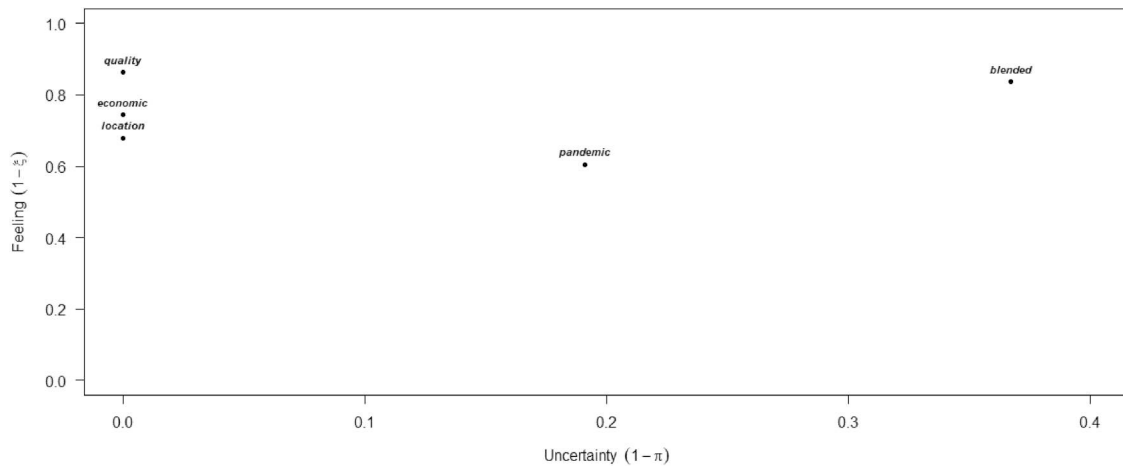


Figure 6. 'On a scale of 1–5, how important do you consider the following factors in choosing the university you are studying at?' Missed migrants (RO2).

Source: authors' elaboration.

reason presents a similar outcome in the two groups, there is a notable difference among the missed migrants. Specifically, regarding *blended* lessons, these students experience a similar feeling but a higher level of uncertainty. As a further finding, the pandemic does not seem to have temporarily altered the main drivers for mobility choice. This outcome indicates a temporary rather than a permanent shock. When decisions are not constrained by external factors, such as quality, economic prospects and university location, they continue to be the driving forces behind migration for educational purposes.

Table 1 shows results for the CUB models with and without shelter for the estimated feeling (ξ) and uncertainty (π). All π and ξ estimates are statistically significant. The dissimilarity index (Diss) indicates goodness of fit, which provides information about the proportion of units that would need to be categorised for the model to achieve a perfect fit.

To address the central tendency bias commonly observed in Likert scales (the tendency to select answers in the middle of the scale and avoid the extremes), a shelter effect (δ) was introduced at $m = 3$. As indicated in Table 2, the distribution of responses for *quality* and *location* does not exhibit the shelter effect. In these cases, according to the standard model, no option receives a preference higher than what is expected.

Table 1. CUB (0,0) models, all sample.

	ξ	π	AIC	BIC	ICOMP	Diss	δ
Quality	0.237***	0.986***	340.56	346.41	336.84	0.048	
Quality with shelter	0.237***	0.986***	342.56	351.34	338.98	0.048	−4.26e-15***
Location	0.308 ***	0.987***	382.31	388.16	379.36	0.098	
Location with shelter	0.292***	0.965***	383.60	392.38	380.33	0.078	0.058
Blended	0.220***	0.586 ***	403.96	409.75	401.13	0.090	
Blended with shelter	0.157***	0.535***	403.32	412.01	399.57	0.033	0.0877*
Pandemic	0.394 ***	0.750***	395.45	401.20	392.86	0.023	
Pandemic with shelter	0.394***	0.752***	397.46	406.08	395.33	0.024	0.000
Economic	0.303***	0.921***	387.94	393.78	385.34	0.074	
Economic with shelter	0.300***	0.918***	389.95	398.71	387.07	0.074	0.007

Source: Authors' elaboration; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2. Descriptives, all sample.

	Mean	Std. dev.	Responses frequency				
			1	2	3	4	5
Quality	4.007194	0.936354	1%	3%	23%	38%	35%
Location	3.733813	1.046565	1%	12%	26%	33%	28%
Blended	3.561151	1.383731	6%	12%	22%	26%	34%
Pandemic	3.136691	1.341649	6%	18%	30%	31%	16%
Economic	3.683453	1.123117	1%	12%	26%	33%	28%

Indeed, incorporating the shelter effect did not improve either the information criteria or the dissimilarity index. It is worth noting that all estimates for ξ and π are statistically significant.

6. Discussion and conclusions

This study examined how uncertainty generated by the COVID-19 pandemic influenced 1) university enrolment motivations and 2) student mobility decisions in a peripheral regional context. Rather than simply altering preferences, this global shock increased decisional ambiguity, particularly among students evaluating mobility outside their home region. The findings contributed to this thread of the literature in several ways.

The exploratory biplot offered a synthetic representation of the underlying motivational structure shaping students' enrolment. Specifically, student motivations clustered along identifiable dimensions reflecting risk attitudes, career orientation, personal development and lesson attendance modality. Within the biplot, spatial proximity among variables suggested that students' choices are embedded in a multidimensional evaluative framework. Bachelor's students exhibited a higher propensity for risk-taking than master's students, consistent with the general tendency evident in younger individuals (Mendick & Peters, 2023). This outcome highlights the importance of considering age-related factors in designing educational strategies post-pandemic. Furthermore, bachelor's students preferred blended courses over master's students. The familiarity of younger individuals with ICT can drive this preference. These insights indicate the need for universities to adapt to continuous technological advancement for younger generations. Master's students were more inclined to pursue further education to enhance their knowledge (i.e., 'personal-intellectual development') and more lucrative employment opportunities (i.e., 'careerism-materialism', 'motivation'). These findings suggest the need to implement tailored academic programmes that reflect students' diverse motivations (Balloo et al., 2017; Côté & Levine, 1997; Gorgodze et al., 2020). Moreover, working master's students who continued their studies because of the pandemic showed a greater propensity to take risks, driven by a desire to broaden their cultural knowledge. This finding underscores the interplay between employment status and educational choices, highlighting the complexity of decision-making within diverse clusters, study programmes and expectations.

CUB further helped clarify how these motivations translate into mobility choices by decomposing ordinal responses into a systematic component (*feeling*) and a stochastic component (*uncertainty*). Indeed, uncertainty accounted for a substantial share of the observed responses, particularly regarding mobility intentions during the pandemic. This finding suggests that the shock increased bias in the evaluation of preferences. Although the pandemic's impact is similarly felt by stayers and missed migrants, a notable divergence emerges within the latter group, with blended lessons becoming less important in the aftermath of the shock. Missed migrants prioritised factors such as educational quality and future economic opportunities. Hence, when external constraints are removed, factors such as university quality, financial feasibility and geographic location remain the primary drivers of educational migration, aligning with findings from previous studies on both national and international student mobility (Mok et al., 2021). This mechanism is especially significant in peripheral regions, where outward mobility may represent an opportunity for individual advancement but also a potential loss of human capital accumulation for the home region where the public investment was pursued (de Boer, 2026). Besides, short-run reductions in outward mobility during a crisis should not be interpreted automatically as evidence of improved regional attractiveness.

By analysing enrolment motivations and mobility decisions within an integrated framework, this paper extended established findings on students' risk-taking attitudes and career orientation (e.g., Mata et al., 2016; Mendick & Peters, 2023) by showing how these behavioural dimensions interact with shock-induced uncertainty in geographically constrained settings (Beine et al., 2014; Mok et al., 2021).

Relevant policy implications also emerge from these findings. Peripheral universities, which have historically struggled to attract students, could adopt effective strategies by targeting working individuals who enrol in university programmes to enrich their cultural capital and enhance their current employment position. Notably, working students have distinct needs; therefore, courses should be offered in flexible formats to attract diverse student groups and be tailored to accommodate their time constraints.

These insights are crucial for fostering resilience and innovation in higher education systems amid new challenges and evolving student requirements. The pandemic has expedited the integration of novel

teaching methods and technology in education. To further enhance the quality and accessibility of education, policymakers should persist in their investments in digital infrastructure and pedagogical innovations. Additionally, policymakers should take into account the transitory nature of mobility choices during an extreme event, which constrains mobility.

Several limitations must be acknowledged. Despite the use of an integrated methodology to uncover complex behavioural patterns, the findings from a single case study cannot be generalised. Further research is required to provide broader evidence on the impact of shocks on student attraction and retention, particularly in peripheral higher education institutions characterised by significant student outflows. Moreover, the current era is marked by profound uncertainty driven by geopolitical and economic instability, in which exogenous shocks pose unprecedented challenges to both individual behaviour and organisational structures. Among these, the rapid development of artificial intelligence adds a further layer of complexity to the higher education sector. These evolving conditions call for continuous monitoring of trends, dynamics and adaptive capacity, especially within peripheral universities.

Note

1. For further information see the following link: <https://www.uniss.it/it/ateneo/amministrazione/servizi-il-personale/emergenza-sanitaria-covid-19>.

Author contributions

CRediT: **Bianca Biagi**: Conceptualization, Data curation, Writing – original draft, Writing – review & editing; **Martina Dal Molin**: Conceptualization, Writing – original draft, Writing – review & editing; **Marta Meleddu**: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing; **Manuela Pulina**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

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Ethical approval

Although ethical approval for this study was not obtained from the Ethics committee of University of Sassari, there was no specific institutional committee in place at the researcher's institution at the time the study was conducted; all procedures adhered to the principles outlined in the Declaration of Helsinki. Written informed consent was secured from all young adults (aged at least 18 years old) who took part in the study. Participants provided informed consent for the publication of their data in an aggregate manner. The authors have the necessary consent to publish the paper and all associated data and materials.

Data availability statement

Data not available – participant consent. The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research, supporting data is not available.

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