Socio-Economic Planning Sciences xxx (xxxx) xxx

Contents lists available at ScienceDirect

Socio-Economic Planning Sciences

journal homepage: www.elsevier.com/locate/seps

The determinants of university dropout: A review of the socio-economic literature

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ARTICLE INFO

JEL classification:
I20
I21
I22
I23
H52

Keywords:
Tertiary education
University dropout
Student retention
Student completion
Student success
Human capital theory

ABSTRACT

This article provides a comprehensive review of the socio-economic literature on the student determinants of tertiary education dropout, in order to help research scholars better understand this phenomenon. Empirical findings are framed within a theoretical model that analyzes higher education choices and prospective outcomes in a dynamic setting, where informative issues (emphasized by the economic literature) and relational ones (emphasized by the sociological literature) are crucial to predicting students' achievements. Our review suggests that student university persistence/attrition depends on a mix of individual, institutional, and economic factors, the effects of which on the dropout decision are mediated by a student's ability to integrate into the academic system. Some factors are given, and their effects are valuable only in a descriptive perspective. Others, instead, can be manipulated by the decisionmakers in the tertiary education system and, as such, are more interesting from the policymaker's viewpoint. In particular, all interventions aimed at fulfilling the initial informational gap of students and at improving their integration into academic and social life are key to study success.

1. Introduction

Tertiary education systems have expanded remarkably during recent decades in terms of enrollment and graduation rates. Nonetheless, recent statistics from the member countries of the Organization of Economic Co-Operation and Development (OECD hereafter) show that, on average, one third of students who enroll at university leave their studies without obtaining a degree [1].

We look at this phenomenon, commonly known as dropout, in the countries covered by OECD statistics, which define it as the share of students who did not complete a bachelor's program within the theoretical duration plus three additional years, while providing other information useful to draw a complete picture of students' academic trajectories.[1]

Table 1 reports the share of students completing a bachelor's degree by the theoretical duration of their program, by the theoretical duration plus three years (the most commonly used indicator of student success) and the share of students dropping out during the first enrollment year in OECD countries that provided comparable information.[2] The portion of students who do not complete a bachelor degree program by the theoretical duration plus three years ranges from less than 20% in the UK, Israel, Switzerland, and Ireland, to more than 40% in Brazil, Slovenia, Chile, Belgium (French community), Sweden, Italy, Austria, and Estonia. The first-year dropout rate ranges from 6% to around 20%. It is interesting to observe that despite a low share of first-year withdrawal, more than 30% of US students do not achieve their degree three years beyond the legal duration, suggesting that they experience increasing difficulties over time. Nevertheless, it is important to note

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[1] For instance, the share of students who complete a bachelor degree within the theoretical duration, the share of students who drop out by the beginning of the second year, by the theoretical duration, and by the theoretical duration plus 3 years.

[2] For Italy, which was not included in the OECD statistics, we have added comparable information drawn from the Italian National Agency for the Evaluation of Universities and Research Institutes (2018).

https://doi.org/10.1016/j.seps.2021.101102
Received 3 June 2020; Received in revised form 18 June 2021; Accepted 21 June 2021
Available online 28 June 2021

Table 1
Non-completion and first-year dropout rates of students enrolled in bachelor degree programs – Countries ranked in descending order of the rate of non-completion by the theoretical duration plus 3 years.

	Non-Completion Rates		Dropout Rates
	By the theoretical duration	By the theoretical duration plus 3 years	By the beginning of the second year of study
United Kingdom	28.2	14.8	8.1
Israel[a]	40	16.8	8.2
Switzerland	61.3	19	8.4
Ireland[b]	37.4	19.3	
New Zealand	65.5	23.2	10.1
Finland	56.7	27.3	7.9
Norway	56.5	28.1	12.3
Australia	66.3	30.1	12.3
Netherlands	72	30.4	11.8
United States[b,c]	61.5	31.2	6.2
Iceland	64.5	31.4	18.3
Flemish comm. (Belgium)[a]	67	32.7	13.6
France[b]	59.2	33	8.7
Lithuania	39	35	17.3
Portugal	70.3	35.1	12.1
Estonia	66.4	40.8	11
Austria	73.9	41.7	13.9
Italy	69.4	43.3	12.2
Sweden	58.2	43.9	15.4
French Comm. (Belgium)[d]	72.9	46.2	21.1
Chile	84.4	46.5	17.1
Slovenia	76.2	47.3	19.5
Brazil[e]	66.7	49.6	10.6
Canada[b]	52.1		

Source:
For all countries with the exception of Italy: OECD [1]; Table B5.1 (Completion rates) and B5.3 (Dropout rates).
For Italy: ANVUR [2] Figure I.1.3.1

[a] The completion rate of students who entered a bachelor's program does not include students who transferred to and graduated from short-cycle programs.

[b] Year of reference differs from 2017.

[c] The theoretical duration plus 3 years refers to the theoretical duration plus 2 years.

[d] Data refer only to the hautes écoles (HE) and the écoles des arts (ESA), representing about 60% of entrants to bachelor or equivalent programs.

[e] Data do not include entrants to 6-year bachelor programs, which correspond to about 2% of total entrants at this level.

that these statistics are simply average figures regarding how widespread this phenomenon is across countries and do not display heterogeneous components between institutions within the same country (i.e., different dropout rates by field of study, university facilities, admission rules, etc.)

The extent of the university withdrawal phenomenon, in countries with very different tertiary education systems, is a first sign of its complexity. In this regard and to the best of our knowledge, the socio-economic literature does not clarify whether dropout represents a waste of time, as well as of public and private financial resources, or an unavoidable step for some students[3] who have enrolled at university with inadequate knowledge of themselves, their capacity to integrate into the academic system, and/or an incomplete set of information[4] about present and future conditions of the labor market.

In the attempt to fill this gap, this paper provides a comprehensive review of the socio-economic literature on the determinants of university dropout, along with a crisp overview of the state of the art on this issue. We aim to provide an evaluation of the factors at stake in leaving university without obtaining a degree, in addition to producing an accurate picture of the various channels/mechanisms that lead to this educational outcome. In particular, our goal is to offer an integrated framework to understand the interplay among individual, institutional, and relational variables in the college persistence process. Therefore, our main contribution lies in the integration of the economic approach, based on the analysis of expected benefits and costs and emphasizing informative issues in a dynamic setting, with a complementary approach offered by the sociological literature, which argues that any explanation of student outcomes should look beyond individual characteristics and pay attention to the institutional and social context in which students make their decisions. In that context, we will refer to a set of "relational factors" that represent the student's level of integration within the university system, i.e., her level of identification with the academic system's attitudes and values, her capacity to meet the university's specific standards, as well as the extent and quality of her relationships with faculty and peers. Such factors are key in the major studies of university dropout within the sociological approach [4].

Although the empirical evidence is still fragmented as most studies focus only on a few drivers and are unable to evaluate the role of each of them, by bringing together the features that have been found to be the strongest predictors of the predisposition to leave, we strive to discuss the most relevant determinants of early withdrawal, upon which intervention strategies can be addressed. Therefore, the proposed analysis will disclose possible mechanisms beyond the dropout phenomenon, thus allowing us to distinguish which factors (individual, parental background, institutional, contextual, and the way students confront and interact each with other and with the environment) are more likely to predict university student (non-)completion. To make the perspectives of existing empirical studies more understandable, we also provide a theoretical framework that aims to reconcile the economic and sociological theories that have attempted to explain the student persistence process over time. By gathering together scholars from different disciplines, it is possible to enhance our understanding of the process that affects students' decisions to remain in university (for more details, see Section 2). We conclude that, among other factors, informative issues (emphasized by the economic literature) and relational ones (emphasized by the sociological literature) are crucial for predicting students' achievements.

We are well aware that other disciplines (psychology and pedagogy) have addressed this topic, but we opted for the socio-economic viewpoint because, as will be shown below, these approaches are complementary and when integrated provide a clear framework for analyzing the issue at stake. To cover the contributions in the socio-economic fields effectively, we illustrate studies spanning from the 1970s (i.e., when university dropout started to garner attention in the US; see, for example, the early sociological contributions of [5–7,185]) to the most recent years, focusing on several countries characterized by very different tertiary education systems. To select the papers, we searched Google Scholar, JSTOR, and NBER, etc. for published articles with a socio-economic perspective that included the following keywords: "university dropout", "university withdrawal", "university retention", "university completion", "university persistence", "university attrition". As an additional criterion, we pragmatically restricted the search to English-language literature.

The outline of this paper is as follows. Section 2 describes a dynamic theoretical version of the human capital model amended to consider uncertainty regarding returns to tertiary education and the quality of interactions in the academic and social context. This provides a unified theoretical framework that we believe may help to introduce and explain the different factors to which both the economic and sociological empirical literature attribute a role in explaining the phenomenon investigated. Section 3 summarizes findings from various empirical studies, discussing whether each determinant - according to the

[3] As [3] argues, the fact that students voluntarily enter college is de facto evidence that these risky experiments are desirable.

[4] When making any decision, an individual who operates in a context of perfect information (i.e., no hidden information) is perfectly informed of every determinant that can influence the decision-making process.

methodology applied - is associated with (or causally related to) dropout. To improve the readability of the literature contributions, the wide range of factors are clustered into five homogeneous groups. Section 4 discusses the main findings and their generalizability, offering some policy implications.

2. Theoretical framework

The student dropout phenomenon has been extensively studied by at least three disciplines: psychology, sociology, and economics. By adopting different approaches, each of these disciplines reveal specific mechanisms and determinants of students' decisions and achievements. In our opinion, the economic and sociological perspectives support each other and, if integrated in a unified framework, offer an effective tool for the interpretation of the phenomenon under consideration. In what follows, we present such an attempt.

We start by analyzing the economic model that seems the most appropriate to explain student outcomes. After showing the limits of the economic approach, we then integrate it with the main findings of two sociological models that unveil mechanisms useful for outlining a comprehensive overview. By doing so, we can document the extent to which both theoretical approaches may help to explain students' decisions to remain in university and interpret the empirical findings from these two disciplines.

Within the economic literature, Becker's human capital model (HCM) assumes that the decision to invest in education is the result of the comparison between expected benefits and costs (both monetary and non-monetary) at the individual level [8].[5] Each individual will achieve a certain education level (e.g., university degree) if the expected net present value of her lifetime earnings is positive at the time of enrollment. This will be calculated by forecasting the time needed to enter and the remuneration offered by the labor market during her working life, once graduated.

However, before enrolling at university, students are not perfectly informed about the characteristics of the study program/major they are going to choose, as they likely have only a rough idea of the difficulty level of the subjects, of the effort needed to pass the exams, of their true ability to interact with peers and the academic system, and whether the professions for which they are studying for are in line with their ambitions. Moreover, they are not fully aware of their own genuine interest in the content of the courses or the abilities/skills needed to comply with the specific study program requirements as well as with the university environment in which they find themselves. Essentially, imperfect information and limited consciousness may prevent students from correctly assessing the expected costs and benefits of the decision to invest in further education. To overcome these limits, a few studies attempt to improve the original HCM by providing a dynamic framework that can more adequately deal with uncertainty. We refer to random utility models developed, for instance, by Comay et al. [9]; Manski [3]; Altonji [10]; and Stinebrickner and Stinebrickner [11,12]),[6] which extend the original HCM and introduce the latent demand for higher education as a function of expected utility and costs [183]. In this framework, students' decisions and their outcomes are modelled by applying a sequential process, which updates the additional information/awareness acquired over time. Consequently, once enrolled at university students may revise their initial educational choice as a result of improving their information set through exposure to college life.[7]

Therefore, in every time period t ($t = 0, 1, 2, \ldots, x$), student i enrolls at university,

$$iff \quad U\left(NPV_t^i,\ B_{NMt}^i\right) > C_{NM}\left(e_t^i\right), \tag{1}$$

where NPV is the expected net present value of obtaining a university degree, B_{NM} are the expected non-monetary benefits of studying, and C_{NM}, as a function of effort e, are the expected non-monetary costs. Expected monetary benefits, together with expected direct and indirect monetary costs, determine the NPV of the university degree:

$$NPV_t^i = \sum_{j=x+1}^{L} \frac{Y_{Dt}^j}{(1+r)^j} - \sum_{j=1}^{x} \frac{C_{Mt}^j}{(1+r)^j} - \sum_{j=1}^{L} \frac{Y_{Nt}^j}{(1+r)^j}\ , \tag{2}$$

where Y_D is the yearly earnings of a university graduate, Y_N is the yearly earnings of a high-school graduate (which is also the foregone earnings for the period when the student is enrolled at university), C_M is the amount of direct monetary costs of getting the degree, L is the retirement age, and r is the discount rate. Note that all are expected values, and monetary benefits and costs may change over the period t in which the student is enrolled at university.

Students may revise their education decision throughout all of the periods t in which they study. The learning process can modify, *ex-post*, both the expected monetary benefits and costs associated with university investment, thus changing their NPV. As time passes and the end of the study period approaches, the forecasts of the conditions of the labor market faced after graduation will be more precise. Moreover, students learn more about non-monetary benefits associated with a study program (or the types of jobs they can find once they graduate) and about non-monetary costs (effort), which depend on their ability. In response to the additional information acquired, students shape their behavior.

If expected monetary benefits and costs do not change, a student either:

i. remains enrolled at university if her expectations about the contents of the study program (B_{NM}) are satisfied and the effort needed to keep up the study program (C_{NM}) is affordable, i.e., $B_{NM} > C_{NM}$;
ii. drops out if her non-monetary benefits (B_{NM}) are lower than expected and/or the effort required (C_{NM}) is higher, i.e., $B_{NM} < C_{NM}$.

Trivially, if the expected monetary benefits and/or costs also change (for instance, once expected earnings, tuition fees, family financial conditions, time devoted to study, etc. vary), the initial NPV may become negative and the optimal outcome turns out to be withdrawal from university. As an example, an interesting case is when an economic downturn (or upturn), by changing the labor market opportunities, influences a student's foregone and expected earnings and thus the monetary benefits and costs of staying enrolled at university.

The HCM and its extensions in the dynamic setting rely on the assumptions of neoclassical economics, according to which perfectly rational and independent individuals make optimal decisions (i.e., maximize utility) if they are fully informed about all relevant options. According to this theoretical framework, in a world of perfect information and complete rationality, no dropouts should be observed. Although we believe that informative issues are key to explaining why individuals may decide to complete (withdraw from) university studies, we are aware that the mainstream economic models disregard other factors that may play a relevant role. Among these, particular attention should be given to how individuals interact with the surrounding environment (family, campus life, classmates, professors, etc.). For

[5] Although other theoretical approaches can be used to discuss early university withdrawal (i.e., the bargaining model, search model, etc.), we chose the human capital model because it provides a unified and readily comprehensible framework to analyze the topic under review.

[6] This paper analyzes dropout within the first two years of first enrollment.

[7] In a further extended version of such theoretical models, Arcidiacono et al. (2016) assume that students may decide to work at college, thus also updating their beliefs on their skills in the workplace.

instance, a competitive (collaborative) student might perform better if she is in a competitive (collaborative) environment, given her abilities. Moreover, her commitment could be conditioned by the empathy that characterizes her relationships with the faculty.

In this perspective, given the complexity of the phenomenon of student retention/dropout, it may be helpful to turn to other approaches than can add valuable elements to the analysis. In particular, the sociological literature focuses on a set of features of the university experience that seem relevant to a better understanding of students' achievements. According to Aljohani [4]; there are at least six different theoretical models that explain student retention at university. They all share the view—expressed in the first theoretical model in this literature [6,13])[8]—that any explanation of student outcomes should look beyond individual characteristics and pay attention to the institutional and social context in which students make their decisions. They all assume that students are not "independent individuals" who act regardless of the context in which they live. Among these models, the most extensively examined and empirically tested are those of Tinto [7,14] and Pascarella [15]. Tinto's models emphasize the role of the interaction between students and the academic and social systems: integration into both systems is key for a student to persist in the institution. Quite interestingly, some features of the Tinto framework recall the random utility models described above. In Tinto's models, students start their university experience setting goals and commitments that depend on their individual and background (family) characteristics. Once enrolled at university, they continuously revise goals and commitments according to their academic and social integration (or revise costs and benefits in the economic framework). This process leads them to stay enrolled until they achieve the degree or to drop out. Interactions also play a key role in shaping academic experiences in Pascarella's model [15]. In this framework, however, not all interactions are equally valuable: informal interactions with the faculty contribute more to committing students to the institution in which they are enrolled, eventually leading them to complete their degree. The quality of such interactions depends, on the one hand, on the individual and family characteristics (personality, ability, aspirations, family and home environment, etc.), and on the other hand, on the faculty and institution features (size, culture, organization, etc.). The intersection between students and institutional characteristics shapes student decisions and achievements.

Having established that the relationships and interactions of students with the academic and social context seem to be valuable determinants of their university trajectories, how can we combine two relevant theories (economic and sociological) for our theoretical framework? We argue that formally, the investment decision is still shaped by the expected *NPV* of equation [2] but that the non-monetary expected costs of and expected returns to education in equation [1] are individual-specific and thus also influenced by one's capacity to integrate into the academic and social systems. Equation [1] is the main driver of the decision to remain enrolled until the completion of a degree (or to dropout). In other words, the sociological approach argues that all other things remaining equal, the higher the level of integration of students into the university environment, the lower the probability of dropping out.

2.1. Determinants of student dropout

Resting on the contributions of the above-described theoretical approaches, in what follows we provide a list of the determinants that can affect students' benefits and costs of education investment, distinguishing between monetary and non-monetary aspects. Table 2 reports how the common predictors influence the expected benefits and/or costs in the student decisions model adopted, making it easier for the reader to interpret the empirical evidence according to the HCM random utility models integrated to take account of relational factors according to the above-mentioned sociological literature.

The expected earnings of graduates, which depend on graduate wages and employment probabilities, represent the first category. Monetary benefits (i.e., graduates' expected earnings) are related to student characteristics (i.e., ability, hard and soft skills, gender, ethnicity, family network), the field of study chosen, and the graduates' labor market conditions (for instance, the graduate employment rate).

Non-monetary benefits depend on the matching between students' expectations and the features of their study programs. They reflect non-pecuniary preferences for education together with inclinations towards the specific degree program attended (for instance, business, medicine, law, and so on) and for the type of job it leads to (for instance, manager, doctor, lawyer, etc.) [16]. Together with such individual factors, "relational factors" emphasized by the sociological literature may affect the non-monetary aspects of the investment decision. A good level of integration in the academic and social context as well as worthwhile relationships with the faculty and peers are likely to increase the satisfaction/fulfilment students draw from the university experience, thus increasing the non-monetary benefits associated with education.

Direct monetary costs are schooling-related expenses—for example, tuition fees, books, living costs, and so forth—while indirect costs are foregone earnings.[9] The former strictly related to the university funding system and to the financial condition of households. In countries where tertiary education is funded by the state (i.e., zero or very low tuition fees) or subsidized (i.e., scholarships and/or transfers in kind given to less well-off students), direct costs are approximately zero, hence household conditions do not affect students' choices, except in terms of indirect costs. Instead, in countries where students pay non-negligible tuition fees (either fixed or related to family income), monetary costs and their sustainability greatly depend on family financial conditions and on the possibility of borrowing money from the market.

Indirect monetary costs, namely foregone earnings, depend on the same set of variables that affect graduates' expected earnings.

Non-monetary costs (effort and dislike for education) are related to a student's ability within a specific degree program (the greater the ability, the lower the effort needed), the time devoted to commuting or working during university, the organization of teaching activities, and the quality of the facilities provided by the university (for instance, tutoring activities, counseling services, etc.). Furthermore, low integration into the academic and social context and difficulties building positive relationships with peers and the faculty (i.e., weak relational linkage) can worsen the overall university experience, thus increasing the non-monetary costs of education.

The determinants of university dropout drawn from the theoretical framework described above can be grouped into several homogeneous categories (summarized in the first column of Table 2) that help organize the wide empirical literature along different research lines. In the following section, we detail the main findings of the socio-economic literature by using such categories.

3. Main findings of the socio-economic literature

As argued in Section 2, university dropout is the result of a sequential process made under gradually decreasing levels of uncertainty and a student's consciousness about education costs and future returns, as well as by that student's level of integration into the academic system. In short, university withdrawal is a multivariate phenomenon wherein the

[8] This paper defines dropout rates as the share of students who leave the tertiary education system within four years of first enrollment.

[9] We mean the earnings that an individual can obtain by entering the labor market rather than enrolling at university.

Table 2
Set of predictors and their effects on the costs and benefits within the theoretical model.

	Costs		Benefits	
	Monetary	Non-monetary	Monetary	Non-monetary
Student factors				
- Higher age	Increase foregone earnings	Increase study effort	Reduce, on average, the expected returns	
- Female vs. male	Decrease foregone earnings		Reduce, on average, the expected returns	
- Minorities	Decrease foregone earnings		Reduce, on average, the expected returns	
- High abilities vs. low abilities	Increase foregone earnings	Reduce study effort	Increase, on average, the expected returns	
Family characteristics				
- Highly educated parents		Reduce study effort		
- Parents with better occupations/well-off parents			Increase, on average, the expected returns	
- Better family networks			Increase, on average, the expected returns	
Integration and commitment		Reduce study effort and costs of attendance		Increase the non-monetary benefits of attendance
- Social integration				
- Academic integration				
Tertiary education system and context				
- Better facilities (i.e., small class size, labs, etc.)		Reduce study effort		Increase non-monetary returns (i.e., fruitful relationship with peers and teachers)
- Generous financial aid (i.e., scholarships)	Reduce direct costs	By reducing the need to work, may increase study time		
- Higher tuition fees	Increase direct costs	May increase the need to work, hence reducing study time		
Labor market performance				
- Greater job opportunities	Increase foregone earnings		Increase the expected returns	

Note. Blank cells represent the cases in which the sign of the effects of the analyzed determinant on costs and benefits cannot be established *a priori*.

final decision is mediated by different determinants.

In what follows, we review the existing empirical literature[10] to assess the factors that shape this decision, organizing them into five categories that encompass micro, meso and macro levels:

I. student demographic characteristics, abilities, and behavior;
II. parental background and family networks;
III. academic/social integration and institutional/goal commitment (relational factors);
IV. features of the tertiary education system and context (at the institution and country level);
V. labor market performance.

Categories I and II describe the "micro level" of the analysis in that they focus on the individual/family dimension. Categories III and IV (at the institution level) refer to the "meso level" as they look at differences between higher education institutions along different dimensions within countries. Finally, categories IV (at the country level) and V consider the "macro level", as the analysis reflects the differences across countries.

For the sake of clarity and to link the theoretical framework with the empirical literature, note that all determinants may affect both the expected benefits and costs of university investment, thus modifying the opportunity cost of investing in further education. Likewise, in the exposure of the main findings within each category, we make clear whether the results obtained are purely associated or causally related to the decision of dropping out. Applying this distinction allows for a better understanding of the mechanisms behind university student attrition as well as the identification of the factors that can be tackled to contrast this phenomenon. Last but not least, we are also well aware that both "academic/social integration and institutional/goal commitment" have a direct effect on the expected non-monetary benefits and costs of the investment, but that they could also act indirectly through factors I, II, and IV as important mediators. Table 3 offers a summary of the main empirical findings discussed.

3.1. Student demographic characteristics, abilities, and behavior

Student *age* is a relevant factor frequently explored to study educational success. Students enrolling in university at an older age, whatever the reason, are more likely to drop out [17,19–23,151]).[11] This finding highlights a clear correlation between entry age and university failure, but not a causal relationship since these studies do not deal with the non-random selection of freshman students by age at enrollment. In short, this correlation suggests, on the one hand, that opportunity costs increase with age, supporting the hypothesis that older students have a lower net benefit from attendance. In sociological models, age is a pre-entry attribute that affects student's goals and institutional commitments, together with gender, ethnicity, family background, and prior schooling [18]. Therefore, according to the integration theory of [7]; the age difference could in general make it difficult for an older student to integrate with her classmates and interact with professors, thus explaining a higher probability of withdrawing from university (i.e., generational mismatch).

Results are much less robust when an exogenous factor, namely *gender*, is investigated. On average, men tend to drop out of university more often than women [24–26,28,29,33,35]. According to Goldin et al. [32]; among the main determinants of women's completion advantage are higher ex-post payoffs to tertiary education, the postponement of maternity, a stronger commitment to education, as well as insurance

[10] Note that the majority of the proposed papers investigate the dropout issue by focusing only on the first academic year, namely the portion of students who do not enroll in the subsequent year. Very few contributions define dropout behavior over several academic years, and mainly when the outcomes studied are university persistence or degree completion.

[11] These papers apply the following definitions of dropout rate: the share of students who leave the tertiary education system within the legal duration [21,23,151] and within six years of first enrollment [17].

Table 3
Summary of the estimated effects of the predictors of university dropout in the empirical evidence.

	Effects	Reference
Student factors:		
- Age	Older freshmen have a higher dropout probability as opportunity costs increase with age.	[17–23]
- Gender	Females, on average, are less likely to dropout.	[11,24–37, 185]
- Minority students (ethnicity)	Higher dropout probability at large.	[38–53]
- Ability	Mixed evidence. Most studies find that ability is negatively correlated with dropout probability. However, a few studies find that students with better high school scores are more likely to withdraw (expectations too high).	[17,20–22, 24–28,54–67]
- Self-awareness	Students who are too optimistic about their abilities are more likely to dropout	[3,10,12, 68–70]
- Early academic achievement	Good early academic achievement reduces the dropout probability.	[11,12,19,27, 71,72]
- Time dedicated to study/ work	No clear effect of the time dedicated to study (interaction with students' ability).	[73–77];
	Negative effect of the amount of working hours on the probability of obtaining a degree.	[52,77–86]
Family characteristics		
- Parents' education and occupation	Students from poorer backgrounds are more likely to drop out as they receive less cultural capital and habitus from their families.	[24,25,29,62, 79,87–101]
- Family income	Mixed evidence. Students from low-income families are more likely to drop out, but only in countries with high tuition fees (necessity to work).	[77,87,99, 102–105]
Academic/social integration and institutional/goal commitment		
- Interactions with peers/ teachers	Closer ties with peers reduce the dropout probability.	[5,50,106–114, 185]
- Student academic integration	A greater institutional commitment reduces the risk of withdrawal.	[49,50,90,108, 109,115–119];
Institution factors		
- Services offered to students, facilities, class size, flexibility in curricula, etc.	Reductions in the quantity and quality of services/facilities are correlated with a dropout increase. Students attending very small or very large classes are more likely to withdraw.	[19,28,53,56, 63,120–129]
- Admission criteria	Selective tertiary education systems have lower dropout rates.	[21,28,41,56, 89,121, 130–133]
- Tuition fees, financial aid	Mixed effects Higher tuition fees affect only low-income students. Once controlling for endogeneity issues, financial aid has a positive impact on the probability of student retention.	[22,38,57,60, 76,93, 134–146]
Labor market conditions	Mixed effects (interaction with tertiary education system)	[17,21,58,70, 147–150]

against income deprivation. Accordingly, DiPrete and Buchmann [149] show that the total value of tertiary education, including its value in the labor and marriage markets, has risen faster for females than males, thus explaining the reasoning behind the growing female advantage in college completion. Similarly, by analyzing the reversal of the gender gap in university completion, Buchmann and DiPrete [152] find that crucial elements in this process are the decline of gender discrimination, the change in higher education incentives, and the impact of these variations on resource provision by parents. In line with Conger and Long [30]; Stinebrickner and Stinebrickner [11] report that the academic success of women is largely due to gender differences in study effort, resulting in differences in grade point average (GPA) and beliefs about ability. In sociological models, early empirical studies aimed at assessing the role of gender as a pre-entry attribute find that academic integration is more important than social integration for men, while the opposite is true for women (Pascarella & Terenzini 1979, [37]. Other research analyzes the performance of students who decide to study a subject that is atypical for their gender. Findings show that women are more likely to drop out when most of their classmates are men [27,34,36] [12] or when they are enrolled in STEM majors. A possible explanation is that such students might be less socially integrated with their fellow students or even with the faculty members. Moreover, they may feel less academically integrated as they may doubt their capacity to address a gender-atypical field of study. This happens more frequently to women who are more affected by stereotypes that lead them to self-assess their performance negatively.

Another exogenous determinant is *ethnicity*. Most studies that focus on the university performance and persistence of "minority" students show higher-than-average dropout rates [38,39,41,53]. These contributions also argue against the effectiveness of affirmative-action policies, which advocate the application of less severe criteria when selecting minority students. Intriguingly, when analyzing the same dataset (National Longitudinal Survey of Youth) but using two different statistical strategies—a two-period model with simultaneous estimates and propensity score matching, respectively—Light and Strayer [41] and Alon and Tienda [39] draw opposite conclusions. Light and Strayer [41] conclude that regardless of ethnicity, the higher the quality of the matching between a university and a student's skills, the greater the likelihood of educational attainment. Alon and Tienda [39]; instead, argue that minority students are more likely to get a degree if they enroll in universities that are more selective. While the first result is rather intuitive, the second is supported by the fact that the performance of minority students is enhanced when universities provide higher-quality standards of both faculty and peers. Sociological contributions observe that blacks drop out from university at a significantly higher rate than whites [43,44,51]),[13] but they do not agree on the nature of the differences observed as it is not yet clear how ethnicity interacts with the various factors that influence persistence [47–50]. Although these contributions improve our understanding of the factors behind the differential success of minority groups in university, the existing body of research is not sufficient to form a reliable set of conclusions since it has mainly been guided by inconsistent data and by a correlational approach. Indeed, more recent papers are still not conclusive. For instance, using the Education Longitudinal Study Ciocca Eller and DiPrete [40] show that black people are more at risk of bachelor degree non-completion because of their lower academic and socio-economic resources. Other studies emphasize the role played by relational factors [184]. Similar to women in male-dominated subjects, students from ethnic minorities have a feeling of being "less at home" than students

[12] These papers apply the following definitions of dropout rate: the share of students who leave tertiary education system within the legal duration [36] and within the first two years of first enrollment [27].

[13] Withdrawal is calculated as the portion of students dropping out within eight years of first enrollment.

from ethnic majorities. This may result in a difficulty in sharing the "institutional habitus" of the academic context in which they find themselves [52] and in a sense of not belonging to the institution [42,45], with a negative impact on their probability of study success.

Likewise, *student ability*—generally measured by prior school achievements—seems to play a controversial role in determining the probability of dropping out. Some articles show that students with better educational attainments (i.e., better type of high school and prior educational achievement) are less likely to drop out of university [20–22,24,25,54,62–64,66].[14] Researchers have found high school grades to be stronger predictors of college academic achievement during the first college year and first-year retention than any other factors [57,61,65,67].[15] By analyzing the longitudinal retention of 52,989 students attending 365 higher institutions and using average high school grades to generate a regression formula to estimate expected institutional retention rates, Astin's [55] study reveals that high school grades are viable predictors of college persistence. For Germany, Danilowicz-Gösele et al. [59] find that one's high school final mark is the most important determinant of both the probability of earning a degree and of obtaining a high final grade [17,58]. provide evidence that students from technical and vocational high schools have lower chances of obtaining a university degree in Italy. By interacting a student's prior in-class performance with the university ranking, Arulampalam et al. [26] show that stronger students are less likely to dropout, a result driven by the behavior of students in highly ranked universities.

In contrast, a number of studies show that students with higher final marks in secondary school are more likely to withdraw [27,60]. In this regard, educational behavior can be influenced by the combination of high expectations and university achievement: whenever students' beliefs are not met by university performance, they are more likely to drop out. Such findings further prove the key role played by the degree of academic integration in determining students' outcomes.

The dropout probability is also directly correlated to a student's awareness of her academic skills, which could be overly optimistic at the time of starting college [3,10,12,68–70].[16] In line with these findings, Bound et al. [28,56] compare two cohorts of high school leavers in the US (1972 and 1992) and observe that the increase in the number of freshmen was not paralleled by an equal increase in graduates. They argue that this might be due, in part, to the fact that freshmen are ill-prepared to complete post-secondary education. In particular, the authors show that a decline in the pre-collegiate preparation of students, which is measured by math test scores, accounts for about one third of the dropout rate observed.

Early academic achievements appear to significantly influence the probability of dropping out: students are more likely to continue university if they get good grades right at the beginning, regardless of their previous school experience [19,27,71,72]. In addition, in a survey conducted on students at Berea College,[17] Stinebrickner and Stinebrickner [12] observe that poor grades at the beginning may influence dropout in three ways: a) through grade progression cutoffs that force students out of university, b) by decreasing the ex-post payoffs to education, and c) by reducing the enjoyability of university. Through a dynamic learning model of university dropout, they also show that 45% of dropouts in the first two years are due to increased student awareness of their low academic performance; however, this effect vanishes in the following years. As expected, early academic achievements reinforce a student's feeling of academic integration and her commitment to the institution.

Another issue concerns the correlation between the *amount of time dedicated to study* and university outcomes, although the time devoted to study may not always be an individual decision when, for example, students have to work to finance their degree program. Or it could be related to the characteristics of the institution in terms of organization, type of services, quality of teachers, and workload required (see Section 3.4.1). Research carried out in the US highlights that the time spent attending classes and studying has decreased over the past few decades, thereby lengthening the time to degree completion [73,76]. Such empirical evidence should nonetheless be examined carefully as tertiary education outcomes not only depend on the time spent studying but also on the interaction between study time and a student's abilities and motivation [74,75]. A reduction in study time is often related to the fact that students work. For example, Stinebrickner and Stinebrickner [77]; by using as an instrumental variable (IV) the random assignment of Berea College students to a mandatory work-study program, correlated with different working hours, show that an increase in working time during university negatively affects academic performance. This finding is partially confirmed by Darolia [81]; who extends the analysis to all American students (divided into part-time and full-time workers), as well as to all off-campus jobs. This analysis relies on estimates with fixed effects to control for unobserved and permanent student characteristics that may affect both work and study intensity. In addition, generalized method of moments (GMMs) models are employed to account for potentially endogenous relationships between working and academic performance varying over time. Darolia [81] shows that long working hours decrease the number of credits completed by full-time students but do not significantly affect the grade distribution. Bozick [79] finds that students from low-income families are more likely to live at home and to work during the first year of college; this cost-saving strategy reduces the likelihood of enrolling in the second academic year. In particular, this study underlines that the risk of withdrawal is larger for students working more than 20 h but who live with their families rather than on campus, as if peers might be more helpful than families when students have to combine work and study loads. Similarly, the negative impact of working time on academic progression, even at a "low intensity", is confirmed by Triventi [86] in a study where a cohort of European students is analyzed by means of a negative binomial regression model that considers work experience as an endogenous multinomial treatment. In general, having a job while at university entails a high risk of dropping out—especially for students who work more than 20 h per week, namely long part-time workers [52,78,80,82–85]).[18]

In summary, even though they have been found to be relevant, pre-entry characteristics of students such as age, gender, and ethnicity are insufficient to predict dropout. Although entering university at an older age will reduce the payoff time of tertiary education, there are reasons to believe that investment costs may also be lower given the better knowledge of one's skills and inclinations. But expected non-monetary costs may be higher if older students are unlikely to integrate with their classmates or interact with professors. At the same time, gender and ethnicity are not sufficient to determine persistence as there is no clear relationship between gender or race and net returns to tertiary education, unless the labor market discriminates. According to the results of the above literature, a student's behavior and awareness of her

[14] [62] defines the dropout rate as the share of students who leave the tertiary education system within six years of first enrollment, while for [63] this is within four years of first enrollment.

[15] Dropout is defined as the portion of students who leave university within the legal duration of a degree.

[16] Other psychological characteristics at the time of post-secondary education enrollment (e.g., self-confidence, stress management, inclination to procrastinate, and so on) that may affect university success or failure are key topics of some psychological/cognitive studies, but as explained, this review will not address these. See, for instance, [153–155]; and [156].

[17] Berea College was founded with the aim of offering access to tertiary education for deserving students who had limited financial resources, thanks to low tuition fees and affordable accommodation.

[18] These papers apply the following definitions of dropout: the share of students who leave the tertiary education system within the legal duration [80,83], within four years of first enrollment [52], and within eight years of first enrollment [85].

ability are more effective in determining her persistence, as well as the time devoted to studying (and being a full-time student). Given the effort, and therefore the non-monetary costs of the investment, a motivated and well-integrated student will have higher non-monetary benefits as well as a greater return on her degree, all things being equal in terms of monetary costs.

3.2. Parental background and family networks

The body of literature addressing the intergenerational transmission of education has provided conclusive evidence that family characteristics strongly affects children's educational attainment, although to a different extent depending on the country and education system considered (e.g., Refs. [157–163]. In particular, several studies show that *parental background* (proxied by parents' education or occupation) is negatively correlated with dropout behavior [62]. For instance, Johnes and McNabb [98] find that parent occupation plays a significant role in determining both educational attainment and voluntary dropout, providing evidence that students with parents employed in unskilled jobs are more at risk of failure. Indeed, DeAngelo and Franke [91] find that academic readiness[19] eliminates differences in university persistence for low-income and first-generation students, while this link remains for less-ready students. A consistent result in the literature is the positive connection between socio-economic status on the one hand and retention and degree completion on the other (see, among others, [29,79,87,88,92,94–97]; and [100])[20]. This does not appear to be a general result, since Arulampalam et al. [24,25,89])[21] find a negligible effect of social class background for students enrolled in medical school—although having a medical doctor as a parent reduces the likelihood of non-completion. It has to be noted that poor parental background has a negative impact on students' achievements *per se*, regardless of the effect mediated by worse family financial conditions. Students who come from backgrounds characterized by low (no) participation in higher education may find it difficult to comply with the academic culture and habitus as they cannot benefit from support offered by parents and friends who already had similar experiences. As for females in male-dominated fields or students from ethnic minorities, they may develop a sense of not belonging to the institution [101].

Raw data show that high-school leavers from *low-income families* are generally less likely to obtain a university degree. For example, according to Manski [99] the probability of graduating for students from low-income families in the US is half that of those from affluent families. A possible explanation is that poor students might have to work in order to afford increasingly higher tuition fees (e.g., in the US and the UK), especially in the absence of financial aid (i.e., scholarships, grants, or loans). This, in turn, would reduce their commitment to graduating by increasing their need to devote time to non-academic activities [90,93].

Family resources may influence the probability of dropping out through another channel as well. Students from low-income households could be the first ones in their family to get a degree, leading to potentially lower-than-expected university returns due to the lack of good family networks[22] or family business inheritance. This could prevent them from enrolling at university but could also favor the choice to drop out after experiencing early academic or financial problems [102–104]. Nevertheless, in investigating the relationship between parental income and persistence, results are driven by the specific nature of the tertiary education system (see, for example, [170]. When tuition fees are related to family income, like in the Italian university system, Aina [87] finds that household economic conditions do not affect dropout rates but academic persistence is positively correlated with parental education. Stinebrickner and Stinebrickner [77] provide an alternative explanation for the higher dropout rate observed for less-privileged students. Again, using administrative data and *ad hoc* surveys of Berea College students, they demonstrate that academic failure of students from low-income families also occurs in the absence of direct education costs. By integrating this administrative data with a set of information gathered through repeated surveys on financial conditions, Stinebrickner and Stinebrickner [105] identify credit-constrained students and show that dropout determinants are mainly related to other factors; indeed, when financial constraints are removed dropout rates remain unchanged.

Given the conclusive evidence offered by the literature regarding the strong effect of parental background on children's education attainments, we interpret the results presented in this section as supporting the idea that the family positively influences children's cognitive development and effort, their motivation, and the expectations from their tertiary education investment. Financial support—and therefore the reduction of the investment cost—is important but it is secondary (especially in countries where universities are publicly funded) to what parents can do to help their children choose the right university path and how they guide them during the study period. Any parental support (monetary or non-monetary) reduces the costs of university investment, and whenever a family's networks favor entry into the labor market, their expected returns also increase.

3.3. Academic/social integration and institutional/goal commitment (relational factors)

Since the studies of Spady [6]; Tinto [7]; Pascarella and Terenzini [5,109]; 1979), Pascarella et al. [110]; and Terenzini and Pascarella [110]; the nature of students' institutional relationships has been extensively explored, especially in the field of sociology. In short, this literature asserts that the matching between a student's initial motivation, intentions, and commitment and the institution's academic and social characteristics helps shape the degree of commitment of each undergraduate and thus her probability of retention. The baseline assumption is that students are more likely to stay enrolled when they are actively involved in campus activities and feel a sense of community in the institution [107,108]. As mentioned above, student's initial goals and commitments are in turn affected by student's pre-entry attributes, the role of which has been clarified in previous sections. We now focus on the effect of integration *per se* in shaping student outcomes and on the potential ways to ameliorate it. In fact, *students' abilities to interact* with peers and professors is crucial to determining their university persistence. In particular, Tinto [113] reports that students participating in study/learning groups are more likely to persist between the first and the second year of university. This is thanks to the reference network and the bond created with the institution, albeit the results reveal only a simple correlation as the adopted methodology does not address the endogeneity of student participation in study groups. To date, the most convincing post-secondary peer-effect studies have exploited situations in which students have been randomly assigned to dorms and/or roommates. Findings have shown only mixed evidence regarding the existence of positive peer effects on academic performance.[23] For example, using administrative data integrated with a unique survey on

[19] We mean the set of skills, knowledge, and behaviors a high school student should have upon graduating and entering their freshman year of college. Basically, whether a student has the ability to succeed when studying at an institute of higher learning.

[20] Dropout is calculated as the portion of students who withdraw within the legal duration of a degree.

[21] Dropout is defined as the portion of students who withdraw within three years of first enrollment.

[22] The existing literature suggests the central importance of social networks [164]. Family and social networks are stated as one of the main channels that affect labor-market outcomes (see [165–169].

[23] A major drawback of these contributions is that roommates are generally only a small subset of an individual's actual peer group.

roommates' observable characteristics, Stinebrickner and Stinebrickner [112] find small contextual effects for females at Berea College and no evidence of peer effects for males.[24] Similarly, Zimmerman [114] and Sacerdote [111] find small positive peer effects on students' grades, grade point averages, and the take-up of social networks such as fraternities/sororities. Carrell et al. [106]; using data that enable them to identify with great precision the known exogenous peer group that a student spends a majority of her time interacting with, instead find larger positive effects than observed in previous studies, though these effects persist at a diminishing rate.

As mentioned, a large body of literature correlates the probability of obtaining a degree with the level of *student academic integration* (see, for instance Refs. [7,172], and institutional commitment [115]. According to Pascarella and Terenzini [109] and Terenzini and Pascarella [50, 118]; among the relationships between faculty members and students, the informal exchange of views or interactions aimed at discussing students' academic achievements are especially important. However, such contacts are not equally effective for all students as these academic ties are strictly related to student characteristics such as ethnicity and socio-economic background. In this regard, Cabrera et al. [90] argue that financial aid to low-income students promotes their integration into the academic and social components of the institution and their degree of commitment to staying enrolled. With reference to Pascarella et al. [108]; the organization of intensive (i.e., full-time) orientation days at the beginning of university courses appears to be particularly effective at strengthening the link between students and universities. Nevertheless, this literature cannot give policy indications because it does not consider the potential endogeneity of student integration into university. Similarly, Pascarella and Terenzini [49] conclude that a quick identification (by means of proper determinants) of students who are more at risk of dropping out would allow universities to implement *ad hoc* interventions for these students (e.g., counseling, tutoring, etc.). Zhao and Kub [119] find a positive correlation between student engagement and persistence to the second academic year, even after controlling for a host of pre-university characteristics and other variables (e.g., parental background, merit, etc.). Overall, academic integration can be influenced by institutions with teaching practices and programmatic interventions, such as first-year seminars, service-learning courses, and learning communities, that promote involvement in complementary academic and social activities beyond the classroom. Empirical evidence shows that these out-of-class activities increase student retention and personal and interpersonal development (see, for example, [117]. By monitoring the participation of freshmen in social media groups managed by other students (e.g., on Facebook), Masserini and Bini [116] analyze the effects of the exposure to this type of community, which provides information on courses and other useful materials for exam preparation, on the probability of dropping out in the first year. Their results are robust to sample selection bias in the treatment, showing that the risk of withdrawal is lower for students participating in these groups as they demonstrate a greater engagement with academic life.

In our view, these empirical results support the idea that relational factors influence dropout either directly or indirectly. Directly because students who are actively involved in campus activities and feel a sense of community in the institution incur lower non-monetary costs and obtain higher non-monetary benefits, thus increasing their persistence; indirectly because the way in which a student relates to peers and faculty also depends on her personal characteristics (age, sex, race, ability), motivation, family background, and organizational features of the institution (facilities, tuition fees, and financial aid).

[24] For a general overview of the role exerted by peers on educational outcomes, see [171].

3.4. Features of the tertiary education system and context

This feature cluster includes a wide and rather heterogeneous set of characteristics; hence, we distinguish between two different subcategories. The first is university facilities, admission rules, and the organization of academic activities, and the second involves tuition fees and financial/in-kind aid.

3.4.1. University facilities, admission rules, and the organization of academic activities

There are several useful indicators to identify facilities offered to students by universities that may affect the cost of education (principally non-monetary). Indeed, features of degree-course organization may influence student success by stimulating or discouraging their motivation and college progression [124,129]. Among these, the most commonly investigated is the *teacher/student ratio*. Other measures include the number of students attending class, the number of tutoring hours, and the time spent on bureaucratic tasks. According to some studies widely acknowledged in the US [56,63,121], the increase in university failure over the last few years is related to a worsening of the *"quality" of the services* offered to students, as a result of an increased demand for post-secondary education not paralleled by an adequate growth in university resources. In this regard, three papers by Bound and Turner [120] and by Bound et al. [28,56] analyze two cohorts of students, enrolled in 1972 and 1988, to estimate the 1988 counterfactual attainment rates based on collegiate characteristics in 1972. They demonstrate that the increase in dropouts, dating back to the 1990s, is determined not only by a decrease in the financial and human resources per student but also by an upturn in enrollment in universities with poorer resources (i.e., sectoral shift). Focusing on the supply-side of higher education, they underline that declines in resources per student account for about one fourth of the observed aggregate reduction in completion rates. Herzog [123] corroborates the importance of the quality of academic resources, obtaining a negative correlation between the ratio of *tenure-track faculty members to temporary faculty members* and the dropout probability. A more recent paper [127] quantifies resources through the total number of available slots in various courses at the University of California, Davis. This analysis is based on the observation that in a situation of course scarcity, students are more likely to enroll in courses they are not very interested in, thus working less hard, passing fewer exams and eventually dropping out with higher probability, due to decreasing future returns. According to Ref. [128]; retention and graduation rates are higher in large institutions because of the greater amount of academic services and support universities can provide to students, due to scale economies. As shown in Section 3.3, the availability of academic services and support enhances retention also through the relationships created between students and faculty during these activities.

Tertiary education systems applying *admission criteria* are characterized by lower dropout rates compared to less-selective systems [28, 56,121]. Nevertheless, selective processes are effective only if they are designed to obtain a good match between students and higher institutions. In this respect, by taking advantage of a natural admission experiment at the University of California, Kurlaender and Grodsky [133] find that students who are overqualified do not benefit in terms of higher grades or lower dropout rates, while attending less competitive universities ensures the accumulation of more credits. Indeed, Light and Strayer [41] find a significant effect of the match between student ability and college quality. In particular, students at the bottom of the ability distribution increase their chances of graduating by attending the least-selective colleges, while the prospects of the most-able students increase when enrolled in a top-tier college compared to low-level ones. Meaning that to express all of their potential, students need to confront themselves within an academic environment that makes their full integration possible. Regarding the design of admissions tests, Arulampalam et al. [89] show that the dropout rate at UK medical schools is mainly

caused by increasingly less efficient rules for the selection of entering students. Such policies, which are generally based on observable characteristics of students (e.g., final high school marks, type of high school attended, grades in the main subjects, etc.), do not allow for a correct assessment of student motivation or attitudes to medical studies. More generally, Arulampalam et al. [89] and Smith and Naylor [21] discuss the trade-off faced by universities. On the one hand, to preserve their financial stability tertiary education institutes need to increase enrollments, which may lead to admitting students who lack adequate academic preparation and/or motivation. On the other hand, universities are forced to improve their efficiency by reducing dropout. Francesconi et al. [132]; using administrative data from a large private Italian university, report the inefficacy of the admission selection process with regard to the academic performance of selected students, thus arguing that the existence of many public universities not implementing strict procedures for student selection provides a valid outside option. Carrieri et al. [130] instead find that a selective admission policy introduced in a large, public, southern Italian university reduced the dropout rate for freshmen and improved their grade point averages. They claim that this result was mainly driven by the narrow university supply in the area. Using counterfactual analysis, Declercq and Verboven [131] analyze the region of Flanders in Belgium, where no university admission policies are applied, showing that the introduction of ex-ante screening criteria significantly contributes to reducing early dropout, thanks to a better match of students with the right majors.

According to Montmarquette et al. [19]; the learning environment and the possibility for a student to establish fruitful relationships with faculty members and peers is crucial. In support of this hypothesis, the authors show the existence of a non-linear relationship between *class size* and dropout probability. In disagreement with a previous analysis, which highlights that small classes favor academic performance, Montmarquette et al. [19] find that the ideal class size, in terms of persistence probability, is between 80 and 90 students; if it exceeds 110 students the persistence probability drops dramatically. The authors provide a rationale for their finding by speculating that optimal academic performance is achieved through the greater effort provided by professors in developing a lesson plan once the class size is perceived as adequate and effective (i.e., neither too small nor too large). Furthermore, in this context other factors such as the availability of technology support in the classroom, peer tutoring and mentoring, learning services, supplemental instruction, and demonstrably effective teaching practices—if they are in place and working as intended—seem to boost academic performance [125,126].

According to Di Pietro and Cutillo [122]; a greater *flexibility in curricula* and the improvement of services offered to students after the 2001 reform of the Italian tertiary education system (i.e., the Bologna Process)[25] had an overall positive effect on academic performance, leading to a subsequent decrease in the rates of dropout within three years of first enrolment. Likewise, a recent paper by Hahm and Kluve [173] using administrative data from a large German university found that the probability of retention increases for students enrolled in degree programs post-Bologna.[26] Different universities deliver different completion rates. With reference to two-year and four-year colleges, Velez [53] shows more dropouts among students enrolled in the former than in the latter, and he suggests that to improve the overall completion rates—and especially for the weakest group—policies aimed at enhancing the amount of campus housing and the number of work-study jobs are required.

3.4.2. *Tuition fees and financial/in-kind aid*

The degree of public funding and the amount of financial aid available to students has a great impact on the costs of getting a degree, and these depend on the characteristics of the university system in a particular country. For example, in OECD countries 70% of tertiary education costs, on average, are financed by taxpayers, whereas this figure is about 78% in EU countries [175]. The public support for tertiary education goes from less than 40% of total spending in some countries (i.e., the US, UK, Korea, Japan, Chile, and Australia) to more than 90% in others (i.e., Sweden, Iceland, Austria, Denmark, Finland, and Norway).

Kane [141] shows that university fees play a major role when deciding whether it is worthwhile to invest in tertiary education. Remarkably, students coming from low-income families appear to be more responsive to a one-dollar reduction in tuition fees than to a one-dollar increase in financial aid. Similarly, Voorhees [146] highlights the positive influence of student finances on the persistence of freshmen with high financial need, regardless of the type or amount of aid awarded. The empirical analysis of Garibaldi et al. [139]; which applies a regression discontinuity design to a homogeneous sample of students enrolled at a private Italian university, shows that an increase in university fees does not cause more students to drop out. Instead, Scott-Clayton [76] finds that high university fees (and low public support of tertiary education funding) force low-income students to work to support their studies as their families either cannot help them financially or cannot get access to loans. Even though such a result might seem to contrast with those mentioned above, it has to be noted that the average tuition fees in the US, where Scott-Clayton's empirical exercise was carried out, are much higher than in Europe where the other two studies are focused.

University students may benefit from various types of *monetary or in-kind transfers*: scholarships, fee exemptions, food stamps, housing, books, etc. In this regard, previous studies of university dropout have mainly focused on the effect of financial aid, omitting from their analysis transfers in kind (i.e., services directly offered to students). In general, the findings suggest that financial aid improves the equality of opportunities between affluent and low-income students (see, for example [90,93,136,137,140,144],).[27] For example [38], observes that the negative or negligible effects of financial aid on the probability of university persistence—a quite puzzling result of the empirical literature until the early 2000s—are mainly due to the endogenous access to such aid [60]. If not properly addressed, the non-random selection of students who can access financial aid could attribute to intervention a misleading effect, which in fact depends on the characteristics of the students benefiting from it, notably individuals who often belong to low-income groups (e.g., minority groups). An example of such a result can be found in Stratton et al. [22]; who analyze three outcomes (i.e., persistence, dropout, and stopout behaviors) in a multinomial logit context to demonstrate that students receiving a scholarship are more likely to drop out than students receiving a loan. This finding can be explained by observing the different criteria that regulate the access to loans and scholarships: university loans generally go to students with high credit scores, while scholarships are given to low-income students according to merit. Studies that consider the non-random selection of financial aid recipients reach different conclusions. Comparing individuals who are entitled to a scholarship with those who actually receive one, Singell [145] shows that an increase of $1000 in a scholarship can increase the probability of persistence to the second year of university by 1.4%–

[25] The Bologna Process seeks to bring more coherence to higher education systems across Europe by creating the European Higher Education Area (EHEA). In 1999, all signatory countries had to adapt their education systems in accordance with a two-tier system consisting of an undergraduate level (Bachelor) and a graduate level (Master).

[26] A further paper on Germany [174] finds no significant effect of the Bologna reform on the dropout probability. [173] argue that this result depends on the use of aggregate-level data that do not allow identifying causal effects.

[27] These papers apply the following definitions of dropout: the share of students who leave the tertiary education system within the first two years of first enrollment [136] and within six years of first enrollment [137].

4.3%. Furthermore, using an IV strategy, Alon [102] finds similar results for the probability of obtaining a degree, especially when minority students (e.g., Afro-Americans, Hispanics, and so on) are the recipients of such benefits. Considering that the access to financial aid was available to all students who turned down other incomes, Arendt [135] reports that a reform implemented in Demark in 1988—which brought the total amount of financial aid per student to $3000 per year—had negligible effects on the dropout rates of students from wealthy and highly educated families. The same reform dramatically reduced the dropout rate of students from non-graduate families, however. Likewise, Dynarski [138] applies a difference-in-differences methodology to exploit a policy change due to the elimination of a benefit program dedicated to helping the children of Social Security beneficiaries go to college, finding a positive effect of aid grants on the probability of attending college and of obtaining a degree. By exploiting the discontinuity created in the dollar amount of Pell grants in the US when students have siblings attending college, Alon [134] find that the benefits of need-based grants are not equally distributed in the student population as the greater advantage is for low- and middle-income students. Thus, to achieve equality of educational opportunities it is necessary to implement more efficient allocation criteria. Kerkvliet and Nowell [142] report that financial aid affects retention, but the effects differ by type of support and university.

Interestingly, a greater geographical diffusion of universities may also be seen as an "indirect" financial aid to students, considering that this reduces mobility costs. In the 1990s, the Italian education system changed the geographical distribution of its universities at the province level; exploiting this change and controlling for selection at the time of enrollment, Oppedisano [143] finds that the opening of a new university site reduces by 6% points the rate of dropout within the legal duration of a degree.

University systems are quite different between and within countries, given the resources available and the way they use them. The literature shows that in order to have high university persistence it is fundamental: a) to create the conditions to improve the quality of the match between the skills of the students and the characteristics of the programs; b) to offer a high quality of teaching and services (e.g., tutoring, counseling) in order to promote the learning process; but even c) to create the right climate that fosters collaboration between students as well as a fruitful exchange between students and professors. Finally, financial aids to low-income students, which reduce the cost of investment, have proven their efficacy in more recent papers where the endogeneity issue is rightly considered.

3.5. Labor market conditions

Labor market conditions are crucial determinants of student decisions regarding education [70] since they affect both foregone earnings once enrolled and earnings as university graduates.[28] Consequently, a rise in the unemployment rate could lead either to educational persistence, by reducing the opportunity cost of the investment due to job scarcity, or to university dropout if students predict a lower-than-expected ex-post return to education.

Analyzing community college students—who tend to be more sensitive to changing local labor market conditions than 4-year college students— Kienzl et al. [177] find that the worsening of labor market conditions increases the likelihood of dropping out. Nevertheless, the authors show that when reevaluating their costs relative to the benefits after each year, students take into consideration not only changes in local employment rates but also possible changes in tuition fees. Accordingly, Smith & Naylor [21] found that an increase in unemployment rates increases dropouts in the UK. Similarly, Bradley and Migali [148] find that in high-unemployment areas, the causal effect of the last recession (measured with a diff-in-diff methodology) increased the risk of dropping out, especially for men. As for Italy, the evidence is mixed. Contini et al. [58] find that enrolment, retention, and timely completion are negatively related to local youth unemployment rates, suggesting that poor labor market conditions demotivate university students. Di Pietro [149] shows that such a result holds only in specifications omitting regional dummy variables since unemployment rates would capture the uncontrolled regional heterogeneity effect. In contrast, the inclusion of regional dummy variables reveals a negative correlation between unemployment rates and dropout probability. This result can be explained by the tendency of Italian students to remain at university in the presence of job scarcity, a choice that is also determined by the relatively low (direct) cost of attending Italian public universities. Similarly, Adamopoulou and Tanzi [147]; analyzing data within three years of first enrollment, find that the recession reduced the risk of withdrawal for Italian students. The authors explain this result, which contrasts with findings reported by Bradley and Migali [148] in the UK, by arguing that during recessions in Italy the youth unemployment rate increases more sharply than the adult one, therefore confirming the importance of opportunity costs in education decisions. In line with Adamopoulou and Tanzi [147]; Ghignoni [150] shows that during the crisis in Italy the aggregate decline of the dropout rates within three years of first enrollment occurred due to two opposite forces. Notably, better university intakes in terms of parental background and student characteristics reduces non-completion, whereas student behavior, in response to changes in family economic conditions, drives up withdrawal.

Labor market conditions play a central role in the decision to invest in tertiary education. They influence the net return by acting on the opportunity costs and the expected returns, unless the economy is hit by a very temporary shock. The literature surveyed above shows that the unemployment rate could capture the probability of entering the labor market and therefore the opportunity cost. But to forecast the future returns it would be necessary to know the actual future perspectives of the graduate (given her profile), which also depend on her family network and on the college ties she will be able to build during her university studies. This kind of analysis is rather lacking in the literature (see, for instance, Ref. [165].

4. Discussion and concluding remarks

Using a theoretical framework able to encompass the dynamic human capital investment model [3,9–11] and two milestones of the sociological analyses [7,14,15], we review the recent literature on university dropout. According to the adopted framework, once enrolled at university students update their information set and react to the stimulus they receive from the environment, thus revising the expected benefits and costs of their investment. As a consequence, they could change their previous choice, modifying the optimal number of years of schooling. Students more at risk of dropout, *ceteris paribus,* are those who experience that the actual returns to tertiary education (i.e., the expected NPV of the investment decision) are lower than expected at the time of first university enrollment. Within this framework, reducing the information gap is a key aspect to fighting early withdrawals. Therefore, effective policy interventions are those aimed at helping young people understand their attitudes, abilities, and aspirations and, in line with these, to choose the university path that best suits them (e.g., investing in orientation programming).

Furthermore, this review underlines that beyond the dimensions mainly explored by the economic literature—namely individual and family characteristics, labor market conditions, and the university system context—it is necessary to consider the integration of students into

[28] A recent paper by Ghignoni et al. [176] shows reverse causality: spending a period of time at university and dropping out before completion within four years of first enrollment makes the transition to work substantially more difficult. According to the theoretical model we refer to, since students incorporate this information into their decision sets, the likelihood of enrolling in university will be reduced.

the academic and social components of the university, because establishing successful relationships with peers and faculty increases student engagement with the institution and reduces the probability of dropping out.

All in all, this survey argues that the dynamic human capital economic model, based on cost/benefit analysis and emphasizing informational issues, needs to be integrated with the contributions of the sociological literature in order to provide a more powerful explanation of the dropout phenomenon. The extensive empirical socio-economic literature surveyed here suggests that the dropout process is a complex phenomenon characterized by several channels and mechanisms, making it difficult to rank each determinant. Despite these limitations, we offer a discussion of the factors that lower graduation rates. By doing so, we highlight the characteristics upon which actions can be taken to deal with early withdrawal, referring to the five categories into which they have been grouped (see Section 3). Findings on student demographic characteristics (age, gender, and ethnicity, etc.), parental background, and prior educational achievements confirm that they are related to students' academic outcomes. Once students are enrolled at university, these pre-entry determinants can only be used to detect those who are more "at risk" of dropping out. Likewise, the labor market conditions (expected salaries for undergraduates and graduates) significantly affect the opportunity costs of staying in university, though they cannot be directly tackled. Therefore, given the resulting most predictable effects on university attrition of these categories of determinants, it is important to act on them either ex-ante, by improving the information set of individuals when they make the choice to enroll in university, or ex-post, by increasing their integration into the academic and social components of the institution.

With reference to tertiary education features (described in Section 3.4), which are quite different between and within countries, evidence suggests that they are key to explaining college persistence. These factors are more interesting from a policy point of view as they can be manipulated with appropriate interventions.

Finally, a central role is played by relational factors as college students who are more socially or academically integrated are less likely to drop out. The level of social or academic integration depends both on student characteristics (age, sex, race, ability, motivation, family background) and on organizational features of the institution (facilities, campus activities), thus shaping the overall student experience.

Given the above findings, to reduce dropout policymakers may directly intervene with measures aiming to improve features of the tertiary education system and context as well as promote academic and social integration on university campuses. To pursue the best possible match between the characteristics, motivations, and ambitions of students and the degree programs, policy interventions should mainly tackle public tertiary education systems at two different levels, namely the macro and meso levels.

At the macro level, each country should offer different pathways to students with heterogenous secondary school backgrounds.[29] It is also important that the education system provides students with reliable information about their attitudes and competencies at the end of secondary school, for instance, by offering them national standardized tests and the possibility to participate in orientation programs. Nonetheless, the implementation of selective policies is not an easy task as they should ensure equality of opportunities in education—that is, individuals can access quality education regardless of gender, social background, race, area of residence, etc. To this aim, to encourage attendance as full-time students (i.e., increasing study time), we suggest having a widespread presence of universities throughout the country (see, for example [143], and/or a well-designed scholarship system to finance the cost of living outside the parents' home and overcome potential financial constraints.

At the meso level, each institution should ensure a good variety of options by offering a wide range of degree programs, so that each student can find the university program that best suits her characteristics and aspirations. Moreover, all initiatives that foster social and academic integration can positively affect student persistence. For instance, outside the classroom the presence of "agents" (instructors/faculty, staff, other students) helping minority students or students from disadvantaged backgrounds can increase their sense of belonging to the institution [178]; within the classroom, problem-based learning (instead of conventional lecture-based learning) can help students develop connections within their peers [179].

Finally, to increase persistence each institution should monitor its students' progress and when it detects critical issues, it should intervene with counseling, mentoring, and tutoring activities. Needless to say that the effectiveness of all these actions can vary between countries and institutions on the basis of the amount of resources allocated.

In summary, by comparing the two approaches it emerges that sociological studies are more careful to properly represent the complexity of the dropout process, unveiling all of the potential mechanisms that explain this behavior, and especially those related to the social dimension of the individual. A limit of this approach is that it makes it difficult to predict student behavior, given the complexity of the model adopted and the interactions across factors. On the other hand, the economic approach is based on a "simpler" (in terms of the factors and mechanisms considered) but more operative model in that it is possible to foresee student behavior once one or more parameters of the model change. Moreover, empirical economic studies devote more attention to the causality issue and, as such, they may provide more insight to policymakers. In our opinion, incorporating the relational dimension of the individual within the economic model, as suggested by this survey, could improve our understanding of the dropout phenomenon. In order to better address university dropout issues, future research should jointly consider the determinants mainly explored by the economic literature (i.e., personal characteristics, family background, institutional features, and labor market conditions) as well as those drawn from the sociological literature, namely relational factors.

CRediT authorship contribution statement

Carmen Aina: Conceptualization, Methodology, Investigation, Writing – review & editing, Funding acquisition. **Eliana Baici:** Conceptualization, Writing – review & editing, Funding acquisition. **Giorgia Casalone:** Conceptualization, Methodology, Investigation, Writing – review & editing, Funding acquisition. **Francesco Pastore:** Conceptualization.

Acknowledgements

Funding from the Università del Piemonte Orientale is gratefully acknowledged. All authors declare that they have no conflict of interest. The usual disclaimers apply.

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