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A place too crowded to study: The impact of student cohort growth on the probability of university dropout

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Abstract

Introduction: This study examines the influence of major fluctuations in the number of students enrolling at university on the probability of dropout or a switch to a different course of study. Findings from the US show that a pronounced increase in student numbers leads to more dropouts. *Materials and methods:* This article provides an analysis of this relationship for the first time outside the US and for an entire university system. We use administrative data for all the students who started studying at Swiss universities between 1980 and 2001. *Results:* The results suggest a significant relationship between positive cohort growth and the probability of dropout. A reduction in student numbers, on the other hand, does not increase the probability of persistence. *Discussion:* Despite the negative influence of a big cohort on the probability of persistence, no statistically significant relationship exists, by contrast, between the change in student numbers and the probability of a student switching to a different course of study.

Keywords: dropouts, university, higher education, costs

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Introduction

The issue of university dropouts has received considerable attention in most European countries (Stiburek, Vlk, & Švec, 2017). Both the EU (European Commission, EACEA, & Eurydice, 2014) and Switzerland (WBF & EDK, 2015) have specified educational policy objectives that call for a reduction in the number of university dropouts. There are many reasons for this objective, but three of these stand out. First, in view of the high demand for a skilled workforce, it is in a country's interests to have as many students as possible achieving a tertiary-level qualification. Every student leaving university without a degree thus entails a loss for the economy as a whole. Second, policymakers committed to opening up universities to a greater extent, i.e., admitting "non-traditional" students to courses of study, have an obligation to ensure that these students not only enroll in a university but also leave the university with a degree. This is particularly important because being a dropout can entail negative consequences for the individual, such as financial costs – i.e., the direct and indirect costs of studying and poorer job prospects as compared to a situation where the student had earned a degree – and psychological or emotional costs (Edwards & Cangemi, 1990; Kaplan, Damphousse, & Kaplan, 1994; McCaul, Donaldson, Coladarci, & Davis, 1992). Moreover, since dropout rates are often higher for students with an unfavorable socioeconomic family background, they tend to increase distributional inequalities and worsen intergenerational mobility. Third, since the universities are primarily funded by the public purse, society incurs considerable education costs for dropouts, which they can scarcely generate in the form of higher tax revenues in the future.

In Switzerland, approximately 76% of undergraduate students currently complete their university studies, including those who have switched to a different course of study (Federal Statistical Office, 2015), and approximately 70% of students who graduated from high school obtain a graduate degree (Wolter, Diem, & Messer, 2014). Switzerland compares well with other OECD countries in this respect, but it must be borne in mind that, when drawing this comparison, Switzerland, with its low baccalaureate (high school) rate (20%; Federal Statistical Office, 2018), imposes greater quantitative restrictions on access to its universities than other countries. In view of the low baccalaureate rate, a much higher number of students would be expected to obtain a degree.

Although the research literature on the findings regarding the individual determinants of dropouts is already well backed up, the evidence for institutional and structural influencing factors is still considerably less well founded (Larsen, Kornbeck, Kristensen, Larsen, & Sommersel, 2013). As American studies suggest (Bound, Lovenheim, & Turner, 2010; Bound & Turner, 2007), it is not just the students and their preparation for university studies that are decisive for dropout. The supply side, i.e., the conduct of the universities, can be equally important. The studies show that if resources are inelastic over the short term, a pronounced increase in student numbers reduces the resources

available for the individual student and leads to more dropouts. On one hand, this could be due to a situation where the quality of the education provided suffers because of the reduction in resources and consequently more students have to leave the university due to inadequate academic performance. On the other hand, the increased dropout risk could also be due to the universities themselves. They may wish to limit the deterioration in staff–student ratios by raising the examination requirements. On the contrary, they might lower academic standards to maintain the number of students in the face of declining cohorts because of the fear of redundancies or the inability to fill job openings.

Other factors explaining the relationship between an increase in student numbers and dropout risk are conceivable. It may happen, for example, that students abandon their studies voluntarily because they find themselves confronted with inadequate study conditions or because they fear a deterioration in their employment opportunities if a pronounced increase comes about in student numbers. However, if the pronounced increases in student numbers are highly subject-specific, this might prompt more switches to a different course of study rather than definitive dropouts.

This article will be first analyzing the relationship between a pronounced increase in student numbers and dropout outside the US context. We will be examining three questions: (a) Does a non-anticipated, pronounced change in the size of an enrollment cohort for a specific subject of study at a university have an influence on definitive dropout? (b) Is this influence symmetrical, i.e., does growth in the enrollment cohort have the same impact as a contraction? (c) Does a non-anticipated, pronounced change in the cohort size also affect the probability to switch to a different course of study?

We use Swiss data to analyze the questions under consideration. Switzerland is a good case to study because the universities have virtually no influence on the student enrollment numbers, which allow students to choose their course of study freely (with just a few exceptions). However, the universities can partly regulate the size of student body and quality by staging (intermediate) examinations during the first few semesters. As compared to other countries, student selection upon entry and varying student population between universities are negligible. This context thus provides an ideal setting to examine the role of supply-side factors. Moreover, Switzerland is an interesting case to study for other countries too because access to university systems has widened globally, wherewith similar issues may arise.

Contextual Background of the Swiss Universities

Switzerland has 12 public universities: 10 cantonal universities and 2 federal institutes of technology (ETH). Seven of the universities are full universities, whereas five are specialized in specific disciplines. The universities vary in size from some 3,000 to more than 25,000 students.

The (conventional) universities are embedded in a higher education landscape, which also includes universities of applied sciences (founded in the past two decades) and professional education. The diversity of the higher education system is the consequence of the structure of the upper-secondary education, which is characterized by a limited access to baccalaureate schools (high schools) and a well-developed vocational education and training (VET) system. Nowadays, about 20% of an age cohort attains an (academic) baccalaureate (high-school diploma; Federal Statistical Office, 2018), which is very low by international comparison (cf. OECD, 2017, p. 258). On the other hand, two thirds of an age cohort attain a VET qualification. Holders of a VET diploma have various further education and training options, which provide good promotion and income opportunities. They can obtain a federal vocational baccalaureate – either during or after VET – which allows access to universities of applied sciences. It also offers the possibility to complete a university aptitude test, which gives access to the conventional universities.

Access to universities generally requires a baccalaureate (high-school diploma), which is attained at baccalaureate schools (general upper-secondary schools). However, 4% of students enter university with other educational qualifications (e.g., teacher education or technical college) and around 2% enter by university aptitude test or by portfolio (according to an analysis of the data in our analytic sample).

Over the past few decades, the number of students at Swiss universities has steadily risen. This increase has been due primarily to a rise in the baccalaureate rate and to a greater number of students with university admission qualifications obtained abroad. Set against this, the proportion of students with a Swiss university admission qualification who have abandoned their studies has fallen from 34% in the 1975 entry cohort to 29% in the 2001 entry cohort (Wolter et al., 2014). The declining trend in the dropout rate has been due almost entirely to the strong decrease in the dropout rates for women (from 46% to 29%), whereas the success rate for men has remained virtually unchanged (Wolter et al., 2014). For those who abandon their studies, somewhat less than half of them leave the university within the first four semesters.

Figure 1 displays the baccalaureate rate, the cohort growth (i.e., the percentage growth in the population entering university compared with the average for the two previous years), the dropout rate (i.e., the percentage of students who acquire no degree within 10 years), and the dropout rate within six semesters (i.e., the percentage of students who abandon their studies within the first six semesters) for the population and time span we focus on in our analyses. The figure shows that the baccalaureate rate has continuously increased over time (from 11% to 18%), whereas the cohort growth and

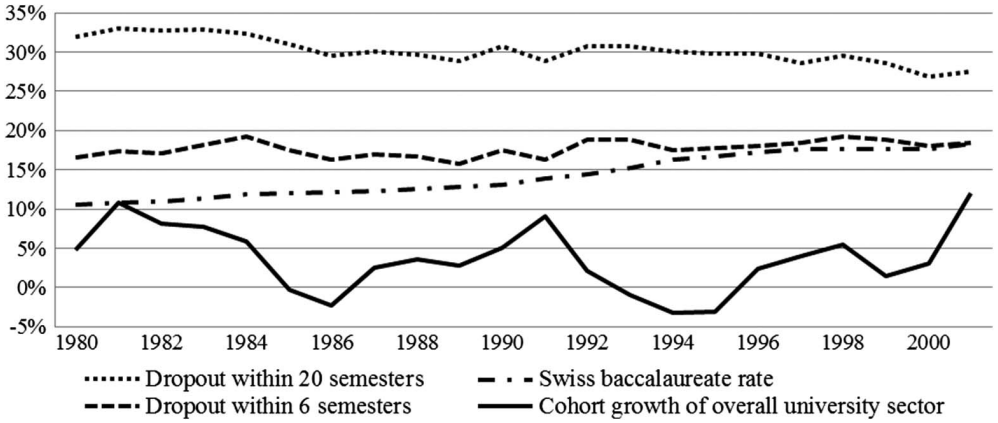

Figure 1. Dropout rates, Swiss baccalaureate rate, and change in cohort size (of overall university sector), 1980–2001

dropout rates have been oscillating unsystematically (the growth rate between −2% and 12%, the total dropout rate between 27% and 33%, and the dropout rate within six semesters between 16% and 19%). The two indicators of dropout run fairly parallel, as expected. However, no systematic association between the baccalaureate rate, cohort growth rate, and dropout rate is apparent at this level of aggregation.

The universities are, for the most part, funded by the public purse. To a great extent, the level of resources available to a university (with the exception of the ETHs) is linked to the number of students. This is because, for students attending the university from other cantons, the canton running a university receives a financial contribution from the student's home canton, which covers almost the full cost of the course of study. Most of the universities charge tuition fees between CHF 1,000 and CHF 1,700 per year, which corresponds to 1%–2% of the median yearly gross salary of a full-time, working university graduate 5 years after completion of their graduate studies. Two universities, however, charge somewhat higher fees (CHF 2,500–CHF 4,000). Overall, the fees paid by students are moderate compared with the fees in other European countries. The tuition fees for students from abroad are mostly similar to those for Swiss residents. The canton running a university receives, however, no financial contribution from the student's home country.

Overall, the universities enjoy a great deal of autonomy. For example, they are free regarding staffing decisions, resource allocation, curriculum design, etc. However, they are obliged to accept all students with a baccalaureate without any further prerequisites due to the limited access to baccalaureate schools. People holding a Swiss baccalaureate can choose to enroll at whichever university and in whichever undergraduate degree

program they want.[3,4] Students from abroad, whose university admission qualifications are assessed to be equivalent to the Swiss baccalaureate and who can show evidence of a study place in their home country, can also access universities.[5] Since the universities are unable to select their students (with the exceptions mentioned), they cannot dictate the quality or quantity of students upon entry. They do have, however, the opportunity to intervene and make adjustments while the students are studying by staging (intermediate) examinations. These exams typically take place at the end of the first and second years of undergraduate studies. The degree of selectivity of the examinations varies by subject field and university. Studies in the humanities, social sciences, and law are generally less selective than those in science, engineering, and economics. Moreover, a strategy with a strong selection during the first semesters is practiced in an exemplary manner for the courses in medicine at universities in the French-speaking part of Switzerland. Since the number of places for clinical studies is limited and no selection process (*numerus clausus*) is applied upon admission, a rigorous selection takes place during the first years of study. Thus, the risk of not obtaining a (further) place on a course essentially depends on the number of fellow students.

Theoretical Explanation Approaches, Status of Research, and Questions

Theoretical explanation approaches

The most influential model for explaining dropout is probably that of Vincent Tinto (1975). According to Tinto's student integration model, the students' integration into the university system is the most important factor in the process of dropout. Students must integrate in two different ways: first, in the academic system where their academic performance is examined, and second, in the social system where interaction takes place with fellow students and academic staff. Preuniversity factors, such as family background, previous schooling, and previously acquired skills, influence the integration process. External factors, such as the situation in the job market or financial circumstances, do not have a direct influence on the decision to drop out and can only exert an indirect influence, via the students' commitment to themselves to achieve their target of leaving university with a degree.

[3] The sole exceptions are the courses in medicine offered in the German-speaking part of Switzerland and, in some cases, the sports sciences, where entrance examinations are held on capacity grounds.

[4] Students may also correct their decision by changing university or subject at the beginning of the academic year or semester. However, in the case of a change to a different course of study, previous academic achievements are often not or only partly credited. Crediting is only possible if the new subject is closely related to the initial one (and thus requires the same modules), or if the originally chosen subject is retained as a minor (which is possible for subjects which are not offered as mono subjects).

[5] Restrictions only exist in one university (upper limit of foreign students of 25%) and for medicine.

Although Tinto's student integration model focuses on the interaction processes between individual student characteristics and the university system, organizational theory approaches place greater emphasis on the influence of institution-specific characteristics. The first considerations regarding the influence of institution-specific characteristics on dropout can be found in the study of Kamens (1971). Kamens argued that institutional characteristics, such as the size of the university or its prestige, influence students' socialization and hence structure the risk of dropout. Bean (1980, 1982) took up these considerations and developed the student attrition model in which the maintenance (or discontinuation) of studies is essentially influenced by the organizational or "bureaucratic" structures experienced. These experiences have an impact on the student's attitude or self-commitment toward the higher education institute and thus influence the decision to continue studying. Apart from this, external conditions, such as the opportunities for gainful employment, also affect persistence. Individual characteristics, such as academic performance, family background, or educational goals, are similarly taken into account in the model but play a subordinate role.

In a later model, Bean (1985) emphasized that the universities influence students' persistence in two ways: first, in their function of socializing, the students in academic terms and second through their function of selection. Dropout can thus be the result of failed socialization or the result of a selection carried out by the university organization.

Other studies highlight the influence of available financial resources. Hence, Titus (2006), working based on organizational action concepts (cf. Berger & Milem, 2000) and the resource dependence theory (cf. Slaughter & Leslie, 1997), argues that the level of institutional expenditure and the internal allocation of the expenses to the different functional units affect the probability of students continuing their studies. In addition, he emphasizes that the origin of the institutional income also has an influence on a student's study path.

In their considerations regarding an explanation for the successful completion of studies, Bound and Turner (2007) outline the supply side with the universities as education actors. They argue that the institutes of higher education actively steer the number of students admitted, the number of students enrolled, and the level of resources per student, as a function of the financial restrictions and the demand for a university or college education. This argumentation is supported by recent findings (Curs & Jaquette, 2017), which indicate that non-resident enrollment – associated with a higher tuition revenue – crowds out resident enrollment at prestigious public universities. Working on the assumption of a positive relationship between the available resources per student and the quality of the education offered, a trade-off takes place between quality and quantity

in the case of non-cost-covering tuition fees. According to this approach, an increase in student numbers without a proportional increase in tuition fees leads to a lower quality of university education.

The aforementioned theories and studies were all developed within the context of the US higher education system. Since the Swiss university system differs from that of the USA, the question of transferability arises. For example, we believe that the students' social integration in the university system is less important in Switzerland than in the USA, as students do not live on university campus in Switzerland. There is, for example, also no room for Swiss universities to steer the quantity or quality of students upon entry, as in the USA. Overall, however, we assume that both preuniversity and within-university factors as well as institutional characteristics (including selection strategies and financial resources) and external conditions are important in explaining university dropout.

Status of empirical research

The empirical research literature for explaining university dropout clearly shows that this is a many-layered phenomenon. The Systematic Review of the Danish Clearing House for Educational Research (Larsen et al., 2013), which is summarized in what follows, provides a current overview of explanatory factors for dropout at universities in Europe.

In the case of formal dropout, i.e., withdrawal from the higher education system and different factors linked to a student's academic preparation for university studies are highly important. In terms of sociodemographic characteristics, most studies show that men and older students have a greater likelihood of discontinuing their studies than female and younger students. In addition, students from lower social classes, i.e., with parents who have a lower level of education or a lower occupational status, are at greater risk of leaving university without obtaining a degree. Moreover, the systematic review as well as further recent studies show that academic problems during a student's studies (Heublein et al., 2017; Ortiz & Dehon, 2013), financial problems (Cardak & Vecci, 2016; Heublein et al., 2017; Ortiz & Dehon, 2013), and gainful employment while studying (Choi, 2018; Hovdhaugen, 2015) can influence dropout.

Recent findings for Switzerland largely confirm the relationships between preparation at school for university studies, age, gender,[6] and the risk of dropout (Wolter et al., 2014). However, this study was not able to take into account either institution-specific effects or the behavior of the students during their studies.

[6] Yet, the gender effect is reversed in less recent cohorts (Wolter et al., 2014).

Empirical evidence also exists of the correlation between institutional resources and the risk of dropout. The findings of Bound and Turner (2007), based on the US data, indicate that the decline in successful completion rates seen in the second half of the 20th century is due in part to the lower public expenditure per student. A positive relationship between the level of expenditure and persistence is also found in further studies (Crisp, Doran, & Reynes, 2018; Gansemer-Topf, Downey, Thompson, & Genschel, 2018; García-Estévez & Duch-Brown, 2014).

The results are not clear-cut when it comes to the question of which investments or resources are effective. According to the results obtained by Webber (2012), there would seem to be a markedly positive correlation between expenditure on instruction and success rates: an increase of 10% in expenditure raised success rates by 4% points. Chen (2012), by contrast, does not find any substantial influence of instructional expenditure on success rates. The results are similarly mixed with regard to the expenditure on academic support measures (Chen, 2012; Johnes & McNabb, 2004; Webber, 2012) as well as in respect of the staff–student ratios (Gansemer-Topf et al., 2018; García-Estévez & Duch-Brown, 2014; Johnes & McNabb, 2004).

Based on decomposition analyses, Bound et al. (2010) show that, of the 4.6% point decline in success rates between 1972 and 1988, 1.1% points can be attributed to the reduced staff–student ratio. A negative correlation between the student–lecturer ratio and success rates was similarly observed for the Spanish context (García-Estévez & Duch-Brown, 2014), while a further US study shows that only the part-time staff–student ratio is positively associated with the retention rates in contrast to the full-time staff–student ratio (which is negatively associated with the retention; Gansemer-Topf et al., 2018). The findings of Johnes and McNabb (2004) would suggest that, while the staff–student ratio reduces the risk of voluntary dropout, it increases the risk of involuntary dropout (contrary to expectations). The authors interpret these results as showing that the main benefit of staff support lies in the pastoral function rather than in academic furtherance.

The study conducted by Arulampalam, Naylor, and Smith (2004) with data from students of medicine also suggests that it is not only the staff–student ratio per se that is decisive but also the person who is looking after the students. In addition, the successful completion of studies is probably a function of not only the objective support provided but also of the way this support is subjectively experienced, as revealed by a German study (Heublein, Hutzsch, Schreiber, Sommer, & Besuch, 2009).

Finally, the study by Heublein et al. (2009) points directly to the studying conditions, which are influenced by the number of students. In the German study, approximately three quarters of the dropouts specified inadequate studying conditions, such as over-crowded lectures and inadequate facilities at the university, as reasons for not completing

their studies. A more recent study (Meggiolaro, Giraldo, & Clerici, 2017) indicates that students in larger courses (more than 100 students) have lower odds of graduating.

Research questions

Based on the literature referred to, a non-anticipated, strong growth (or contraction) in the student population can be understood as a factor leading to substantial changes in the study conditions. Nevertheless, even in cases where pronounced fluctuations in student numbers can be foreseen, changes in studying conditions can result if the alignments on the resources side are made too slowly (hiring of new professors or the phasing out of existing chairs, the construction of new lecture theaters, etc.). In other words, it can be assumed that a pronounced increase in the number of students can have a notable impact on the level of resources available per student. This can be due to the comparatively slow alignment of resources, or to a situation where changes in student numbers are anticipated at too late a stage or even not anticipated at all.

Although an increase in student numbers leads to a decline in the available resources per student and a decline in numbers improves the available resources per student, it is not a priori clear whether this change in resources has any impact on the risk of dropout and, if so, whether this impact is symmetrical. If the resource situation deteriorates, the level of resources may still be sufficient to ensure the successful completion of studies. Conversely, if the resource situation improves, it cannot automatically be assumed that this will have a positive impact on success.

Moreover, there are indications that the universities themselves react to quantitative changes in student population (see Hänsgen, 2010). They may wish to limit any deterioration in staff–student ratios by raising the examination requirements. Alternatively, they may lower academic standards to maintain student numbers in the face of declining cohorts because of the fear of redundancies or the inability to fill job openings. It can also be assumed that the physical scarcity conditions could similarly prompt the students themselves to abandon their studies. However, this does not necessarily have to be a definitive dropout because students could also attempt to switch to a subject for which there is less demand.

There may be other explanations for the relationship between increases in student numbers and dropout risk too. For example, it can be assumed that the relationship is explained by changes in student composition if the increase in student numbers is due to an increase in less able, less prepared, less motivated, or less socioeconomically privileged students. However, concerning the case of Switzerland, such an explanation is not very obvious if we recall the time trends of the increasing baccalaureate rate, on the one hand, and the unsystematically varying cohort growth rate and dropout rate, on the other hand

(see Figure 1). Nevertheless, we will take into account this possible explanation in our methodological approach.

Our considerations give rise to three questions, which we will be examining in detail: First, we look into whether a non-anticipated, pronounced change in the size of an enrollment cohort for a specific subject at a university can have an influence on definitive dropout. Second, we examine whether this influence is symmetrical, i.e., whether growth of the enrollment cohort has the same impact as a contraction of the cohort. Third, we look into whether a non-anticipated, pronounced change of the cohort size also affects the probability of a student switching from the first subject chosen to a different course of study at a later stage.

Materials and Methods

Data basis

The analyses are based on longitudinal data from the Swiss Higher Education Information System (SHIS) provided by the Swiss Federal Statistical Office. This administrative data makes it possible to track the study progress of all students in Switzerland over a prolonged period. The data record provides individual details of the semesters for which the student was enrolled, the qualifications obtained, and several sociodemographic characteristics. The SHIS data record was additionally matched with data on institutional and structural characteristics as well as data on the economic situation.

The sample of this study is composed of all freshmen students of Swiss nationality who started a course of academic study at a Swiss university between 1980 and 2001. We excluded students undergoing teacher training, students of the subject groups "medicine and pharmacy," and "interdisciplinary and others" as well as students of the "multidisciplinary/other" disciplines.[7] One university also had to be left out because of the low number of observations.

In our analyses, the unit of observation is the individual student. The net sample size is approximately 140,000.

[7] Students undergoing teacher training are not taken into account, since these courses are often only partially taught at the universities. Medical courses are not suitable for examining this question, since the cohort size and failure rate are determined endogenously (steered by the *numerus clausus*). The other subjects are excluded on account of their heterogeneity.

Variable of dropout and switch to a different course of study

The variable *dropout* defines the definitive withdrawal of a student from the university system within the first six semesters. Definitive withdrawal is when a student deregisters from a university and does not obtain a university degree within 10 years of starting his or her studies at any university. The variable *switch to a different course of study* defines a change of the subject of study (within the university sector) during the first six semesters. The period of six semesters covers the first six semesters for which students are enrolled at the university, without any semesters that they take off.

Restricting the period of time to the first 3 years of study is justified by the fact that any influence of a change in cohort size can be expected to come about primarily during the initial years of study. This is because, first, selective examinations are held primarily in the first 2 years of courses (the duration of the foundation courses is 1–2 years). Second, since individual entry cohorts will mix with students from other intake cohorts as they progress with their studies (due to students repeating years, delaying their main subject studies for gainful employment or minor subject studies, or through a change of subject or university, etc.), the precision of the cohort size measurement declines with each semester.

For the entry cohorts 1980–2001, the proportion of students who drop out within the first six semesters varies between 15% and 19% in our analytic sample (Figure 2); the average is 17.5%. The share of students who switch to a different course of study varies between 18% and 21%; the mean is 19.5%.

Variable of change in cohort size

The variable *change in cohort size* describes the change in the number of entering students in a specific subject and university. It is measured as the percentage growth of the

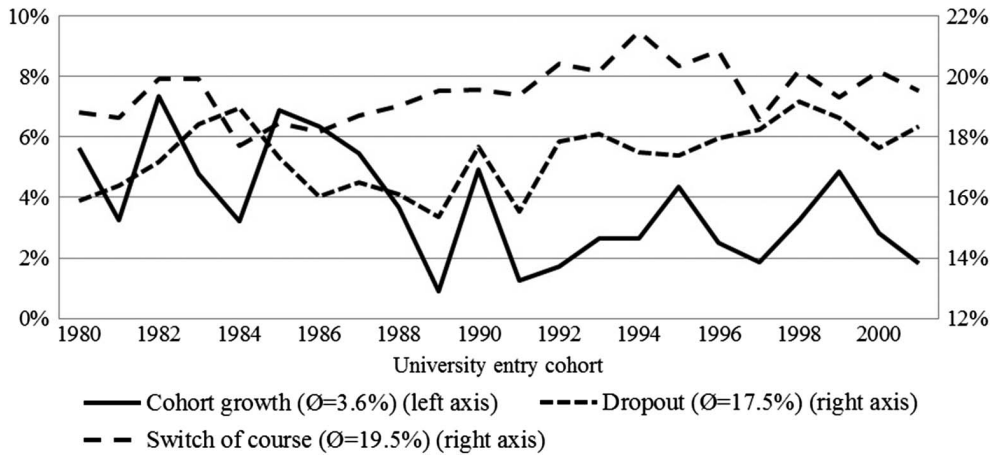

Figure 2. Dropout rate, switch of course of study, and change in cohort size, 1980–2001 (N = 140,346)

(subject- and university-specific) population compared with the average of the two previous years. We measure the cohort size with a high resolution (51 disciplines, 11 universities, and 22 entry years) to make allowance for the fact that each individual discipline generally has its own curriculum.[8] Overall, we have valid data for 1,942 cells.[9] The average cohort size per cell is 98 (median: 60). If we apply this operationalization to measure the change in cohort size as a predictor of withdrawal from studies, we would assume that all changes in cohort size come as a surprise to university actors. Yet, it is more plausible to assume that the university actors can partly anticipate the growth of an annual entry cohort based on demographic data. Therewith, they can take actions to adapt the institutional resources at an early stage correspondingly.

Certainly, it is not possible to know whether the university actors can anticipate changes in cohort size on the overall university sector level only, or more precisely on the university level or level of (groups of) fields of studies. We thus use different measures of (non-foreseeable) changes in cohort size. Our preferred measure, however, corrects the growth rate by the average growth of the overall university sector entry cohort (i.e., students entering all disciplines and universities in a given year). For the cohorts under consideration, the average (non-foreseeable) growth rate in our analytic sample is 3.6%; with growth in the 1980s being somewhat higher than in the 1990s (Figure 2). The variable is approximately normally distributed; the central 90% of the distribution lies between −20% and +29% (cf. Figure 3).

To determine whether positive and negative cohort growths have a different impact on the probability of dropout, cohort growth is used with two separate variables in the analyses: one for positive growth rates and one for negative growth rates. Our measure of cohort growth, which is basically the (non-foreseeable) change in the number of students compared with the average of the two previous years, has the important advantage of being unlikely to be correlated with the share of non-traditional students. Admittedly, the share of non-traditional students might increase with the size of the overall university sector entry cohort. However, we cannot expect the student composition to change significantly within a period of only 2 years. Moreover, it is not very likely that there is a systematic relationship between the share of non-traditional, less motivated, less able, or less prepared students, and the deviation of the subject field and university-specific cohort growth from the overall cohort growth.

[8] No individual disciplines are specified within the economic sciences, since the foundation course is frequently a joint course for all the different specializations.

[9] This number is much smaller than $51 \times 11 \times 22 = 12{,}342$ because not all the disciplines are taught at every university or in all years. Moreover, growth rates based on cell sizes of less than 20 students are set to "missing," as are data points that are to be interpreted as structural breaks (such as a discipline being assigned to a different subject area).

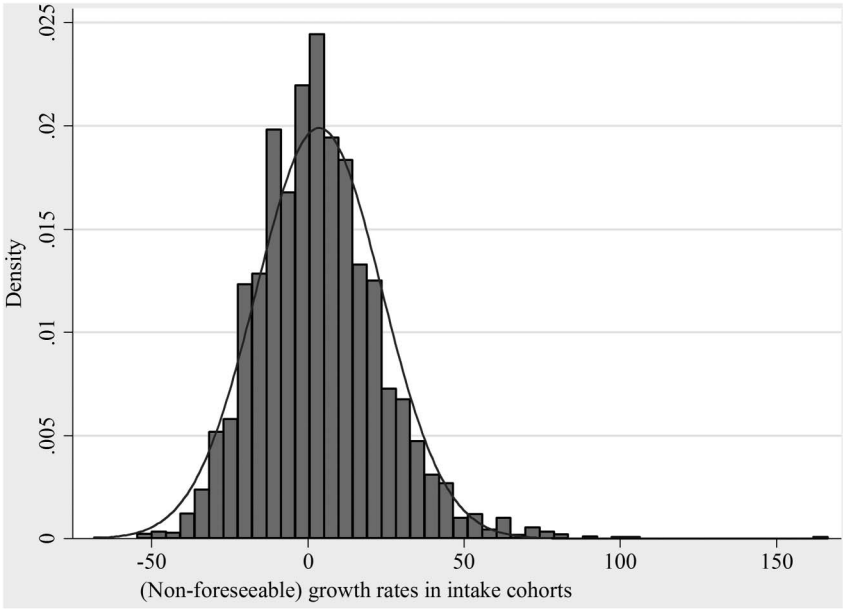

Figure 3. Distribution of the variable "cohort growth" (N = 140,346)

Estimation model

We estimate the relationship between cohort growth and dropout risk using a probit model with the variable of dropout or a switch to a different course of study as the dependent variable and the (non-foreseeable) growth in cohort size as the central independent variable. We show marginal effects to facilitate the interpretation of the results. To make allowance for the fact that the study path depends on the selected discipline and the chosen university, we use clustered standard errors at the level of the individual disciplines and universities in our regressions.

We include a series of control variables based on the findings of the previous research literature. A description of the central variables is provided in Table 1. With respect to individual characteristics, we include gender and age (including a squared term). In addition, we introduce two proxy variables for aptitude for university studies into the models: the type of baccalaureate (specialization) and the variation in cantonal baccalaureate rate of the home canton prior to going to the university. We additionally control for changes in subject, changes in the university attended, and the switch to the Bologna system (during the first six semesters).

To capture possible changes in student composition over time, we include the time-varying baccalaureate rate (measured on the national level) and the overall cohort growth rate. Concerning institutional characteristics, we include dummy variables for the university and the discipline upon entry to university. To control for structural influences over time, we make an allowance for economic growth (change in the real gross domestic

Table 1. Descriptive statistics of variables

	N	Mean	*SD*	Minmum	Maximum
Cohort growth (in 10%)	140,346	0.360	2.005	−6.8	16.6
Positive cohort growth (in 10%)	140,346	0.948	1.431	0.0	16.6
Negative cohort growth (in 10%)	140,346	−0.588	0.925	−6.8	0.0
Dropout (within six semesters)	140,346	0.175	0.380	0	1.0
Switch to a different course (within six semesters)	140,346	0.195	0.397	0	1.0
Woman	140,346	0.381	0.486	0	1.0
Age	140,346	21.097	3.505	14.0	80.0
Variation in cantonal baccalaureate rate	140,346	19.146	5.544	10.5	31.8
Swiss baccalaureate rate (time-varying)	140,346	14.609	2.691	10.6	19.2
Overall cohort growth (in 10%)	140,346	0.356	0.411	−0.3	1.2
Lecturer–student ratio (×10)	140,346	3.106	1.530	0.4	8.1
Assistant–student ratio (×10)	140,346	1.147	0.856	0.1	4.4
Double-baccalaureate-year cohort	140,346	0.055	0.227	0	1.0
Share of foreign students (in 10%)	140,346	1.042	0.962	0	7.1

Note. SD: standard deviation.

product compared with the previous year), the unemployment rate, and the rate of inflation. Moreover, we include a discrete time variable to control for possible time trends.

To check whether the relationship between cohort growth and dropout can be explained by institutional resources, we estimate models that include the staff–student ratio. The staff–student ratio is measured by the number of students per lecturer (in full-time equivalents) and by the number of students per assistant.

We additionally include a dummy variable for the "double-baccalaureate-year cohort" (2001). The double-baccalaureate year resulted from the shortening of the number of years of schooling required to achieve an academic baccalaureate. This meant that in 2001 two cohorts instead of one received their baccalaureate. The double-baccalaureate years were anticipated by the policymakers at an early stage, and corresponding compensatory measures were taken (in particular, more financial resources for the universities were granted). However, since more students took gap years, the growth shock was considerably smaller than anticipated and therefore more than compensated by the allocated financial resources.

Finally, we also control for the share of students with university admission qualifications obtained abroad. Since the universities do not receive compensatory payments from public authorities as they do in the case of Swiss students, a higher share of students with foreign university admission qualifications negatively affects the (per student) resource availability of universities, which possibly translates into a higher dropout rate.

Further analyses verify the robustness of the estimated effects. On one hand, we carry out sensitivity analyses for alternative operationalizations of the cohort growth variables and, on the other hand, we conduct a check of the influence of cohort growth in the previous and following years on the risk of dropout.

Results

Relationship between cohort growth and dropout

Table 2 shows the results for the predictors of a dropout within the first six semesters. The results confirm that a positive relationship exists between cohort growth and the risk of dropout. If the change in cohort size is operationalized with a single variable (Model 1), then an increase of 10% in the entry cohort compared with the previous 2 years leads to an increase of 0.2% points in the probability of dropout. This corresponds to an increase in the probability of dropout of approximately 1.1%.[10]

[10] Given the predicted dropout rate of 17.5%, the figure is obtained by calculating $(0.2/17.5) \times 100$.

Table 2. Determinants of dropout within the first six semesters: average marginal effects (average: 17.5%)

	Model 1	**Model 2**	**Model 3**
Cohort growth (in 10%)	0.002 (0.001)**		
Positive cohort growth (in 10%)		0.002 (0.001)*	0.002 (0.001)*
Negative cohort growth (in 10%)		0.000 (0.002)	0.000 (0.002)
Woman	0.021 (0.003)**	0.021 (0.003)**	0.021 (0.003)**
Age	0.014 (0.001)**	0.014 (0.001)**	0.014 (0.001)**
Variation in cantonal baccalaureate rate	0.002 (0.000)**	0.002 (0.000)**	0.002 (0.000)**
Swiss baccalaureate rate (time-varying)	−0.016 (0.002)**	−0.016 (0.002)**	−0.016 (0.002)**
Overall cohort growth (in 10%)	0.001 (0.004)	0.001 (0.004)	0.006 (0.005)
Lecturer–student ratio (×10)			−0.007 (0.002)**
Assistant–student ratio (×10)			0.008 (0.004)*
Double-baccalaureate-year cohort			−0.018 (0.008)*
Share of foreign students (in 10%)			−0.001 (0.003)
Pseudo R^2	0.054	0.054	0.054
N	140,346	140,346	140,346

Note. Probit regression, average marginal effects, and standard error are represented in brackets. Additionally, all three models contain control variables for changes in subject and university, the switch to the Bologna system, the baccalaureate type and certificate, economic growth, the unemployment rate and inflation, the time trend, and fixed effects for the university and subject upon entry. The average dropout rate is 17.5%.
*$p < .05$. **$p < .01$.

If we measure the positive and negative growth rates with two separate variables (Model 2), the results confirm the significant effect of the positive growth in entry numbers on the risk of dropout. Conversely, a reduction in the entry numbers does not reduce the risk of dropout. Taking the average dropout rate of 17.5%, a 10% increase in university entries still increases the probability of dropout by approximately 1.1%. The effect is thus seen to be rather small with moderate growth in student numbers and only gains greater practical importance as of a relatively pronounced level of growth. To examine whether the relationship between the cohort growth and risk of dropout is mediated by institutional resources, we additionally include proxy variables that measure the institutional resources in Model 3: staff–student ratios, the share of foreign students, and the double-baccalaureate-year cohort. However, the coefficients of cohort growth do not change between Model 2 and Model 3. This means there is no evidence that the relationship between cohort growth and dropout risk is driven by fewer resources.

Relationship between cohort growth and switching to a different course of study

One possible explanation for the relationship between cohort growth and dropout risk could be that students who find themselves confronted with overcrowded lecture theaters

Table 3. Determinants of switching to a different course of study within the first six semesters: average marginal effects (average: 19.5%)

	Model 1	**Model 2**	**Model 3**
Cohort growth (in 10%)	0.000 (0.001)		
Positive cohort growth (in 10%)		0.000 (0.001)	0.000 (0.001)
Negative cohort growth (in 10%)		−0.001 (0.002)	0.000 (0.002)
Woman	−0.005 (0.008)	−0.005 (0.008)	−0.005 (0.008)
Age	−0.001 (0.002)	−0.001 (0.002)	−0.001 (0.002)
Variation in cantonal baccalaureate rate	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Swiss baccalaureate rate (time-varying)	0.025 (0.003)**	0.025 (0.003)**	0.025 (0.003)**
Overall cohort growth (in 10%)	−0.004 (0.005)	−0.004 (0.005)	−0.001 (0.006)
Lecturer-student ratio (×10)			−0.017 (0.004)**
Assistant-student ratio (×10)			0.001 (0.006)
Double-baccalaureate-year cohort			−0.005 (0.010)
Share of foreign students (in 10%)			−0.003 (0.005)
Pseudo R^2	0.039	0.039	0.040
N	140,346	140,346	140,346

Note. Probit regression, average marginal effects, and standard error are represented in brackets. Additionally, all three models contain control variables for the baccalaureate type and certificate, economic growth, the unemployment rate and inflation, the time trend, and fixed effects for the university and subject upon entry. The average rate of switching course is 19.5%.
**$p < .01$.

or more stringent study conditions drop out voluntarily from their course. Although it is not possible to directly test this explanation with our data, we can examine whether students switch to a different subject that is possibly less popular. In what follows, therefore, we look into whether changes in cohort size also have an impact on the probability of switching to a different course of study. The results in Table 3, however, show no significant relationship in all of the models. That is, we find no evidence that cohort growth increases the probability of switching to a different course of study.

Sensitivity analyses

Alongside the operationalization of the cohort growth variables set out in "Materials and Methods" section, other operationalizations would also be conceivable. First, it can be argued that modeling cohort growth on a linear basis within the positive range does not accurately reflect the true situation, since an increase in student numbers could only be expected to have a noticeable effect on the study process exceeding a certain threshold level. Second, it could be argued that a trend adjustment should be dispensed, since the university actors would be unlikely to estimate the average growth in good

time and be able to, or wish to, instigate the corresponding measures. Third, it can be argued that the university actors anticipate the number of students enrolling at a university or in a (group of) subject field(s), which allows them to adjust the resources more precisely.

We have conducted a series of robustness checks to examine the sensitivity of the results to different operationalizations.[11] Analyses with categorization of the growth rates do not show any effects of declining student numbers, as is set out in the results in Table 2. By contrast, a growth of more than 15% in student numbers is necessary before any significant effects can be detected on dropout. In other words, changes of 5%–15% do not yet generate any statistically significant effects. If we use a measure of cohort growth, which is not corrected by the average growth of the overall university sector entry cohort, we obtain results similar to our original measure. Similarly, operationalizations of growth rates, which are corrected by the cohort growth of the individual university or (group of) subject field, reveal similar results.

Finally, we looked into the question: What influence did the growth of the previous year and the following year have on the dropout risk for the current entry cohorts? The regression results suggest positive cohort growth in the following year reducing the probability of dropout for the current cohort. This finding clearly contradicts the theory that the dropout risk accumulates with continuing growth in student numbers. Instead, quite the opposite would seem to be the case. One explanation for this could be that the growth in the following year reflects "trendiness." If a subject retains its attractiveness, this ought to reduce the number of voluntary dropouts and push the universities to adapt to the growth rates by adjusting the resources. Cohort growth in the previous year, however, does not affect the dropout risk of the current entry cohort.

Summary and Conclusions

This study looks into the relationship between the growth of an enrollment cohort and the probability of dropout as well as the probability of switching to a different course of study. The study is based on administrative individual data for all students at all Swiss universities. Pronounced changes in the number of students enrolling in a specific course of study at a specific university have no significant effect on the risk of a switch to a different course of study. However, we find a statistically significant negative effect of growing enrollment cohorts on the completion rates of studies. By contrast, a reduction in enrollment cohort numbers does not have a positive impact on the completion rate.

[11] The results can be obtained from the authors on request.

The effect sizes are, however, rather small. An increase of an enrollment cohort by 10%, as compared with the average of the last 2 years, increases the probability of dropout by 0.2% points for an average dropout rate of 17.5%, or in other words by only 1.1%. The impact on dropout thus becomes only practically significant if the growth rates are very strong. If we compare the impact of changes in cohort size on dropout risk with the impact of individual characteristics, we can conclude that the former is less relevant. The results are nevertheless interesting as this is the first study to examine this topic outside the US context.

There are various potential explanations for the asymmetric impact of changes in number of students enrolling on dropout risk. Yet, we could examine only some of the potential factors explaining the relationship. In our view, the most plausible explanation compatible with our results is that universities raise the selection hurdles as a result of the increase in student number. In other words, there are indications that universities raise the bar if they are confronted by unexpectedly strong growth in student numbers, but do not change their selection criteria if, by contrast, they register a decline in student numbers.

However, we cannot completely rule out that the relationship between changes in cohort size and dropout risk is explained by changes in student composition. Nevertheless, due to the methodology used, we do not consider this explanation to be the most plausible. Moreover, we find no evidence for the explanation that the higher dropout risk among growing cohorts is due to the short-term deterioration in staff–student ratios, since including staff–student ratios in the analyses does not alter the results. The findings from the USA (Bound et al., 2010), which suggest that the connection between cohort growth and success rate is partly explained by staff–student ratios, are thus not supported in the case of Switzerland.

To the best of our knowledge, studies on this topic are available only for the US and, with this paper, for Switzerland. More research on the relationship between cohort growth and dropout risk would, however, be of interest, since access to universities has been widened during the last decades in most developed countries. In addition, the fact that particular study fields become fashionable and attract many more students literally overnight can be observed in many countries even in times of no general cohort growth. Therefore, similar issues may arise in many countries. Future research should therefore try to examine the mechanisms explaining the relationship between cohort increase and dropout risk using confirmatory hypothesis testing. Evidence from more countries would not only be valuable to better understand this relationship but would also help to isolate the importance of system or country-specific influences on this relationship.

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SCW conceived the idea for the study concept, acquired the funding, and requested the data. AD took the lead in doing the statistical analysis. AD and SCW designed the model and the computational framework and contributed to the interpretation of the results and to the final version of the manuscript. Both authors had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Ethics

The research is based on secondary data analysis with administrative data provided by the Federal Statistical Office. The authors have signed a data protection contract with the Federal Statistical Office.

References

Arulampalam, W., Naylor, R. A., & Smith, J. P. (2004). A hazard model of the probability of medical school drop-out in the UK. *Journal of the Royal Statistical Society Series A*, *167*(1), 157–178. doi:10.1046/j.0964-1998.2003.00717.x

Bean, J. P. (1980). Dropouts and turnover: The synthesis and test of a causal model of student attrition. *Research in Higher Education*, *12*(2), 155–187. doi:10.1007/BF00976194

Bean, J. P. (1982). Student attrition, intentions, and confidence: Interaction effects in a path model. *Research in Higher Education*, *17*(4), 291–320. doi:10.1007/BF00977899

Bean, J. P. (1985). Interaction effects based on class level in an explanatory model of college student dropout syndrome. *American Educational Research Journal*, *22*(1), 35–64. doi:10.3102/00028312022001035

Berger, J. B., & Milem, J. F. (2000). Organizational behavior in higher education and student outcomes. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research: Volume XV* (pp. 268–338). New York, NY: Agathon.

Bound, J., Lovenheim, M. F., & Turner, S. (2010). Why have college completion rates declined? An analysis of changing student preparation and collegiate resources. *American Economic Journal: Applied Economics*, *2*(3), 129–157. doi:10.1257/app.2.3.129

Bound, J., & Turner, S. (2007). Cohort crowding: How resources affect collegiate attainment. *Journal of Public Economics*, *91*(5–6), 877–899. doi:10.1016/j.jpubeco.2006.07.006

Cardak, B. A., & Vecci, J. (2016). Graduates, dropouts and slow finishers: The effects of credit constraints on university outcomes. *Oxford Bulletin of Economics and Statistics*, *78*(3), 323–346. doi:10.1111/obes.12119

Chen, R. (2012). Institutional characteristics and college student dropout risks: A multilevel event history analysis. *Research in Higher Education*, *53*(5), 487–505. doi:10.1007/s11162-011-9241-4

Choi, Y. (2018). Student employment and persistence: Evidence of effect heterogeneity of student employment on college dropout. *Research in Higher Education*, *59*(1), 88–107. doi:10.1007/s11162-017-9458-y

Crisp, G., Doran, E., & Reyes, N. A. (2018). Predicting graduation rates at 4-year broad access institutions using a Bayesian modeling approach. *Research in Higher Education*, *59*(2), 133–155. doi:10.1007/s11162-017-9459-x

Curs, B. R., & Jaquett, O. (2017). Crowded out? The effect of nonresident enrollment on resident access to public research universities. *Educational Evaluation and Policy Analysis*, *39*(4), 644–669. doi:10.3102/0162373717704719

Edwards, M., & Cangemi, J. P. (1990). The college dropout and institutional responsibility. *Education*, *111*(1), 107–117.

European Commission, EACEA, & Eurydice. (2014). *Modernisation of higher education in Europe: Access, retention and employability 2014*. Luxembourg: Publications Office of the European Union.

Federal Statistical Office. (2015). *Übergänge und Verläufe auf der Tertiärstufe* [Transitions and pathways at tertiary level]. Neuchâtel, Switzerland: Federal Statistical Office.

Federal Statistical Office. (2018). *Maturitätsquote* [Baccalaureate rate]. Neuchâtel, Switzerland: Federal Statistical Office. Retrieved January 23, 2018, from https://www.bfs.admin.ch/bfs/de/home/statistiken/bildung-wissenschaft/bildungsindikatoren/bildungssystem-schweiz/themen/abschluesse/maturitaetsquote.html

Gansemer-Topf, A. M., Downey, J., Thompson, K., & Genschel, U. (2018). Did the recession impact student success? Relationships of finances, staffing and institutional type on retention. *Research in Higher Education*, *59*(2), 174–197. doi:10.1007/s11162-017-9462-2

García-Estévez, J., & Duch-Brown, N. (2014). Student graduation in Spain: To what extent does university expenditure matter? *Research in Higher Education*, *55*(3), 308–328. doi:10.1007/s11162-013-9312-9

Hänsgen, K.-D. (2010). *Ausbildungskapazität vor allem entscheidend für Absolventenzahl* [Training capacity above all decisive for the number of graduates]. Retrieved from https://www.unifr.ch/ztd/ems/doc/pruefungserfolg10.pdf

Heublein, U., Ebert, J., Hutzsch, C., Isleib, S., König, R., Richter, J., & Woisch, A. (2017). *Zwischen Studienerwartungen und Studienwirklichkeit* [Between study expectations and study reality]. Hannover, Germany: DZHW.

Heublein, U., Hutzsch, C., Schreiber, J., Sommer, D., & Besuch, G. (2009). *Ursachen des Studienabbruchs in Bachelor- und in herkömmlichen Studiengängen. Ergebnisse einer bundesweiten Befragung von Exmatrikulierten des Studienjahres 2007/08* [Causes for drop-outs in Bachelor's and conventional degree programmes. Results of a nationwide survey of ex-registered students of the academic year 2007/08]. Hannover, Germany: HIS.

Hovdhaugen, E. (2015). Working while studying: The impact of term-time employment on dropout rates. *Journal of Education and Work*, *28*(6), 631–651. doi:10.1080/13639080.2013.869311

Johnes, G., & McNabb, R. (2004). Never give up on the good times: Student attrition in the UK. *Oxford Bulletin of Economics and Statistics*, *66*(1), 23–47. doi:10.1111/j.1468-0084.2004.00068.x

Kamens, D. H. (1971). The college 'charter' and college size: Effects on occupational choice and college attrition. *Sociology of Education*, *44*(3), 270–296. doi:10.2307/2111994

Kaplan, D. S., Damphousse, K. R., & Kaplan, H. B. (1994). Mental health implications of not graduating from high school. *The Journal of Experimental Education*, *62*(2), 105–123. doi:10.1080/00220973.1994.9943834

Larsen, M. S., Kornbeck, K. P., Kristensen, R. M., Larsen, M. R., & Sommersel, H. B. (2013). *Dropout phenomena at universities: What is dropout? Why does dropout occur? What can be done by the universities to prevent or reduce it? A systematic review*. Copenhagen: Danish Clearinghouse for Educational Research, Department of Education, Aarhus University.

McCaul, E. J., Donaldson, G. A., Jr., Coladarci, T., & Davis, W. E. (1992). Consequences of dropping out of school: Findings from high school and beyond. *The Journal of Educational Research*, *85*(4), 198–207. doi:10.1080/00220671.1992.9941117

Meggiolaro, S., Giraldo, A., & Clerici, R. (2017). A multilevel competing risks model for analysis of university students' careers in Italy. *Studies in Higher Education*, *42*(7), 1259–1274. doi:10.1080/03075079.2015.1087995

OECD. (2017). *Education at a glance 2017: OECD indicators*. Paris, France: OECD Publishing.

Ortiz, E. A., & Dehon, C. (2013). Roads to success in the Belgian French community's higher education system: Predictors of dropout and degree completion at the Université Libre de Bruxelles. *Research in Higher Education*, *54*(6), 693–723. doi:10.1007/s11162-013-9290-y

Slaughter, S., & Leslie, L. L. (1997). *Academic capitalism. Politics, policies, and the entrepreneurial university*. Baltimore, MD: The John Hopkins University Press.

Stiburek, S., Vlk, A., & Švec, V. (2017). Study of the success and dropout in the higher education policy in Europe and V4 countries. *Hungarian Educational Research Journal*, *7*(1), 43–56. doi:10.14413/herj.2017.01.04

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, *45*(1), 89–125. doi:10.3102/00346543045001089

Titus, M. A. (2006). Understanding the influence of the financial context of institutions on student persistence at four-year colleges and universities. *Journal of Higher Education*, *77*(2), 353–375. doi:10.1353/jhe.2006.0009

WBF, & EDK (2015). *Erklärung 2015 zu den gemeinsamen bildungspolitischen Zielen für den Bildungsraum Schweiz* [Declaration 2015 on the common educational policy objectives for the Swiss education system]. Retrieved from http://www.edk.ch/dyn/28578.php

Webber, D. A. (2012). Expenditures and postsecondary graduation: An investigation using individual-level data from the state of Ohio. *Economics of Education Review*, *31*(5), 615–618. doi:10.1016/j.econedurev.2012.02.003

Wolter, S. C., Diem, A., & Messer, D. (2014). Drop-outs at Swiss universities: An empirical analysis of data on all students between 1975 and 2008. *European Journal of Education*, *49*(4), 471–483. doi:10.1111/ejed.12096