



Are they coming back? The mobility of university graduates in Switzerland

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Abstract The present paper focus on the possible impact of university graduates' internal mobility in Switzerland. This is an interesting setting because all the cantons have to bear the public costs for their students irrespective of the students' study place of choice. As not all the cantons have a university, in some cantons students have to leave their home involuntarily to attend university. Focusing on the description of factors explaining internal graduate mobility, we investigate which of the cantons lose potential tax payers for which they had to bear the study costs and discuss the potential consequences on the financing of higher education. On average, half of the students who had left their place of living in order to study do not return to their home canton. Approximately half of those who do not return from the canton in which they studied move to a third canton. Besides other factors, which are linked to post-graduation mobility, we find that top-performing students return less often than low performers. As a consequence, the cantons without universities face a quantitative as well as a qualitative disadvantage compared to cantons with a university.

Keywords Student mobility · Graduate mobility · Brain gain · Brain drain

JEL-codes H52 · H75 · I23 · J61

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Kehren sie Zurück? Die Mobilität von Hochschulabsolventinnen und -Absolventen in der Schweiz

Zusammenfassung Die vorliegende Arbeit untersucht die möglichen Auswirkungen der internen Mobilität von Hochschulabsolventen in der Schweiz. Ein empirisch interessantes Setting, da nicht alle Kantone eine Universität haben, müssen in einigen Kantonen die Studierenden ihre Heimat fürs Studium verlassen. Ausgehend von der Beschreibung der Faktoren, die die interne Mobilität der Absolventen erklären, untersuchen wir, welche der Kantone potenzielle Steuerzahler, für die sie die Studienkosten tragen mussten, verlieren und diskutieren mögliche Folgen für die Finanzierung der Hochschulbildung. Etwa die Hälfte derjenigen, die aus dem Kanton, in dem sie studiert haben, nicht zurückkehren, ziehen in einen dritten Kanton. Neben anderen Faktoren, die mit der Mobilität von Hochschulabsolventinnen und -absolventen zusammenhängen, stellen wir fest, dass leistungsstarke Studierende seltener zurückkehren als leistungsschwache. Dies hat zur Folge, dass die Herkunftskantone, die den Grossteil der Kosten auch für die mobilen Studierenden tragen, beim Verlust von Absolventinnen und Absolventen sowohl einen quantitativen wie qualitativen Nachteil haben.

1 Introduction

Student and graduate migration has been the subject of academic and political debates for years. Initially, the focus was on graduates who left the country where they had received their first higher-education degree (up to the master degree or equivalent) in order to obtain a PhD or higher academic qualification in a third country and decided not to return to their country of origin. *Brain gain* or *brain drain* was also an issue that was discussed mainly in the context of industrialized vs. developing countries. More recently, the literature has broadened to study growing numbers of mobile students who leave their country for their initial degree (see e.g., OECD 2015), and found that the mobility between and within industrialized countries can be of the same concern as the mobility between developed and less developed countries. The questions researched in this literature are those of who should finance higher education if mobile graduates do not return to their countries of origin, unequal distributions of positive growth and innovation effects of high-skilled migration, as well as whether less-skilled workers in the receiving countries might be replaced by high-skilled foreign graduates.

This study adds to the growing literature on the migration of university graduates with an analysis of graduate mobility within Switzerland and focus on factors that explaining the internal mobility patterns of students after graduation, and in particular of those who left their place of residence in order to study in another place. Switzerland is a particularly interesting case for studying the internal mobility of university graduates because there are parallels with graduate mobility between countries and as for different other reasons:

In Switzerland, where the costs of higher education are predominantly covered by tax payers, the Swiss cantons¹ risk losing their public investment, similar to countries which also publicly finance higher education and risk to lose these investments if their students move abroad after graduation. The Swiss cantons lose not only if their students leave the canton after graduation, but also if mobile students—students studied in another canton—do not return to their home canton after graduation. This phenomenon is attributable to a compensatory financing arrangement between the cantons that stipulates that the canton of residence transfer the costs of the studies to the canton where the student chooses to study (EDK 1997, SCCRE 2018). Considering the highly decentralized Swiss tax system and the high level of tax competition between the cantons (Federal Tax Administration 2017), the possibility of lower tax might be used as an incentive to attract highly qualified workers. On the other hand, higher taxes may be required to pay the remuneration system. This could even have an impact on the education policies of the cantons, which tend to expect a brain drain (see OECD 2009 on this topic).

Furthermore, Switzerland offers a very advantageous setting, as all holders of an academic baccalaureate (university admission certificate) are generally admitted to all universities, so that the observed mobility of students is not affected by different admission policies of particular universities or cantons. This is a substantial difference from many existing studies on the internal graduate migration, e.g., on graduate migration within Germany, where the admission restriction generally applies (Busch and Weigert 2010; Buenstorf et al. 2016; Maier and Sprietsma 2016; Von Proff et al. 2016; Haussen and Uebelmesser 2018b).

Since not all cantons have universities—in the following we will use the terms “university cantons” and “non-university cantons”—and three universities do not offer all departments, we can take into account not only the postgraduate migration of mobile and non-mobile students, but also voluntary and involuntary mobility patterns. This is interesting because empirical evidence suggests that earlier mobility experiences are an important predictor of later mobility (see for Finland Haapanen and Tervo 2012), for Germany (Busch and Weigert 2010; Maier and Sprietsma 2016; Von Proff et al. 2016; Haussen and Uebelmesser 2018b) and for the U.K. (Faggian et al. 2007).

Given the particularities the Swiss context offers to study the determinants and consequences of student and graduate mobility, this paper addresses in particular the question, whether cantons without a university are more likely to lose tax payers compared to cantons with universities, both in qualitative and quantitative terms. Cantons without universities face three potential disadvantages compared to university cantons. First, all their students have to already be mobile for the purpose of studying, second, the return mobility after graduation might be lower than for university cantons and third, there might be a qualitative difference between those who decide to return to their home canton and those who decide to stay in the canton of studying or move on to a third canton.

¹ The Swiss cantons are comparable with US states, German Länder or the Canadian provinces in terms of their degree of autonomy in educational policy.

The paper is structured as follows: Sect. 2 briefly reviews the literature and the research findings on graduate mobility, focusing mainly on within-country mobility. Sect. 3 gives an overview of the institutional background of the Swiss higher education system and the financing of universities. Sect. 4 describes the database and presents some descriptive findings of the inter-cantonal mobility of graduates. Sect. 5 presents the main results of our empirical analyses, and Sect. 6 summarizes our findings.

2 Literature

The existing empirical evidence on internal mobility is mainly in line with the push and pull factors discussed in Lee's migration theory (1966) and the consideration that individual and structural factors shape the mobility behavior of graduates: In terms of individual factors, many studies show that mobility experience prior to graduation (including exchange semesters) is an important predictor for mobility after graduation (Faggian et al. 2007; Falk and Kratz 2009; Haapanen and Tervo 2012; Maier and Sprietsma 2016; Von Proff et al. 2016; Haussen and Uebelmesser 2018b). Socio-demographic characteristics such as age or marital status or children (Faggian et al. 2007; Van Proff et al. 2016; Bjerke and Mellander 2017) are also relevant for mobility decisions after graduation. The results for sex are not consistent (Busch and Weigert 2010; Venhorst et al. 2011; Abreu et al. 2014; Van Proff et al. 2016; Newbold 2017) as are the results for the fields of study. Mohr (2002) reported that lawyers, natural scientists and social workers tend to be less mobile than graduates in economics. The author suggests that students who continue their academic career with PhD studies and therefore stay for a longer period at their place of study tend to be less mobile afterward and that the probability of doing a PhD is notably different from one field of study to the other. However, no evidence of a link between the field of study and the mobility across Canadian provinces could be found in a recent work (Newbold 2017). In terms of quality of graduates and their mobility patterns, some of the studies analyze the graduation grades (Faggian et al. 2007; Ramos and Royuela 2017) and report that graduates with high grades are more likely to migrate. Capuano (2012) and Marinelli (2013) also found that top grades at university reduce the probability of return to the home region when examining internal graduate mobility in Italy. These results control for academic specialization after graduation (e.g., PhD or other postgraduate qualification).

Studies that stress structural factors show in general that the economic power of a region is an important pull factor (e.g., Falk and Kratz 2009; Haapanen and Tervo 2012). Graduates are attracted to regions that offer more job opportunities and higher wages. Conversely, high regional unemployment rates can be a push factor that makes graduates leave a place of study (Haussen and Uebelmesser 2018b). However, unemployment rates only matter if they are particularly high for high-skilled workers. High rates of average unemployment are not a very good predictor of graduate mobility, as university graduates tend to find jobs more easily also in places with high levels of unemployment (Busch and Weigert 2010; Falk and Kratz 2009). Other factors, such as the size of a region (Falk and Kratz 2009) or

the level of urbanization (Haapanen and Tervo 2012; Krabel and Flöther 2014), might be proxies for more and better job opportunities but also appeal to highly skilled workers for other reasons, such as a higher density or quality of cultural activities. In summary, economic factors should not be neglected when analyzing the determinants of graduate mobility, but they cannot, of course, fully explain (see Crescenzi et al. 2016) the observed mobility patterns.

According to human capital theory, the decision for or against mobility depends on the level of the expected monetary and non-monetary net-costs associated with the mobility decision (Sjaastad 1962). In this context, in addition to the aforementioned factors, the accuracy of expectations also matters and the positive impact of prior mobility experiences could be attributed to the observation that non-mobile students overestimate the mobility costs (Falk and Kratz 2009). On the other hand an overly optimistic expectation of the benefits of migration, which can be observed in migration decision between developing and developed countries, is less likely in the present context, as graduates will only move to another place within the country after having received a concrete job-offer.

The literature on internal mobility examines not only individual factors, but also the potential economic consequences of the migration of highly qualified for regions of origin and destination. The number of highly qualified people is decisive for the economic development of a region. The loss of this population group, known as brain drain, “depletes the region’s human capital” (Corcoran and Faggian 2017). It can therefore be observed that the policy in decentralized systems is directed towards attracting highly qualified people or retaining graduates in the specific region (Venhorst et al. 2010; Krabel and Flöther 2014). There is in fact a positive effect of a higher proportion of the local population with a higher level of education. Wages are higher (Moretti 2004), and labour force participation as well as the likelihood of employment increase for both, for graduates and others in the same region (Winters 2013). With regard to internal mobility, regions with local universities benefit from the inflow of human capital. However, this assumption only holds true if the graduates remain in the region. This does not necessarily have to be the case. The job opportunities for graduates in the region of study might be limited, so that the number of graduates surpasses the local demand for highly qualified employees (Venhorst et al. 2010).

Another strand of literature examine implications for university funding in connection with taxes and tuition fees (Demange et al. 2014; Gérard and Uebelmesser 2014; Haupt et al. 2016; Haussen and Uebelmesser 2016; Winters 2017). In a decentralised system with publicly funded universities, student and graduate mobility leads to high inefficiencies. A temporal inconsistency problem arises, as governments finance the education of individuals before the return on invest is guaranteed (Poutvaara 2001). He argues that this will create competition for highly qualified taxpayers. The possible consequences are tax cuts and correspondingly unfavourable effects on the public financing of education. His conclusion is that graduates should thus pay their income tax to the region that financed their education.

3 University system and financing of university in switzerland

Switzerland has a total of ten cantonal universities spread over ten of the 26 cantons (SCCRE 2018)². These universities differ in terms of the size of their student body (2400–20,000 students) but also in terms of the number of departments. The majority of the universities are so-called full universities, offering the full range of study fields, whereas the remaining three only have two or three different departments. In the following we will refer to them as specialized universities. This institutional difference is important to notice because it impacts the choice of university, and thus the probability of student migration (prior to graduation). We also consider this in our definition of voluntary and involuntary mobility (see p. 8). In general, there is free access to all the universities in Switzerland for holders of an academic baccalaureate (university admission certificate in Switzerland). There are exceptions for medical studies and sport sciences in the German part of Switzerland. The limited number of available study places is assigned after an entrance examination (*numerus clausus*) (SCCRE 2018).³

The bulk of the costs of cantonal universities in Switzerland are covered by public money. Tuition fees cover on average less than ten percent of the real costs. The operating costs of each cantonal university are mainly paid for by the university-canton itself.⁴ In order to share the financial burdens between university- and non-university-cantons and to ensure that all students have free access to all Swiss universities the cantons have agreed on compensatory payments, the so-called Inter-cantonal Agreement between Universities (IUV) (EDK 1997). This agreement states that the student's canton of origin (where she or he had obtained his or her university entrance diplomas⁵) pays a fixed amount for every year of studying to the university canton, in which the student is studying. Depending on the field of study, the amount ranges between 10,000 (e.g. humanities) and more than 50,000 (e.g. medicine) Swiss Francs per academic year. The total of the transferred money between cantons on the basis of the IUV is quite substantial and covers between five and 23% of the total costs of a university.

According to the IUV, non-university-cantons consequently have to pay almost the full average study costs for every citizen who studies at one of the cantonal uni-

² Additionally there are two Federal Institutes of Technology (ETH, EPFL) and two private universities. In our analyses we exclude the two Federal Institutes of Technology and private universities as their financing differs from the cantonal universities; e.g. cantons do not have to pay for their students if they choose to study at one of the Federal Institutes of Technology (EDK 1997). There are also two other types of higher education institutions, the Universities of Applied Sciences and the Universities of Teacher Education. Because of the differences in terms of admission criteria to these institutions (Universities of Applied Sciences) and the differences in terms of labour markets (Universities of Teacher Education), we decided not to include the graduates of these types of institutions in our analyses. They could be analysed in a separate study however.

³ The *numerus clausus* was introduced in 1999 (in some medical disciplines later). In our sample, this only applies to individuals of certain cohorts who we have excluded from our analyses.

⁴ There are also subsidies coming from the Federal level but most of the federal funds cover directly research expenditures and not teaching costs for undergraduate and graduate students.

⁵ The study costs for foreign students have to be covered by the canton of study, and are therefore not covered by the IUV or by federal funds.

versities, whereas the university-cantons only have to give compensatory payments for those who decide against the home university and study at another university. They have, of course, to cover the operating costs of their own university which depend on the total number of students but compared to non-university cantons one can assume that university cantons only have to pay the marginal costs for their own students but receive an equivalent of the average study costs for every external student they host. In sum, the fact that cantons pay the study costs of the students whose parents live and pay taxes locally, regardless of whether those students study locally or elsewhere, makes it understandable that all the cantons have an interest in having mobile students return to their canton of origin after graduation, but that brain gain or brain drain is likely to be a major issue for non-university cantons in particular.

4 Data and descriptive findings

4.1 Data and Operationalization of Variables

We define the mobility of graduates as a change of canton of residence and consider thereto the canton of residence five years after graduation. Since university financing is tied to taxpayers' money and the place of residence⁶ is decisive for individual taxes, we focus on the place of residence of graduates after their studies. Mobile graduates live in a different canton than their canton of origin. The canton of origin is the canton in which the graduates obtained their university entrance diploma. Although we have data on the canton of residence of the graduates for one year and five years after graduation, we decided to focus on the canton of residence five years after graduation because administrative demographic data show (similar to other countries; see Haapanen and Tervo 2012) that there is a high degree of residential stability after this point. The yearly mobility from one canton to another of adults older than 30 (and younger than 65) is less than two percent (BFS 2017).

The data we use comes from four cohorts of the Swiss graduate surveys.⁷ This census-type survey is conducted every two years by the Federal Statistical Office (BFS 2009, 2016). Graduates are interviewed one year and five years after graduation. The analyses are based on the cohorts that graduated with a master's degree in 2002, 2004, 2006 and 2008. The response rate of graduates who answered both the first and second surveys ranges from 37 to 42%, depending on the cohort. Because the costs for foreign students are not subject to inter-cantonal payments, the analyses are limited to persons with a Swiss admission certificate, and therefore to students whose parents in almost all cases pay taxes in Switzerland, irrespective of whether they are Swiss or foreigners.⁸ Table 5 in the Appendix provides an overview of the different surveys and the numbers of observations.

⁶ The canton of residence can differ from the canton in which the graduates work, as some graduates may choose to work in another canton than where they live after graduation.

⁷ The dataset analyzed during the current study is available from the corresponding author on request.

⁸ Due to our focus on internal mobility within Switzerland, we excluded graduates who moved abroad.

4.2 Non-voluntarily mobile

The data also allow us to consider whether the graduates' canton of origin is a university-canton or non-university-canton and therefore we can not only observe the post-graduation mobility but also distinguish between graduates who were voluntarily mobile (from university cantons) and involuntarily mobile (from non-university cantons) students prior to graduation. Graduates from non-university-cantons were all forced to leave their home canton for their studies and are therefore all considered as involuntarily mobile students. In addition to this categorization, we have taken into account that there are three university-cantons, which do not offer a full university. Some graduates from these three cantons, were forced to study at another university due to their choice of studies. This is why we categorize them as involuntarily mobile based on their study subjects.

4.3 Voluntarily mobile

Graduates from university cantons, however who have decided to leave their home canton to study at a university in another canton, even they could have studied the chosen subject at the university back home, are defined as voluntarily mobile.

Since we have no information about the graduates' canton of residence during their studies, we cannot take into account whether both categorizes (involuntarily and voluntarily mobile) commuted to the university from the canton of origin or if they had moved to the canton in which they studied permanently.

4.4 Individual characteristics

The Swiss graduate surveys provide a rich set of individual data (an overview of the variables is given in Table 6 in the Appendix) that does not only cover socio-demographic characteristics but also information on the study programs, the study behavior (e.g., duration, mobility semesters during the study program and final grades). To make the information on grades comparable across students in different study fields and universities, we have standardized the grades by department, university and year of graduation and categorized students into tertiles—high performers, middle performers and low performers. We also control whether graduates are doing a PhD (1 year after graduation), as grades and obtaining a PhD are interlinked, and both are connected to post-graduation mobility (Faggian et al. 2007; Capuano 2012; Marinelli 2013; Ramos and Royuela 2017).

4.5 Cantonal variables

In addition to variables that can be taken or constructed from the data of the graduate survey, we have also matched external data on cantonal tax levels, GDP per capita, the population size and the cantonal unemployment rates to our data set. We construct two variables for each of these four pieces of cantonal information. One variable represents the ratio of the canton of origin to the regional average of the same language region and the second one represents the ratio of the study canton to the

Table 1 Net gains of in- and outflows and population of the cantons

Non-university-cantons			University-cantons		
	Population (in 1000)	Net gain (in %)		Population (in 1000)	Net gain (in %)
Aargau	571	-27	<i>Full universities</i>		
Appenzell A. Rh	53	-58	Basel-Stadt	186	77
Appenzell I. Rh	15	(-49)	Berne	959	11
Basel-Land	267	-44	Freiburg	255	1
Glarus	38	-42	Geneva	431	10
Grisons	188	-35	Neuchâtel	168	-7
Jura	69	-48	Vaud	657	11
Nidwalden	40	-47	Zurich	1282	53
Obwalden	34	(-50)	<i>Specialized Universities</i>		
Schaffhausen	74	-41	Lucerne	360	-19
Schwyz	138	-29	St Gall	462	-38
Solothurn	249	-34	Ticino	323	-15
Thurgau	235	-58	-	-	-
Uri	35	-61	-	-	-
Valais	292	-30	-	-	-
Zug	107	0	-	-	-
Mean Non-university-cantons		-36	Mean University-cantons		14

The population figures are an average for the years 2002–2008

For the net gains a mean value of the of first- and second-wave survey is displayed, the calculations are based on the numbers of university admission certificates per canton (100%)

The net gain shown reflects the gain or loss of graduates (in %)

Figures in parentheses are based on small numbers of cases and are not statistically reliable

regional average of the same language region. We consider only the regional averages of the same language region as appropriate reference points because most Swiss do not change language regions when choosing their places of living. However, for graduates who had left their language region to study, we use the country averages to calculate these ratios because of their study experiences they are likely to consider the whole country as possible living places.

The Swiss language regions are defined as follows: the German-speaking region includes all the cantons in which German is the official language. The other cantons, in which French or Italian is the official language, collectively form Latin Switzerland.

4.6 Descriptive Findings of Graduate Mobility between Cantons

In the context of the system of compensatory payments between the Swiss cantons, we first look at the descriptive gross inflows and outflows of graduates (see Table 1).⁹ We can observe that although all non-university-cantons are net losers and that on

⁹ Further descriptive statistics are shown in Tables 5 and 6 in the appendix.

Table 2 Mobility pattern of university graduates, descriptive statistics (in %)

Student mobility	Graduates originating from university-cantons			Graduates originating from non-university-cantons	
	Not mobile	Voluntarily mobile	Involuntarily mobile	Not mobile	Involuntarily mobile
–	58	33	9	0	100
<i>Canton of residence 5 years after graduation</i>					
Canton of origin	84	54	53	–	44
Canton of study		24	26	–	30
Third canton	16	22	21	–	26
<i>N</i> (analytic sample)	5240	3044	775	–	3202

average university-cantons are net gainers of mobile graduates, there is a remarkable heterogeneity in the group of university-cantons. Being a university-canton therefore is not a guarantee to be a net gainer of mobile graduates. A more refined analysis of the determinants of graduate mobility is therefore needed.

The cantonal averages of gains or losses in graduate mobility, differentiating by university- and non-university-cantons, miss two additional important dimensions, which are shown in Table 2. The first dimension distinguishes whether graduates were mobile or not, and if they were voluntarily or involuntarily mobile due to their studies. The second dimension takes into account that graduates who were mobile can choose to stay in the canton where they graduated, return to their canton of origin, or move to a third canton. Those who had not been mobile while studying do not necessarily have to stay in their canton after graduation.

There are two primary results from this descriptive analysis. First, among mobile students, less than half (for mobile students of non-university-cantons) to about half (for mobile students of university-cantons) of the graduates return to their canton of origin. Among those who do not return, only about half remain in the canton of study. In other words, limiting the research to the question of whether students stay in the canton of study or return to the canton of origin would mask an important third option. Second, the graduates who studied in their canton of origin are considerably less mobile also after graduation. An additional analysis (see Table 7 in the appendix) shows that, even after controlling for differences in the composition of the student body, the probability for a graduate living in the canton he or she was living in prior to study five years after graduation is statistically significantly higher for those who had not left their canton of origin for study compared to those who had left their canton of origin. Interestingly, the probability for a graduate living in the canton of origin five years after graduation is statistically significantly higher for graduates who were involuntarily mobile than for voluntarily mobile graduates. This indicates that the type of mobility experience in connection with studies (voluntarily vs. involuntarily mobile) is also of relevance and is the main reason why we will analyze the factors related to graduate mobility for these two groups separately, because their mobility decision might be affected very differently by these factors.

5 Modelling and findings

In this section we will concentrate on push and pull factors of mobility of those graduates for whom their cantons of origin had to finance their studies in another canton because the students had left for their studies.¹⁰ As the descriptive analysis has shown, the risk of losing the student after graduation is considerably higher if the student had left his or her home canton for studying.

To address the discussed difference of whether the prior mobility was voluntary or involuntary, we analyze the determinants of the within-country migration of university graduates for two groups with separate models—students who voluntarily left their cantons for study purposes and students who had to leave their canton involuntarily.¹¹ The determinants are estimated using a multinomial logit regression model in which the dependent variable, canton of residence five years after graduation, has three categories (j): living in the canton of study, returned to the canton of origin or moved to a third canton. The probability P of the choice of the canton of residence j for the individual i is described as:

$$P(y_i = j | x_i) = \frac{\exp(x'_{ij}\beta_j)}{\sum_{k=1}^3 \exp(x'_{ik}\beta_k)} \quad j = 1, 2, 3 \quad (1)$$

where x_i is a vector of various individual characteristics and structural canton characteristics. In the results we prefer to report average marginal effects, which facilitates the interpretation of the findings. All the statistical analyses are weighted using the weighting variable provided by the Federal Statistical Office.

5.1 Determinants of Graduate Mobility of Non-Voluntarily Mobile Students

The first regression analyzes the factors that affect the post-graduation mobility of those students who were forced to leave their canton of origin to attend university (involuntarily mobile). The results of the multinomial logit model (see Table 3) show four important determinants for a higher return mobility probability. Return mobility is higher if the student showed a low degree of mobility during his or her studies (no exchange or mobility semesters), if the student graduated in the lowest tercile of grades, if the canton of origin had a lower tax level than the cantons of the same language region and if the GDP per capita is higher in the canton of origin than in the rest of the cantons of the same language region. The first three factors are easy

¹⁰ A probit regression in the appendix (see Table 8) shows the factors that affect the probability of graduates, who had initially stayed in their home canton, to leave it five years after graduation. In comparison to the results for mobile students, the graduate mobility of students who studied in the canton of origin is not linked with the students' performance at university. Tax levels, however, are a reason to leave the home canton. At first glance, the positive effect of GDP per capita in the canton of origin is counterintuitive and cannot be interpreted causally. This is probably related to the fact that the GDP per capita is generally higher in university-cantons.

¹¹ We also analyzed the determinants for the full sample of mobile students (results are available on request). However, we choose to present the specification with two samples because too many of the explanatory variables may differ between the two groups.

Table 3 Determinants of graduate mobility of involuntarily mobile university students

Multinomial logit model	Return	Stay	Move
Studied at a specialized university	-0.068 (0.036)	-0.092* (0.037)	0.160** (0.025)
Mobility semester	-0.073** (0.020)	0.030 (0.018)	0.043** (0.016)
Studied in the other language region	-0.018 (0.026)	-0.123** (0.026)	0.141** (0.019)
<i>Academic Performance</i>			
Lowest tercile	Reference		
Middle tercile	-0.052** (0.020)	0.049** (0.018)	0.003 (0.017)
Upper tercile	-0.062** (0.021)	0.035 (0.019)	0.027 (0.018)
<i>Study subject</i>			
Economic sciences	Reference		
Humanities and social science	-0.042 (0.026)	0.057* (0.024)	-0.015 (0.023)
Law	0.121** (0.029)	-0.012 (0.026)	-0.109** (0.023)
Natural sciences	0.020 (0.031)	-0.012 (0.026)	-0.008 (0.028)
Medicine and pharmacology	0.019 (0.037)	0.019 (0.032)	-0.038 (0.032)
Technical sciences ^a	-0.366** (0.078)	0.324 (0.212)	0.042 (0.183)
Interdisciplinary and other subjects	0.220* (0.106)	-0.054 (0.094)	-0.166* (0.065)
Writing a dissertation (1 year after)	-0.035 (0.026)	0.069** (0.022)	-0.034 (0.024)
<i>Canton specific economic variables</i>			
Taxes (canton of origin vs. regional average)	-0.483** (0.073)	0.200** (0.064)	0.282** (0.062)
Taxes (canton of study vs. regional average)	-0.171* (0.078)	-0.027 (0.082)	0.145* (0.057)
GDP per capita (canton of origin vs. regional average)	-0.197** (0.066)	0.018 (0.060)	0.179** (0.056)
GDP per capita (canton of study vs. regional average)	-0.033 (0.038)	0.124** (0.034)	-0.097** (0.029)

Predicted probabilities: return 46.1%, stay 29.4%, move 24.6%

Average marginal effects, pooled sample, robust standard errors in parentheses

Additional controls include socio-demographic characteristics (i.e., sex, age, nationality, tertiary education of parents, marital status, having children), population size and unemployment rate (in the canton of origin as well as canton of study)

^aSmall number of cases, statistically not reliable

* $p < 0.05$, ** $p < 0.01$; $N = 3549$

to explain. The mobility during the studies is not only a sign that these graduates are in general more outward looking (the correlation is in this case a signal for students that are inherently more mobile) but the mobility semester (or any other mobility experience) itself could also be the causal reason for not returning to the home canton (see Oosterbeek and Webbink 2011; Haussen and Uebelmesser 2018a) as it led to new connections and networks. This explanation is backed by the observation that the students who left the canton of study during the studies are not only less likely to return to their home canton but more likely to move to a third canton. Better study results in turn allow students to be more mobile because they will have better job opportunities in many more places and lastly the higher tax levels in the canton of origin deter all students, independent from their place of work to return to their home canton. The fourth finding, that a higher GDP per capita in the home canton reduces the probability of returning, however, is puzzling at first sight. Detailed analyses reveal, however, that the result is driven by graduates from only a few very small cantons that have very high levels of GDP per capita but because of their size are hardly capable to offer enough jobs for the students who had to leave the canton for the purpose of studying.

In sum, the picture that emerges is rather bleak for the non-university-cantons. In particular, that besides losing graduates quantitatively they also tend to lose the best performing students. The findings show, however, also, that the cantons of origin could influence the mobility pattern to a certain degree. If they had a lower tax level, they would be able to attract a part of the graduates that now mainly move to third cantons with low tax levels. As it seems now, the non-university cantons are caught in a vicious circle, where they have to keep higher tax levels in order to finance partly also the cost of studying of their students but where the same tax levels deter these students from coming back home and thereby lead to an erosion of the tax base, which in turn increases the pressure for higher taxes.

The empirical analysis also reveals the factors that increase the likelihood that these involuntarily mobile students move to a third canton instead of returning to the home canton or remaining in the canton where they have studied. Moving away to a third canton is less likely, if the graduates continued their academic career with a PhD (1 year after graduation) and if the GDP per capita is higher in the university canton. Conversely, if the university in the canton of study was not a full university, the probability is higher that the university canton loses graduates to third cantons. This is probably a result of the fact that specialized universities produce a too high number of graduates in a specific field relative to the needs of the local labor market and that therefore most of these graduates have to move away for job-market reasons. This probably also applies to the labor market of the home cantons, which might not offer enough jobs for all students from the same subject area, which is why they mainly move to third cantons.

5.2 Determinants of Graduate Mobility of Voluntarily Mobile Students

The second regression analyzes the determinants of graduate mobility for students who were voluntarily mobile, which is only possible for students from university cantons (i.e. students for whom their home canton has a full university or who have

Table 4 Determinants of graduate mobility of voluntarily mobile university students

Multinomial logit model	Return	Stay	Move
University of the canton of origin with a specialized university	0.046 (0.030)	-0.057* (0.024)	0.012 (0.026)
Studied at a specialized university	-0.107** (0.041)	-0.148** (0.042)	0.255** (0.030)
Studied in the other language region	-0.072** (0.027)	-0.089** (0.023)	0.161** (0.021)
Mobility semester	-0.030 (0.021)	-0.002 (0.017)	0.032 (0.017)
<i>Academic performance</i>			
Lowest tercile	Reference		
Middle tercile	-0.026 (0.021)	-0.001 (0.017)	0.025 (0.018)
Upper tercile	-0.070** (0.023)	0.037 (0.019)	0.033 (0.019)
<i>Study subject</i>			
Economic sciences	Reference		
Humanities and social science	-0.025 (0.030)	0.013 (0.026)	0.012 (0.025)
Law	0.059 (0.033)	-0.067* (0.028)	0.008 (0.027)
Natural sciences	0.009 (0.044)	-0.021 (0.037)	0.012 (0.036)
Medicine and pharmacology	-0.020 (0.046)	-0.055 (0.035)	0.075 (0.041)
Technical sciences ^a	-0.236 (0.174)	0.294 (0.159)	-0.058 (0.129)
Interdisciplinary and other subjects	0.061 (0.099)	0.074 (0.092)	-0.135* (0.066)
Writing a dissertation (1 year after)	-0.059 (0.034)	0.070** (0.027)	-0.011 (0.028)
<i>Canton specific economic variables</i>			
Taxes above (canton of origin vs. regional average)	-0.195* (0.091)	-0.101 (0.075)	0.295** (0.078)
Taxes above (canton of study vs. regional average)	-0.178** (0.082)	0.076 (0.087)	0.103 (0.053)
GDP per capita (canton of origin vs. regional average)	0.089 (0.071)	-0.068 (0.057)	-0.021 (0.061)
GDP per capita (canton of study vs. regional average)	-0.120** (0.037)	0.083** (0.030)	0.037 (0.030)

Predicted probabilities: return 54.7%, stay 23.8%, move 21.6%

Average marginal effects, pooled sample, robust standard errors in parentheses

Additional controls include socio-demographic characteristics (i.e., sex, age, nationality, tertiary education of parents, marital status, having children), population size and unemployment rate (in the canton of origin as well as canton of study)

^aSmall number of cases, statistically not reliable

* $p < 0.05$, ** $p < 0.01$; $N = 2934$

chosen a subject that they could have studied at their home university). Compared to the previous group of involuntarily students, most factors affect post-graduation mobility in a similar way with one notable difference (see Table 4). Contrary to involuntarily mobile students, the mobility during the studies does not affect later graduate mobility of voluntarily mobile students. In our view the most likely explanation for the difference in the impact of mobility semesters for later graduate mobility is the fact that the voluntarily mobile students already constitute a selection of particularly mobility prone students and that therefore the experience of additional mobility during studies does not increase their post-graduation mobility.

Regarding student performance, tax levels and the effect of specialized universities, we observe similar effects as for the involuntarily mobile students and the same interpretation applies. However, it is noteworthy that in the case of voluntarily mobile students the cantons of origin, that are themselves university cantons, do not lose these graduates to the cantons where the students chose to study but mainly to third cantons. In particular, higher tax levels in the canton of origin as well as in the canton of studying are mainly increasing mobility to third cantons at the expense of the cantons of origin and not at the expense of the canton of studying. In both cases graduates choose to avoid places of living with relatively high tax levels.

Contrary to the findings for the involuntarily mobile students, the signs of the coefficients for the relative GDP per capita do make sense, as they indicate that if the canton of study enjoys higher levels of GDP per capita, then this canton is more likely to retain its students. GDP per capita in this case could signal better employment opportunities. This could be an indicator that graduates are actually more likely to find work and stay.

6 Summary and conclusion

In this study, we investigated various pull and push factors, which can be related to graduate mobility of students in Switzerland. Graduate mobility within a country can be of considerable interest, if—as is the case for Switzerland—regional authorities (cantons) have to pay for the studies of their citizens and therefore depend on mobile students returning to their home regions after graduation in order to recoup at least part of the investment through the future tax payments of these graduates. Due to the Swiss context we are able to distinguish in our analyses the voluntary and involuntary mobility of graduates. Those from a non-university canton had to study in another canton as well as graduates from one of the three cantons without a full university, were, depending on their study choice, forced to study at another university. In contrast to the involuntary mobiles, certain graduates from university cantons were voluntarily mobile although they could have completed the same studies in their home canton. In the case of the latter we do not know whether an increased mobility after graduation could be just the effect of those graduates being a particularly mobility prone selection of people. But for the first group we do not have a selection problem. The entire cohort had to be mobile for the purpose of studying. One of the main empirical findings of our paper is therefore, that, controlling for individual, economic and other factors, graduates, who had to

be mobile (involuntarily mobile) for the purpose of studying are less likely to be resident in their canton of origin compared to graduates who remained as students in their home canton. It is therefore likely that student mobility induces graduate mobility. We also find—as expected—a lower return mobility for voluntarily mobile students and as concerns the factors influencing graduate mobility, however, they are with a few exceptions the same for involuntarily and voluntarily mobile students. In essence, students who left their canton of origin for the purpose of studying, independent of their motivation, have a lower probability to live in their canton of origin five years after graduation compared to students who studied in their canton of origin. Therefore, the cantons paying for students that leave the canton to study in another canton are financing the study expenses of people that they will not be able to tax later.

As in previous studies (Faggian et al. 2007; Ramos and Royuela 2017), we find additionally that graduate mobility does not only have a quantitative dimension but also a qualitative one. Graduates with higher grades are more likely to be mobile after graduation, most likely because they have best job opportunities everywhere. Therefore, paying cantons do not only lose graduates in quantitative terms to other cantons but also in qualitative terms. As it is plausible to assume that grades at graduation are related to future earnings, cantons that finance all or a considerable part of their students attending out-of-the-canton universities suffer therefore a double penalty because of the quantitatively lower return mobility of graduates and the negative selection of home-coming graduates.

Finally, the results also reveal important further information when considering the financial agreements between cantons to finance higher education. The analyses show that approximately half of the graduates that choose not to return to their cantons of origin do not stay in the place of study but move to a third canton. It should therefore be borne in mind that brain gain and brain drain is not only an issue between two parties, the financing cantons of origin and the canton of study, but that there is also a potentially profiting third party, as has already been discussed in literature (Poutvaara 2001). These are the cantons that neither covered the direct study cost nor the additional cost of operating the university, but benefit from the taxes of the graduates they were able to attract. Accordingly, a fair system of redistribution of the costs of studying should rather take into account the proportion of tax paying graduates a canton is able to attract than the sole information of the canton of residence at the time of receiving the university entrance diploma.

Appendix

Table 5 Number of observations of study population (5 years after graduation, second-wave survey)

	University cantons	Non-university cantons
Graduates 2002	2325	805
Graduates 2004	2605	869
Graduates 2006	2585	872
Graduates 2008	2335	781
Pooled sample	9850	3327

Table 6 Descriptive statistics of variables (analytic sample, 12,262 observations)

Variable	Mean	Min/Max
Canton of origin is canton of residence (5 years after graduation)	0.461	0/1
Mobility related to the studies		
Not mobile, studied in the canton of origin	0.434	0/1
Voluntarily mobile	0.258	0/1
Involuntarily mobile	0.303	0/1
Studied in the other language region	0.122	–
Mobility semester (domestic or foreign)	0.232	0/1
Studies related variables		
University of the canton of origin is a specialized university	0.148	0/1
Studied at a specialized university	0.096	0/1
<i>Academic Performance, final grade sorted by department, university and year of graduation</i>		
Lowest tercile	0.331	0/1
Middle tercile	0.345	0/1
Upper tercile	0.322	0/1
Economic sciences	0.187	0/1
Humanities and social sciences	0.414	0/1
Law	0.195	0/1
Natural sciences	0.117	0/1
Medicine and pharmacology	0.077	0/1
Technical sciences (small number of cases, statistically not reliable)	0.004	0/1
Interdisciplinary and other subjects	0.006	0/1
Writing a dissertation (1 year after)	0.105	0/1
Socio-demographic characteristics		
Foreigner (non-Swiss nationals)	0.043	0/1
Female	0.524	0/1
Age (1 year after graduation)	28.321 (4.48)	21/75
Highest level of education of one or both parent(s) is tertiary, ISCED 5A	0.392	0/1
Lives with his/her partner in the same household (5 years after)	0.404	0/1
Married (5 years after)	0.110	0/1
Children (5 years after)	0.067	0/1
Canton specific economic variables		
Taxes (canton of origin vs. regional average)	1.004 (0.156)	0.398–1.325
Taxes (canton of study vs. regional average)	1.028 (0.216)	0.000–1.447
GDP per capita (canton of origin vs. regional average)	1.013 (0.249)	0.618–2.046
GDP per capita (canton of study vs. regional average)	1.110 (0.357)	0.000–2.108
Population (canton of origin vs. regional average)	1.949 (1.378)	0.054–4.670
Population (canton of study vs. regional average)	2.323 (1.520)	0.000–4.670
Unemployment rate (canton of origin vs. regional average)	1.011 (0.240)	0.317–1.487
Unemployment rate (canton of study vs. regional average)	1.095 (0.336)	0.000–2.731

For metric variables standard deviation in parentheses

Table 7 Probability of living in the canton of origin (5 years after graduation)

Probit regression	Return
From a university canton, voluntary mobile	Reference
From a non-university canton, involuntarily mobile	-0.033** (0.016)
From an university canton, not mobile	0.228** (0.013)
<i>Control variables</i>	
Studies related variables	x
Individual characteristics	x
Canton specific economic variables	x
<i>N</i>	11,405

Predicted probabilities: return 65.3%, average marginal effects, pooled sample, robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

Table 8 Probability of leaving the canton of origin for graduates who had studied in their home canton (5 years after graduation)

Probit regression	Leave
Studies at a specialized university	0.179** (0.022)
Mobility semester	0.017 (0.012)
<i>Academic performance</i>	
Lowest tercile	Reference
Middle tercile	-0.002 (0.012)
Upper tercile	-0.001 (0.012)
<i>Studies related variables</i>	
Writing a dissertation (1 year after)	-0.027 (0.017)
<i>Canton specific economic variables</i>	
Taxes (canton of origin vs. regional average)	0.297** (0.044)
GDP per capita (canton of origin vs. regional average)	0.088** (0.033)
<i>N</i>	4922

Predicted probabilities: leave 15.2%, average marginal effects, pooled sample, robust standard errors in parentheses

Additional controls include the study subject, socio-demographic characteristics (i.e., sex, age, nationality, tertiary education of parents, marital status, having children), population size and unemployment rate (in the canton of origin)

* $p < 0.05$, ** $p < 0.01$

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