

The Effects of Local Major Offer on Major Choice[#]

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February 15, 2013

Abstract

This paper uses the establishment of the University of Lugano in the Swiss Canton of Ticino as a natural experiment to estimate the effect of distance to a university with a limited major offer on individual major choice. Results indicate that the effect of distance on major choice is significant and quantitatively important. The probability of an average student from Ticino to choose a major offered at the University of Lugano increased by at least 4.6 percent after its establishment compared to the control group. Distance to college might influence major choice because of transaction costs, social costs, spill-over effects and ability sorting of parents. The setting of our natural experiment allows us to estimate an upper border of the distance effect which is not biased by ability sorting of parents.

Key words: Major Choice, Distance to College, Natural Experiment.

JEL Classification: I21, I23, J24.

[#] Acknowledgements: I am grateful to Reiner Eichenberger, Volker Grossmann, Mario Jametti, Wolfram Richter, David Stadelmann, Stephanie Fürer, Michael Keller, Luca Piezzi, Marco Portmann, Mark Schelker and Eva Spring for illuminating and inspiring discussions and prove reading. I am also grateful for many instructive comments from the audience on the annual congress of the International Institute of Public Finance and the audience of the PhD Seminar of the University of Fribourg (Switzerland).

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1 Introduction

The number of tertiary graduates has been constantly increasing over the past decade in all OECD countries. The share of graduates in Germany, for example, doubled from 14 percent in the cohort of 1995 to 28 percent in the cohort of 2009 while, in Switzerland, the share more than tripled from 9 to 32 percent during the same period (see OECD, 2011). Major and university choices of talented high school graduates receive high attention in public debates on educational policy. When implementing, for example, the Bologna-Reform and the Excellence Initiative, policy makers in Germany aimed to encourage competition between universities. The intensity of competition depends on the mobility of students and their willingness to apply to the best universities when choosing their major. This raises the question whether high skilled students are really sensitive to distance to college in their major choice. The importance freshmen attach to physical distance may help to develop appropriate support programs to increase students' mobility.

The establishment of the University of Lugano in the Swiss Canton of Ticino serves as a natural experiment to identify the effect of distance on major choice of college graduates. Before its establishment in 1996, Ticino's high school graduates had to attend university out of their home canton. Leaving Ticino is associated with comparatively high costs as the canton of Ticino is the only Italian speaking canton in Switzerland and geographically separated by the Alps from the other parts of the country. In 1996, the University of Lugano started offering majors in Economics, Humanities (Media Science and Italian Literature) and technical sciences (Informatics, Architecture). Choosing one of these majors would allow high school graduates from Ticino to avoid the costs of attending university abroad or in a distant canton with another official language than their mother tongue. Hence, first year students have to weigh the costs of a potential mismatch in their preferences for certain majors against the costs of moving out of Ticino and having full major choice. Due to this exogenous change in the individual incentive scheme of Ticino's high school graduates we should expect that Ticino's high school graduates are more likely to choose a locally offered major after the establishment of the University of Lugano in 1996. Since the university and major offer remained fairly constant in the other parts of Switzerland, high school graduates from these parts form an appropriate control group for overall trends in major choice. For our estimations we draw on data of the Swiss Graduate Survey from 1995 to 2007.

Our paper complements the literature and contributes to a recent discussion on the effect of distance on university and major choice. Frenette (2004, 2009), Long (2004), Dwenger, Spiess

and Wrohlich (2012) as well as Gibbons and Vignoles (2012) find that distance to college has a negative effect on college attendance. They propose four underlying mechanisms why distance to college has a negative impact on college attendance: transaction costs due to commuting or moving to college, social costs of leaving family and friends, spill-over effects of a local university providing specialized information on higher education and ability sorting of parents who prefer to live next to a university. In line with this literature we use the setting of a natural experiment to explore the effects of distance on major choice. Denzler and Wolter (2010, 2011) were the first who analyzed the impact of distance to college on major choice of college applicants in Switzerland.¹

Our results show that the effect of distance on major choice is significant and quantitatively important. The probability of an average student from Ticino to choose a major offered at the University of Lugano increased by at least 4.6 percent after the establishment of the university compared to the control group. Our estimates represent a potential upper border for the effect of distance which is not biased by ability sorting of parents: Firstly, the canton of Ticino is out of commuting distance to universities situated in other parts of Switzerland. This markedly raises transaction costs for students from Ticino. Secondly, the social costs of moving away to another cultural and social environment are comparatively high as families and friends are left behind. Thirdly, the political debate about the opening of the University of Lugano should provide high school graduates with specialized information on locally offered majors. At the same time, the new faculty members and the student body are likely to promote studying at the University of Lugano. Thus, high spill-over effects of the local University can be assumed. Finally, the fast and uncertain establishment of the University of Lugano makes it unlikely that parents sorted themselves next to the new university. Additionally, the populated part of Ticino is geographically so small that it is only a drive of maximal 45 minutes to the University of Lugano for 70.95 percent of Ticino's total population. Ability sorting is a common problem in the distance to college literature because families with high preferences for education might move next to universities. The setting of our natural experiment may allow us to exclude that ability sorting of parents bias our results and to estimate an upper border for the effect of distance to a college with limited major offer.

¹ Beside distance to college, the main determinants of college major choice suggested by the previous literature were quantitative abilities (e.g. Arcidiacono, 2004), parental background (e. g. Boudarbat and Montmarquette, 2009), expectations on future labor force participation (e. g. Polachek, 1978; Blakemore and Low, 1984) and life time earnings (Berger, 1988 and Zafar, 2009). Arcidiacono et al. (2012) give a short review of the recent literature.

The remainder of this paper is organized as follows: Section 2 gives an overview over the literature on major choice in general and the effects of distance in particular. In section 3, we explain the structure of the natural experiment including a description of our dataset and our estimation strategy. Empirical results of the relationship between major and university choice are presented in section 4. Section 5 concludes.

2 Literature Overview

Distance to college has a negative impact on college attendance as a recent strand of literature shows (e.g. Card, 1993; Long, 2004; Frenette 2004, 2009; Carneiro, Heckman, Vytlačil 2010; Gibbons, Vignoles, 2012). Card (1993) used the distance to college as an instrument for college attendance to estimate the return to schooling without selection bias. Follow up papers showed that distance to college is correlated with ability measures of high school graduates (Cameron, Taber 2004; Carneiro, Heckman, 2002) and the characteristics of the local labor market (Cameron, Heckman, 1998, 2001). Nevertheless, distance to college is a widely used and accepted instrument in the return to schooling literature (e.g. Card, 1993; Kane, Rouse, 1995; Currie, Moretti, 2003, Carneiro, Heckman, Vytlačil, 2010).

At the same time, distance to college and its negative impact on college attendance are a highly debated topic in the literature of university choice which is interested in the effect of local institutions of higher education on college enrollment and, in particular, the underlying mechanisms (e.g. Frenette 2004, 2009; Alm, Winters, 2009). The findings help policy makers to understand why students do not attend college and how educational policy may increase college enrollment. Additionally, the results help colleges and universities to anticipate which teaching capacities are needed when the population grows or shrinks (see Alm, Winters, 2009). The literature of university choice highlights four reasons why distance to college has a negative effect on college attendance: transaction costs, social costs, spill-over effects and ability sorting of parents. The following subsections review each of these reasons in more detail.

A higher distance to college raises transaction costs. Those can be commuting costs for students living in a reasonable distance or the expenses to move to an apartment near the college (Alm, Winter, 2009). In the latter case, students have to pay the rent of the flat as well as travel costs to go home (e.g. Denzler, Wolters, 2010; Gibbons, Vignoles, 2012). Students also lose scale effects of living in their family household (Spiess, Wrohlich, 2010). In sum, living out of commuting distance increases transaction costs considerably which makes it expensive to attend a college (Frenette, 2004). There is some empirical evidence that transaction costs influence

university choice. Long (2004) as well as Gibbons and Vignoles (2012) find for the US and England that the effect of distance on college attendance decreases if parents have a higher income. In Switzerland, the distance effect diminishes completely for students with a wealthy family background (see Wolters and Denzler, 2010, 2011). The probability of attending a college shrinks markedly if a student lives out of commuting distance (see Frenette, 2004).

The choice of university is also associated with social costs: Moving to another city means to give up the whole social environment like family, friends, and local networks (e.g. Frenette 2009, Spiess, Wrohlich, 2010). Frenette (2009) shows that social costs are especially high for ethnic minorities. In such an environment, a higher income of parents does not reduce the size of the negative distance effect. This result suggests that social costs dominate transportation costs in ethnic minorities. This effect cannot only be observed in minorities: Controlling for household income and ability measures Turley (2006) finds that high school graduates are less likely to attend college when their parents think it is important for their child to stay at home during college. Surprisingly, the gap between “college-at-home parents” and “college-anywhere parents” is the largest when a child has proved a high ability in standardized tests. In this case, 95 percent of high school graduates with “college-anywhere parents” apply to college, whereas only 76 percent of high school graduates with “college-at-home parents” apply. Turley (2006) proposes three potential explanations for this observation: “College-at-home parents” influence indirectly the preferences of their children. They prohibit directly their children from applying to college. They put social pressure on them to raise social costs.

The presence of a college is also supposed to have direct spill-over effects on the local environment. The literature distinguishes peer group and network effects. Concerning peer group effects, parents and pupils living next to a university might take faculty members and the local student body as an example so that going to university becomes a natural goal in the direct neighborhood of a university (see Do, 2004; Spiess, Wrohlich, 2010; Wolters, Denzler, 2010). Network effects emerge from the direct contact to faculty members and students. Pupils within the direct catchment area of a college may have special knowledge of life and possibilities at college, support programs and career prospects after a college degree. For example, families living next to a college can easily participate on official briefings on open days (see Siegfried, Getz, 2006, Spiess, Wrohlich, 2010, Wolters and Denzler, 2010). Spiess and Wrohlich (2010) try to capture spill-over effects by controlling for the student density in different areas. The insignificant result for this variable suggests that spill-over effects seem to be rather low on aggregated levels. Siegfried and Getz (2006) compared the university choice of high school graduates with parents working at university and graduates with a similar socioeconomic

background. They find that high school graduates of faculty members are much more selective in their college choice. This might be due to the fact that specialized knowledge on higher education changes decisions on university choice (see Siegfried and Getz, 2006).

Card (1993, 1995) already suspected the distance-to-college variable to be a proxy for ability sorting of parents. Parents with higher education or strong preferences for education might prefer to work and live in more urban areas which are more likely to have a good local college access. Cameron and Taber (2004) find a correlation between distance to college and ability measures of high school graduates. Cameron and Heckman (1998, 2001) show that local labor market measures reduce the distance effect on college attendance of high school graduates. Gibbons and Vignoles (2012) as well as Spiess and Wrohlich (2010) try to control for ability sorting using the distance to other universities than the next or, alternatively, large cities without universities. They show that the distance to the next university still matters for the attendance decision.

The literature shows that distance to college has an effect on college attendance. There are several underlying mechanisms why such a correlation can be observed. These mechanisms seem to influence also the choice of the college type. In Canada, students can apply for 2-Year-Colleges, 4-Year-Colleges and research universities. Frenette (2004, 2009) uses the establishment of colleges and research universities as a natural experiment for identifying the distance effect on the college choice. He finds that high school graduates are more likely to apply for the colleges situated next to them – independent of the fact whether it is a 2-Year-College or a 4-Year-College. With respect to research universities, such an effect cannot be observed. However, distance to different college types might distort the type of education chosen by high school graduates.

As shown before the literature finds an effect of distance to college on both the college attendance rate and the type of college chosen by high school graduates. This raises the question whether a restricted local major offer distort the major choice decision of students. In such a situation, students have to weigh the different costs of going away against a potential mismatch between their preferences for a certain major and the local major offer. Denzler and Wolters (2010, 2011) analyze the effect of distance to the University of Lucerne and the Swiss Federal Institute of Technology (ETHZ) in Zurich on major choice for college freshmen situated in the German speaking part of Switzerland. The University of Lucerne was established in the year 2001 and is mainly focused on Law. The Swiss Federal Institute of Technology is the only University in the German speaking part of Switzerland offering majors in Technical Science and a broad range of high quality majors in Natural Sciences. Denzler and Wolter (2010, 2011) find

that high school graduates living next to the University of Lucerne or the ETHZ are more likely to apply for law studies resp. for a major offered at the ETHZ. Denzler and Wolter (2010, 2011) limit their analysis on pupils who actually attend college. They argue that this reduces possible doubts about a potential selection bias because the attendance decision of a high school graduate is already made and cannot distort the results anymore. In the analysis of major choice they assume that the distance-to-college variable is less suspicious of being endogenous. For example parents had no time to sort themselves next to the University of Lucerne because it is relatively new.

Our paper contributes to this literature by estimating a time persistent upper border for the effect of distance to the next university with restricted major offer on major choice using a natural experiment. Our results confirm Denzler and Wolter (2010, 2011) who found a distance effect on the major choice of for college freshmen. The main determinants of college major choice suggested by the previous literature were quantitative abilities (e.g. Arcidiacono, 2004), parental background (e.g. Boudarbat and Montmarquette, 2009), expectations on future labor force participation (e.g. Polachek, 1978; Blakemore and Low, 1984) and life time earnings (Berger, 1988). An interesting recent literature uses surveys to elicit measures of expectations and counterfactuals in major choice and confirms the effect of wage expectations on major choice (e.g. Zafar, 2009, Arcidiacono et al., 2010).

3 Study Design

3.1 The natural experiment

3.1.1 The Treatment Group

We use the establishment of the University of Lugano to identify how a local university with a limited major offer alters students' major choice. The University of Lugano is the first university in the Swiss canton of Ticino. Its major offer is restricted to Economics, Humanities (Media Science and Italian Literature) and Technical Sciences (Informatics and Architecture). Before the establishment of the University of Lugano in 1996, students from Ticino had to leave their home canton to attend university in the other parts of Switzerland or abroad. For students from Ticino going away is associated with relatively higher costs than for other students from Switzerland. First, the canton of Ticino is the only Italian speaking canton in Switzerland. Second, in the north of Ticino, the Alps are a natural barrier separating the canton geographically from the other parts of the country. In the south, the canton is surrounded by Italy. Hence, leaving Ticino means for college freshmen going abroad or moving to a distant canton and doing

their studies in another language. The establishment of the University of Lugano can be regarded as an exogenous shock for Ticino's high school graduates. We exploit this exogenous change of individual incentives for analyzing major choice: Before 1996, all college freshmen had to bear the costs of going away. Thus, each major choice was associated with similar costs. After 1996, high school graduates could potentially stay in their home canton for doing their studies. However, they faced a restricted local major offer if they decided to apply for the University of Lugano. Hence, Ticino's high school graduates had to weigh the costs of a potential mismatch in major choice against the costs associated with leaving their home canton. Thus, we expect a shift in the major choice of Ticino's high school graduates towards the majors offered at the University of Lugano. At the same time, the university and major offer in the other cantons of Switzerland remained fairly constant without any major change. Using high school graduates from other Swiss cantons as control group allows us to identify the impact of the new local university in the setting of a natural experiment. The institutional and socio-economic conditions in this control group are comparable to the treatment group of students from Ticino.

The literature review showed that distance to college can also work through spill-over effects and ability sorting by parents. Concerning spill-over effects, the political discussion about the establishment of the University of Lugano and the advertising of the new university imparted a great deal of specialized knowledge about the local programme options fostering strong spill-over effects on Ticino's high school graduates. Concerning the ability sorting of parents, it is unlikely that our results are biased by such an effect because the canton of Ticino is very small and most of the population is living in commuting distance to Lugano. Altogether, transaction costs, social costs and spill-over effects should be particularly pronounced in the case of our natural experiment whereas ability sorting of parents should not bias our results. Thus, we should get an upper border for the distance effect on major choice in the long run which is not biased by ability sorting. In the following, we will discuss in more detail why transaction costs, social costs and spill-over effects should be especially strong in the case of Ticino and why ability sorting of parents should not be observed. Furthermore, we will argue that the French and the German part of Switzerland are appropriate control groups for capturing overall trends towards the majors offered at the University of Lugano.

Transaction costs for attending university are peculiarly high if high school graduates are living out of commuting distance (see e.g. Frenette, 2004). In Ticino, this was the case for college freshmen if they wanted to attend a Swiss University before 1996. It took students 2 hours and

40 minutes, to go by train from Lugano² – the largest city in Ticino – to the next Swiss university situated in Zurich. Thus, in 1990, only 1.31 percent³ of Ticino's students commuted to another Swiss canton. With respect to universities in Italy, it was a travel time of about an hour from Lugano to the next university in Milano. Two years after the establishment of the University of Lugano, the Italian University of Insubria was founded offering majors in (Italian) Law, Economics, Medicine and Natural Science. This reduced the travel time to a distance of 35 minutes by train from Lugano. Although the travel time to the next Italian university was much shorter compared to Swiss Universities, border effects could additionally reduce the number of students studying abroad. For example, the literature on bilateral trade finds strong negative effects of national borders on trade (see e.g. McCullum, 1995; Anderson, Van Wincoop, 2003). Analogous to this literature the border may also reduce the number of students commuting or moving to Italy.

Our estimates for the impact of the University of Lugano on major choice might indicate a stronger effect due to students who would have studied in Italy before the establishment of the University of Lugano. Since Swiss graduates abroad are not included in our dataset, our estimation of the effect size should be particularly pronounced due to a systematic change in our sample structure: Students having preferences for majors offered in Lugano could stay in Switzerland instead of going abroad. Students with preferences for studying a major in their mother tongue, which is not locally offered, still go to university in Italy and therefore they do not appear in our national survey. Because of that, a higher number of graduates having preferences for majors offered in Lugano is included in our dataset after the establishment of the University of Lugano – just because of staying in Switzerland and not because of major choice. Consequently, a part of the measured effect of the University of Lugano on major choice might be driven by a pure substitution effect between foreign universities and the University of Lugano without having any direct effect on major choice. For our estimation strategy this is no problem because it makes it even more likely that we estimate an upper border for the long-run impact of a locally restricted major offer.

² 70.95 percent of Ticino's total population lives in commuting distance to Lugano. Thus, Lugano will serve us as a useful point of reference for distance measures illustrating the geographic position of the region. For calculation, we divided the population of the districts Lugano, Bellinzona and Mendrisio by the total number of inhabitants. In these districts, the maximal commuting distance to Lugano is a drive of about 45 minutes by car. Using only public transportation it would take a student up to 2 hours by bus and train. A short drive by car to the next main central station would reduce the maximal overall commuting time to one hour mostly using public transportation.

³ For calculation, we used statistics on commuting flows and high school graduates in Ticino. The data on commuting flows are online available under <http://www.media-stat.admin.ch/stat/pendler>. The data on high school graduates are available on request from the Federal Statistical Office.

Relative transaction costs might also be driven by divergent tuition fees among Swiss universities. Since the total amount of tuition fees and its variance is much lower in Switzerland than in Anglo-Saxon countries, the impact of such differences on transaction costs might be substantially lower in Switzerland. However, we should note, that the University of Lugano asks 4,000 CHF tuition fee per year. On average, students studying at the University of Lugano have to pay 2,580 CHF more per year than students from other Swiss universities.⁴ In terms of annual gross income, a blue-collar worker in Ticino has to spend notable 5.45 percent more of his income on tuition fees if his child applies for the University of Lugano. Though, we should also keep in mind that a move to another Swiss canton would be much more expensive so that the influence of different tuitions fees on relative transactions costs seems to be negligible.

If there is no alternative but to move to a university city, students have to bear high social costs for going to university. For example, they have to leave their families and their social networks (see e.g. Frenette, 2004). In the case of our natural experiment, social costs are even higher for Ticino's high school graduates living in the only Italian speaking canton of Switzerland: They have to carry the costs of going abroad or moving to a canton in which another language is spoken. Altogether, these costs markedly reduce the exchange between the canton of Ticino and its neighboring cantons. Figures on inter-cantonal migration flows seem to confirm this hypothesis. In 2000, only 0.57 percent of Ticino's Swiss population emigrated to another canton. Compared to an average emigration rate of 1.94 percent in the other parts of the country, this is rather low. The same effect can be observed for inter-cantonal immigration. Whereas only 0.68 percent of the cantonal Swiss population moved to Ticino in 2000, this rate amounts on average to 1.91 percent in the other cantons.⁵

Two mechanisms could weaken the supposed effect of social costs due to friends and language: First, the social network of a high school graduate in Ticino might migrate to other Swiss university cities because most of his schoolmates apply there for university. If a high school graduate is well-integrated in his family or in clubs and societies outside school, the social costs of a migrating school network are less important. If high school graduates feel a stronger rapport with schoolmates, instead, they might be more likely to apply together with their friends for a certain university. However, we should also note, that school networks could decide to stay

⁴ The tuition fees of all Swiss Universities are published by the Rectors' Conference of the Swiss Universities. Detailed information on tuition fees in Switzerland are online available under: <http://www.crus.ch/information-programme/study-in-switzerland.html?L=2>.

⁵ The figures used in the text are based on own calculation. We draw on data of the cantonal population statistic, which are online available from the Federal Statistical Office of Switzerland.

together in their home canton after the establishment of the University of Lugano. We cannot entirely exclude that the migration of school networks reduces the relative social costs of moving to other university cities.

Second, the Italian speaking part of Switzerland is very small. Only 6.5 percent of the total population speaks Italian as mother tongue. Consequently, a good command of at least one additional national language might be very important for college graduates: First, a student might have better career prospects in Ticino because the other national languages are also necessary in daily business life of local companies. On the other hand, speaking a second national language could also open up the labor market in other parts of Switzerland. In sum, a college freshman has to weigh the social benefit of studying in his mother tongue against potential disadvantages in his future career due to language problems. This trade-off should further reduce the relative costs of a high school graduate to leave Ticino. However, if language is so important, visiting language courses at the University of Lugano or an exchange year might be sufficient to overcome such difficulties without giving up the social benefits of staying at home.

Because of potential peer group and network effects, universities are also supposed to have spill-over effects on the local youth (see e.g. Spiess, Wrohlich, 2010; Wolter, Denzler, 2010; Siegfried, Getz, 2006). Peer groups may serve as a good example for parents and pupils. Local networks provide special knowledge of life at university, support programs and career perspectives after graduation. In the case of our natural experiment, it is unlikely that peer group and network effects work in a traditional way. Local networks of the faculty staff and the student body need some time to develop. At the same time, it takes a while until successful students and graduates can serve as an example for younger peers. However, peer group effects can already arise from high school graduates going to university in Lugano who set an example for their peers. Thus, this classical mechanism should also induce some effect on major choice.

However, spill-over effects of the University of Lugano are likely to be particularly pronounced at the time of its establishment because of non-traditional mechanisms: Both the political discussion and the advertising of the new university should provide high school graduates with specialized information on life at university and the offered majors. The fast and uncertain establishment of the university should allow us to capture most of these spill-over effects triggered by the establishment of the University of Lugano.

Concerning the political discussion, it is only possible that spill-over effects already exert an influence on the cohorts of 1994 and 1995: A small group of politicians planning a new university in architecture introduced the public to their intentions in 1993 for the first time. At

the end of the same year it was proposed to set up two faculties in economics and humanities as well (cp. Bischoff, 2001). Because of that, it is unlikely that cohorts before 1994 were influenced by the political proposal. Therefore the fast establishment of the University of Lugano reduces the probability that students or parents anticipated the locally offered majors in advance and adapted their school career correspondingly.

Concerning the advertising of the new university, we gain considerable advantage from the uncertain establishment of the University of Lugano: First, the cantonal government disputed with the city of Lugano on the funding of the different faculties. Afterwards, deciding on the university law in October 1995, the cantonal parliament did not know whether the new institution would be recognized as a university on national level (cp. Bischoff, 2001). Finally, the University of Lugano already opened its doors for the winter semester 1996. Due to this setting, we can exclude that the advertising of the local university was important in shaping preferences of Ticino's high school graduates for certain majors before the cohort of 1996.

At the same time, it is unlikely that our results are driven by ability sorting of parents before and after the establishment of the University of Lugano. The language barrier, the geographic position and the effect of the Italian border makes it unlikely that parents with high abilities or high preferences for education moved next to a university before 1996. After the establishment of the University of Lugano, it is also unlikely that parents sorted themselves next to the new university for two reasons: Firstly, for 70.95 percent of Ticino's total population (districts of Lugano, Bellinzona and Mendrisio), the maximal commuting distance to the University of Lugano is a drive of 45 minutes by car. Thus, most of the population lives in commuting distance to the University of Lugano so that it is easy for all high school graduates to attend even if there is some ability sorting by parents. Secondly, the fast and uncertain establishment of the University of Lugano reduces the probability that parents have chosen the place of residence with regard to the location of the new university. Altogether, our results should not be biased by ability sorting of parents. However, we control later on for the educational level of parents to further decrease the suspicion that results might be affected by ability sorting of parents.

3.1.2 The Control Group

So far we have discussed in detail the Canton of Ticino as the treatment group of our natural experiment. We propose the other cantons of Switzerland as control groups. This seems to be plausible because of two reasons: In the control and in the treatment group, the

institutional setting and socio-economic trends are almost the same, the major offer in the control group remained almost identical over time.

Firstly, the institutional setting on national level is the same. For example, important regulations of the labor market (e.g. protection against dismissal, unemployment benefits) are regulated in national law.⁶ Therefore it can be excluded that varying regulations in these areas might lead to different expectations about future earnings or unemployment. Furthermore, the different university degrees are officially acknowledged all over Switzerland. The Rectors' Conference of Swiss Universities accredits universities and study programs.⁷ Consequently, it is not necessary to choose a particular university for pursuing a certain occupational career.

Moreover, socio-economic outcome levels vary across the different parts of the country, but they changed in the same way over the relevant time horizon. Since the setting of our natural experiment allows us to control for systematic and time constant differences between treatment and control group, it is only important for our econometric approach that overall trends influence both groups in similar ways. Graphic 1 to Graphic 4 show the development of different aggregated economic, educational and political outcomes in the Italian, French and German speaking part of Switzerland.

Arcidiacono (2004), Berger (1988) and Boudarbat and Montmarquette (2009) argue that earnings expectations and expected unemployment have an impact on major choice. Therefore, these labor market conditions should develop in a similar way to avoid an estimation bias in our results. Graphic 1 and 2 show the development of the real annual earnings and the unemployment rate as indicators for economic trends. In the German part, earnings are highest and the unemployment rate is lowest. With respect to both indicators, Ticino and the French speaking cantons have almost the same level. However, the development of earnings and unemployment is very similar across the different parts of Switzerland. Therefore, it is unlikely that our results are biased because of regional economic trends.

The share of high school graduates might highlight differences in the educational system, which is regulated at the cantonal level. The share of high school graduates is highest in Ticino

⁶ The protection against dismissal is regulated in the Swiss "Obligationenrecht", Article 335ff. The "Bundesgesetz über die obligatorische Arbeitslosenversicherung und die Insolvenzschiädigung" is the law governing unemployment benefits. Both laws are online available at the homepage of the Swiss Government.

⁷ The "Vereinbarung zwischen dem Bund und den Universitätskantonen über die Zusammenarbeit im universitären Hochschulbereich" authorize the Rectors' Conference of Swiss Universities to accredit Universities and majors in Article 7f. All degrees are officially acknowledged all over Switzerland. The law and the corresponding information are online available at the homepage of the Swiss Government and the Rectors' Conference of Swiss Universities.

and lowest in the German speaking part of Switzerland. However, the rise in the share follows a similar trend across the different regions. Thus, a potential bias is again unlikely.

Finally, the university landscape did not change much in the other parts of Switzerland.

3.2 Data

The Swiss Graduate Survey of the Federal Statistical Office of Switzerland is a unique dataset which allows us to identify the impact of a locally limited major offer on major choice. The survey is conducted since 1977 by the Federal Statistical Office of Switzerland. In 1995, graduates are asked for the first time in which canton they lived at the time of their high school graduation. This distinction is crucial for our natural experiment using students from Ticino as treatment group and students from other parts of the country as control group. The survey also provides the exact number of semesters. We use this variable in combination with the cohort variable to determine in which year a graduate started his studies.⁸ The individual information on both home canton and the start of studies allow us to estimate whether major choice developed differently in Ticino than in the other parts of Switzerland after 1996. Since the University of Lucerne was founded in 2001 in the German speaking part of Switzerland, we restrict our dataset on graduates who started their studies between 1990 and 2000. This ensures that university and major offer remains fairly constant in the control group.

In the Swiss Graduate Survey, the Federal Statistical Office of Switzerland surveys all graduates of Swiss universities who are asked to answer a questionnaire one year after graduation. Attendance is voluntarily and the response rate is high at approximately 60 percent. As the survey of graduates changed over time since its beginning in 1977 (see e.g. FOS, 2001, 2003b, 2005c, 2007), most variables are not available for each cohort. However, the dataset covers a large array of individual background variables including e.g. gender, major at school as well as the education of parents so that we can also control for the influence of individual characteristics on major choice. Moreover, we use the home canton of graduates to merge individual attributes of college graduates with cantonal characteristics at the time of their major

⁸ Since a cohort covers all graduates up to a period of two years, it is likely that we have some measurement error in determining the exact year a student started his studies. This measurement error is of less importance for our paper because we only need information whether a student started his studies before or after the establishment of the University of Lugano in 1996. Consequently, measurement is only a problem at the threshold of the year dummy. Robustness tests show that our results do not depend on the actual year (1995, 1996, 1997) chosen as threshold for the time dummy.

choice. This allows us to control for the economic and educational environment a student lived in while choosing his major. For example, we include the average real income, the unemployment rate and the rate of high school graduates. These additional datasets are provided by the Federal Statistical Office of Switzerland and the State Secretariat for Economic Affairs of Switzerland.

Since the education system is regulated on cantonal level, we include the rate of high school graduates as a control variable for cantonal differences in education at school. The Federal Statistical Office publishes the annual rate of high school graduates for each canton since 1980. The rate is calculated by dividing the number of high school diplomas by the size of the theoretical cohort. Since average high school graduates are 19 years old, the Federal Statistical Office takes the permanent cantonal population in the age of 19 as theoretical reference group.⁹

The unemployment rate of a graduate's home canton is taken as an indicator for the situation of the local labor market at the time of major choice. It is officially published each month by the State Secretariat for Economic Affairs. For estimation, we use the unemployment rate in June. The rate is calculated by dividing the number of the registered unemployed by the total workforce. To be counted as unemployed it is necessary to work less than six hour per week and to look for a job by means of an official employment agency. In 2000, the State Secretariat for Economic Affairs lowered the working time for being registered as unemployed to the international standard of one hour per week. Receiving unemployment benefits is not required. The size of the work force is defined by the national Census.¹⁰

We include the real average annual income of a student's home canton as control variable for the regional economic performance. Until 1993, data on wages are based on the "Wage and Salary Survey in October" covering 54'000 companies with more than 1.25 million employees. Firms were asked to indicate their total payroll and the total number of employees. Based on this information the average annual income was calculated for each canton. After 1993, the calculations were based on data of the public accident insurance. Since the membership in this insurance is obligatory for each employee, the coverage of the survey was extended to the total workforce in Switzerland (see BFI, 1993, BFS, 2009).

⁹ Information on the definitions and methods used for calculating the rate of high school graduates are provided by the Federal Statistical Office of Switzerland on their home page: <http://www.bfs.admin.ch>.

¹⁰ The State Secretariat for Economic Affairs provides the definitions and methods used for calculating the official unemployment rate of Switzerland on their home page: www.amstat.ch.

3.3 Estimation Strategy

For analyzing the impact of a restricted local major offer on major choice we consider the establishment of the University of Lugano in Ticino as a natural experiment. For empirical identification, we apply the Difference-in-Differences approach which is widely used in natural experiment settings since the seminal work by Ashenfelter (1978) and Ashenfelter and Card (1985). Such an approach requires at least two groups and two time periods. In the first time period, both groups are not exposed to any treatment. In the second period, a treatment, for example a policy change, affects the members of one group, whereas the other group remains unaffected (see Imbens and Wooldridge, 2009). For the identification of the treatment effect, the linear Difference-in-Differences approach assumes a common time trend across groups. Thus, the potential outcome in both groups is assumed to change in the same way without treatment from period 0 to period 1. This crucial assumption allows the identification of the treatment effect by differencing first across groups and then across time. If the treatment group ($G_i = 1$) is only treated in period 1 and the control group ($G_i = 0$) neither in period 0 nor in period 1, the average treatment effect τ_{DID} on a continuous outcome variable Y_{gt} can be estimated by

$$\hat{\tau}_{DID} = (\bar{Y}_{11} - \bar{Y}_{01}) - (\bar{Y}_{10} - \bar{Y}_{00}) \quad (1)$$

where g indicates the group and t indicates the time period. If the common time trend assumption is fulfilled, such a double differencing makes the estimated treatment effect independent of group and time specific effects in a linear Difference-in-Differences model (see Imbens and Wooldridge, 2009; Blundell and Costa Dias, 2009; Puhani, 2012).

In our natural experiment setting, we consider high school graduates from Ticino as treatment group. As control group, we propose high school graduates from the other parts of Switzerland. Since our dataset provides individual data, we analyze whether the establishment of the University of Lugano has significantly increased the probability among Ticino's high school graduates of studying a major offered at the University of Lugano. In a first step, we follow Blundell, Meghir, Costa Dias and Van Reenen (2004) and estimate a linear probability model. The dependent variable M is 1 if student i chooses a major offered in Ticino and is 0 if student i chooses a major which is only offered at other Swiss universities. Using the standard linear Difference-in-Differences approach we include a group dummy G for college freshmen graduated in Ticino as well as a time dummy T for college freshmen who started their studies after the establishment of the University of Lugano. The interaction term of the group and the time dummy ($G \times T$) is the variable of interest which allows us to estimate the average treatment effect τ_{DID} by estimating the following model by means of ordinary least squares:

$$M_i = \beta_0 + \beta_1 G + \beta_2 T + \tau_{DID}(T \times G) + \beta \mathbf{X} + \varepsilon \quad (2)$$

where \mathbf{X} is a set of individual and cantonal control variables and ε an error term. A major advantage of this linear approach is that the common trend assumption is fulfilled (see Lechner, 2011). However, the approach is not without any costs. The linear probability model suffers under the restriction that the estimated effects β_i and τ_{DID} are constant and are not allowed to depend on the other values of the covariates \mathbf{X} . For some observations, this disadvantage can lead to a predicted probability which is smaller than 0 percent or higher than 100 percent (see Blundell et al., 2004; Puhani, 2012).

To tackle these problems, we follow Blundell, Meghir, Costa Dias and Van Reenen (2004) as well as Puhani (2012) and estimate a nonlinear probit model. Contrary to the linear probability model the outcome variable is bounded to values between zero and one. Therefore, predicted probabilities have to be in the range of 0 to 100 percent. However, in a probit model, the treatment effect cannot be constant across the individuals in the control and the treatment group because the effect size depends on all characteristics of each individual (see Athey and Imbens, 2006; Blundell and Costa Dias, 2004; Lechner, 2011; Puhani, 2012). In other words, the common trend assumption used in the linear model cannot be applied in a nonlinear probit model. Puhani (2012) propose “to apply the difference-in-differences assumption of a constant difference between groups across time not to the observed limited dependent variable itself, but instead to the unobserved latent linear index” (p. 86). For this assumption, Puhani (2012) derives the probit “difference-in-differences” model which is simply the probit model of the linear specification:

$$M_i = \Phi(\beta_0 + \beta_1 G + \beta_2 T + \tau_{DID}(T \times G) + \beta \mathbf{X} + \varepsilon), \quad (3)$$

where again G is the group dummy, T the time dummy, \mathbf{X} a set of control variables and $\Phi(\cdot)$ the conditional distribution function of the standard normal distribution.

The interpretation and the significance level of interaction terms are a widely discussed topic in the economic literature. Ai and Norton (2003) pointed out that, contrary to the linear model, the coefficient of the interaction term in a nonlinear model cannot be directly used to estimate its partial effect. This is due to the fact that the correct cross derivative of the interaction effect is for two binary variables:

$$\begin{aligned} \frac{\Delta^2 E[M|G, T, \mathbf{X}]}{\Delta G \Delta T} &= [\Phi(\beta_1 + \beta_2 + \tau_{DID} + \beta \mathbf{X}) - \Phi(\beta_2 + \beta \mathbf{X})] \\ &\quad - [\Phi(\beta_1 + \beta \mathbf{X}) - \Phi(\beta \mathbf{X})], \end{aligned} \quad (4)$$

instead of

$$\frac{\Delta^2 E[M|G, T, \mathbf{X}]}{\Delta G \Delta T} = \tau_{DID} \quad (5)$$

in a linear specification (see Ai and Norton, 2003; Greene, 2010). Puhani (2012) argue that, the treatment effect in nonlinear models is the “difference of two cross-differences: the cross difference of the conditional expectation of the observed outcome minus the cross difference of the conditional expectation of the potential outcome without treatment” (p.87). Consequently, Puhani (2012) formally derives the treatment effect in a probit “Difference-in-Differences” model:

$$\begin{aligned} \tau(G, T, TG, X) &= \frac{\Delta^2 E[M|G = 1, T = 1, TG = 1, X]}{\Delta G \Delta T} \\ &\quad - \frac{\Delta^2 E[M|G = 1, T = 1, TG = 0, X]}{\Delta G \Delta T} \\ &= \Phi(\beta_1 + \beta_2 + \tau_{DID} + \beta X) - \Phi(\beta_1 + \beta_2 + \beta X). \end{aligned} \tag{6}$$

Contrary to the intuition of Ai and Norton (2003), Puhani’s result shows that the coefficient of an interaction term always indicates the sign of the treatment effect in a probit “Difference-in-Differences” model.

4 Empirical Results

4.1 Descriptive Statistics

Table 1 and Table 2 show the development of the share of students studying the majors offered at the University of Lugano in a Difference-in-Differences setting. We present once the figures for Humanities, Economics and Technical Sciences in Table 1 and once the figures for the two major subjects Humanities and Economics in Table 2. The overall results are quite similar in both tables. Before and after 1996, the share of students choosing majors offered at the University of Lugano is higher in Ticino than in the other cantons of Switzerland. Furthermore, we can observe a time trend towards these majors in both the control and the treatment group. However, the increase in Ticino was almost twice as high as in the other parts of Switzerland. The Difference-in-Differences estimator is slightly significant at a 10 percent level if we consider Economics, Humanities and Technical Sciences. For the two major subjects Economics and Humanities, the Difference-in-Differences estimator is significant at a 5 percent level. These findings suggest that the restricted major offer of the University of Lugano may induce some of Ticino’s high school graduates to change their major choice towards the local major offer.

Table 3 presents the arithmetic mean and the standard deviation of all variables included in our analysis for Ticino (treatment group) as well as the German and French speaking part of

Switzerland (control group) before and after the establishment of the University of Lugano in 1996. The table reveals a large increase in the share of Ticino's college freshmen after 1996 who graduated at the University of Lugano later on. Before 1996, 4.7 percent of Ticino's college freshmen graduated at the University of Lugano.¹¹ This share increased to 23.3 percent after 1996. Thus, a notable part of Ticino's high school graduates seem to consider the University of Lugano and its local major offer as a relevant option for their studies. This is particularly important for our natural experiment, because the newly founded University is assumed to be a relevant exogenous event in this setting. The high share of Ticino's students suggests that studying at the University of Lugano is perceived as a real alternative among high school graduates grown up in Ticino.

Whereas such an effect is desired for the treatment group, the control group should not be influenced by the exogenous event. Table 3 states that the share of students coming from other parts of Switzerland and studying at the University of Lugano is rather small. After 1996, the share is 0.6 percent in the German speaking part of Switzerland. In the French speaking part, 0.2 percent of college freshmen choose the University of Lugano for doing their studies. This suggests that the establishment of the University of Lugano has not substantially affected university and major choice in the other parts of Switzerland. In that respect, the French and the German speaking part of Switzerland seems to form appropriate control groups for our natural experiment.

However, we should note that we cannot conclude that all students taking up their studies at the University of Lugano are influenced in their major choice and those who are doing their studies at another university are not. A considerable part of the students at the University of Lugano might have studied the same major at another university. In this case, the decision of the student would just be a question of university choice and not of major choice. At the same time, first year students who decide to study the majors offered in Lugano at another university might base their choice on specialized knowledge made available by spill-over effects of the University of Lugano. Because of these two effects we should be careful by interpreting the share of high school graduates studying at the University of Lugano.

¹¹ The number of students studying at the University of Lugano is not zero before 1996 because of two reasons: Since our data refer to institutions at which students graduated, we cannot exclude that students who started their studies at another university before 1996 and changed to the University of Lugano afterwards. Secondly, we draw on the number of students and the survey year for constructing the year students started to go to university. Both the used survey data and the calculation method may lead to some measurement error – particularly in the years around the cut-off point of the dummy for the establishment of the University of Lugano. This is supported by Figure 5 showing that most students with a predicted begin of their studies before 1996 are observed in the years 1994 and 1995.

Concerning the control variables included in our estimations we can observe that all cantonal characteristics and most individual characteristics differ in level and size of change across the control and treatment group. However, the general trends are the same. This further indicates that the control and the treatment group develop in a similar way with respect to a large set of socio-economic indicators.

An interesting exception is the development of the share of students, whose father has obligatory schooling or less. Whereas this share increased in Ticino, it decreased in the control group. This divergent development might be induced by the establishment of the University of Lugano. Because of relocation costs, going to university was particularly expensive for Ticino's high school graduates before the establishment of the University of Lugano as the Swiss and Italian universities were out of commuting distance. Such costs were substantially reduced after the opening of the University. This might attract high school graduates of families with a low educational level and low income to go to university.

4.2 Results

Table 4 presents the estimates of the linear probability models (LPM) and probit regressions whether a student decide to choose Economics or Humanities as a major at university. For the analysis of our natural experiment we include a time dummy, a dummy for Ticino, and an interaction term of both variables identifying the treatment effect of the establishment of the University of Lugano on the major choice of Ticino's high school graduates. Table 4 shows that the interaction term gets significant at a 5 percent level even if we control for individual characteristics as for example gender, major at school and education of parents. The significance level drops to 10 percent if we also control for cantonal characteristics (e.g. real GDP in CHF). Both the LPM and the probit regressions provide the same result concerning the significance level of the interaction term.

Since it is not possible to interpret the coefficients of a probit estimation directly, we predict the treatment effect of the establishment of the University of Lugano for an average high school graduate from Ticino after 1996. Following Puhani (2012) we calculate the predicted probability of studying a major offered at the University of Lugano first. Afterwards, we subtract the predicted probability for the counterfactual setting the interaction term to zero. For prediction, we set all continuous variables to their sample average and all dummies to zero except the time dummy and the dummy for Ticino. Table 4 also shows the estimated impact of the new

University of Lugano on the major choice of Ticino's high school graduates. The predicted effect for an average graduate from Ticino varies between 4.99 percent and 7.77 percent depending on the specification. Controlling for individual variables, the estimated effects are significant at the 5 percent level. After including cantonal variables the significance level drops to 10 percent. The standard errors of the effect sizes are estimated using the delta method. Although the estimated effects of the linear probability model are slightly higher, the estimated effect sizes are quite comparable between the linear probability model and the probit regressions. On average, the probit estimates are only 0.87 percent points lower than the predicted impact of the linear probability models.

Table 5 shows the results of linear probability models and probit models whether a graduate choose Economics, Humanities and, in addition, Technical Sciences. This extension seems to be a reasonable robustness test because the University of Lugano also offered Informatics and Architecture as majors. As the number of students in these majors is rather small compared to the wide range of different majors in Technical Science, we neglected this offer in the estimations shown in table 4. Table 5 shows that the interaction terms get only significant at a 5 percent level if we include the major choice of the high school graduates at school. In the other cases, the interaction terms are significant at a 10 percent level controlling for individual characteristics and insignificant if we control for cantonal characteristics. The estimated treatment effects in Table 5 are on average 1.2 percent points lower than the effects estimated for the dummy restricted on Economics and Humanities. The effect size seems again to be independent of the chosen model type. The estimates of the linear probability models and the probit regressions suggest quite similar effects of the new university.

The estimations in Table 4 and Table 5 suggest that also individual and cantonal characteristics influence the major choice of high school graduates. In particular, women and college freshmen whose parents only have obligatory schooling or less tend to choose more often the majors offered at the University of Lugano. Having a major in Economics or Languages at school increases the probability of choosing one of the majors offered at the University of Lugano. Since the omitted school major is Natural Sciences, such a result could be expected because the University of Lugano only offered informatics and architecture as technical majors. Consequently, most high school graduates with strong preferences towards Natural Sciences, Medicine and Technical Sciences had to leave Ticino after high school. The significant effects of gender, educational background of parents and early preferences are in line with the findings in the literature on major choice (cp. Arcidiacono, 2004, 2010; Berger, 1988; Bouderbatt and Montmarquette, 2010).

4.3 Further Findings

In Table 6, we apply our natural experiment approach on the dependent variable whether a high school graduate returns to his home canton after graduation or not. Ticino's college freshmen who decided to do their studies at the University of Lugano might be more likely to stay in their home canton after receiving their university degree. In particular, local politicians might find it useful to know about such an effect of a university because they want to hold local high potentials in their home canton. In Table 6, the interaction term identifying the treatment effect of the University of Lugano gets significant at a 5 percent level in each specification. The linear probability models suggest that the probability of returning to Ticino raised by 6.7 percent due to the establishment of the University of Lugano. We calculated again the impact of the new university for the probit model setting all continuous to their average and all dummies to zero except the time and treatment dummy. In comparison to the estimates of the linear probability model, the predicted effect of the new university is on average 1.1 percent higher in the probit models. Subsequently, the probit results suggest that the University of Lugano raised the probability of Ticino's graduates to stay in their home canton by 7.29 to 8.36 percent. All estimated effects are significant at a 1 percent level. Standard errors are calculated using the delta method.

Even before the establishment of the University of Lugano, Ticino's students were more likely to return to their home canton than students from the other parts of Switzerland. In table 6, the dummy for Ticino indicates a positive and significant impact in almost every specification. This might be simply due to the fact that the cantonal structure in the French and German speaking part is in some places very small. Subsequently, it is more likely that students from the other parts of Switzerland can live out of their home canton while still living in the same region where they are grown up. Another explanation might be that Ticino's graduates have higher preferences to return to their home canton because they prefer living in an environment where their mother tongue is spoken. This might also be combined with less competition for graduates from Ticino on the labor market of their home canton because workers from other parts of Switzerland cannot easily enter Ticino's labor market due to language barriers. At the same time, workers from Italy might be less likely to enter Ticino's labor market because of border effects. However, we should also note that there is an overall time trend in Switzerland that students return to their home canton after graduation. Perhaps, this is due to improvements in the public infrastructure so that more workers commute to their work place while living in their home canton.

In Table 7, we further analyze the factors influencing high school graduates from Ticino in their decision to apply for the University of Lugano. A striking result of this table is that students whose father had only obligatory schooling or less are significantly more likely to attend the University of Lugano. Such an educational background of the father raises the estimated probability of studying in Ticino by 14.68 percent up to 19.62 percent depending on the specification. This might be due to the fact that it is much cheaper to send a child to a local university. The student can stay at home during his studies avoiding the costs of moving. Since families with a low educational background normally do not have high salaries, it is much easier for them to send their children to a local university.

Table 7 also reveals that students who already choose a major at school corresponding to a major offer at the University of Lugano are more likely to stay in Ticino. This suggests that many students who already have preferences for a major offered at the local university stay in Ticino because they can avoid social and transaction costs.

5 Conclusion

We use the establishment of the Swiss University of Lugano as a natural experiment to estimate the effect of distance to a college with limited major offer on individual major choice. We find a significant and quantitatively important effect of distance which also remains when controlling for a large number of individual specific variables. The probability of an average student from Ticino to choose a locally offered major is at least 4.6 percent higher after the foundation of the University of Lugano. The highest estimate for this effect even suggests an increase in the probability of 9.1 percent for an average student from Ticino. These results imply that a limited local major offer may alter major choices of the local youth in particular for direct catchment area of the university. Due to the setting of the natural experiment our effects are supposed to be an upper border for the influence of distance without a potential bias of ability sorting of parents: (1) Students from Ticino lived out of commuting distance before the establishment of the University of Lugano and had to leave their social and cultural environment. (2) Spill-over effects of a local university should be rather high because specialized information on the offered majors should be easily available by means of the advertising of the University of Lugano and the public debate about the locally offered majors. (3) The high distance to other universities from Ticino may reduce potential bias of our results due to ability sorting of parents.

Our dataset also allows us to estimate which individual characteristics influence the probability of a high school graduate from Ticino to attend the University of Lugano. Average high school graduates from Ticino whose parents have only finished obligatory schooling or lower, are at least 16.39 percent more likely to apply for the University of Lugano. This might suggest that transaction costs due to moving to another university city play an important role for university choice. Our results also indicate a high influence of early preferences on major and university choice. In particular, high school graduates from Ticino who already had a focus on locally offered majors in high school are more likely to apply for these majors and the University of Lugano.

An important insight for policy decisions from this research is that a limited local major offer may distort major choices of high school graduates in the long run. Future research on major choice should control for distance to the next college offering a certain major because this distance might influence the results for other factors. Our results also raise the question whether the distance to a college with a high reputation in a certain major also distorts major choice. Future research might try to find an answer to this question because such an effect might lead to an even higher bias in the estimations of major choice models. At the same time, our results suggest that particularly high school graduates from poor families take advantage of local universities because local institutions of higher education reduces their costs of going to university significantly.

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Tabel 1: Difference-in-Differences Estimator for the Share of Students Studying Economics, Humanities and Technical Sciences

	<i>Before 1996</i>	<i>After 1996</i>	<i>Difference</i>
Other Cantons	0.532*** (0.006)	0.575*** (0.005)	0.043*** (0.008)
Ticino	0.586*** (0.025)	0.686*** (0.018)	0.1*** (0.031)
	0.054** (0.025)	0.11*** (0.019)	0.057* (0.032)

Notes: The table provides a Difference-in-Difference Estimator whether Ticino's share of students studying Economics, Humanities and Technical Science increased due to the establishment of the University of Lugano in 1996. Data is provided by the Federal Statistical Office of Switzerland. Estimated standard errors are shown in parentheses. They are calculated under the assumption that the populations are independent of each other. The stars indicate the significance level of a coefficient: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Tabel 2: Difference-in-Differences Estimator for the Share of Students Studying Economics and Humanities

	<i>Before 1996</i>	<i>After 1996</i>	<i>Difference</i>
Other Cantons	0.418*** (0.006)	0.48*** (0.005)	0.063*** (0.008)
Ticino	0.444*** (0.025)	0.581*** (0.019)	0.137*** (0.031)
	0.027 (0.026)	0.101*** (0.02)	0.074** (0.032)

Notes: The table provides a Difference-in-Difference Estimator whether Ticino's share of students studying Economics and Humanities increased due to the establishment of the University of Lugano in 1996. Data is provided by the Federal Statistical Office of Switzerland. Estimated standard errors are shown in parentheses. They are calculated under the assumption that the populations are independent of each other. The stars indicate the significance level of a coefficient: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Descriptive Statistics of all variables used in probit regressions before and after opening of Lugano university in 1996.

Variables	German Part			French Part			Italian Part		
	Before 96	After 96	Change	Before 96	After 96	Change	Before 96	After 96	Change
<i>Dependent Variables</i>									
Studying Economics, Humanities and Technical Sciences	0.506 (0.008)	0.544 (0.006)	0.038 (0.010)	0.579 (0.010)	0.631 (0.008)	0.052 (0.013)	0.586 (0.025)	0.686 (0.018)	0.100 (0.031)
Studying Economics and Humanities	0.376 (0.007)	0.443 (0.006)	0.068 (0.010)	0.492 (0.010)	0.544 (0.008)	0.051 (0.013)	0.444 (0.025)	0.581 (0.019)	0.137 (0.031)
Studying at University of Lugano	0.001 (0.000)	0.006 (0.001)	0.006 (0.001)	0.000 (0.000)	0.002 (0.001)	0.002 (0.001)	0.047 (0.011)	0.233 (0.017)	0.186 (0.020)
Returning to Home Canton	0.623 (0.007)	0.659 (0.006)	0.036 (0.009)	0.755 (0.009)	0.803 (0.006)	0.049 (0.011)	0.764 (0.021)	0.872 (0.013)	0.108 (0.025)
<i>Individual Characteristics</i>									
Obligatory Schooling Mother	0.140 (0.005)	0.119 (0.004)	-0.021 (0.007)	0.188 (0.008)	0.160 (0.006)	-0.028 (0.010)	0.184 (0.019)	0.159 (0.014)	-0.025 (0.024)
Obligatory Schooling Father	0.070 (0.004)	0.061 (0.003)	-0.008 (0.005)	0.104 (0.006)	0.097 (0.005)	-0.007 (0.008)	0.125 (0.017)	0.133 (0.013)	0.008 (0.021)
Woman	0.430 (0.008)	0.482 (0.006)	0.053 (0.010)	0.496 (0.010)	0.524 (0.008)	0.028 (0.013)	0.474 (0.025)	0.500 (0.020)	0.026 (0.032)
Major in Languages (at High School)	0.530 (0.008)	0.512 (0.007)	-0.017 (0.010)	0.507 (0.010)	0.502 (0.009)	-0.005 (0.013)	0.400 (0.024)	0.432 (0.021)	0.032 (0.032)
Major in Economics (at High School)	0.234 (0.007)	0.234 (0.006)	0.000 (0.009)	0.162 (0.008)	0.184 (0.007)	0.022 (0.010)	0.223 (0.021)	0.209 (0.017)	-0.015 (0.027)
Major in Natural Sciences (at High School)	0.237 (0.007)	0.254 (0.006)	0.017 (0.009)	0.331 (0.010)	0.314 (0.008)	-0.017 (0.013)	0.377 (0.024)	0.360 (0.020)	-0.017 (0.032)
<i>Cantonal Characteristics</i>									
Real GDP (in CHF)	45488.573 (125.851)	48453.860 (126.929)	2965.287 (178.745)	41366.210 (126.879)	44317.414 (119.467)	2951.203 (174.272)	37626.965 (50.709)	38405.971 (31.787)	779.006 (59.849)
Unemployment Rate (in percent)	3.521 (0.013)	2.945 (0.016)	-0.576 (0.020)	6.658 (0.014)	4.865 (0.029)	-1.793 (0.032)	5.958 (0.006)	5.248 (0.068)	-0.710 (0.068)
Share of High School Graduates (in percent)	14.304 (0.058)	15.556 (0.040)	1.252 (0.070)	23.052 (0.112)	23.872 (0.075)	0.821 (0.134)	25.529 (0.040)	27.721 (0.053)	2.192 (0.067)
<i>Population Sizes</i>									
Observations	4260	6733		2394	3903		403	656	

Notes: The table shows the arithmetic means of each variable used in probit regressions before and after opening of Lugano university in 1996. Standard error estimates are presented in parentheses. Real income per capita and unemployment rate are taken from the Swiss Statistical Office (2011) using the values of year and canton of origin when a student starts his studies.

Table 4: Linear Probability Models and Probit Models for a Students' Decision to Choose a Major in Economics and Humanities

Variables	OLS				Probit			
	I	II	III	IV	V	VI	VII	VIII
<i>Natural Experiment</i>								
Ticino	0.027 (0.025)	0.019 (0.025)	0.046* (0.024)	-0.058** (0.026)	0.068 (0.065)	0.049 (0.066)	0.125* (0.067)	-0.149** (0.068)
After 95	0.063*** (0.008)	0.059*** (0.008)	0.049*** (0.008)	0.049*** (0.008)	0.158*** (0.020)	0.151*** (0.020)	0.133*** (0.021)	0.127*** (0.022)
Ticino x After 95	0.074** (0.032)	0.073** (0.032)	0.091*** (0.032)	0.061* (0.032)	0.186** (0.082)	0.188** (0.083)	0.254*** (0.089)	0.157* (0.083)
<i>Individual Characteristics</i>								
Obligatory Schooling Mother		0.049*** (0.012)	0.034*** (0.012)	0.047*** (0.012)		0.127*** (0.030)	0.093*** (0.033)	0.121*** (0.030)
Obligatory Schooling Father		0.075*** (0.015)	0.062*** (0.016)	0.067*** (0.015)		0.193*** (0.039)	0.166*** (0.043)	0.174*** (0.039)
Woman		0.142*** (0.007)	0.084*** (0.008)	0.138*** (0.007)		0.362*** (0.019)	0.222*** (0.022)	0.353*** (0.019)
Major in Languages (at High School)			0.228*** (0.009)				0.632*** (0.026)	
Major in Economics (at High School)			0.353*** (0.011)				0.954*** (0.030)	
<i>Cantonal Characteristics</i>								
Real GDP (in CHF)				-0.001*** (0.000)				-0.001*** (0.000)
Unemployment Rate (in percent)				-0.003 (0.003)				-0.009 (0.007)
Share of High School Graduates (in percent)				0.009*** (0.001)				0.024*** (0.002)
<i>Constant</i>								
Constant	0.418*** 0.006	0.197*** 0.012	0.091*** 0.013	0.118*** 0.024	-0.208*** 0.015	-0.775*** 0.032	-1.114*** 0.037	-0.984*** 0.061
<i>Statistics</i>								
Observations	18349	18265	15879	18265	18349	18265	15879	18265
R ²	0.0057	0.0299	0.0907	0.0381				
R ² adjusted	0.0055	0.0296	0.0903	0.0377				
Pseudo R ²					0.0041	0.0218	0.0691	0.028
Impact of the New University	0.074** (0.032)	0.073** (0.032)	0.091*** (0.032)	0.061* (0.032)	0.0736** (0.033)	0.0668** (0.029)	0.0777*** (0.027)	0.0499* (0.026)

Notes: The table provides the coefficients of linear probability models and probit models on a dummy whether a graduate studied Economics or Humanities. Since the coefficients of a probit model cannot be directly interpreted, we calculate the effect of the new University of Lugano on an average individual from Ticino. Therefore we set the treatment dummy "Ticino" and the time dummy "after 96" to the value one. For determining the impact of the University of Lugano we calculate the predicted probability of choosing Economics or Humanities setting once the interaction term to one and once to zero for calculating the counterfactual. The other dummy variables were set to zero and the continuous variables to their mean. For example in column 1, our estimates suggest that the establishment of the University of Lugano raised the probability of an average high school graduate in Ticino to study a locally offered major by 7.4 percent. The omitted major at High School is Natural Sciences. Data is provided by the Federal Statistical Office of Switzerland. Estimated standard errors are shown in parentheses. The stars indicate the significance level of a coefficient: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Linear Probability Models and Probit Models for a Students' Decision to choose a Major in Economics, Technical Sciences or Humanities

Variables	OLS				Probit			
	I	II	III	IV	V	VI	VII	VIII
<i>Natural Experiment</i>								
Ticino	0.054** (0.025)	0.051** (0.025)	0.058** (0.025)	0.001 (0.026)	0.136** (0.065)	0.128** (0.065)	0.150** (0.066)	-0.001 (0.068)
After 95	0.043*** (0.008)	0.044*** (0.008)	0.043*** (0.008)	0.045*** (0.008)	0.110*** (0.020)	0.112*** (0.020)	0.111*** (0.021)	0.114*** (0.022)
Ticino x After 95	0.057* (0.032)	0.053* (0.032)	0.069** (0.033)	0.046 (0.032)	0.158* (0.083)	0.149* (0.084)	0.199** (0.088)	0.129 (0.084)
<i>Individual Characteristics</i>								
Obligatory Schooling Mother		0.036*** (0.012)	0.023* (0.013)	0.035*** (0.012)		0.093*** (0.030)	0.060* (0.032)	0.089*** (0.031)
Obligatory Schooling Father		0.065*** (0.015)	0.057*** (0.016)	0.059*** (0.015)		0.170*** (0.040)	0.149*** (0.042)	0.155*** (0.040)
Woman		0.021*** (0.007)	-0.003 (0.008)	0.018** (0.007)		0.053*** (0.019)	-0.008 (0.021)	0.045** (0.019)
Major in Languages (at High School)			0.062*** (0.010)				0.157*** (0.025)	
Major in Economics (at High School)			0.145*** (0.011)				0.376*** (0.029)	
<i>Cantonal Characteristics</i>								
Real GDP (in CHF)				0.001 (0.001)				0.001 (0.001)
Unemployment Rate (in percent)				0.005* (0.003)				0.013* (0.007)
Share of High School Graduates (in percent)				0.005*** (0.001)				0.013*** (0.002)
<i>Constant</i>								
Constant	0.532*** (0.006)	0.490*** (0.012)	0.464*** (0.014)	0.400*** (0.024)	0.080*** (0.015)	-0.026 (0.032)	-0.092*** (0.035)	-0.259*** (0.061)
<i>Statistics</i>								
Observations	18349	18265	15879	18265	18349	18265	15879	18265
R ²	0.004	0.0072	0.017	0.0119				
R ² adjusted	0.0039	0.0069	0.0165	0.0114				
Pseudo R ²					0.003	0.0053	0.0127	0.0088
Impact of the New University	0.057* (0.032)	0.053* (0.032)	0.069** (0.033)	0.046 (0.032)	0.0581* (0.031)	0.0571* (0.032)	0.0765** (0.034)	0.0507 (0.033)

Notes: The table provides the coefficients of linear probability models and probit models on a dummy whether a graduate studied Economics, Technical Sciences or Humanities. Since the coefficients of a probit model cannot be directly interpreted we calculate the effect of the new University of Lugano on an average individual from Ticino. Therefore we set the treatment dummy "Ticino" and the time dummy "after 96" to the value one. For determining the impact of the University of Lugano we calculate the predicted probability of choosing Economics, Technical Sciences or Humanities setting once the interaction term to one and once to zero for calculating the counterfactual. The other dummy variables were set to zero and the continuous variables to their mean. For example in column 1, our estimates suggest that the establishment of the University of Lugano raised the probability of an average high school graduate in Ticino to study a locally offered major by 5.7 percent. The omitted major at high school is Natural Sciences. Data is provided by the Federal Statistical Office of Switzerland. Estimated standard errors are shown in parentheses. The stars indicate the significance level of a coefficient: *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Linear Probability Models and Probit Models for a Students' Return to his Home Canton after University Graduation

Variables	OLS				Probit			
	I	II	III	IV	V	VI	VII	VIII
<i>Natural Experiment</i>								
Ticino	0.094*** (0.023)	0.090*** (0.023)	0.092*** (0.023)	0.038 (0.024)	0.279*** (0.071)	0.268*** (0.071)	0.274*** (0.071)	0.073 (0.074)
After 95	0.042*** (0.007)	0.042*** (0.007)	0.065*** (0.007)	0.050*** (0.008)	0.118*** (0.020)	0.121*** (0.021)	0.189*** (0.022)	0.152*** (0.023)
Ticino x After 95	0.066** (0.030)	0.067** (0.030)	0.069** (0.030)	0.065** (0.029)	0.298*** (0.095)	0.300*** (0.095)	0.360*** (0.102)	0.295*** (0.096)
<i>Individual Characteristics</i>								
Obligatory Schooling Mother		0.021* (0.011)	0.017 (0.011)	0.025** (0.011)		0.061* (0.032)	0.049 (0.034)	0.081** (0.033)
Obligatory Schooling Father		0.028** (0.014)	0.030** (0.015)	0.012 (0.014)		0.086** (0.042)	0.096** (0.045)	0.041 (0.043)
Woman		-0.001 (0.007)	-0.001 (0.008)	-0.011 (0.007)		-0.004 (0.020)	-0.003 (0.022)	-0.033* (0.020)
Major in Languages (at High School)			0.019** (0.009)				0.056** (0.026)	
Major in Economics (at High School)			0.005 (0.010)				0.015 (0.031)	
<i>Cantonal Characteristics</i>								
Real GDP (in CHF)				0.001*** (0.000)				0.001*** (0.000)
Unemployment Rate (in percent)				0.033*** (0.003)				0.099*** (0.008)
Share of High School Graduates (in percent)				0.006*** (0.001)				0.020*** (0.003)
<i>Constant</i>								
Constant	0.671*** (0.006)	0.666*** (0.011)	0.656*** (0.012)	0.138*** (0.021)	0.441*** (0.016)	0.429*** (0.033)	0.397*** (0.036)	-1.153*** (0.065)
<i>Statistics</i>								
Observations	18349	18265	15879	18265	18349	18265	15879	18265
R ²	0.0073	0.0081	0.0121	0.0631				
R ² adjusted	0.0072	0.0078	0.0116	0.0626				
Pseudo R ²					0.0067	0.0073	0.0111	0.0543
Impact of the New University	0.066** (0.030)	0.067** (0.030)	0.069** (0.030)	0.065** (0.029)	0.0729*** (0.024)	0.075*** (0.025)	0.0836*** (0.024)	0.0807*** (0.027)

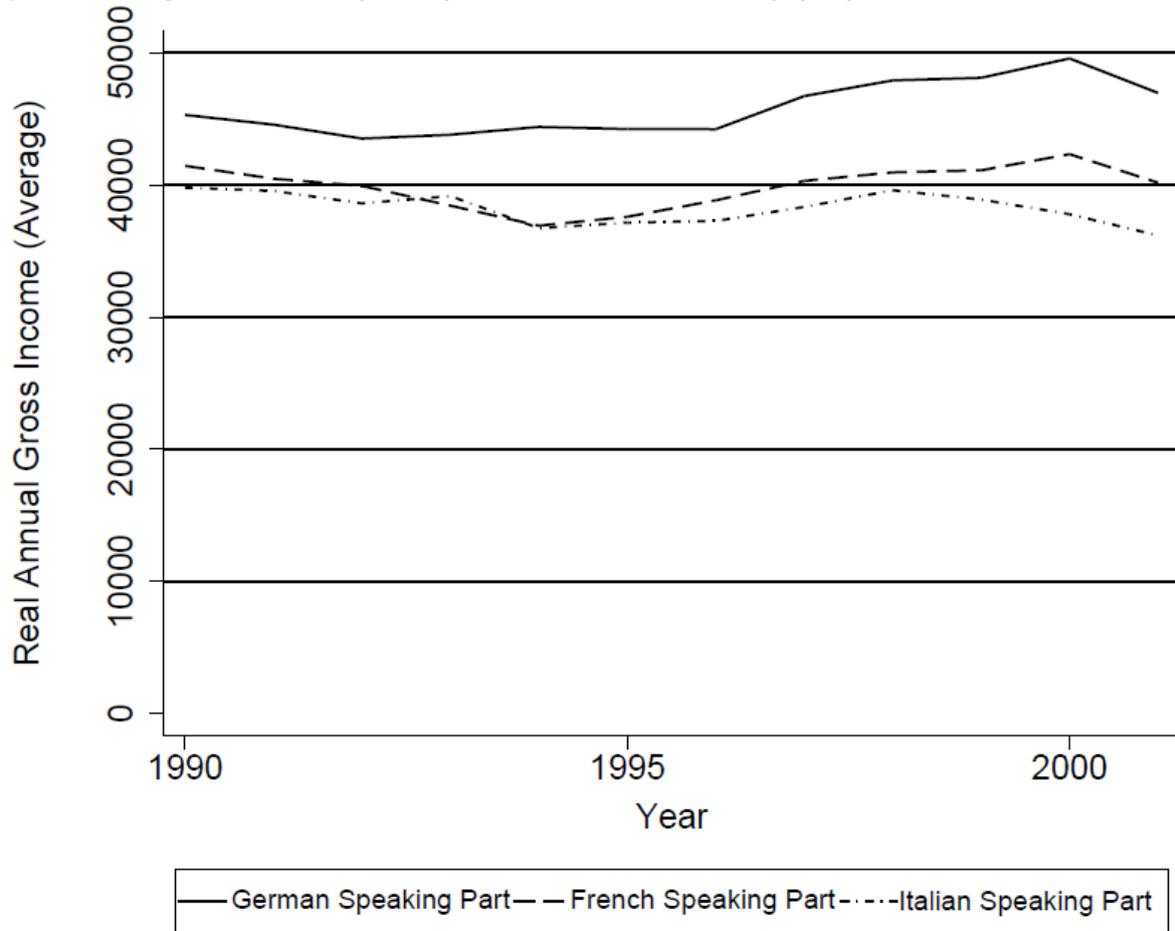
Notes: The table provides the coefficients of linear probability models and probit models on a dummy whether a student returned to his home canton after graduation. Since the coefficients of a probit model cannot be directly interpreted, we calculate the effect of the new University of Lugano on an average individual from Ticino. Therefore we set the treatment dummy "Ticino" and the time dummy "after 96" to the value one. For determining the impact of the University of Lugano we calculate the predicted probability of choosing Economics or Humanities setting once the interaction term to one and once to zero for calculating the counterfactual. The other dummy variables were set to zero and the continuous variables to their mean. For example in column 1, our estimates suggest that the establishment of the University of Lugano raised the probability of an average high school graduate in Ticino to study a locally offered major by 6.6 percent. The omitted major at High School is Natural Sciences. Data is provided by the Federal Statistical Office of Switzerland. Estimated Standard Errors are shown in parentheses. The stars indicate the significance level of a coefficient: *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Linear Probability Models and Probit Models for a Students' Decision to Choose the University of Lugano as Place of Study

Variables	OLS			Probit		
	I	II	III	IV	V	VI
Individual Characteristics						
Obligatory Schooling Mother	0.064 (0.054)	0.046 (0.059)	0.048 (0.053)	0.193 (0.172)	0.133 (0.186)	0.139 (0.175)
Obligatory Schooling Father	0.163*** (0.058)	0.152** (0.064)	0.175*** (0.058)	0.478*** (0.182)	0.447** (0.196)	0.532*** (0.185)
Woman	-0.035 (0.033)	-0.055 (0.039)	-0.041 (0.033)	-0.122 (0.110)	-0.176 (0.128)	-0.152 (0.113)
Major in Languages (at High School)		0.115*** (0.043)			0.401*** (0.147)	
Major in Economics (at High School)		0.214*** (0.050)			0.678*** (0.161)	
Cantonal Characteristics						
Real GDP (in CHF)			-0.001** (0.000)			-0.001** (0.000)
Unemployment Rate (in percent)			-0.003 (0.010)			-0.013 (0.033)
Share of High School Graduates (in percent)			-0.033*** (0.012)			-0.116*** (0.042)
Constant						
Constant	0.250*** (0.052)	0.211*** (0.059)	3.153*** (0.886)	-0.667*** (0.174)	-0.838*** (0.198)	8.917*** (2.972)
Statistics						
Observations	652	552	652	652	552	652
R ²	0.0299	0.0614	0.049			
R ² adjusted	0.0254	0.0528	0.0401			
Pseudo R ²				0.0252	0.0532	0.0434
Impact of Obligatory Schooling of the Father	0.163*** (0.058)	0.152** (0.064)	0.175*** (0.058)	0.1728*** (0.073)	0.1468*** (0.075)	0.1962*** (0.075)
Impact of Obligatory Schooling of the Mother	0.064 (0.054)	0.046 (0.059)	0.048 (0.053)	0.0653 (0.061)	0.0392 (0.057)	0.0472 (0.061)

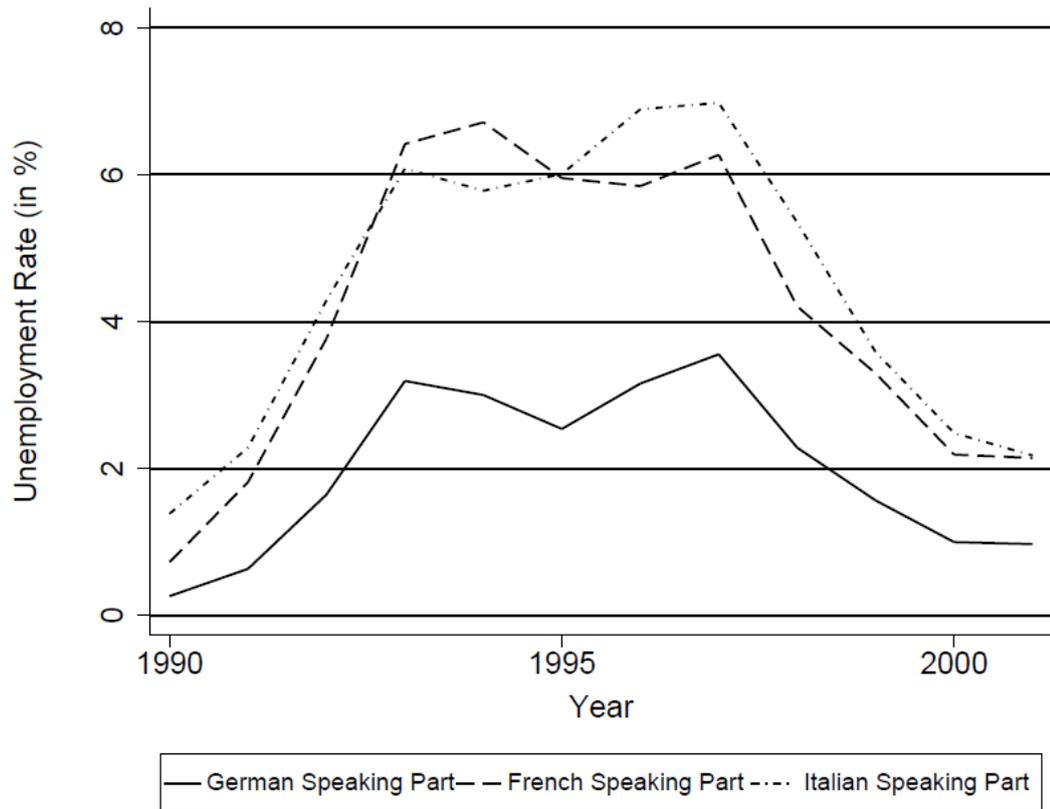
Notes: The table provides the coefficients of linear probability models and probit models on a dummy whether a high school graduate from Ticino decided to do his studies at the University of Lugano. Since the coefficients of a probit model cannot be directly interpreted, we calculate the effect of having a father resp. mother with obligatory schooling or less on an average individual from Ticino. The other dummy variables were set to zero and the continuous variables to their mean. For example in column 1, our estimates suggest that a father with obligatory schooling or less raises the probability of an average high school graduate from Ticino to choose the University of Lugano by 16.3 percent. The omitted major at High School is Natural Sciences. Data is provided by the Federal Statistical Office of Switzerland. Estimated Standard Errors are shown in parentheses. The stars indicate the significance level of a coefficient: *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: The development of the real average annual gross income in the different Swiss Language Regions (1990-2001)



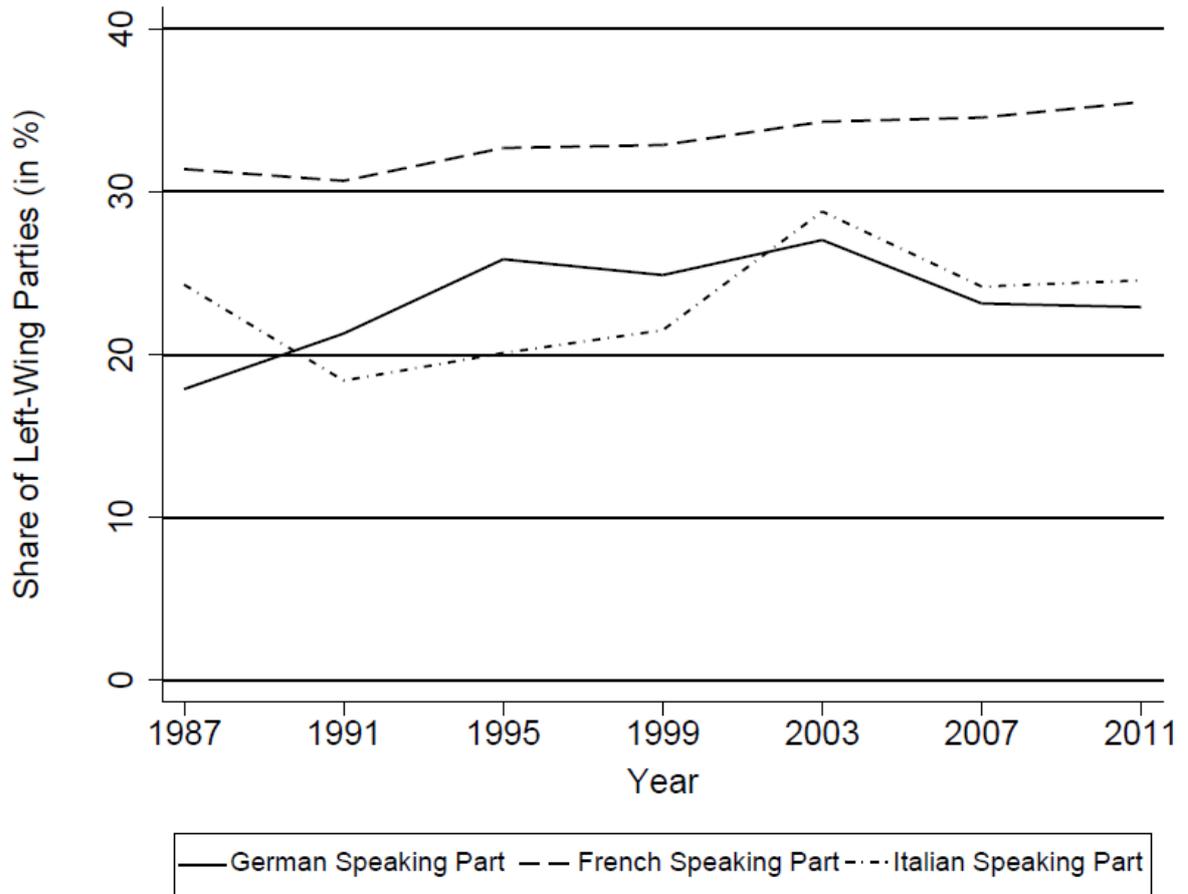
Notes: The figure shows the development of the real average annual income of employees in the different language regions of Switzerland between 1990 and 2001. Since the canton of Ticino is the only Italian speaking canton in Switzerland, the values for the Italian speaking part are the values surveyed in Ticino. The average earnings in the French and German speaking part are averages of the main regions in these parts. Data is provided by the Federal Statistical Office of Switzerland.

Figure 2: The development of the unemployment rate in the different Swiss language regions (1990-2001)



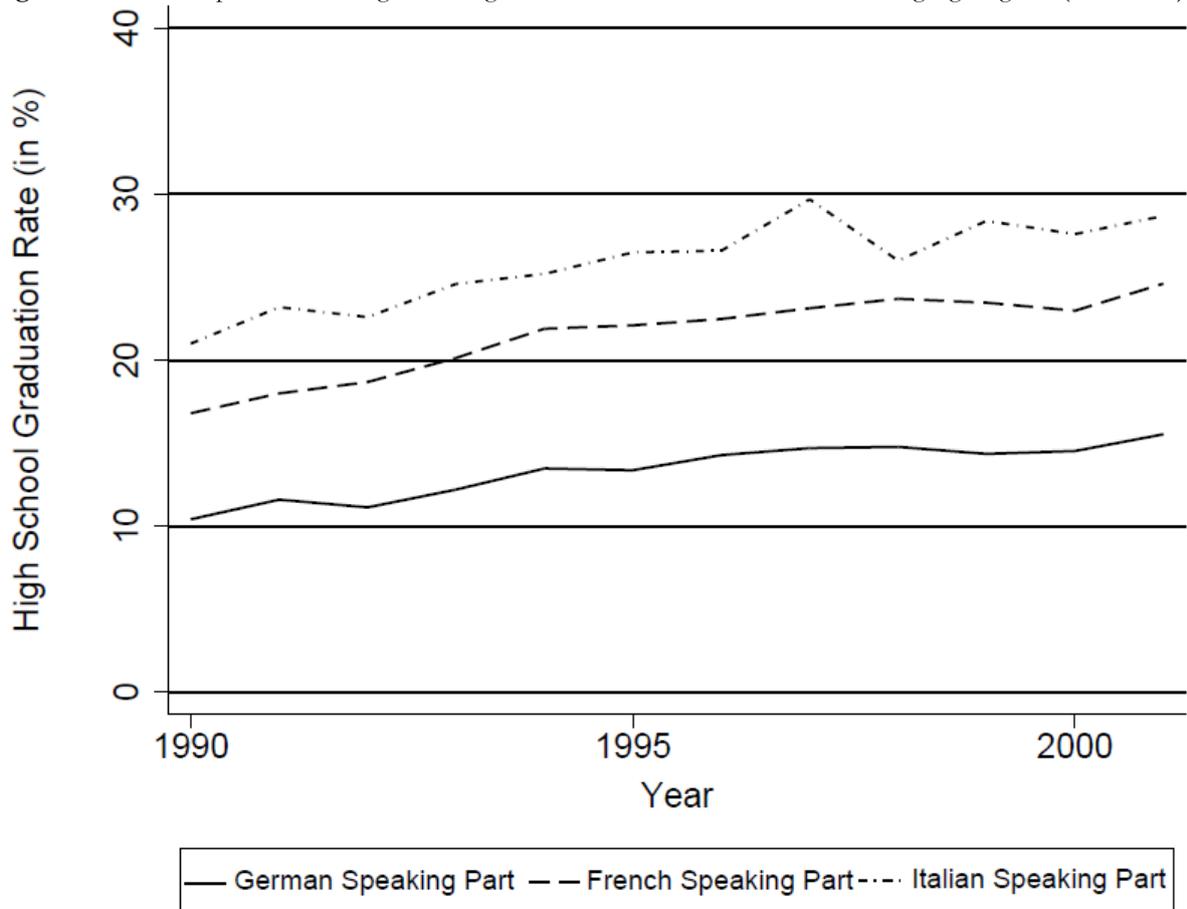
Notes: The figure shows the development of the unemployment rate in the different language regions of Switzerland between 1990 and 2001. Since the canton of Ticino is the only Italian speaking canton in Switzerland, the values for the Italian speaking part are the values surveyed in Ticino. The average unemployment rates in the French and German speaking part are cantonal averages. Data is provided by the State Secretariat for Economic Affairs (SECO).

Figure 3: The development of the share of left-wing parties in the different Swiss language regions (1990-2001)



Notes: The figure shows the development of the share of Left-Wing Parties in national elections for the different language regions of Switzerland between 1987 and 2011. Since the canton of Ticino is the only Italian speaking canton in Switzerland, the values for the Italian speaking part are the results observed in Ticino. The average shares of left-wing parties in the French and German speaking part are cantonal averages. Data is provided by the Federal Statistical Office of Switzerland.

Figure 4: The development of the high school graduation rates in the different Swiss language regions (1990-2001)



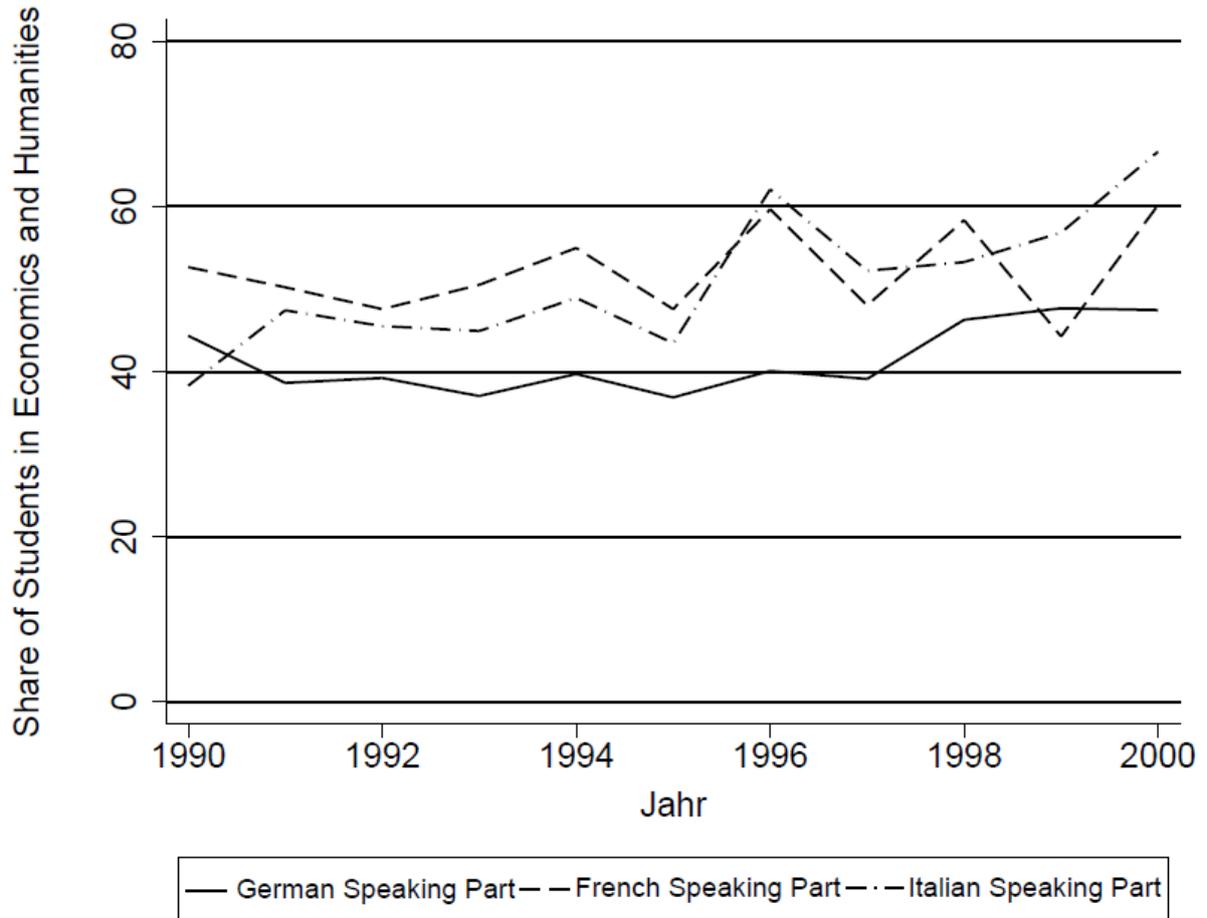
Notes: The figure shows the development of the share of left-wing parties in national elections for the different language regions of Switzerland between 1987 and 2011. Since the canton of Ticino is the only Italian speaking canton in Switzerland, the values for the Italian speaking part are the results observed in Ticino. The average high school graduation rates in the French and German speaking part are cantonal averages. Data is provided by the Federal Statistical Office of Switzerland.

Figure 5: The development of the share of Ticino's college freshmen graduated at the University of Lugano



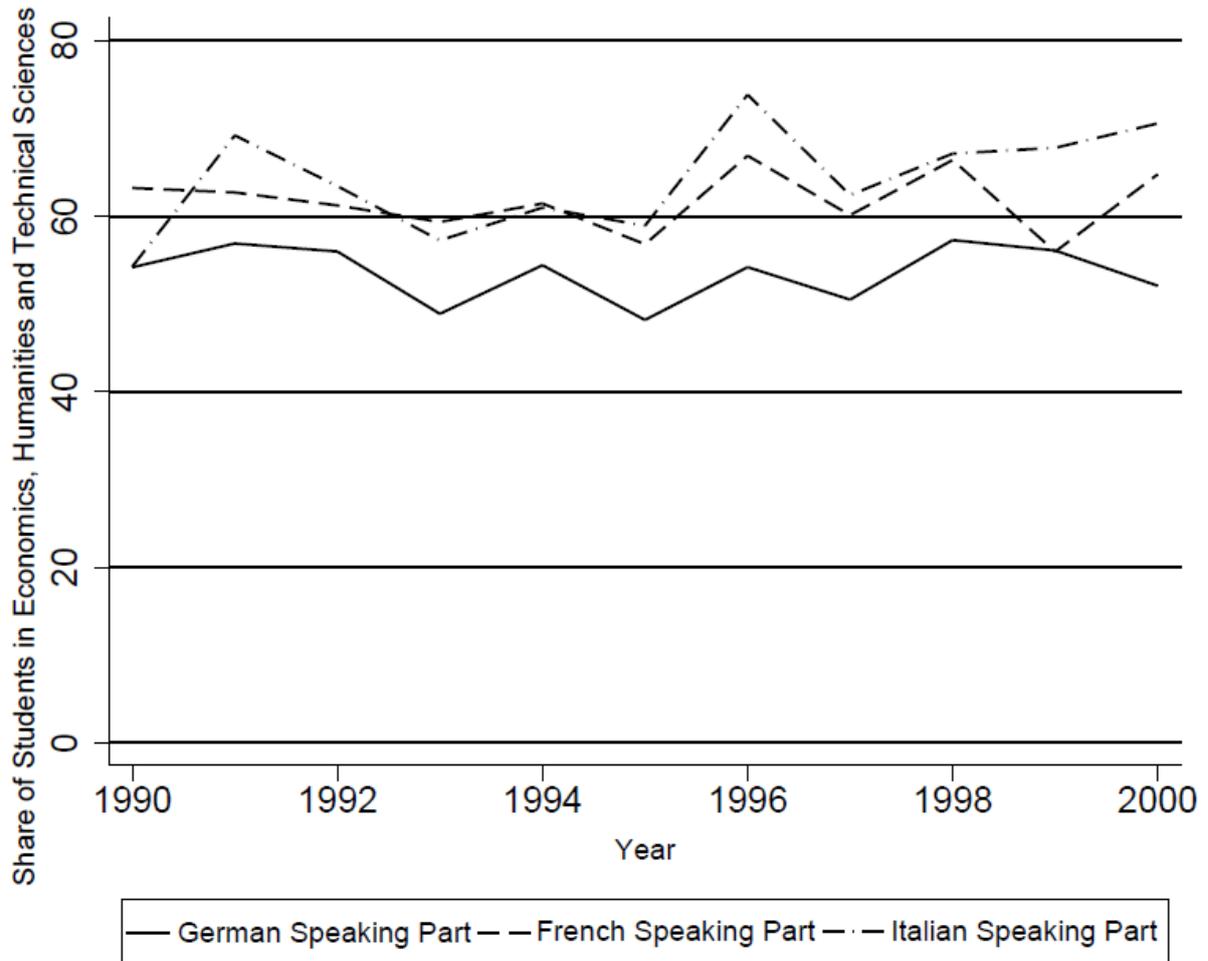
Notes: The figure shows the development of the share of Ticino's college freshmen graduated at the University of Lugano. For a reading example, in 1996, 31 percent of all college freshmen in Ticino started their studies at the University of Lugano and graduated afterwards. Since the canton of Ticino is the only Italian speaking canton in Switzerland, the values for the Italian speaking part are the values surveyed in Ticino. Data is taken from the Swiss Graduate Survey.

Figure 6: The development of the share of Ticino's college freshmen graduated in Economics and Humanities



Notes: The figure shows the development of the share of college freshmen who started their studies in the year shown on the x-axis and who graduated in Economics and Humanities afterwards. For a reading example, in 1996, 61 percent of all college freshmen in Ticino started their studies in Economics and Humanities and graduated afterwards. Since the canton of Ticino is the only Italian speaking canton in Switzerland, the values for the Italian speaking part are the values surveyed in Ticino. Data is taken from the Swiss Graduate Survey.

Figure 7: The development of the share of Ticino's college freshmen graduated in Economics, Humanities and Technical Sciences



Notes: The figure shows the development of the share of college freshmen who started their studies in the year shown on the x-axis and who graduated in Economics, Humanities and Technical Sciences afterwards. For a reading example, in 1996, 72 percent of all college freshmen in Ticino started their studies in Economics and Humanities and graduated afterwards. Since the canton of Ticino is the only Italian speaking canton in Switzerland, the values for the Italian speaking part are values surveyed in Ticino. Data is taken from the Swiss Graduate Survey.