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The Second Dividend of Studying Abroad: The Impact of International Student Mobility on Academic Performance*

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Abstract

This paper investigates the effect of studying abroad on students' success at university. Using an extensive dataset, propensity score matching is applied to account for possible self-selection into international mobility. Our empirical analysis suggests that a temporary study-related visit abroad significantly improves the final university grade, thus granting a second dividend in addition to personal experience. However, it seems that this effect is mainly driven by selective transferring of grades. Moreover, the study shows that a sojourn reduces the probability of finishing studies within the standard time period, suggesting that this dividend comes at a cost.

Keywords: Tertiary education, international student mobility, academic performance, grade point average, propensity score matching
JEL classification: I21, J61, J11

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1 Introduction

Globalization and internationalization do not only influence business and political decisions, but also affect university education. According to OECD figures (OECD, 2012) the number of students studying abroad increased by about 400% between 1975 and 2010. In 2010 more than 4.1 million students in higher education attended universities outside their home country (OECD, 2012). A similar pattern can be observed in Germany: until the year 2000 the share of university students going abroad increased to one third and stayed at this level since then (DAAD and HIS, 2013). Some of these students obtain their whole degree in a foreign country, while others do an internship or a language course. However, it is noted that the most popular reason for going abroad for German students is a temporary study-related visit abroad. More than half of the German students who decide to go abroad choose to study at a foreign university for one or two semesters (DAAD and HIS, 2013). The popularity of such a sojourn raises the question of what gains can be expected from being internationally mobile during university education.

The most prominent benefit from studying in a foreign country is arguably personal development. Study-related visits abroad are seen to have a positive impact on students' personality and cross-cultural skills. Students who went abroad for part of their university education report to be more independent, approachable and agreeable than before their stay. Furthermore, they are more open to foreign cultures and ways of working (Clarke et al., 2009; DAAD and HIS, 2013; Zimmermann and Neyer, 2013).

International experience seems to affect job market opportunities and decisions: Parey and Waldinger (2011) point out that studying in a foreign country influences the probability of working abroad later in life. Using an instrumental variables approach, they find that internationally mobile students are 15 percentage points more likely to work abroad after graduation than their counterparts who stayed at home. As possible reasons they emphasize the importance of factors such as having a partner from another country or interest in different cultures. These results are supported by Teichler (2011) who analyzes the impact of international experience gained during or shortly after graduation on later employment. Additionally, he finds that even if graduates with international experience work in their home country, they are more likely to have a job that requires cross-cultural skills in particular. In their study regarding the relationship between studying abroad and later migration, Dreher and Poutvaara (2011) show that an increase in the number of foreign students studying in the United States also leads to higher immigration later on.

More directly looking at the success in the job-market, Di Pietro (2013) finds that a study-related visit abroad increases the probability of being employed three years

after graduation by 24 percentage points. In contrast, Messer and Wolter (2007) do not find a causal effect of a study-related visit abroad on the first job salary and the probability of starting a Ph.D. once they instrument for studying abroad. They suggest that differences in later job-market success and academic careers may be due to internationally mobile students generally being more capable rather than due to the visit abroad.

Our study contributes to the literature on the effects of international student mobility by focusing on the impact of a sojourn on academic performance. Drawing on a rich dataset collected at Göttingen University, Germany, we analyze if and how studying one or two semesters at a foreign institution influences the final university grade achieved and the time needed to finish the degree program. We apply a propensity score matching strategy in order to overcome a potential problem of self-selection into studying abroad. This is possible due to the unique dataset at hand containing a variety of individual information on more than 2500 students who successfully completed their bachelor studies.

We find that a temporary study-related visit abroad improves the final university grade by 0.095-0.17 grades. We call this effect the second dividend of studying abroad, as it seems that it arises as a consequence of students strategically deciding which grades count towards their degree. With regard to students who studied abroad, we note that the final university grade is 0.2 grades better for those who count the grades obtained at the foreign university towards their degree in contrast to those who do not transfer any grades. Furthermore, we find that students who go abroad have a lower probability of finishing their bachelor studies within the standard time period. This further supports our interpretation that students selectively transfer grades achieved abroad which are better than the average grade achieved at the home university. Moreover, it implies that selective transferring of grades comes at a cost.

This paper is structured as follows: Section 2 describes the dataset and presents summary statistics. Section 3 gives an overview of the empirical framework used in the analysis. Section 4 presents and interprets our empirical results. Section 5 tests the robustness of our results. Finally, Section 6 summarizes the main findings and concludes.

2 Data Description

For our analysis we use a unique dataset consisting of administrative student data collected at Göttingen University. It contains detailed, anonymous information about more than 2500 students who successfully completed their bachelor studies between 2006 and 2011, such as the students' university and high school degree and

grade, subjects studied, their gender, type of health insurance and the zip-code of their address during semester as well as that of their parents' residence. Information on study-related visits abroad is provided by the international office of Göttingen University which collects data concerning students who take part in international mobility programs such as the European Union student mobility program, ERASMUS. We also use information about exams taken at a foreign university provided by the examination office in order to register stays abroad for students who did not take part in such a program but still studied at a foreign university.[1]

We restrict our sample to bachelor students who started their university studies at Göttingen University. The reason for this is that we can then observe all examinations relevant for the degree for these students. Furthermore, for all bachelor programs at Göttingen University some common rules apply, among them, a regular length of study of six semesters including thesis. As we have detailed information on the students' course of study, we are able to take into account only semesters of the field of study the respective student achieved her bachelor degree in. We restrict our attention to students who hold a German high school certificate as we use the grade received to control for pre-university ability.

Since we examine the impact of a study-related visit to a foreign university (usually one or two study terms) on academic performance, we are only interested in study-related stays during which the student could take courses counting towards her degree at Göttingen University. Students who took part in mobility programs that also support other kinds of stays, such as internships, short term field excursions and language courses, are dropped. Furthermore, in some unusual cases, students are enrolled in more than one bachelor program at the same time. In this case it cannot clearly be identified which courses taken abroad were transferred to the respective degree. Therefore, we exclude these students from the analysis.

We distinguish between students who stayed abroad and counted all or some of the grades obtained towards their bachelor degree at Göttingen University and students who stayed abroad, but did not transfer any of the grades achieved at the foreign university. Although most students taking part in an international mobility program are obliged to take courses at the foreign university, these courses taken abroad might not necessarily be part of the home curriculum, and therefore cannot be counted towards the degree at the home institution. For the courses taken abroad to be part of the final university grade, the grades need to be converted into the German grading scheme. Therefore, we require a student who transferred grades, that is count grades she achieved at a foreign university towards her degree at Göttingen University, to have at least one grade from the foreign university that is within the German grading interval. For students with no grade corresponding to

[1]Detailed information on data collection, processing and filtering is available upon request.

the German grading scheme from courses taken abroad or who did not register their grades from the foreign university, the respective indicator variable is zero.

Dependent Variables. Firstly, we analyze the effect of a sojourn on the final university grade. German university grades range from 1 to 4 with 1 being the best and 4 the worst grade still allowing students to pass. In order to make results internationally comparable, we convert them into the U.S. grading scheme with 4 being the best and 1 the worst grade that is still a pass.[2]

Secondly, we examine whether a study-related visit abroad affects the probability of finishing the bachelor studies *in time*, i.e. within the standard time period of six semesters. To do so, we create an indicator variable that is equal to one if the student finished within six semesters, and equal to zero if she took longer to complete her degree.

Independent Variables. We control for the student's pre-university ability by using the grade of the high school leaving certificate. Similar to the university grades, the grades of the high school leaving certificate are converted into the U.S. grading scheme.

To account for the students' socio-economic background, we use the type of health insurance a student holds and the purchasing power index related to the zip-code area her parents live in. The health insurance status can be used in this context due to the features of the German health care system, distinguishing between private and public health insurance. One has to fulfill certain criteria concerning income or employment status in order to select a private instead of the generally compulsory public health insurance. Therefore, compared to the overall German population, a disproportionately high number of people who hold a high school certificate enabling them to register at a university or a university of applied sciences and people who finished university or university of applied sciences with a degree or even a Ph.D. are privately insured.[3] Taking into consideration that students in Germany are normally insured through their parents, their health insurance contains information about their socio-economic background.

The purchasing power index is provided by the market research firm *GfK* and measures the purchasing power within a zip-code area relative to the German average in 2007.[4] As the German zip-code areas are relatively small − for instance there are

[2]We converted the grades into the US grading scale by subtracting the final university grade from five.

[3]In 2008, 56.7% of the privately insured held a high school degree that enables enrolment at a university or a university of applied sciences, 38.0% finished university or university of applied sciences with a degree or a Ph.D. The corresponding numbers for the whole German population are 24.4% and 13.0% respectively (Finkenstädt and Keßler, 2012; Statistisches Bundesamt, 2009).

[4]*GfK* is one of the biggest companies worldwide in the field of market research. It collects information on people's consumption behavior and lifestyle. The purchasing power index used in

about 190 different zip-codes in Berlin − we are confident to apply a well-founded measure of the students' socio-economic background.

We include the distance between the students' home town and Göttingen into our analysis in order to account for prior mobility decisions.[5] Furthermore, we control for gender, the university's faculties offering bachelor programs and the student's cohort.

Summary Statistics. Summary statistics are shown in Table 1. Our final dataset contains 2624 observations, out of which 12% spent part of their studies at a university in a foreign country. The mean university grade point average (GPA) of these students is slightly higher, i.e. better, than the mean university GPA of their counterparts who stay at home. A t-test shows that this difference is significant at the 1% level. The same results hold for the GPA earned at high school.

In our sample, there are slightly more female than male students and it seems that a disproportionately high number of female students go abroad. Students who go on a study-related visit abroad appear to have a higher socio-economic background, accounted for by the private health insurance and the purchasing power index. Moreover, these students seem to be generally more mobile as the mean distance between their parents' home and Göttingen is greater than for students who take all their courses at Göttingen University. These findings are in line with surveys focusing on German students in general (DAAD and HIS, 2013).

Furthermore, it can be seen that 80% of the students in our sample who go on a study-related visit abroad also count grades from the foreign university towards their degree. When taking a look at the time needed to finish a degree, summary statistics show that only 36% of the students studying abroad graduate in time, i.e. within six semesters, in comparison to 62% of their counterparts who stay at home.

The faculties having the highest shares of students studying abroad are the faculty of economic sciences (27%) and the faculty of humanities (31%). For both faculties, this share is disproportionately high compared to their overall share of students (18% and 20% respectively) in our sample. The faculty of agriculture, on the other hand, has a disproportionately low share of students who decide to go abroad for part of their studies compared to its overall share of students (17% and 21% respectively). These findings are also in line with results found with regard to all German students (DAAD and HIS, 2013).

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the analysis is based on data provided by the German tax offices as well as other relevant statistics concerning e.g. pensions and unemployment benefits.

[5]GoogleMaps standard route planer is used to measure the distance between the parents' zip-code area and Göttingen.

Table 1: Summary Statistics

	Total		Study Abroad =1		Study Abroad =0	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
University GPA	2.86	0.47	2.99	0.44	2.85	0.47
Graduate in time	0.59	0.49	0.36	0.48	0.62	0.48
Study Abroad	0.12	0.32	1.00	0.00	0.00	0.00
Transfer Grades	0.09	0.29	0.80	0.40	0.00	0.00
High School GPA	2.60	0.63	2.71	0.59	2.58	0.63
Male	0.46	0.50	0.36	0.48	0.48	0.50
Private Health Insurance	0.18	0.39	0.23	0.42	0.18	0.38
Purchasing Power Index	97.73	11.58	99.04	10.71	97.56	11.68
Distance to University	184.69	118.41	204.25	118.91	182.13	118.13
Medicine	0.02	0.12	0.01	0.08	0.02	0.13
Humanities	0.20	0.40	0.31	0.46	0.18	0.39
Mathematics	0.04	0.19	0.03	0.17	0.04	0.20
Physics	0.04	0.19	0.02	0.13	0.04	0.20
Chemistry	0.05	0.21	0.01	0.10	0.05	0.22
Geology/Geography	0.03	0.18	0.01	0.08	0.03	0.18
Biology	0.11	0.31	0.08	0.28	0.12	0.32
Forest Sciences	0.09	0.28	0.05	0.21	0.09	0.29
Agriculture	0.21	0.41	0.17	0.37	0.22	0.41
Economic Sciences	0.18	0.38	0.27	0.44	0.17	0.37
Social Sciences	0.05	0.21	0.06	0.24	0.05	0.21
Cohort 1	0.08	0.27	0.04	0.20	0.08	0.28
Cohort 2	0.08	0.27	0.09	0.28	0.08	0.26
Cohort 3	0.18	0.38	0.22	0.42	0.17	0.38
Cohort 4	0.35	0.48	0.36	0.48	0.35	0.48
Cohort 5	0.31	0.46	0.29	0.45	0.32	0.46
Observations	2624		304		2320	

Grades converted to 1-4 Scale, with 4 being the best and 1 being the worst grade that is still a pass.

3 Empirical Framework

The summary statistics suggest that students who go abroad during their university studies might be systematically different from students who stay at home. If this is indeed the case, a direct comparison of the two groups and ordinary least squares regressions may lead to biased results.

The best way to overcome this problem of self-selection into studying abroad would be through the design of an experimental framework, where students are randomly assigned to the treatment, i.e. studying abroad. Such a procedure is, however, not feasible for obvious reasons. Since there is no specified threshold at which students become eligible to go abroad also empirical strategies like regression discontinuity designs cannot be applied in our setting. In fact, there exist several different mobility programs and every institute individually allocates the available amount of places on these programs. Thereby, students are not restricted to only applying at the faculty they are studying at. This means that students who want to go abroad have a lot of different possibilities to apply for an international mobility program. Hence, not being accepted for a certain program or at a certain institute does not necessarily imply that the student cannot go abroad at all.

Bearing this in mind, we apply a propensity score matching strategy in order to take self-selection into studying abroad into account as much as possible. The general idea of this matching approach is to compare individuals that have received a certain treatment and individuals of a control group who have not, but who are very similar concerning their pre-treatment characteristics. Since the matched individuals only differ in the treatment, a difference in the outcome can be assigned to the treatment (Becker and Ichino, 2002; Caliendo and Kopeinig, 2008; Heckman et al., 1998). As it might be difficult to find counterparts that are equal with regard to a variety of covariates, Rosenbaum and Rubin (1983) suggest to use a balancing score in order to group treated and untreated individuals. The balancing score they introduce is the propensity score which measures the conditional probability of being exposed to a treatment given a set of pre-treatment covariates (Becker and Ichino, 2002):

$$p(X) = Pr(A = 1 \mid X) = E(A \mid X)$$

where A denotes the treatment, which is studying abroad in our case, and X is a set of pre-treatment covariates.

The treated and untreated individuals are grouped by their propensity scores so that within a respective group, the distribution of covariates is identical and independent of the assignment to the treatment, i.e. receiving the treatment is as

good as random given the controls. The average treatment effect on the treated, τ_{ATT}, is the difference between the expected outcome when being and not being exposed to the treatment for all individuals who actually received the treatment (Becker and Ichino, 2002):

$$\tau_{ATT} = E[E\{Y_{1i} \mid A_i = 1, p(X_i)\} - E\{Y_{0i} \mid A_i = 0, p(X_i)\} \mid A_i = 1]$$

with Y_{1i} and Y_{0i} being the outcome for individual i in the case that she received and did not receive the treatment respectively.

In our analysis we estimate the propensity score of going abroad for all students in the sample using a probit model with Φ being the standard normal cumulative distribution function and $h(X_i)$ a function of the individuals' covariates:

$$Pr(A_i = 1 \mid X_i) = \Phi\{h(X_i)\}$$

From the summary statistics presented in Section 2 as well as the results of other studies on the topic (e.g. DAAD and HIS, 2013), we expect the high school leaving grade, gender, socio-economic background, pre-university mobility, field of study and the student's cohort to have an impact on going abroad.

We match treated and untreated individuals based on their propensity scores. Specifically, we first apply nearest neighbor matching. This means that in order to estimate the average treatment effect on the treated, each individual of the treatment group is assigned the counterpart in the control group that is closest with regard to the propensity score. To reduce the risk of bad matches, we require the nearest neighbor to be within a caliper of 0.05. Additionally, we provide estimation results for kernel matching, with an Epanechnikov kernel function and the standard bandwidth of 0.06, and radius matching, with a caliper of 0.05. The letter two algorithms make use of more individuals of the control group at the cost of these additional matches not being as close as the nearest neighbor.

Unconfoundedness and Weak Overlap. A crucial assumption of propensity score matching is unconfoundedness or conditional independence: $Y_0, Y_1 \| A | X$, with $\|$ denoting independence. This means that given the characteristics we observe, potential outcomes do not depend on treatment assignment. Nonetheless, if there exist unobserved variables which affect both going abroad and success at university, propensity score matching would lead to biased results.

By using the grade of the high school leaving certificate, we control for the fact that students who go abroad might be generally academically more able than students who stay at their home university. The grade of the high school leaving certificate is shown to be a strong predictor for university success (Cyrenne and

Chan, 2013; Danilowicz-Gösele et al., 2014; Girves and Wemmerus, 1988). Furthermore, the grade may be a measure of motivation since students with a very good high school leaving certificate are typically not only smart, but also willing to put a lot of effort into studying.

The fact that studying abroad might be more costly than staying in Germany may lead to students with a higher socio-economic background being more likely to pursue part of their studies in a foreign country. Going to another country might be difficult to finance, especially for students who cannot afford to move away from their parents' residence when starting university. Moreover, highly educated parents might support a sojourn not only financially, but also by emphasizing the advantages of getting to know another country, language and culture. Therefore, we address a possible self-selection with regard to socio-economic characteristics by using the type of health insurance a student holds and the purchasing power of the parents' zip-code area as controls. Furthermore, we include gender in our model in order to account for systematic differences between male and female students regarding their choice of going abroad as well as academic performance.

Another factor that might influence the decision to go abroad as well as success at university is pre-university mobility. Moving away from home when starting university may imply a high level of independence and openness. Students who already once decided to leave their social environment may be more likely to go to a foreign country than their counterparts who decided to study at a university close to their home town. In addition, pre-university mobility might also affect the final university performance. A possible reason for this could be that students who move far away from home when starting university put more effort into finding the perfect match regarding university and field of study. This might lead to a high level of motivation, resulting in better grades. As it seems likely that the impact of pre-university mobility is non-linear with a decreasing marginal effect of distance, we use the natural logarithm of this variable as a control.

We also take into account that the possibility to go abroad as well as university performance may be influenced by the different faculties. Each student is assigned to one of the thirteen faculties at Göttingen university, depending on the field of study. Since a sojourn may be more common and more useful in some fields, such as in foreign language studies, literature and culture, students belonging to those faculties might be more likely to go abroad. At the same time, examination regulations and policies may differ among faculties, and thereby influence the final university grade as well as the time needed to graduate. In Danilowicz-Gösele et al. (2014), we provide evidence for this assumption by examining determinants of students' success at university.

Finally, we account for cohort effects by controlling for the semester the student

started a bachelor program in the field of study she obtained her degree in. Studying abroad might be more promoted in some years than in others and cohort size as well as the number of available places may differ in different years. Therefore, cohorts could have an impact on the probability of studying at a foreign university. Further, students within the same cohort are affected by the same study regulations and conditions: they may even take the same courses and examinations. As these cohort effects are probably even stronger within each of the faculties, we include interaction effects.

To sum up, we are confident to observe the relevant characteristics that might impact both assignment to the treatment and the outcome variables. Nevertheless, we are aware that propensity score matching only leads to robust and unbiased results if the assumption of conditional independence holds. We address this issue by testing the sensitivity of our results with regard to unobserved heterogeneity in Section 5.

Besides unconfoundedness the assumption of weak overlap also needs to be satisfied in order to get robust and unbiased results: $Pr(A = 1|X) < 1$. It means that individuals with a given set of covariates have a positive probability of not being treated. In our analysis, the weak overlap condition is fulfilled.

4 Results

We start the empirical analysis with a simple OLS model. Table 2 shows a positive and highly significant effect of studying abroad on the university GPA in all three regressions. In the full specification, column (3), the estimated effect of studying abroad is 0.08 grade points, which is slightly larger than the estimated effect of an increase in the high school leaving grade by one fifth of a grade. However, as described above, these results may suffer from a bias due to self-selection.

The descriptive analysis has already shown that students who study abroad might be systematically different from those who stay at their home university. Therefore, we expect that spending some time at a foreign university is not necessarily random and take a closer look to characteristics explaining whether or not a student goes abroad. Table 3 presents results of the corresponding probit regression. We display marginal effects for a benchmark student and the coefficients of the underlying regression. The benchmark student is female, publicly insured, studies at the faculty of humanities and belongs to the last cohort of the sample. She is average with regard to all continuous variables.

Our findings confirm the descriptive results of DAAD and HIS (2013) as they show that a better high school grade increases the probability of going abroad. Also, the private health insurance status, which proxies socio-economic background, shows

Table 2: Final University Grade - OLS Results

Dependent variable: University GPA			
	(1)	(2)	(3)
Study Abroad	0.139***	0.087***	0.084***
	(0.027)	(0.024)	(0.025)
High School GPA		0.407***	0.379***
		(0.011)	(0.010)
Male			0.060***
			(0.014)
Private Health Insurance			-0.008
			(0.014)
Purchasing Power Index			0.003***
			(0.001)
Log Distance			0.014
			(0.008)
Constant	2.848***	1.796***	1.745***
	(0.011)	(0.028)	(0.088)
Faculties included	No	No	Yes
Cohorts included	No	No	Yes
Faculties # cohorts included	No	No	Yes
Observations	2624	2624	2624
R^2	0.009	0.309	0.477

OLS; coefficients, standard errors in parentheses; clustered by counties; $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

the expected positive sign and is significant. The finding of Parey and Waldinger (2010) is supported in our analysis as we find that earlier mobility decisions have predictive power for studying abroad: The coefficient of the variable measuring distance of the parental address to Göttingen carries a positive sign and is highly significant. Besides, male students are less likely to go abroad.

Based on this regression, we apply propensity score matching as described in Section 3. Table A.1 in the appendix shows that the matching applied balances the treatment and the control group with respect to all variables used.[6] In addition, Figures A.1.a and A.1.b present the distributions of students in the two groups by

[6]The balancing table presents results for nearest neighbor matching. However, kernel and radius matching also balance the two groups with respect to all variables used. For the sake of brevity, we leave out corresponding tables.

Table 3: Probability of Studying Abroad

Dependent variable: Pr(Study abroad = 1)		
	Marginal Effects	Coefficients
	(1)	(2)
High School GPA	0.049***	0.223***
	(0.012)	(0.053)
Male	-0.030*	-0.148*
	(0.014)	(0.069)
Private Health Insurance	0.048*	0.197*
	(0.021)	(0.080)
Purchasing Power Index	0.001	0.004
	(0.001)	(0.003)
Log Distance	0.030***	0.135***
	(0.009)	(0.033)
Constant		-2.741***
		(0.358)
Faculties included	Yes	Yes
Cohorts included	Yes	Yes
Faculties # cohorts included	Yes	Yes
Observations	2411	2411
Pseudo-R^2	0.076	0.076
Log Likelihood	-842	-842

Probit estimation; column (1) marginal effects for benchmark student, column (2) coefficients; standard errors in parentheses; clustered by county; $^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$.

their propensity score before and after nearest neighbor matching.

Table 4 contains corresponding matching results. The estimated effect is between 0.095 and 0.17 grades and highly significant.[7] This corresponds to between one fifth and one third of a standard deviation of university GPA. Our findings confirm the positive effect on the final university grade from studying abroad. The effect in Table 4 is larger than the OLS coefficient of studying abroad in the full specification in Table 2.

Concerning the channels through which studying abroad affects the grade of the degree, at least two main strands of interpretation can be thought of: firstly, an

[7]The statistical inference for the treatment effect does not take into account that the propensity score is estimated. However, repeating the nearest neighbor matching with the teffects psmatch routine of Stata 13 shows that this does not alter our findings. The estimated effect is almost identical and the corresponding standard error is even smaller.

Table 4: Final University Grade - Matching Results

Dependent variable: University GPA			
	Propensity Score Matching		
	Nearest Neighbor	Kernel	Radius
	(1)	(2)	(3)
Study abroad	0.170***	0.095***	0.096***
	(0.043)	(0.028)	(0.028)
Treated Observations	302	302	302
Untreated Observations	2108	2108	2108

Propensity score matching, average treatment effects on the treated using nearest neighbor matching with caliper 0.05 (column 1), kernel matching with an Epanechnikov kernel function, bandwidth 0.06, (column 2), and radius matching with caliper 0.05 (column 3) calculated using PSMATCH2 package for Stata by Leuven, E. and Sianesi, B. (2003) Version 4.0.10; only observations on common support are used; standard errors in parentheses; variables used for the estimation and calculation of the propensity score are High School GPA, Male, Private Health Insurance, Purchasing Power Index, Log Distance to University and indicator variables for faculties and cohorts as well as interactions of faculties and cohorts; $^{*}p < 0.05$,$^{**}p < 0.01$,$^{***}p < 0.001$.

argument based on learning and secondly, an argument based on grades. Spending some time studying at a foreign university allows students to complement their courses at their home institution. They may take specialized courses that are not available at their home university and are potentially confronted with different styles of teaching, learning and studying. In many cases, the language spoken is different. Furthermore, the cultural experience is considered to contribute to the personal development of students. Therefore, going abroad may improve the student's academic ability.

The second interpretation refers to grades transferred back to the home university: if these grades are on average better than the average grade earned at the home university, the positive effect shown above can be explained. There are several reasons why this could be the case: For instance, the effect could be based on better teaching or studying conditions at the host university, a more lenient grading policy on average at the foreign universities in the sample or selectively better grades given to visiting students. However, in our opinion, the most convincing reason why grades transferred back are better than the average grade earned at home, is that students primarily count the good grades of the sojourn towards their degree and leave out mediocre ones.

To shed light on the question of how important the grades transferred are for the positive effect on the final university grade shown above, we focus on the subsample of students who studied abroad. Since about 20% of this group did not transfer grades, we can exploit this variation to analyze the effect of counting grades towards

Table 5: Transferring Grades

Dependent variable: University GPA	
High School GPA	0.416***
	(0.037)
Transfer Grades	0.213***
	(0.052)
Male	0.082
	(0.055)
Private Health Insurance	0.046
	(0.043)
Purchasing Power Index	0.002
	(0.002)
Log Distance	-0.005
	(0.024)
Constant	1.708***
	(0.273)
Faculties included	Yes
Cohorts included	Yes
Faculties # cohorts included	Yes
Observations	304
R^2	0.559

OLS; coefficients, standard errors in parentheses; clustered by county; observations of students who studied abroad; $^{*}p < 0.05$,$^{**}p < 0.01$,$^{***}p < 0.001$.

the degree. All students in this subsample studied abroad so that self-selection into going abroad is not an issue. Still, who transfers grades might not be random. However, the data at hand does not support this hypothesis: estimating whether or not students who go abroad transfer grades does not yield any significant effect. Specifically, we do not find evidence that academically stronger students are more likely to transfer grades than weaker students.[8] Besides, based on theoretical considerations, it is not obvious why some students should systematically be more likely to transfer grades than others. The individual attractiveness of such a transfer should rather depend on how these grades are relative to those that the student earned at the home university.

Table 5 presents OLS results for the effect of transferring grades from abroad on the final university grade. The coefficient of interest is highly significant and positive, implying that the grades transferred on average improve the final grade. A descriptive comparison of the individual grades confirms this econometric result: on average, the difference between the grades a student transferred and her final university GPA is about 0.2 grades.[9] The corresponding median difference is even larger, a quarter of a grade.

Our second measure of academic success is whether bachelor students graduate within the standard period of time of six semesters. Table 6 presents results of the corresponding probit estimation. According to these estimates, going abroad decreases the probability of graduating in time, whereas a better high school leaving grade increases it. Both effects are significant at 0.1% level. However, as shown above, the group of students who spent part of their studies abroad is not a random selection. Therefore, we address this issue again by applying propensity score matching. We present results of nearest neighbor, kernel and radius matching in Table 7.[10] The negative effect of going abroad on the probability of graduating within the standard time period is highly significant and robust with regard to the different matching algorithms. This suggests that students on average are not simply replacing a semester at their home institution with a semester abroad, but extend their overall time spend at university.

Summarizing our empirical results, we show that spending some time at a foreign university during bachelor studies has a positive effect on the final university grade. Taking into account only students who studied abroad, it can be noted that transferring grades significantly improves the bachelor grade. However, a sojourn reduces the probability of finishing a bachelor program within the standard time

[8] Corresponding estimation results are included in the appendix in Table A.2.

[9] The corresponding difference in means is significant at the 0.1% level.

[10] Since the same three matching algorithms as above are applied, additional balancing analysis is not necessary.

Table 6: Graduating in Time - Probit Results

Dependent variable: Pr(Graduate in time=1)		
	Marginal Effects	Coefficients
	(1)	(2)
Study abroad	-0.238***	-0.743***
	(0.035)	(0.086)
High School GPA	0.131***	0.549***
	(0.021)	(0.053)
Male	0.018	0.076
	(0.016)	(0.066)
Private Health Insurance	-0.028	-0.112
	(0.021)	(0.075)
Purchasing Power Index	0.001	0.004
	(0.001)	(0.003)
Log Distance	0.007	0.030
	(0.005)	(0.021)
Constant		-0.949***
		(0.279)
Faculties included	Yes	Yes
Cohorts included	Yes	Yes
Faculties # cohorts included	Yes	Yes
Observations	2595	2595
Pseudo-R^2	0.223	0.223
Log Likelihood	-1361	-1361

Probit estimation; column 1: marginal effects for benchmark student; column 2: coefficients, standard errors in parentheses; clustered by county; $^{*}p < 0.05$,$^{**}p < 0.01$,$^{***}p < 0.001$.

Table 7: Graduating in Time - Matching Results

Dependent variable: Pr(Graduate in time=1)			
	Propensity Score Matching		
	Nearest Neighbor	Kernel	Radius
	(1)	(2)	(3))
Study abroad	-0.219***	-0.224***	-0.226***
	(0.043)	(0.030)	(0.030)
Treated Observations	302	302	302
Untreated Observations	2108	2108	2108

Propensity score matching, average treatment effects on the treated using nearest neighbor matching with caliper 0.05 (column 1), kernel matching with an Epanechnikov kernel, bandwidth 0.06, (column 2), and radius matching with caliper 0.05 (column 3) calculated using PSMATCH2 package for Stata by Leuven, E. and Sianesi, B. (2003) Version 4.0.10; only observations on common support are used; standard errors in parentheses; variables used for the estimation and calculation of the propensity score are High School GPA, Male, Private Health Insurance, Purchasing Power Index, Log Distance to University and indicator variables for faculties and cohorts as well as interactions of faculties and cohorts; $^{*}p < 0.05$,$^{**}p < 0.01$,$^{***}p < 0.001$.

period. Selective transferring of grades can explain these findings. It seems that students primarily count those grades awarded abroad towards their degree that are better than the average grade they earn at their home institution. Thereby, students can improve the final grade at the cost of extending the time needed to graduate.

5 Sensitivity to Unobserved Heterogeneity

As discussed in Section 3, propensity score matching is based on the assumption that we observe the relevant pre-treatment characteristics that determine whether a student goes abroad. If there are unobserved factors that influence both treatment assignment and the outcome variables, our estimated effects may be biased. We follow the bounding approach proposed by Rosenbaum (2002) in order to test to what extend our results are sensitive to such unobserved heterogeneity. The idea of this approach is to analyze how much an unobserved variable could cause two individuals with the same pre-treatment characteristics to differ in their odds of going abroad without changing the inference of the estimated effects of a sojourn.[11]

Results of the sensitivity analysis for both outcome variables are shown in Table 8. The values for the variable Γ give the differences in the odds of treatment assignment for individuals with the same pre-treatment characteristics that may occur due

[11]For a detailed description as well as further empirical applications see also Aakvik (2001), Becker and Caliendo (2007), Caliendo, Hujer and Thomsen (2008), DiPrete and Gangl (2004).

Table 8: Sensitivity Analysis

Γ	Rosenbaum Bounds Upper Bound Significance Level (1)	Mantel-Haenszel Bounds Lower Bound Significance Level (2)
1	<0.0001	<0.0001
1.05	<0.0001	<0.0001
1.1	0.0001	<0.0001
1.15	0.0005	0.0002
1.2	0.0015	0.0004
1.25	0.0037	0.0009
1.3	0.0084	0.0020
1.35	0.0171	0.0039
1.4	0.0320	0.0071
1.45	0.0549	0.0123
1.5	0.0879	0.0201
1.55	0.1319	0.0314
1.6	0.1871	0.0468
1.65	0.2524	0.0670
1.7	0.3255	0.0924
1.75	0.4037	0.1234

Γ are the odds of differential assignment due to unobserved factors; column (1) calculated using the rbounds Package for Stata by Gangl, M., Version 1.1.6; column (2) calculated using mhbounds package for Stata by Becker, S. O. and Caliendo, M., Version 1.1.5.

to unobserved heterogeneity. With regard to the effect of going abroad on the final university grade, we find a positive and significant effect when assuming that there is no hidden bias ($\Gamma = 1$). The effect turns insignificant at a critical value between 1.4 and 1.45. This means that an unobserved variable could cause a difference in the odds of going abroad for two individuals with the same pre-treatment characteristics of more than 40% without changing the inference of our result. With relation to the impact of studying abroad on the probability of graduating in time, an unobserved bias could even cause the odds of treatment assignment to differ by more than 60% without turning the effect insignificant. This leads us to the conclusion that the results of our propensity score matching estimation are fairly robust to unobserved heterogeneity.

6 Conclusion

Using a unique dataset from a German university, this paper empirically investigates the academic gains to expect from a temporary study-related visit to a foreign university. We can apply a propensity score matching strategy due to the variety of individual information in the data. Our results are robust to different matching estimators and unobserved heterogeneity.

The empirical analysis shows that studying abroad improves the final university grade achieved at the home institution by 0.095-0.17 grades. Two possible explanations for this result are that studying abroad improves the students' academic ability or that the grades obtained at the foreign university are better than the average grade achieved at the home institution.

To shed light on this question, we examine the importance of counting grades obtained abroad towards the degree at Göttingen University. We find that students who transfer grades from their study-related visit abroad have a significantly better final university grade than their counterparts who do not count any grade awarded abroad towards their degree. Furthermore, descriptive statistics show that on average the grades a student obtained abroad and transferred towards the degree at Göttingen University is 0.2 grades better than the grade of her final university degree. This supports the interpretation that transferring grades is an important channel through which studying abroad affects academic performance.

Finally, it can be seen that a temporary study-related visit abroad decreases the probability of finishing a bachelor program within the standard time period. This finding suggests that students who go abroad do not count enough courses towards their degree at their home university as they would need in order to be in time with their studies. Thereby, it strengthens our interpretation that students primarily transfer classes if the grade obtained at the foreign university is better than the

average grade they achieved at home.

Through our results, it can be noted that the impact of studying abroad on academic performance is ambiguous. There is a positive effect of a sojourn on the final university grade, but this result seems mainly driven by selective transferring of grades. As a sojourn decreases the probability of graduating in time, the question of gains from studying in a foreign country also depends on the measure of academic performance used.

On the one hand, the shown second dividend can be seen as an unintended consequence of the existing regulations. In this case universities might want to think of alternative arrangements. For instance, students could be required to transfer a certain number of courses or simply to count all courses taken at the foreign university towards their degree at their home university. On the other hand, the positive effect might be seen as a bonus awarded to those students taking the effort of organizing a study-related visit abroad. If policy makers aim to increase the number of students spending some time at a foreign university, they might appreciate this feature.

For students going abroad for one or two semesters the results shown might also be of importance. These students need to decide whether to realize the second dividend of studying at a foreign university, in addition to the expected positive effect on their personality. By selectively transferring grades, they can improve their final grade, but should take into account that this might come at the cost of prolonged studies.

Appendix

Table A.1: Balancing Table for Nearest Neighbor Matching

Variable	Sample	Mean		Bias(%)	t-Statistic
		Treated	Control		
High School GPA	Unmatched	2.71	2.57	23.9	3.81***
	Matched	2.71	2.70	1.1	0.14
Male	Unmatched	0.36	0.47	-21.7	-3.48***
	Matched	0.36	0.42	-12.2	-1.50
Private Health Insurance	Unmatched	0.23	0.17	15.6	2.65**
	Matched	0.23	0.23	-0.8	-0.10
Purchasing Power Index	Unmatched	99.03	97.57	13.1	2.07*
	Matched	99.03	100.35	-11.8	-1.24
Distance to University	Unmatched	5.03	4.85	17.6	2.77**
	Matched	5.03	5.01	2.4	0.31
Medicine	Unmatched	0.01	0.00	5.5	1.06
	Matched	0.01	0.01	-4.8	-0.45
Humanities	Unmatched	0.31	0.20	25.7	4.43***
	Matched	0.31	0.27	9.2	1.07
Mathematics	Unmatched	0.03	0.03	-2.5	-0.40
	Matched	0.03	0.03	-1.9	-0.23
Physics	Unmatched	0.01	0.02	-4.6	-0.70
	Matched	0.01	0.02	-7.9	-0.91
Chemistry	Unmatched	0.01	0.05	-24.7	-3.28***
	Matched	0.01	0.01	0.0	0.00
Geology/Geography	Unmatched	0.01	0.01	-3.7	-0.56
	Matched	0.01	0.01	0.0	-0.00
Biology	Unmatched	0.08	0.12	-11.7	-1.81
	Matched	0.08	0.07	3.3	0.46
Forest Sciences	Unmatched	0.05	0.09	-17.6	-2.59**
	Matched	0.05	0.06	-5.3	-0.73
Agriculture	Unmatched	0.17	0.24	-17.8	-2.77**
	Matched	0.17	0.15	5.8	0.78
Economic Sciences	Unmatched	0.27	0.18	20.1	3.45***
	Matched	0.26	0.31	-11.9	-1.35
Social Sciences	Unmatched	0.06	0.05	4.0	0.67
	Matched	0.06	0.05	2.9	0.35
Cohort 1	Unmatched	0.04	0.07	-13.3	-1.98*
	Matched	0.04	0.04	0.0	-0.00
Cohort 2	Unmatched	0.09	0.07	4.5	0.76
	Matched	0.09	0.09	-2.4	-0.28
Cohort 3	Unmatched	0.22	0.17	11.5	1.94
	Matched	0.22	0.24	-4.2	-0.49
Cohort 4	Unmatched	0.36	0.34	4.0	0.65
	Matched	0.36	0.34	3.5	0.43
Cohort 5	Unmatched	0.29	0.34	-9.9	-1.59
	Matched	0.29	0.29	1.4	0.18

Treatment: Study abroad; summary statistics for treated and controls before and after matching; interactions between faculties and cohorts included and balanced after matching; column Bias(%) displays the standardized bias in percent; column t-Statistic shows the statistic of the t-test for equality of means before and after matching; calculated using PSMATCH2 package for Stata by Leuven, E. and Sianesi, B. (2003) Version 4.0.10; $^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$.

Figure A.1.a: Before Matching

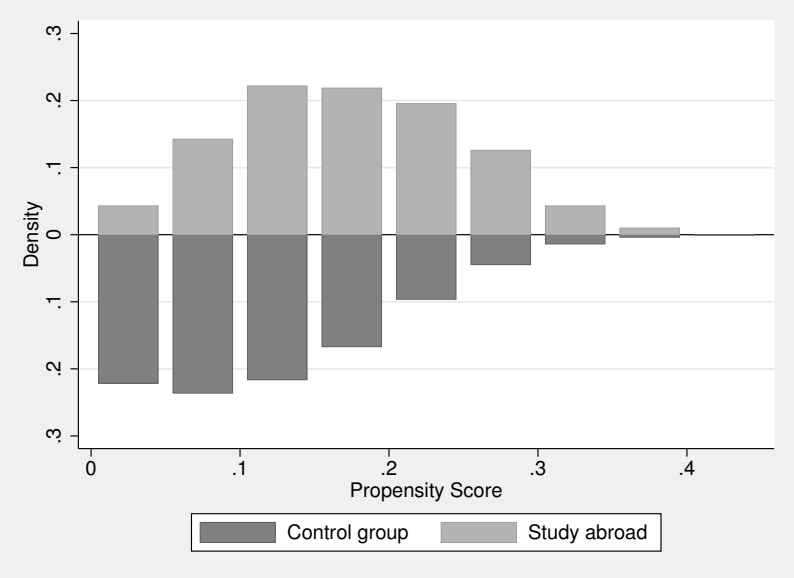
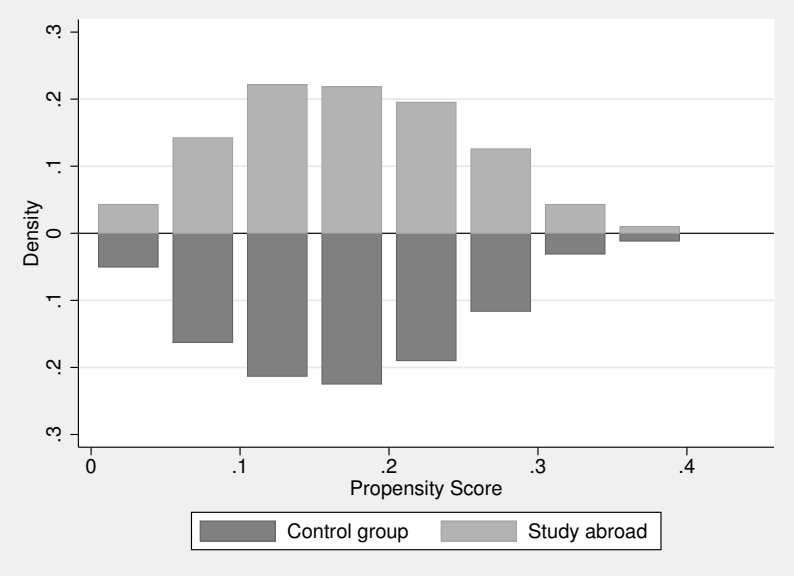


Figure A.1.b: After Nearest Neighbor Matching



Distribution of the propensity score before and after nearest neighbor matching with caliper 0.05. Calculated using PSMATCH2 package for Stata by Leuven, E. and Sianesi, B. (2003) Version 4.0.10; only observations on common support are used; variables used for the estimation and calculation of the propensity score are High School GPA, Male, Private Health Insurance, Purchasing Power Index, Log Distance to University and indicator variables for faculties and cohorts as well as interactions of faculties and cohorts.

Table A.2: Determinants of Transferring Grades

Dependend variable: Pr(Transferring grades=1)	Coefficients
High School GPA	0.114
	(0.167)
Male	-0.296
	(0.202)
Private Health Insurance	0.060
	(0.224)
Purchasing Power Index	-0.005
	(0.008)
Log Distance	0.074
	(0.071)
Constant	0.397
	(1.100)
Faculties included	Yes
Cohorts included	Yes
Faculties # cohorts included	Yes
Observations	257
Pseudo-R^2	0.091
Log Likelihood	-124

Probit estimation; coefficients; standard errors in parentheses; clustered by county; only students who studied abroad; $^{*}p < 0.05$,$^{**}p < 0.01$,$^{***}p < 0.001$.

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