Cooperation Between Education Institutions: Overcoming the Distance Barrier to Student Migration
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Abstract

Usually student migration behaviors are described with a gravity model pointing out the central role of geographical distance as a factor that inhibits student flows. When applying a gravity model we find evidence for this distance effect, but extending the model with data on organizational cooperation bears two important findings. Positive direct effects of cooperation on student flows indicate that networking among educational institutions can be used as a means of supporting and guiding students’ career choices. Mixed interaction effects of distance and cooperation provide implications for higher education institutions how to improve their strategies of student recruitment, and shows how whole education systems can achieve a better allocation of students in the system of higher education.

Introduction

National economies are increasingly forced to draw their attention to an effective production and use of human capital in order to stay competitive in future. Especially with respect to the area of science and technology, it is widely acknowledged that countries should strive to increase their innovative capacity by educating scientists. This is not only reflected in national policies. In Europe these goals have been set up by the European Union on the international level, first with the Lisbon Strategy (2000), and recently succeeded by Europe 2020, the EU’s economic targets for the current decade. In light of this research on possible factors that influence and optimize human capital production on the macro level, gain significance.

What are the factors that generally hinder a beneficial allocation of students in a nation’s higher education system? In the field of education economics, individual choices with regard to higher education are traditionally assumed to be based on rational decisions about the expected cost of and returns to possible future education. This applies to both, the decision of whether to pursue a program in higher education and the choice of a specific program in a particular univer-

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sity. In line with this theory, researchers have proposed to explain students’ choices on the one hand by regional aspects, such as distance between a student’s home and a university, or regional push- and pull factors, and on the other hand on the individual level by student’s characteristics such as socio-economic status or parents’ education level.

The distance between students’ homes and universities, as well as regional characteristics and university characteristics can influence students’ choices negatively. The distance between students’ homes and universities or colleges is a central determinant that explains participation in higher education and patterns of student migration at the transition from secondary to higher education. It is assumed that distance to the nearest higher education institution affects the degree of participation negatively (Spiess and Wrohlich, 2008) and prior research findings support the assumption that higher distances between two educational institutions are resulting in smaller student flows between the two institutions (Sa, Florax, and Rietveld, 2004). The negative effect of distance on student migration has been labeled as the distance barrier (Spiess and Wrohlich, 2008) or the deterrence effect of distance (Sa, Florax, and Rietveld, 2006) and there is a variety of studies providing evidence for such a deterrence effect on student migration in different countries (Alm and Winters, 2009; Dal Bianco et al., 2010; Denzler and Wolter, 2010; Sa et al., 2004, 2006). Sà and colleagues additionally provide a review of literature on distance and student migration. The findings are conclusive indicating a negative distance effect (Sa et al., 2004).

Anyhow the distance between origin and destination of students is not the only geographic factor that plays a role in explaining patterns of student migration. Also regional characteristics such as the economic, social and institutional context play a role in explaining students’ choices whether or not to attend higher education courses, and which universities to choose. Typical examples of such contextual factors in models of the transition to higher education or the demand of higher education are: quality of higher education institutions (Faggian, McCann, and Sheppard, 2007; Mixon, 1992; Ono, 2001) or tuition fees (Baryla and Dotterweich, 2001; Mchugh and Morgan, 1984; Mixon, 1992; Tuckman, 1970), competition between institutions or number of alternative higher education institutions (Alm and Winters, 2009; Des-Jardins, 1999; Faggian et al., 2007), regional per capita income and unemployment rates (Faggian et al., 2007; Kyung, 1996; Mixon, 1992) or peer group influences (Ordovensky, 1995). In fact also individual characteristics have often been included in these models.

Thus the issue of student migration and educational choices has been researched consid-

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erably. Yet, none of the before-mentioned studies contains any kind of organizational cooperation or networks in the education sector as a determinant of student choice behavior at the transition to higher education. Disregarding the studies including quality of the higher education institution, the researchers generally leave out any kind of organizational characteristics or actions. Here education institutions are not viewed as actors, that can possibly influence students’ behaviors.

When trying to shed light on the determinants of student flows from secondary to higher education, we thus do not only look at such standard factors as distance, regional push and pull factors, or the popularity of certain programs but we also investigate how these regional and subject related factors can be influenced by organizational interventions. One factor that might have an effect here is the initiation of cooperation among the education institutions in order to strengthen the respective field of education. This has been done in the Dutch education sector within the last years. Between 2007 and 2010, institutions of secondary and higher education in the Netherlands were supported in building up cooperations related to science and technology education with other institutions.

**The Dutch Education System**

The Dutch system of higher education is organized in two different types of institutions offering different levels of higher education. Next to the regular scientific universities offering bachelor and master programs in scientific higher education, there are also colleges at which students can study programs with a stronger professional focus. In total there are 30 institutions of higher education in the Netherlands of which 13 are universities and 17 are colleges. Two of the universities are technical universities.

In the last years of secondary education, students have to choose one out of four possible educational tracks of specialization. The four tracks are science and technology, science and health, economics and society, and culture and society. One special issue about higher education programs in science and technology is that in some of them it is a prerequisite to graduate from secondary school with the respective specialization. As a consequence, when analyzing student flow, we only base our estimation on the population of students that graduates from this track.

With regard to tuition fees the institutions do not differ. There is a yearly tuition fee of approximately 1.700€ for all higher education institutions in the Netherlands. Thus we can assume that tuition fees do not influence educational choices. Dutch students are eligible for finan-
cial support from the state. The amount depends, among other factors, also on the living conditions of a student. Students living with their parents receive a lower support. Additionally to this financial support students receive a ticket for the national public transport system. Based on these characteristics of the support system, it seems justified to suppose there are no strong financial incentives to study at certain places.

With regard to the quality of higher education institutions it can be assumed that there are some differences in the reputation of certain institutions or subjects, but compared to countries with many private universities, where the differences can be quite high, these disparities among Dutch education institutions are relatively small. Regional aspects, on the contrary, seem to play a decisive role in explaining student migration. A preliminary descriptive analysis of the student migration behaviour has shown that most universities draw the majority of their students from a relatively small number of the nearest schools.

**Hypotheses on Cooperation**

When school graduates make their choices about what kind of further education to attend, and whether to move away from home, they are facing a situation of extreme uncertainty. Many of the subjects they can decide to study are not very familiar to them, and especially moving away from home produces a completely new life situation. In such a situation, information about future possibilities play a central role in reducing uncertainty. When universities cooperate with schools in order to create more coherence among the different levels of education, there are two positive effects conceivable. First, students are able to obtain more information about the respective university, which enables them to get an idea of what it means to study at that university. Secondly, a cooperation that focuses on certain subjects, improves the students’ perception and knowledge of that subject, and possible future career perspectives. Thus the perceived informational costs are decreased by cooperation and the expected returns to education might be higher, due to more information about career prospects.

If we look at the dyadic relationships between schools and universities the assumption that cooperation can increase student flow fits relatively well into the theoretical argumentation about distance and transaction costs as it has been discussed before in the literature of education economics. Transaction costs do not necessarily need to be monetary. Spiess and Wrohlich (2008) distinguish financial costs, emotional costs and informational costs, and claim that all of
them are captured in the argumentation that distance is a barrier to student flow. Similarly Denzler and Wolter propose additional to costs also other distance effects, which relate more to a student’s social environment. They claim that local rootedness can cause a barrier to moving longer distances (Denzler and Wolter, 2010).

In order to evaluate the effect of cooperation on student migration, we base our estimation on a gravity model of student migration as it has been proposed by prior research in the field of student migration (Alm and Winters, 2009; Sa et al., 2004). Similar to our study the authors of prior student migration studies try to explain student flows between secondary school districts and higher education institutions. In a gravity model student flow between a school and a university is determined by the size of the two institutions, their distance, and additional push- and pull-factors of the school and university (or their regions). While the size of institutions is expected to be positively related to student flow, distance has a negative impact on the number of students choosing to go from one institution to another. According to Alm and Winters higher distances imply both, “greater monetary and greater ‘psychic’ costs to migration” (Alm and Winters, 2009: 730). In our model we will build on this conceptualization of distances insofar as we do not only include distance as a factor, but also account for the ‘perceived distance’ of students to a higher education institution. In line with the argument of the important role of distance perception in explaining individual choices for trajectories to further education, we assume that cooperation between institutions attenuates the obstacles of student migration by reducing this perceived distance. Thus student flow ($F_{XY}$) between a school X and a university Y is modeled as follows:

$$F_{XY} = D_{XY}^{\beta_1} \cdot S_X^{\beta_2} \cdot S_Y^{\beta_3} \cdot R_X^{\beta_4} \cdot CW_{XY}^{\beta_5} \cdot CS_{XY}^{\beta_6}$$

$D_{XY}$ indicates the distance between a school (X) and higher education institution (Y). This variable was measured as the linear distance between the exact locations of the two education institutions. Another possibility to measure distance is to account for actual or estimated travel distances. Because distance is assumed to be negatively related to student flow, the exponent $\beta_1$ is expected to be negative.

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1 At first glance such a measure of distance seems to be more suitable, but there is also a problem coming along with the measurement of travel distance, because we would obtain different values for public and private transport. Apart from that, a comparison of the predictive validity of the two measures showed that they are highly correlated (Rietveld et al., 1999) and their explanatory power is comparable (Kjellstrom and Regner, 1998).
University size $S_Y$ was measured by an estimated number of students enrolled in sciences and technology programs at a university, and is expected to be positively related to student flow. School size $S_X$ was measured by the number of students in a school graduating in the science tracks and is, similarly to university size, expected to be positively related to student flows. Thus $\beta_2$ and $\beta_3$ are expected to be positive.

In order to account for the fact that universities might compete with each other in recruiting the best students, we added a term called relational competition $R_X$, which captures the number of other universities a school is linked to. If a school cooperates with other universities, it is expected that these partners are competitors in attracting students from that school. Accordingly we expect $\beta_5$ to be negative.

Finally we assume that the effect of weak cooperation ($CW_{XY}$) and the effect of strong cooperation ($CS_{XY}$) are positive, whereas the effect of strong cooperation is higher, which implies positive parameters $\beta_6$ and $\beta_7^2$. In a further model there will be also interaction terms included for distance with each cooperation level.

In order to estimate the model statistically, we need to transform the product into a linear equation. This is done by taking the natural logarithm of the whole equation:

$$
\ln(F_{XY}) = \beta_1 \ln(D_{XY}) + \beta_2 \ln(S_Y) + \beta_3 \ln(S_X) + \beta_4 \ln(R_X) + \beta_5 CW + \beta_6 CS
$$

The cooperation dummies need no transformation because they are dichotomous. This estimation equation we can generally estimate by a regression model. The elasticity terms in Equation 1 are transformed into linear effects. This implies that, when interpreting the results in substance we will have to turn back to the original equation.

**Data Analysis**

There are some specific characteristics of the data we have to take into consideration when analyzing it. Because the level of analysis is the dyad, consisting of a school and a university, there is a high proportion of zeros and small values in the dependent variable student flow, which indicates a violation of the normality assumption. Thus we cannot use a simple OLS estimation. A Poisson regression, which would generally be applicable for a count dependent varia-

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2 both effects are included separately as dummies
ble, is also not providing reliable results, because there is some overdispersion in the student flow variable. To control for this overdispersion, we chose a negative binomial regression model.

The data on cooperation in the Dutch education sector was collected by means of an electronic survey in 2008. There is data available about cooperation between schools and universities related to science and technology for 523 secondary schools and 243 institutions of higher education in the Netherlands. We differentiate between three levels of cooperation. No cooperation is used as a reference category and two dummies are used for weak and strong cooperation. Cooperation was measured in frequency of cooperation between the two institutions. Weak cooperation equals once or a few times operating per year, and strong cooperation signifies at least monthly contacts. To assess the student flow between two institutions, individual level data was available for all Dutch students graduating from secondary schools, including information on the subject of specialization in school, as well as information about their study program one year after graduation from school. By aggregating this data for possible pairs of schools and universities, a general student flow score and another score, of student flow for science and technology students could be computed. The level of analysis is thus the dyad consisting of a school and a university. The number of cases equals the number of all possible school-university combinations, which is \( n = 1552 \).

Since there is a large number of observations for each institution of higher education, it is necessary to account for the emerging grouping structure in the data. The observations are not necessarily independent. Different recruitment strategies and inflow patterns, but also other unobserved characteristics of the higher education institutions might affect the model. It is necessary to control for these dependencies by including a dummy for each university. Since there are no hypotheses about possible differences between institutions, the grouping effects are not interpreted.

**Results**

As expected, distance is negatively related to student flow. In the simple model, which excludes the interaction of cooperation and distance, the distance effect is smaller than some of

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3 Originally there is data for all 30 higher education institutions. Six of the universities and colleges had to be excluded from the analysis, because they either did not offer any educational programs in the field of sciences and technology (this was the case for one university) or their location could not be identified adequately (five colleges have diverse locations offering education in math or sciences). Thus an exact geographical analysis is impossible in these cases.
those shown in other studies of student migration. The other core components of the basic model are the sizes of the two organizations. They are expected to be positively related to student flow, because bigger flows can occur between larger units. Here we find the expected positive results for institution size. As expected, the effect of competition is negative.

Model 2 through 4 reveal that the impact of collaboration on the student flow between a high school and a HEI is relatively modest. The models all exhibit better model fit than the baseline model (model 1), but the positive effect of collaboration is dwarfed by the negative effect of distance in terms of effect size. Moreover, a comparison of model 4 to model 2 reveals that a strong collaboration has no additional effect on the student flow above that of simply having a (weak) collaboration.

The picture changes drastically, however, once we take the interactions between collaboration and distance into account. Model 5 and 6 reveal that there is a strong and positive interaction effect between the two indicating that the positive effect of collaboration on the student flow is stronger the more distant the high school and the HEI are. This distance negating effect is stronger for strong collaborations than it is for weak collaborations. This contrasts nicely with the findings of the earlier models which indicated that there was no main effect of a strong collaboration on the student flow. These differences between strong and weak collaborations remain unchanged if we include them in a single model (model 7).

**Discussion**

In this study, we added cooperation as a new factor to the gravity model of student migration, which has not been investigated before. In general organizational cooperation is not often found in the studies of education economics. Though the literature review has shown that cooperation is a relevant issue in the contemporary discussions on education systems, and their ability to adapt to the new needs of present day economies.

With this analysis we do not only make a first step in evaluating the effectiveness of cooperation in the education sector statistically, but we also could fit it into a well established econometric model of student migration. Anyhow, basing the evaluation of cooperation effect upon this gravity model, restricts the analysis to the level of the dyadic relationships, which is still a very simple way of analyzing cooperation effects. Research on interorganizational networks generally suggests that collaboration between two organizations has to be seen as embedded in a
wider network of actors and collaborations. To draft and analyze the effects of wider network structures in the Dutch education system might be especially interesting because of the relatively strong regional orientation of student flows. Methods of social network analysis could help to identify how this relates to a possible regional clustering in network formation among the actors. With respect to the outcome, that was most relevant for policymakers, namely the enhancement of a country’s innovative capacity through improved human capital production, it might be especially interesting to compare different regions, and detect high performing regions and advanced regional networks of education.

With respect to the gravity model of student migration the findings of this study point at the importance to re-conceptualize distance in the models. As it has been discussed in this paper, there are two aspects of distance playing a role, when talking about a distance barrier to migration. One is the traditional economic cost calculation, based on expected monetary costs and benefits related to moving far, or staying close to home. The other aspect is the perceived distance, related to non-monetary costs, which in turn can refer to social embeddedness or informational costs.

References
Kjellstrom, C., Regner, H., 1998. Does distance to a university affect enrollment decisions? Evi-


APPENDIX:

Negative Binomial Gravity Model Results

Dependent variable: Number of students moving between a high school – HEI pair

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>-0.72***</td>
<td>0.03</td>
<td>-0.63***</td>
<td>0.03</td>
<td>-0.70***</td>
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<tr>
<td>HEI size</td>
<td>0.21***</td>
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<td>0.28***</td>
<td>0.03</td>
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<td>0.03</td>
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<tr>
<td>High school size</td>
<td>0.71***</td>
<td>0.03</td>
<td>0.73***</td>
<td>0.03</td>
<td>0.71***</td>
<td>0.03</td>
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<tr>
<td>Time lagged student flow (2 yrs)</td>
<td>1.08***</td>
<td>0.02</td>
<td>0.94***</td>
<td>0.02</td>
<td>1.07***</td>
<td>0.02</td>
</tr>
<tr>
<td>TU dummy</td>
<td>0.94***</td>
<td>0.05</td>
<td>1.09***</td>
<td>0.05</td>
<td>0.95***</td>
<td>0.05</td>
</tr>
<tr>
<td>Competition</td>
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<td>0.04</td>
<td>-0.27***</td>
<td>0.04</td>
<td>-0.11***</td>
<td>0.04</td>
</tr>
<tr>
<td>Collaboration</td>
<td>0.68***</td>
<td>0.04</td>
<td>0.69***</td>
<td>0.04</td>
<td>-1.27**</td>
<td>0.18</td>
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<tr>
<td>Collaboration – strong</td>
<td>0.49***</td>
<td>0.04</td>
<td>0.60***</td>
<td>0.07</td>
<td>0.20***</td>
<td>0.07</td>
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<tr>
<td>Dist * collaboration</td>
<td>0.37</td>
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<td>0.38</td>
<td>0.38</td>
<td>0.38</td>
<td>0.38</td>
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<tr>
<td>Dist * collaboration - strong</td>
<td>-3.44***</td>
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<td>-4.54***</td>
<td>0.38</td>
<td>-3.64***</td>
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<tr>
<td>Constant</td>
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<td>0.72***</td>
<td>0.04</td>
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<td>Alpha</td>
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N 10563 10563 10563 10563 10563 10563 10563
-2 log likelihood -10666.44 -10502.92 -10660.55 -10502.59 -10444.16 -10636.36 -10439.27
Significance 0.000 0.000 0.000 0.000 0.000 0.000 0.000
AIC 21348.88 21023.84 21339.12 21025.18 20908.31 21292.72 20902.54

a: Robust standard errors
***: p<0.01, **: p<0.05