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The Network of International Student Mobility: Enlargement and Consolidation of the European Transnational Education Space?

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ABSTRACT

In this paper, we investigate the impact of membership in the Bologna Process on patterns and driving forces of cross-national student mobility. Student exchange flows are analyzed for Bologna Process member states and non-Bologna OECD members over a ten-year period (from 2000 to 2010). We apply a social network approach focusing on outbound diploma-mobility. Based on social network analyses, we first visualize the exchange patterns between sampled countries. In doing so, we analyze the student exchange linkages to first gain descriptive insights into the development of the network. Second, we use exponential random graph models (ERGM) to test which factors determine transnational student mobility. The results of our network analyses reveal that cross-national student exchange networks are stable over time. At the core of these networks are the United States, Great Britain, France, and Germany; they attract the highest shares of students from the remaining countries in our sample. Moreover, the results of the ERGM demonstrate that homophily between countries determines student exchange patterns. The most relevant ties exist between bordering countries. Moreover, membership in the Bologna Process impacts mobility patterns, but surprisingly, it has a mitigating effect.

CONTENTS

1 INTRODUCTION

Cross-national scholarly exchange has been part of academic culture since the founding of the first universities during the medieval period. Since their establishment, the most distinguishing characteristic of universities has been a cosmopolitan attitude, furthered through transnational exchanges of students, scholars, and ideas. The diversity of program structures and governance traditions of European universities has long been regarded as a cultural heritage worth preserving. In keeping with this tradition, the primary goal of the Bologna Process, named after the 1999 Bologna Declaration, was to not only increase cross-border student mobility (see Zgaga 2006), but also to improve comparability and compatibility of European higher education program systems, as a central focus of the European Higher Education Area (EHEA). According to the discussion of the Bologna Process in the 2012 EHEA Report, student mobility “has been conceived both as a transversal action to complement the original action lines of the process and as a key instrument to develop the European Higher Education Area” (Eurydice 2012:151). To this end, the European Qualifications Framework (EQF) was established and implied, for instance, a common usage of the European Credit Transfer and Accumulation System (ETCS) within the EHEA or the adaptation of national systems to make educational credits and qualifications comparable to the ECTS.

Despite these efforts to promote student mobility in Europe, the driving forces of cross-national, student-based linkages between countries are less clear, or at least largely debated. One strand of literature discusses rationales on the individual level for studying abroad and conceptualizes students as rational actors investing in their education with the goal of maximizing their life-time earnings (Rosenzweig 2006; Beine et al. 2011). According to this human capital approach, students seek higher education outside of their country of origin when the benefits outweigh the costs of studying abroad (for a detailed overview of micro-level approaches to determinants of student mobility, see Netz forthcoming). Another strand of literature focuses on cultural factors for explaining student migration patterns (Bessey 2010; Dreher and Poutvaara 2005; Tremblay 2001). In addition to studies analyzing the determinants of student outflows, several studies have examined the mobility of incoming students. For instance, Zhao and Wildemeersch (2008) name four rationales that underlie the motivation for recruiting international students from the institutional perspective: 1) competing for the best brains and building an international quality profile; 2) generating revenue to benefit the institution’s departments and members; 3) establishing long-term international relations, business connections, and 4) reciprocal exchange among international institutions and enhancing cross-cultural understanding and communication (53).

Whatever the reason or direction, diploma-seeking student mobility flows from country A to country B are best analyzed with data that captures this pair-wise structure, or dyadic structure in a cross-national context. Dyadic analyses can provide detailed insights into country-wise exchange patterns. However, this perspective can be further extended by taking on a social network perspective, which additionally accounts for the degree to which countries are embedded in a wider network. While simple dyadic analyses assume the stochastic independence of dyads from the surrounding relationships, models of social networks explicitly take the statistical non-independence of dyads into account.

Recent studies have shown that SNA is a fruitful approach in regional studies (Andrews 2009). Moreover, the monograph by Maoz (2011) has convincingly demonstrated that SNA approaches offer extremely useful strategies to model many different kinds of relationships (e.g. trade and ally relationships) at the state level, which can be analyzed not only in the static sense but also in a dynamic time-varying fashion. In our investigation, we focus only on outbound students and analyze what determines whether a particular country is a receiver of a high proportion of outbound students from other countries. Moreover, special consideration is given regarding the impact of the Bologna Process on such flows. In order to test if the Bologna Process has reinforced cross-border student mobility, we choose a sample that includes Bologna member countries and non-Bologna participant OECD members (see Section 4). We assume that the Bologna Process corresponds with a comparatively high level of ties between countries with regard to student mobility, and what is more, that participation in the Bologna Process has furthered these mobility-based relations over time. We thereby treat countries as vertices (or “nodes”) and ties between them resulting from cross-national student exchanges as arcs. We give some descriptive insight into the development of the network with regard to closeness centrality over time. Additionally, we test whether being a Bologna member raises the probability of exchanging students with other Bologna member countries by using exponential random graph models (ERGM). These models estimate “the probability of observing a given structure in a real data network from a family of hypothetical networks with similar properties […and] actual relations as a consequence of hidden structures that result from some random processes” (Maoz 2011:36-37). Finally, we compare the effect size of Bologna membership over three different time periods (2000, 2004, and 2009) in order to check whether membership in the Bologna Process enhances the chances for cross-national student exchange ties over time.

2 BOLOGNA AND MOBILITY

Established by the 1999 Bologna Declaration, a system of easily readable and comparable degree qualifications was established through the introduction of a two-tier – later a three-tier (Berlin Communiqué 2003) – credit transfer system, the promotion of academic mobility, and European cooperation in quality assurance. For the degree cycles to work in a transparent and harmonious manner across Europe, a number of tools were developed or adapted for use at institutional and country levels (also Toens 2007). Foremost among them at the institutional level are the ECTS and the Diploma Supplement.

Under the Sorbonne Declaration, perhaps the first substantial policy document for the purpose of implementing these reform processes, student mobility was stated as *the* main goal of the harmonization process. Internationally mobile students are defined as "students who have crossed borders expressly with the intention to study" (Eurostat 2009:98). Every declaration or communiqué in the realm of the Bologna Process reiterated the commitment of the Ministers of Education to further cross-national student mobility. For instance, the London Communique (2007) states that mobility of staff, students, and graduates is one of the core elements of the Bologna Process, creating opportunities for personal growth, developing international cooperation between individuals and institutions, improving the quality of higher education and research, and giving substance to the European dimension. In their 2009 meeting in Leuven/Louvain-la-Neuve, the ministers "gave a new boost to mobility in the form of a target to be reached by the EHEA countries: In 2020, at least 20% of those graduating in the European Higher Education Area should have had a study or training period abroad" (Eurydice 2012:151).

Enabling international mobility of students across Europe has required structural adjustments at the institutional level. The EHEA can only function as a transnational higher education space if the higher education program structures are comparable and compatible between the participating countries. The 2009 Stocktaking Report of the Bologna Process commended progress made with regards to the implementation of the Bologna Process's higher education policies. Yet, the inevitable question remaining after the inception of the EHEA is whether these structural adjustments were successful in creating a transnational educational space across Europe. One indication of success is, for example, the degree to which strong student exchange relationships have been developed between Bologna participants.

3 DRIVING FORCES OF TRANSNATIONAL NETWORK FORMATION

Apart from institutional reforms that aim to establish student exchange networks, such as those implemented through the Bologna Process, student exchange patterns between countries can arise due to factors common to both of the countries' exchanging students. The *principle of homophily,* derived from social network theory (McPherson et al. 2001), states that actors who share the same or similar characteristics tend to establish ties with each other. Since culturally similar states are more likely to have cooperative ties (see Maoz 2011:191), we expect countries sharing common cultural characteristics to have international agreements (such as special visa regulation) in place, which should facilitate student exchanges. Moreover, countries that display similar socio-economic, institutional as well as cultural characteristics should exchange students among one another to a greater extent than countries that are more dissimilar.

Yet, similarities or symmetries are not the only characteristics that determine the constitution of a relational network. Exchange relationship can also be based on *complementarity*. For instance, students originating from countries on the periphery of the world economy could engage in cross-border migration for educational purposes. If these students return to their home countries as highly skilled graduates, the country of origin might profit from this exchange relationship. Following this reasoning, we would expect migration flows from low GDP per-capita to high GDP per-capita countries. At least, higher-GDP countries might be more attractive for students. This type of migration flow could hold ambivalent implications from the sending country's point of view, since the risk of brain drain[1] arises if their outgoing students do not return to their home country upon graduation. From the receiving country's point of view, educating foreign students from less developed countries offers the chance to gain a qualified labor force and potentially also foster the diffusion of desired cultural, political, and value orientations (see Boyle et al. 1998: 84pp).

Thus, exchange relationships within a network can be imbalanced and characterized by *dependence structures and power asymmetries* between the countries constituting a dyad. Power is defined as the ability of an actor to influence outcomes (see Maoz 2011: 211). An important element of power concerns the structure of exchange relations between units (Barnett and Duvall 2005). In resource dependence theory (Pfeffer and Salancik 1978), an approach examining imbalanced exchange relationships and power asymmetries, organizations are dependent on constant interexchange with other groups or counterparts in their environment. Hence, relationships can be competitive or symbiotic. Competitive relationships exist when organizations require identical resources, and

[1] Brain drain is the loss of highly skilled professionals from a source country to a recipient country (see Sako 2002: 25).

therefore must compete with one another for survival. Such description is often the case with tertiary education institutions because all of them need to attract students and academics to ensure their survival. In symbiotic relationships, one organization requires the products of the other and thus uses different resources. This is again relevant for institutions of higher education, as they need students and graduates from other tertiary education institutions for their functioning, especially in the context of international student mobility. Organizational behavior can thus be understood by analyzing information about the organization's environment, whereas the importance of a resource depends on the concentration of resource control (Pfeffer and Salancik 1978: 51). The likelihood of resistance to external pressures, for example, can be predicted from an organization's dependence on the actors exerting pressure. The power of an organization is thus derived from the position it assumes in its interactions with other organizations. Therefore, the most important ability of an organization is that of connecting its interests and activities with social norms held by the actors exerting these pressures.

In order to define which actors possess the ability to control other actors' behavior, we refer to theories of *hegemony*, which regard the dominance or supremacy of an institution, state, organization or similar actor as a driving factor for alliances. In international relations, hegemony is considered an indirect form of government (and of imperial dominance) in which the hegemon (i.e. the one exerting power) rules geopolitically subordinate states by implied means of power rather than by direct military force. Compared to the hegemon, other actors have only limited possibilities to enforce their own interests. Within a hegemony, dominance is established by means of cultural imperialism, whereas the hegemon dictates the internal politics and the societal character of the subordinate states that constitute the hegemonic sphere of influence. According to the Italian Marxist philosopher Antonio Gramsci, cultural hegemony denotes a specific type of power execution, a type of leadership that is based on the ability to define and enforce one's own interests as common societal interests (Brand and Scherrer 2003:91). Following the social network perspective, what distinguishes a great power or hegemon from an "ordinary" state is its position in cooperative networks. Applying this line of argument to the case of international student flows, countries holding a central position in the international system and having the current lingua franca as their teaching language in their higher education institutions should attract the largest share of internationally mobile students.

In line with this, the concept of *preferential attachment* (Barabási and Albert 1999) stipulates that the probability of gaining new relational ties in a network is proportional to the already realized relationships. That is, new nodes are more likely to attach themselves to central nodes than to marginal ones (Maoz 2011:219). From individual actors' point of view, the engagement in a relationship with another actor is more rewarding if

the other actor is already engaged in numerous relationships (Barabási 2003), that is to say if the actor holds a central position and degree of popularity within the network. The network structure that results from this logic can be described by a power-law distribution (see for details Barabási and Albert 1999).

In addition to social network theory, our empirical investigations are also motivated by *macro-level theories of migration*. Early theories of migration processes are based on Ernest George Ravenstein's seven laws of migration (Boyle et al. 1998). His arguments as well as his empirical results stimulated additional theories, developed in close connection to the physical model of gravitation. As is the case with bodies in the physical model of gravitation, gravitation models in migration theory assume that migration flows depend on mass and distance. Interestingly, Rodríguez Gonzales et al. (2011: 425) have already demonstrated for the ERASMUS program that student mobility is indeed in line with this theoretical model. In macro-economic theories of migration, migration flows are usually directed from economically less developed areas to areas with a higher development level. Accordingly, equilibrium is the natural state of supply and demand of labor in combination with wages. Regional disequilibria resulting from exogenous shocks are compensated by migration. If wages differ between areas, migration from low-wage to high-wage areas re-establishes equilibrium in the following period. Even though this macro-economic theory of migration has been criticized (Massey and Espinosa 1997), it is appropriate for explaining the functioning of a perfect market. The core argument is similar to what we can derive from the resource dependence approach: If there is an unequal distribution of knowledge or a difference in the level of educational standards, there will be an incentive to equalize the disequilibrium through migration. Students arguably migrate in order to benefit from higher educational standards abroad. Therefore, the migration flow is expected to follow from low-standard tertiary educational levels to high-standard tertiary educational levels.

4 DATA AND METHODS

In order to gain insight into student mobility patterns, we investigate cross-national student exchanges over a ten-year period between 2000 and 2010. However, we apply a cross-sectional approach by focusing on the years 2000, 2004, and 2009 and use the remaining data to impute missing data for the observed time points. Since we assume that the Bologna Process impacts patterns of international student mobility, we include all Bologna participants in our sample. Additionally, we include the remaining non-Bologna OECD countries because we wish to explore exchange relationships on a large transnational scale. In doing so, we wish to make the group of countries roughly comparable and to control for the membership effect of the Bologna Process. However, we exclude all countries with less than one million inhabitants, countries that did not pos-

sess a university sector at the onset of our investigation (Luxembourg) and countries that changed their statehood during the period of investigation (Serbia and Montenegro). Moreover, countries for which data were missing beyond imputation were excluded (Greece and Mexico). The data used for analysis stems from the UNESCO und OECD online resources and consists of counts of students from one country of origin studying in another country in a certain year. We use this data because “it is the only source of internationally comparable data based on common definitions and reporting procedures” (Teichler, Ferencz and Waechter 2011:31). Unfortunately, data is only available for degree-seeking, and thus long-term, student mobility, whereas short-term or credit mobility for all countries of our sample is not available for this analysis[2].

The data on internationally mobile students reflect absolute numbers of dyadically exchanged students in the respective years. We analyze two different outcomes: First, we analyze absolute numbers of dyadically exchanged students divided by the total number of all outbound-mobile students from a respective country (i.e. by *outbound mobile* students). The second outcome is the number of exchanged students divided by the total number of students enrolled in tertiary education (International Standard Classification of Education [ISCED] level 5A and 6) in the sending country (“by *all* students enrolled”). The second measure accounts for the size of the tertiary education sector of the countries investigated. Thus, we account for the likelihood of internationally mobile students seeking a degree in a foreign country as well as for the opportunity of the whole student body of a given country to become internationally mobile.

The first dependent variable (outbound students in ego from alter, by *all* students enrolled in alter) refers to the number of students ego receives from alter, divided by the number of all students enrolled in alter. It has been dichotomized by setting the highest quartile to one and the three lower quartiles to zero. The second dependent variable (outbound students in ego from alter, by *outbound mobile* students from alter) refers to the number of students ego receives from alter divided by the number of all internationally mobile students in alter. Again, this variable has been dichotomized by assigning the value one to the highest quartile. By imposing this restriction to the definition of a network tie in the respective dimension, we ensure that only a relevant share of alters’ students who migrate to the ego-country constitute a tie between the two countries.

As has been outlined above, *homophily* assumptions are central to our investigation. We thus analyze whether, on the one hand, (a) structural similarity in higher education policies between countries (e.g. the common use of ECTS), (b) general socio-economic similarities or (c) cultural similarities influence the probability for exchange ties be-

[2] However, as of recently, this data is, with certain limitations, available for 20 EU member countries (see Orr, Gwosć and Netz 2011).

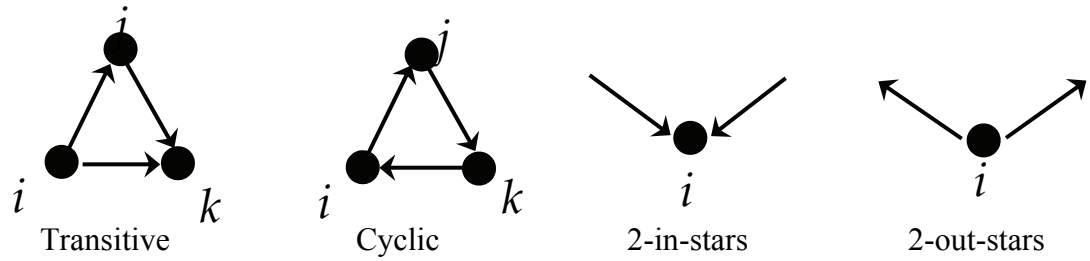
tween the countries under investigation. General socio-economic similarities – in our case measured as the (negative) absolute distance between the GDP per-capita of two countries – also account for national capabilities since development theorists often look at per-capita GDP as an indicator of development status (Maoz 2011:215). Since cultural similarities are often reflected by geographical proximity, we include information as to whether two countries of a dyad share a common land or sea border. In addition to these similarities, the effects of (d) common membership to supra and transnational institutions are considered and measured through a variable that indicates if both countries of a dyad are EU member states and members to the Bologna Process, respectively. Thereby, we identify “political” sub-samples for our analyses: EU and Bologna Process members, Bologna Process but not EU members, and OECD countries that are neither an EU nor a Bologna Process member.

To this end, we apply social network analysis (SNA), an approach that evolved out of graph theory in mathematics and sociological studies on the structure of relations. Network analysis provides a framework for the “systematic description, analysis, and estimation of the structure of relations among different units” (Maoz 2011:33) that might become manifest within a single network or across multiple networks. Dyads, representing relationships between nodes in a network, are the basic building blocks of relational networks. SNA investigates processes and structures “from a vantage point in which voluntary associations (due to the choices made by units) or involuntary associations (such as geographical proximity between units or shared cultural attributes) result in structures and relationships” (Maoz 2011:6). Moreover, SNA is able to distinguish between relational networks (in which the presence, direction, and magnitude of a relationship is defined by rules) and affiliational network (in which the relationship is defined through membership in professional associations or international organizations etc.). A relational network can therefore be symmetric or asymmetric, whereas an affiliational network is by definition symmetric. In our analysis, we investigate both types of networks because the magnitude of the cross-border student exchange relationships serves to identify relational networks, whereas membership status in the Bologna Process provides information on affiliational networks. Since we assume that causality originates from unit attributes and choices and impacts the structure of the system, we can use the attributes of the units (i.e. dyads) and “the logic that defines their networking choices to derive processes that result in certain systemic structures” (Maoz 2011:23).

An important point concerning the analysis of dyadic relationships is the statistical non-independence of observations. As already mentioned, the structural embeddedness of dyads in social networks often has a specific effect on the probability of a tie in a respective dyad. One example of such embeddedness in social networks is the *activity*

(or “expansiveness”) of actor *i* which affects a set of other actors simultaneously, as measured by the number of 2-out-stars or two arcs emanating from one node (for visual representation of types of social networks, see Figure 1). In a similar way, the *popularity* of an actor *i* prompts other actors to establish ties to *i*, which can be also measured by the number of 2-out-stars. Another type of social networks is triadic closure in friendship networks, which may be represented as cyclic or transitive. In the transitive triad, actor *k* receives more ties than actors *i* and *j*, whereas the distribution is equal in the cyclic triad. In a transitive triad involving nodes *i*, *j,* and *k*, there is a tie between *i*→*k* whenever there are ties *i*→*j* and *j*→*k* (Wasserman and Faust 1994: 243). In other words, *i*→*k* is conditional on the other ties. If we find a positive effect of transitive triads and a negative effect of cyclic triads, the network tends to be *hierarchic* in this way (Lusher et al. 2013). This interpretation presupposes that 2-in- and 2-out-stars are controlled – otherwise, the number of transitive or cyclic triads could result by chance from an overlap of in- and out-stars (Robins et al 2007: 184).

Figure 1: Configurations in social networks: Transitive and Cyclic Triads, and 2-in- and out-stars



In friendship networks, for instance, we normally find negative effects of cyclic triads and positive effects of transitive triads, meaning that friendships (e.g. in classrooms) tend to appear in a hierarchical structure. So far, little is known about the network embeddedness of ties between countries with regard to relevant shares of internationally mobile students. Therefore, we also analyze the pattern of structural embeddedness of dyadic relationships between countries by controlling for mutuality, 2-in and 2-out-stars, as well as transitive and cyclic triads (Wasserman and Pattison 1996; see Figure 1). Consequently, this approach has two advantages: First, it accounts for the statistical non-independence of observations in networks, which might be an issue in all dyadic data settings where one node could have a tie to any other. Secondly, models of social networks allow for a direct assessment of the structural embeddedness of ties into the wider network beyond the dyad.

The fact that prestige and quality of university programs is perceived as being rather heterogeneous among OECD countries is a strong argument for the assumption that similar hierarchies might occur also in networks of international student mobility flows.

Thus, a social network analysis (SNA) is applied so as to address the question of which factors explain student mobility patterns.

In our empirical investigation we first describe the development of basic trends regarding the two network dimensions (“outbound students in ego from alter, by *all* students enrolled” and “outbound students in ego from alter, by *outbound mobile* students”) over time. Secondly, we use exponential random graph models (ERGMs) (p*) that were developed in order to explain why we observe a specific empirical realization of a network among a given set of units (vertices). Here, the focus is on the structural characteristics of the network, on the attributes of countries as well as on their similarity or difference with regard to salient characteristics, which determine whether there is a tie between them or not. As stated above, explaining a tie in a social network requires accounting for the statistical non-independence of dyads. In contrast to other recent studies, we use a simple approach in EGRM since we assume a Markov-dependence of ties and account for structural dependencies of ties in the network by controlling for the change statistics of transitive triads, cyclic triads, mutuality, as well as 2-in- and 2-out-stars. We use logistic regression (for details, see Robins et al. 2007) for explaining the probability of a tie in a dyad. Since coefficients of non-linear models cannot easily be compared across models (Mood 2010), we have to make additional efforts to compare the effect size of Bologna membership between periods. Thus, we also compute average marginal effects (AME) (see Long 1997), enabling us to compare coefficients across different statistical models. Such comparisons are currently not implemented in state-of-the-art simulation methods (Lusher et al 2013).

Descriptive Analysis: Maps of Student Flows

In a first analytical step, we visualize the exchange patterns between the sampled countries. As demonstrated in Figures 2-5, the centrality of countries with regard to student mobility differs to a large extent. In network analysis, the concept of “centrality is one of the most important instruments for comparing individual nodes within and across networks” (Maoz 2011:53). The centrality of a given country is a function of the proportion of ties it has with all other nodes in the network and is thus used as “an indicator of prestige within a social system” (Maoz 2011:53). This means that the prestige of a higher education system in a given international network of higher education systems depends on whether or not students from other states choose it as a study destination.

Figure 2: Students received by ego from alter, by all students enrolled, 2009

Figure 3: Students received by ego from alter, by all students enrolled, 2009

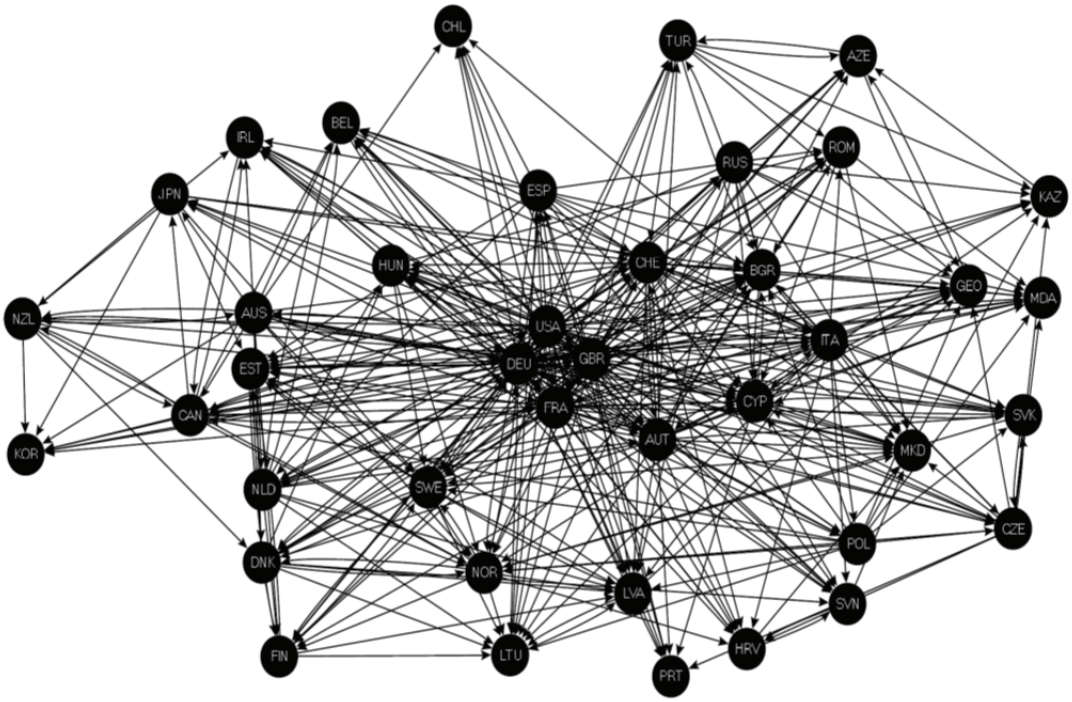
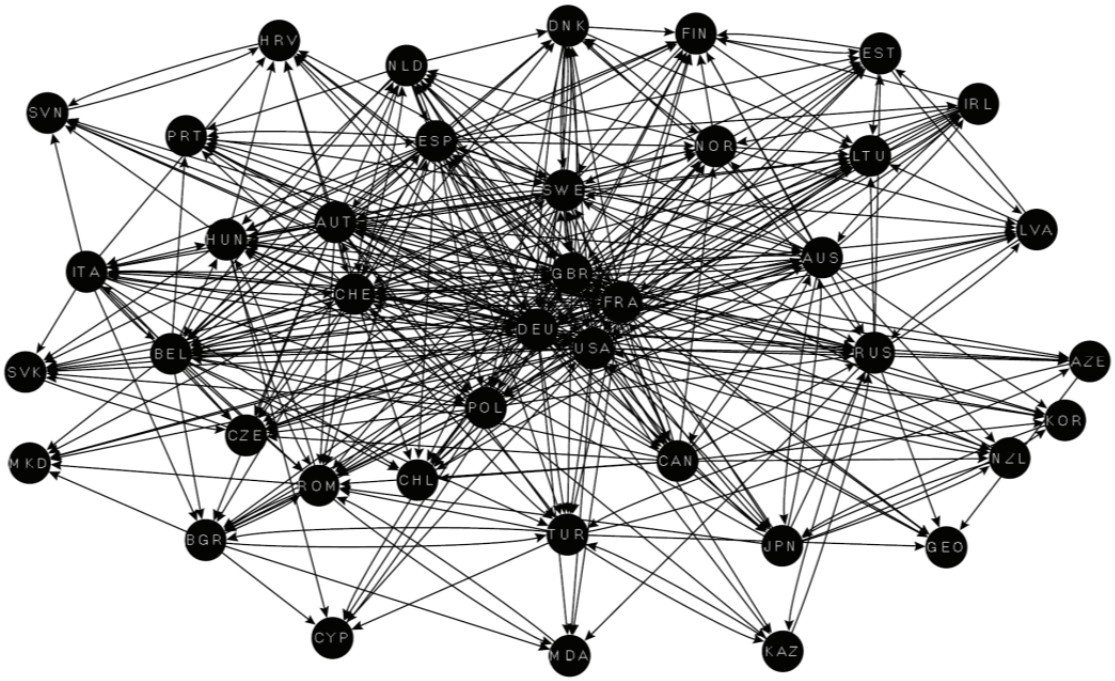


Figure 4: Students received by ego from alter, by outbound mobile students, 2009

Figure 5: Students received by ego from alter, by outbound mobile students, 2009



Figures 2 and 4 show the networks as projected on a map of Europe, which gives a rather unclear picture at first glance, indicating high density of these networks. The great advantage of visually abstracting these networks from geographic locations is that network plots based on spring-embedder algorithms (Krempel 2010) can reveal the central-

ity or marginality of vertices, or the cohesiveness of cliques. According to Figures 3 and 5, the United States of America (USA), Great Britain (GBR), France (FRA), and Germany (DEU) are at the core of our student exchange network (referred to as the core group below). In the year 2009, these countries constituted a highly centralized core in both networks (all students enrolled in Figure 3 and outbound mobile students in Figure 5). Computing closeness centralization (see below) for each vertex as a *local* measure, which indicates for each ego *i* the sum of the distance to all alteri *j* in the network, we take on a longitudinal perspective in order to answer the question of whether the Bologna Process triggered a fundamental change in the networks during the period from 2000 to 2009. Since France, Great Britain, and the USA are the centers of the network, we compute closeness centralization for each vertex as a *local* measure, which indicates for each ego *i* the sum of the distance to all alteri *j* in the network.

Since the number of alteri (g–1) is divided by this sum, the closeness centrality is a standardized measure.

$$C_c(n_i) = \frac{g-1}{\sum_{j=1}^{g} d(n_i, n_j)}$$

Global measures, in contrast, describe properties of the complete network. In the following expression, n^* is the highest local closeness centralization (Freeman 1979; Wasserman and Faust 1994:186):

$$C_c = \frac{\sum_{i=1}^{g} [C_c(n^*) - C_c(n_i)]}{[(g-2)(g-1)]/(2g-3)}$$

Closeness centrality can be computed either by different measures of the degree of centrality, which are referred to as indegree, outdegree or by a combination of both. We choose the latter option because we expect that the Bologna Process had an impact on the flow of international students, but did not influence the direction of the flow. If the Bologna Process substantially transformed the network of student mobility, we would also expect a substantial change with regard to the degree of closeness centrality within the core group. Otherwise, if there were any transformation at all, it would have been restricted to the vertices outside the core.

Table 1 shows the global measure of closeness centrality and reveals a remarkable stability of both networks (share of students received by ego from alter, highest quartile, by all students enrolled as well as by outbound students). Using the share of all students enrolled, we find a slight increase in global closeness centrality from 2000 to 2004 and a slight decrease afterwards. The same pattern holds for the network based on the share

of outbound students. Here, the value is the same in 2000 and 2009. Again, this hints at the stability of the network over time.

*Table 1: Development of network closeness centralization (in- and out-degree) over time**

	2000	2004	2009
by all students	0.718	0.721	0.707
by outbound students	0.739	0.740	0.740

*share of students received by ego from alter, highest quartile

The stability of closeness centrality measures from 2000-2009 does not necessarily mean that the network is also stable at the vertex-level, which can be tested by the stability of closeness centrality for our core group (Table 2). The development of the local closeness centralities in our core group is also in line with the notion of network stability. In Great Britain and France, we find high levels of centrality and even the maximum value of 1.0 for the USA and Germany. Interestingly, in the outbound student network, we find identical values for France and Great Britain for the years 2000 and 2009, which again corroborates our argument of network stability.

*Table 2: Development of network closeness centralization (in- and out-degree) for the core group of countries over time**

	2000	2004	2009
by all students			
Great Britain	0.952	0.975	1.000
France	0.930	0.952	0.952
USA	1.000	1.000	1.000
Germany	1.000	1.000	1.000
by outbound students			
Great Britain	0.930	0.975	0.930
France	0.909	0.952	0.909
USA	1.000	1.000	1.000
Germany	1.000	1.000	1.000

*share of students received by ego from alter, highest quartile

The fact that the networks are rather stable over time, however, does not necessarily mean that the mechanisms of network-formation are stable as well. Even though the outcome of a process is the same, the determinants of the process can change over time. We therefore refer to a simplified version of ERGM (Lusher et al. 2013) in order to analyze determinants of ties in our networks for the three time points 2000, 2004, and 2009.

5 DETERMINANTS OF TIES IN THE STUDENT MOBILITY NETWORK: RESULTS OF ERGM

Table 3 shows determinants of ties of “outbound students in ego from alter by *all* students enrolled” between countries in the international network. Model 1 is based on data from the year 2000, model 2 on data from 2004 and model 3 on data from 2009. For all three years, we observe positive effects of ego’s GDP per-capita on receiving a relevant share of students from alter. In contrast to what we would expect from the hegemony perspective, results show no effect of ego being an English-speaking country. Since ego is the country that receives students from alter, we would expect that English-speaking countries, which define the hegemonic language, should develop significantly more ties, conditional on other characteristics. However, in the multivariate model, which controls for other characteristics, we do not find this expectation confirmed. Moreover, the implementation of ECTS or a comparable study credit transfer and accumulation system is significant only at the 10%-level for alter in the year 2004. Unsurprisingly, we find a very strong and highly significant effect of shared borders in all three models: If two countries are geographically close to each other, the chance that they exchange a high proportion of students increases. In contrast, we do not find any significant effect of EU membership. More interestingly, in the period 2000, we observe a significantly positive effect of both having signed the Bologna Declaration – an effect that vanishes in the following periods. Thus, at the time when only long-time EU members were participating in the Bologna Process, there was an effect of Bologna membership, but with an increase in members and the inclusion of countries not forming part of the EU, the impact of Bologna participant status disappears. We also find highly significant positive effects of similarity in GDP per-capita in 2000 and 2004, whereas this effect is not significant in 2009. Taken together, these results are in line with the homophily assumptions with regard to economic performance.

In addition, we determine five characteristics relating to the embeddedness of a country pair or dyad in the social network. First, we have highly significant and strong effects of mutuality, indicating that if one country sends a high share of students to another country, it is very likely that this tie is reciprocated. We also find significantly positive effects of in- and out-stars as well as a constellation of transitive and cyclic triads. Hence high transitivity implies that exchange relations are consistent. The effect of transitive triads is significant and positive at least in the first two periods, whereas the effect of cyclic triads is negative in all three periods and highly significant. This indicates that the exchange relationships between countries tend to be rather hierarchical (Lusher et al. 2013:44). After controlling for the embeddedness of dyads in network structures, we find a high share of explained variance since the smallest R^2 value (McKelvey and Zavoina, see Long 1997) is .66.

Table 3: Determinants of ties between countries in the international student mobility network: “outbound students in ego from alter, by all students enrolled”

	1 2000	2 2004	3 2009
ego: GDP per-capita	0.033 *	0.033 **	0.030 **
ego: English-speaking country	-0.927	-0.185	0.247
ego: applies ECTS or comparable system	0.287	0.102	0.616
alter: applies ECTS or comparable system	0.054	-0.431 +	-0.444
borders	2.805 ***	2.656 ***	2.725 ***
both EU member	-0.228	-0.244	0.014
both Bologna participant	0.672*	0.414	0.182
similarity in GDP per-capita	0.063 ***	0.057 ***	0.015
mutuality	0.647 *	1.217 ***	0.437
2-out stars	0.137 ***	0.127 ***	0.122 ***
2-in stars	0.141 ***	0.138 ***	0.130 ***
transitive triads	0.141 ***	0.156 ***	0.131 ***
cyclic triads	-0.350 ***	-0.418 ***	-0.346 ***
Constant	-6.278 ***	-5.769 ***	-6.269 ***
R^2 (McKelvey/Zavoina)	0.760	0.753	0.710
Observations	1640	1640	1640

$^{+}p < .1$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

If we analyse the determinants of ties with regard to outbound students in ego relative to the number of outbound mobile students in alter country (see Table 4), we find similar effects, but also some differences. For example, we see that there is a negative effect of ego’s GDP per-capita in 2000 and 2009. English speaking countries have a high propensity toward receiving a relevant share of outbound-mobile students, but only in 2009. For the year 2000, we find positive effects of ego and alter having implemented ECTS or a comparable credit transfer system, while they are not significant in the following periods. Again, we also find a strong and significant effect of sharing a border. EU membership does not have any significant effect, whereas the effect of both having signed the Bologna Declaration is again positive and – at the one-percent level – significant in the periods 2000 and 2004, while it is insignificant in 2009. In contrast to the models in Table 3, we find a negative effect of similarity in GDP per-capita in the year 2000 (at the 10%-level). Moreover, the effects of the embeddedness of a dyad into the network further confirm our expectations: There is a strong mutuality, significant effects of 2-out-stars and 2-in-stars, highly significant positive effects of transitive triads and highly significant negative effects of cyclic triads. Indeed, student exchanges between countries tend to be hierarchical.

Table 4: Determinants of ties between countries in the international student mobility network: “outbound students in ego from alter, by outbound mobile students”

	4 2000	5 2004	6 2009
ego: GDP per capita	-0.074 ***	-0.020	-0.040 **
ego: English-speaking country	-0.832	-0.026	1.176 **
ego: applies ECTS or comparable system	0.447 *	0.194	-0.897
alter: applies ECTS or comparable system	0.347 *	0.209	-0.335
borders	3.375 ***	2.802 ***	3.144 ***
both EU member	-0.302	-0.220	-0.026
both Bologna participant	0.639 **	0.538 *	0.162
similarity in GDP per capita	-0.026 +	0.014	-0.010
mutuality	1.715 ***	1.683 ***	1.598 ***
2-out stars	0.143 ***	0.116 ***	0.123 ***
2-in stars	-0.040	-0.027	-0.062 +
transitive triads	0.070 ***	0.048 **	0.080 ***
cyclic triads	-0.130 ***	-0.131 ***	-0.177 ***
Constant	-6.292 ***	-5.279 ***	-3.562 **
R^2 (McKelvey/Zavoina)	0.703	0.657	0.698
Observations	1640	1640	1640

$^{+}p < .1$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Finally, we estimated average marginal effects (AME) in order to assess how the effect of Bologna membership has decreased in magnitude over time. Regarding the first dependent variable “outbound students in ego from alter by all students enrolled (in alter-country)” in Table 3, this effect was significantly positive in 2000 and insignificant thereafter. The AME decreases from 0.037 in 2000 to 0.020 in 2004, and 0.002 in 2009. Hence, even though the confidence intervals of these effect sizes overlap, the AME steadily tends to decrease.

The results are very similar for the other dependent variable “outbound students in ego from alter by all *outbound mobile* students (in alter-country)” (see Table 4). For instance, the AME decreases from 0.044 in 2000 to 0.023 in 2004, and 0.002 in 2009. Although the confidence intervals again overlap, this is at least a hint that Bologna membership becomes less important for explaining patterns of student mobility as the set of member countries increases both in size and heterogeneity with regard to country characteristics. Furthermore, recall that also the significance level decreased over time (see Tables 3 and 4). Of course, this does not imply that the Bologna Process does not impact on student mobility patterns. Nevertheless, the strongest effect is that of com-

mon borders, which points to the importance of spatial proximity. It is quite likely that spatial proximity was already important before the start of the Bologna Process. If this is so, than the effect of spatial proximity we observe today is confounded with historical path dependencies and well-established and “taken-for-granted” opportunities to study abroad. Of course, such an interpretation would require a further micro-level foundation on the basis of individual actors.

6 SUMMARY AND CONCLUSION

In this paper, we have analyzed the structure of cross-national student exchange patterns by means of social network analysis. Moreover, we have examined factors that determine the magnitude of these exchange relationships. By calculating measures of closeness centrality, we could reveal that both networks investigated (controlling for already outbound-mobile students and for the size of the higher education sector of the sending country) are stable over time. At the core of these networks are the USA, Great Britain, France, and Germany. These countries attract the highest shares of students from the other countries in our sample.

Although interesting, these findings may result from four limitations in our investigation. The first one concerns the quality of data used. First, despite being the only source of internationally comparable data on student mobility, the UIS data on internationally mobile students is not completely reliable. Especially for earlier years, the data collection contained only data on students of foreign nationality (see Teichler, Ferencz and Waechter 2011:32). This has severe limitations, especially where migration flows can overestimate mobility in some countries. Currently, important improvements are underway: “The criterion of prior education (i.e. considering as mobile a student enrolled in a country different from the one of previous level of education that is, ISCED 3 or 4 for students enrolled in ISCED 5) should be preferably used. However, few countries have so far collected this information” (Eurostat 2009: 39). Second, due to data availability and sample size, we are only able to investigate degree- or diploma-seeking student mobility, not short-term or credit mobility. If we limited our sample to long-time EU member countries, we could analyze short term or credit-mobility; however, we would lose insights about student mobility patterns on a global scale. Third, relating to sample compilation, we can only reveal patterns between the OECD countries investigated; disregarding countries that have high outbound mobility patterns. More precisely, the inclusion of large Asian countries (see Teichler, Ferencz and Waechter 2011: 31-35) into our sample might yield different insights, especially with regard to the mutuality of exchange patterns. Forth, our approach should be extended to the analysis of valued relations, which would enable us to use more detailed information so as to control the embeddedness of ties in the surrounding network at the same time. That way, it would

be possible to consider not only the most relevant but also any ties in the analysis due to more variance on the dependent variable.

Nevertheless, our investigation also yields some important insights regarding the determinants of student mobility patterns at the macro-level. Referring back to the hypotheses on the interplay of homophily and relevance of student exchanges, we can state that the only factor positively influencing student exchange patterns of the sampled countries over all models estimated is the existence of a common border. This is also in line with macro-level theories of migration. For the other homophily factors, the results are mixed. The implementation of ECTS or a comparable system by ego and alter has a positive impact only in the year 2000 when controlling for outbound-mobile students. It is insignificant over all periods of investigation if we control for enrollment. Likewise, similarity in GDP per-capita does not enhance the relevance of exchange relationships if we control for outbound-mobile student flows. However, it positively and significantly impacts on the magnitude of exchange relationships when we control for enrollment. Unlike common Bologna membership, common EU membership does not appear to impact student exchange patterns. However, the positive impact of common membership is strongest in the earlier periods of investigation, with a decreasing tendency.

With regard to complementarity, the results are again mixed. While we can detect migration patterns from low GDP per-capita to high GDP per-capita countries when controlling for enrollment, the effect reverses if we account for outbound-mobile students. The effect of cultural hegemony, singling out English-speaking countries, is not very influential, except for in 2009. Overall, the results for outbound students in ego from alter, by *all* students enrolled, are more reliable than those controlling only for the students of the sending country that are already internationally mobile since we do not limit our sample to those students already seeking a degree outside of their home country. Moreover, we thereby control for the size of the higher education sector of the sending country. With regard to the relevant shares of outbound students in ego from alter by *all* students, our study gives a rather clear picture: Countries with a high GDP tend to host relevant shares of alters' students. If two countries share a border, they also host a relevant share of the other's countries' students. If countries are Bologna members, they have a higher propensity of being relevant hosts for each other's students, but as we have shown, this effect vanishes over time. On the one hand, we have argued that the creation of a European Higher Education Area in the realm of the Bologna process is important for student mobility; but on the other hand, this importance decreases with an increasing internal heterogeneity of countries, especially with regard to culture, language, and the quality of their higher education programs.

In addition, we saw that the basic pattern of hierarchical triadic relationships also holds for the countries' student mobility networks. While the effect of transitive triads

tends to be positive, the cyclic triads tend to have a negative effect. Moreover, there is a strong tendency towards mutuality. The mutuality effect does not vanish after controlling for the homophily measures of our model specification – indicating that mutuality seems to be an endogenous process in our networks as well. According to our findings, the most relevant student inflow is into countries with a high GDP per-capita. Secondly, the values for similarity in GDP per-capita are positive, which indicates that homophily with regard to GDP also plays an influential role. In addition, the effect of common borders is largely positive. Finally, common membership in the Bologna Process is influential, albeit with decreasing tendencies. Hence the influence of membership decreases over time, although we would expect – due to an increasing similarity in higher education program structures and policies between Bologna participants (see Stocktaking Report 2009; Eurydice 2012; Westerheijden et al. 2010; Knill, Voegtle and Dobbins 2012) – that increasing compatibility in higher education structures would further mobility. However, maybe this is more relevant for short-term or credit-seeking mobility, for which, unfortunately, we currently lack adequate data for all the counties contained in our sample.

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