International Student Mobility, Student Exchange Programs, and Migration: Evidence from Gravity Estimations

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Preface

When completing a task as monumental as a doctoral thesis, you become indebted to a number of people who lend you assistance along the way. For those who I may unwittingly leave out, a thank you for supporting me.

I would like to thank my supervisor Gabriel Felbermayr. You have not only enabled me to start with this dissertation, but also encouraged me through your knowledge, wisdom, and guidance to complete this work. Your publications and achievements inspired me throughout the process. Without you, this work would never have been possible.

Further I would like to thank my second supervisor, Benjamin Jung, who encouraged me in the final stages to complete this work.

I did not reach this point by myself, my family and friends have always been there to support me. I want to thank all of you for being there for me and giving me the strength and motivation to complete this work, especially my sister Alice. I cannot thank you enough.

Summary

The thesis is dedicated to the empirical investigation of international student mobility and is divided into eight chapters. The introductory chapter 1 describes the motivation for the thesis and provides a brief overview of the current literature and the gap that this dissertation fills. Chapter 2 discusses the rationales for cross-border education, describing the four approaches of the OECD (2004b) for international student mobility: the mutual understanding approach, the skilled migration approach, the revenue-generating approach, and the capacity building approach. The chapter then discusses the challenges resulting from international student mobility. Besides the brain drain and brain gain phenomenon that occurs when international students decide to work abroad, international student mobility raises the question of how to provide equal access to higher education and ensure the same level of quality and accreditation across the board. Furthermore, the chapter includes a detailed discussion on the challenges that arise when higher education is mainly publicly financed in a world where students and graduates are mobile. This is mainly the case in Europe, whereas students in other countries are accustomed to paying for higher education.

Chapter 3 goes on to describe the data on international student mobility used in this work. Since data for years prior to 1998 are only available from printed UNESCO Statistical Yearbooks, this dissertation has constructed a new database entering the data manually for the years 1970 to 1997 for 29 destination countries and almost all countries of origin. The chapter demonstrates that student mobility increased sharply. Starting with an average number of roughly 460 thousand students in the first period covering the years 1970 to 1974, the number grew by a factor of about 8 to roughly 3.7 million students in the last period covering the years 2010 to 2015. This number is strongly concentrated on a few destination and origin countries: while the concentration in the destination countries decreased over the decades which were analyzed, with the top five countries accounting for about 77 percent in the 1970s and 50 percent in the period 2000 to 2015, the concentration in the origin countries increased from about 23 to 33 percent. The decreasing concentration of destination countries demonstrates the strong competition among these countries trying to attract international students.

In order to better understand this concentration, chapter 4 provides a descriptive

analysis of destination and origin countries. Apart from the five main Anglo-Saxon destination countries–the United States, the United Kingdom, Australia, Canada, and New Zealand–the European countries France and Germany have always been among the most important destination countries since 1970. Furthermore, Russia and Japan have played an important role and some Asian, European, and Arab countries have also recently emerged as important destination countries. The countries that send the most students abroad are Asia-Pacific Rim countries followed by European countries. With this in mind, three groups of countries have had a major impact on student mobility: Europe, Asia-Pacific countries, and Anglo-Saxon countries. In contrast to the other regions, student mobility in Europe is supported by policy-makers and instruments which are supported by large investments. Therefore, this work strives to investigate the effects of the two famous European programs which were introduced to promote student mobility: the student exchange program Erasmus that was launched in 1987, and the Bologna Process that began in 1999.

Chapter 5 strives to test the hypothesis of whether the student exchange program Erasmus increases student mobility between the member countries. The chapter uses data on international student mobility for the years 1999 to 2015 obtained from the electronic UNESCO database for 155 host and 187 origin countries which are merged with a dummy variable on joint membership in the Erasmus program. Using these panel data in a theory-grounded gravity model by running fixed effects methods, the chapter finds that student mobility between Erasmus member countries is, on average, about 53 percent higher. To address the causality question, the chapter follows Wooldridge (2002) and performs an F-test for strict exogeneity and finds a positive causal effect on international student mobility. This effect is more stable for the time during and after the economic crisis. Furthermore, student exchange between Erasmus countries seems to occur more in favor of cultural experience and is not based on economic factors.

Chapter 6 repeats these estimates controlling additionally for joint membership in the Bologna Process and finds that student mobility between Bologna Process members is, on average, about 50 percent higher. Importantly, both European programs–Erasmus and the Bologna Process–turn out to be significant determinants separately. Estimating the effect for the time before and after the establishment of the European Higher Education Area (EHEA) shows that the impact is higher and more stable since the EHEA was established in 2010. These findings suggest that the Erasmus program and the Bologna Process have fulfilled their goals of increasing student mobility and, therefore, justify their budget.

Since the skilled migration approach argues that countries attract international students hoping that they stay in the country of studies afterwards and increase the stock of highly-skilled workers, chapter 7 investigates the question: to what extent do countries that attract foreign students benefit from an increased stock of educated foreign workers?

Using information from the UNESCO Statistical Yearbooks, the chapter constructs a new panel database of bilateral international student mobility for 150 origin countries, 23 host countries for the years 1970 to 2000. These data are matched with information on bilateral stocks of international migrants by educational attainment from Docquier et al. (2008), available for 1990 and 2000. Running theory-founded gravity models by conditional fixed effects Poisson Pseudo Maximum Likelihood methods, this chapter finds that, on average, an increase of students by 10 percent increases the stock of tertiary educated workers in host countries by about 0.9 percent. That average effect is, however, entirely driven by Anglo-Saxon countries. On average, the results imply a student retention rate of about 70 percent. These findings suggest that the costs of educating foreign students are at least partially offset by increased availability of foreign talent. Finally, the last chapter 8 concludes.

Zusammenfassung

Die Dissertation widmet sich der empirischen Untersuchung der internationalen Studentenmobilität und gliedert sich in acht Kapitel. Das einführende Kapitel 1 befasst sich zunächst mit der Motivation für die Arbeit und stellt einen kurzen Überblick über die aktuelle Literatur sowie die Lücke, die diese Dissertation füllt, dar. Kapitel 2 befasst sich mit den Gründen grenzüberschreitender Bildung und beschreibt die vier Hauptansätze der OECD (2004b) für internationale Studentenmobilität: der auf gegenseitige Verständigung abzielende Mutual Understanding Approach, der auf qualifizierte Migration setzende Skilled Migration Approach, der profitorientierte Revenue-Generating Approach und der auf den schnellen Aufbau von Kapazität abzielende Capacity Building Approach. Anschließend werden in diesem Kapitel Herausforderungen diskutiert, die sich aus der internationalen Studentenmobilität ergeben. Neben dem Brain Drain und Brain Gain Phänomen, das auftritt, wenn internationale Studierende sich dazu entscheiden im Ausland zu arbeiten, wirft internationale Studentenmobilität die Frage auf, wie ein gleichberechtigter Zugang zur Hochschulbildung gewährleistet und das gleiche Qualitäts- und Akkreditierungsniveau sichergestellt werden kann. Darüber hinaus enthält das Kapitel eine detaillierte Diskussion der Herausforderungen, die sich aus einer hauptsächlich öffentlich finanzierter Hochschulbildung ergeben wenn Studenten und Absolventen mobil sind. Dies ist vor allem in Europa der Fall, während Studierende in anderen Ländern gewöhnlich für ihre Hochschulbildung zahlen müssen.

In Kapitel 3 werden die in dieser Dissertation verwendeten Daten zur internationalen Studentenmobilität beschrieben. Die Daten aus den Jahren vor 1998 sind nur aus den gedruckten statistischen Jahrbüchern der UNESCO verfügbar. Daher wird in dieser Dissertation ein neuer Datensatz erstellt, indem die Daten aus den Jahren 1970 bis 1997 für 29 Zielländer und fast alle Herkunftsländer manuell eingegeben wurden. Das Kapitel zeigt, dass die Mobilität der Studierenden stark zugenommen hat. Ausgehend von einer durchschnittlichen Zahl von rund 460 Tausend Studierenden in der ersten Periode von 1970 bis 1974, wuchs die Zahl um den Faktor 8 auf rund 3,7 Millionen Studierenden in der letzten betrachteten Periode, die die Jahre 2010 bis 2015 abdeckt. Die Zahl der internationalen Studierenden ist stark auf wenige Ziel- und Herkunftsländer konzentriert: während die Konzentration bei den Zielländern über die analysierten Jahrzehnte abnahm – hier machten die fünf wichtigsten Länder etwa 77 Prozent in den 1970er Jahren und 50

Prozent im Zeitraum von 2000 bis 2015 aus – stieg die Konzentration in den Herkunftsländern von etwa 23 auf 33 Prozent im gleichen Zeitraum. Die abnehmende Konzentration bei den Zielländern zeigt, dass es zwischen diesen Ländern einen starken Wettbewerb gibt und dass sie versuchen, internationale Studenten anzuziehen.

Um diese Konzentration besser zu verstehen, bietet Kapitel 4 eine deskriptive Analyse von Ziel- und Herkunftsländern. Neben den fünf wichtigsten angelsächsischen Zielländern – USA, Großbritannien, Australien, Kanada und Neuseeland – gehören seit 1970 auch die europäischen Länder Frankreich und Deutschland zu den wichtigsten Zielländern. Darüber hinaus sind auch Russland und Japan bedeutende Zielländer; zudem haben sich einige asiatische, europäische und arabische Länder in den letzten Jahren zu wichtigen Empfängerländern entwickelt. Die Länder, die die meisten Studierenden ins Ausland schicken, sind asiatisch-pazifische Länder, gefolgt von europäischen Ländern. Vor diesem Hintergrund lassen sich drei Ländergruppen ableiten, die einen bedeutenden Einfluss auf die Mobilität der Studenten haben: Europa, asiatisch-pazifische Länder und angelsächsische Länder. Im Gegensatz zu den anderen Regionen wird die Studentenmobilität in Europa durch politische Entscheidungsträger und Instrumente unterstützt, die durch hohe Investitionen gestützt werden. Daher beabsichtigt diese Dissertation die Auswirkungen der zwei bekannten europäischen Programme zu untersuchen, die zur Förderung der Studentenmobilität eingeführt wurden: das Studentenaustauschprogramm Erasmus, das 1987 ins Leben gerufen wurde, und der im Jahre 1999 initiierte Bologna-Prozess.

Kapitel 5 überprüft, ob das Studentenaustauschprogramm Erasmus die Mobilität der Studierenden zwischen den Mitgliedsländern erhöht. In dem Kapitel werden Daten zur internationalen Studentenmobilität der Jahre 1999 bis 2015 verwendet, die aus der elektronischen UNESCO-Datenbank für 155 Gast- und 187 Herkunftsländer stammen. Diese Daten werden mit einer bilateralen Dummy-Variablen zur Mitgliedschaft im Erasmus-Programm zusammengeführt. Unter Verwendung dieser Paneldaten in einem theoriebasierten Gravitationsmodell mit fixen Effekten stellt das Kapitel fest, dass die Mobilität der Studierenden zwischen den Erasmus-Mitgliedsländern im Durchschnitt um etwa 53 Prozent höher ist. Um die Frage der Kausalität genauer zu adressieren, folgt das Kapitel Wooldridge (2002) indem es einen F-Test auf strikte Exogenität durchführt und findet einen positiven kausalen Effekt auf die internationale Studentenmobilität. Der Effekt ist für die Zeit während und nach der Wirtschaftskrise stabiler. Außerdem scheint der Studentenaustausch zwischen Erasmus-Ländern eher zugunsten kultureller Erfahrungen anstatt wirtschaftlicher Faktoren zu erfolgen.

Kapitel 6 wiederholt diese Schätzungen und integriert zusätzlich die bilaterale Dummy-Variable zur Mitgliedschaft im Bologna-Prozess. Hier wird festgestellt, dass die Mobilität der Studierenden zwischen den Mitgliedern des Bologna-Prozesses im Durchschnitt um etwa 50 Prozent höher ist. Wichtig ist, dass sich die beiden europäischen Programme – Erasmus und der Bologna-Prozess – jeweils als signifikante Determinanten für die

Mobilität von Studierenden erweisen. Der Vergleich für die Zeit vor und nach der Errichtung des europäischen Hochschulraums – der European Higher Education Area (EHEA) – zeigt, dass der Effekt seit der Gründung der EHEA im Jahr 2010 höher ist. Diese Ergebnisse deuten darauf hin, dass das Erasmus-Programm und der Bologna-Prozess ihre Ziele durch die Erhöhung der Studentenmobilität erfüllt haben und daher ihr Budget rechtfertigen.

Der Skilled Migration Approach (Ansatz der qualifizierten Migration) argumentiert, dass Länder internationale Studierende in der Hoffnung anziehen, dass sie danach im Studienland bleiben und den Bestand an hochqualifizierten Arbeitskräften erhöhen. Daher geht Kapitel 7 der folgenden Frage nach: Inwieweit profitieren Länder, die ausländische Studierende anziehen, von einem erhöhten Bestand ausgebildeter ausländischer Arbeitskräfte? Unter Verwendung von Daten aus den statistischen Jahrbüchern der UNESCO wird in dem Kapitel ein neuer Panel-Datensatz erstellt. Dieser beinhaltet Daten zur bilateralen internationalen Studentenmobilität für 150 Herkunfts- und 23 Gastländer für die Jahre 1970 bis 2000. Diese Daten werden mit dem Datensatz von Docquier et al. (2008) zusammengeführt, der Informationen über die bilateralen Bestände internationaler Migranten nach Bildungsabschlüssen für die Jahre 1990 und 2000 enthält. Durch die Anwendung der Poisson Pseudo Maximum Likelihood (PPML) Fixe-Effekte-Methode die auf einem theoriegestützten Gravitationsmodell basiert, findet dieses Kapitel, dass ein Anstieg der Studierenden um 10 Prozent den Bestand an tertiär ausgebildeten Arbeitskräften in den Gastländern im Durchschnitt um etwa 0,9 Prozent erhöht. Der Effekt wird jedoch ausschließlich von angelsächsischen Ländern getragen. Die Ergebnisse implizieren im Durchschnitt eine Studentenbindungsrate von etwa 70 Prozent. Diese Ergebnisse deuten darauf hin, dass die Kosten für die Ausbildung ausländischer Studierenden zumindest teilweise durch die erhöhte Verfügbarkeit ausländischer Talente ausgeglichen werden. Kapitel 8 stellt das abschließende Kapitel dar.

Chapter 1

Introduction

There is little doubt that innovation, new technologies, and productive processes are key factors for driving economic growth in modern societies. The ability of a society to provide these elements, in turn, depends on the level of qualification of its workforce. Employees with a higher education are generally more productive and may also increase the productivity of their coworkers (OECD, 2004a).

In times where industrialized countries are being confronted with a demographic shift which is leading to ageing societies and a lack of young highly skilled workers, countries have a vested interest in increasing the number of educated employees in their workforce. As higher education can be considered a means of increasing future human capital, policy-makers have incentives to invest in education. As a consequence, the need for skills has spurred demand for higher education. In emerging economies with a growing middle class, however, capacities have not increased to the same extent as the demand for higher education (OECD, 2018).

If access to domestic higher education is restricted, countries are motivated to raise capacities for their citizens. Apart from increasing domestic capacity, making use of capacities abroad is another possibility for increasing access to higher education. This can occur through the reception of foreign institutions, which is referred to as program and institution mobility (PIM). The most common way to participate in cross-border education, however, is sending students abroad to study. As student mobility increases capacity for domestic students in the short run, this approach to international student mobility is referred to as the capacity building approach (OECD, 2004b). Besides an increased capacity, studying abroad brings additional advantages. Firstly, students can benefit from programs of higher quality than those provided in their home country (see for instance Hanushek and Kimko, 2000). Secondly, there may be educational programs abroad which are not offered in the home country. For instance, in many countries there are no programs available in engineering (Beine et al., 2014). Thirdly, especially in times of an increased internationalization of labor markets and a global demand for tertiary

education, studying and living in a foreign country is beneficial for personal development. The knowledge of foreign cultures and languages derived from studying abroad increases employability, establishes social and business networks and fosters bilateral ties (OECD, 2016a). In this context, student mobility is motivated by the mutual understanding approach (OECD, 2004b). Furthermore, Spilimbergo (2009) demonstrated that student mobility also raises the level of democracy in the home country, especially if the student studied in a democratic country.

However, sending a student abroad also yields the risk that the student may not return after their studies. This would mean a loss of the initial education investment and of a potential highly skilled worker. This loss for the sending country, in contrast, means a gain of an educated worker for the country of studies (Beine et al., 2014). Mobility of students is therefore very much related to high-skilled migration and the *brain drain* and *brain gain* phenomenon which is discussed in the recent literature investigating the emigration of skilled workers (see for instance Beine et al., 2008; Docquier and Rapoport, 2012; Beine et al., 2014).

Indeed, especially industrialized countries which face a lack of high-skilled workers try to attract international students in the hope that they will remain in the country to work after graduation. If students do stay in the country, this yields the additional advantage that they are already familiar with the country's language, culture and customs (OECD, 2004b). Clearly, for countries applying this skilled migration approach, knowing a student's proclivity to stay is of crucial importance.

Furthermore, since international students pay tuition fees and other living expenses, they can be regarded as an additional source of income. Very often, international students pay higher fees than domestic students (OECD, 2017b). In 2011, this was the case in half of the OECD countries for which there are data available (OECD, 2016a). In the United Kingdom, for instance, the higher education sector generated export earnings of 10.7 billion GBP in 2011 to 2012, of which 3.8 billion GBP was spent on tuition fees and accommodation from non-EU students, and a further 3.4 billion GBP on goods and services by non-EU students (Universities UK, 2014). In 2014 to 2015, the number of export receipts increased to 13.1 billion GBP, which is equivalent to 2.6 percent of all exports of goods and services in the same year (Oxford Economics, 2017). This high income that can be generated through cross-border education is a driving force for countries that apply the revenue-generating approach to attract international students, as these countries want to participate in the multibillion-dollar sector of higher education.

The increasing demand for cross-border education of sending and receiving countries alike can also be seen in the development of the level of international student mobility. The number of international students has increased dramatically over the years, from 0.8 million in 1975 to 2.1 million in 2000 and 5.6 million in 2018 (OECD, 2011, 2020). This increase is due to a number of factors. Initially, student mobility was mainly driven by the

mutual understanding approach, that is public policies mainly aimed at fostering political, academic, cultural, and social ties between countries. This was especially the case for Europe, where the construction of a European identity by the promotion of a mutual understanding among young Europeans played a key role. In North America, policies were driven by the same approach aimed at fostering academic co-operation (OECD, 2004b, 2010). During the 1980s and 1990s, societies and economies became increasingly interdependent due to lower transport costs, faster and cheaper communications and the spread of new technologies. The trend of increasingly connected economies was especially notable in the labor market and high-technology sector for highly skilled workers, which motivated students to gain international experience as a part of their tertiary studies. As such, economic factors became more important for student mobility. Furthermore, the decreased transaction and information costs of studying abroad have led to an increased demand for international studies (OECD, 2010).

The number of international students has grown over the last twenty years (1998 to 2018) with an average annual growth rate of 4.8 percent; this growth has been primarily concentrated on a few countries. English-speaking destinations are the most attractive countries for international students, with four countries–the United States, the United Kingdom, Australia, and Canada–attracting more than 40 percent of international student mobility in 2018. The EU is another important region that in 2018 attracted about 1.7 million students in total, with the United Kingdom, Germany, and France accounting for 8 percent, 6 percent, and 4 percent of global international students, respectively. The Russian Federation–which has been a member of the Bologna Process since 2003 but not of the EU–is also an important destination country that attracted about 5 percent of student mobility worldwide in 2018 (OECD, 2020).

The concentration of student mobility is also high among sending countries. Asia sends the highest number of students abroad, accounting for 57 percent of global student mobility in OECD countries in 2018. The most important sending countries are China and India, which together make up more than 30 percent. The second largest region of origin is Europe, accounting for 23 percent of global student mobility in OECD countries. While two-third of Chinese and Indian students study in Australia, Canada, Japan, the United Kingdom and the United States, European students prefer to study in Europe, with 40 percent studying in EU23 countries (OECD, 2020).

From the data, three groups of countries can be identified as having a major impact on student mobility: Europe, Asia-Pacific countries, and Anglo-Saxon countries. These groups have developed differently in terms of cross-border education. While student mobility in Europe has been policy-driven, the Asian-Pacific region can be regarded as demand-driven–though some countries have recently been emerging as important destinations–and Anglo-Saxon countries can be regarded as a magnet for international students (OECD, 2004a,b).

Among these regions, Europe is of special interest since it is both an important sending and destination region for students, and student mobility is supported by EU policy-makers. The importance of student mobility for EU policy-makers is reinforced by the fact that it makes up part of the EU's overall strategic goal for 2020. This goal states that by 2020, 20 percent of students in the EU graduating from higher education shall have experienced tertiary studies or training abroad (Council of the European Union, 2011). When it comes to achieving this goal, there are two famous European programs whose aim is to enhance student mobility that deserve a special interest: the student exchange program Erasmus that was launched in 1987, and the Bologna Process that began in 1999. The EU invests considerable budgets in these programs to increase student mobility: in the period 2007 to 2013 the total budget for the Erasmus program was 3.1 billion Euro, i.e. an annual budget of 442.9 million Euro. This budget was increased under Erasmus+, resulting in an investment of 548.1 million Euro in 2015 for mobility of tertiary students and staff within countries included in the program (European Commission, 2017).

In order to create efficient policy instruments to attract students and increase student mobility within a region, it is crucial to know the determinants of student mobility. However, to the best of my knowledge, there is currently no study that examines whether the Erasmus program or Bologna Process increase student mobility between their member countries. This work strives to fill that gap. Chapter 5 uses a data set on bilateral student mobility obtained from the electronic UNESCO database covering the years 1998 through 2015 for 155 host countries and 187 source countries. These data are merged with a bilateral dummy for participation in the Erasmus program and other variables. Using these data in a theory-grounded gravity model and controlling for country-specific time-varying variables by using time-variant country dummies for both the destination and home country in a panel setup, the chapter investigates how joint membership of the sending and receiving countries in the Erasmus program affects international bilateral student mobility. The chapter finds that student mobility between Erasmus member countries is, on average, about 53 percent higher. To investigate whether the effect is causal, we follow Wooldridge (2002) and perform an F-test for strict exogeneity and find a positive causal effect on international student mobility. This effect is more stable for the time during and after the economic crisis. Furthermore, student exchange between Erasmus countries seems to occur more in favor of cultural experience and is not based on economic factors.

Chapter 6 repeats these estimates with the additional inclusion of the bilateral time-varying dummy on Bologna membership in order to address the question of whether membership in the Bologna Process increases student mobility between the participating member countries, and if there is a difference between the time before and after the establishment of the European Higher Education Area (EHEA). I find that student mobility between Bologna Process members is, on average, about 50 percent higher. Importantly,

both European programs–Erasmus and the Bologna Process–turn out to be significant determinants separately. Estimating the effect for the time before and after the establishment of the EHEA shows that the impact is higher and more stable since its establishment in 2010. These findings suggest that the Erasmus program and the Bologna Process have fulfilled their goals of increasing student mobility.

As some countries strive to attract students in the hope that they stay in the country to work after graduation, besides knowing the pull factors, it is crucial to know the proclivity of a student to stay in the country. If students do not stay in the country and education is financed publicly such as in European countries, the country of studies only bears the costs and does not benefit from the graduated student staying and providing the economy with an educated worker. However, there is scarcity estimating the effect of student exchange programs on international student mobility. This may be due to the lack of data on international student mobility by country of origin *and* destination, especially for years prior to 1998. My new data set fills this gap. Using data from printed UNESCO Statistical Yearbooks for the years prior to 1998 (and from the UNESCO online database for more recent years) and matching them with information on bilateral stocks of international migrants by educational attainment from Docquier et al. (2008), available for 1990 and 2000, allows to investigate the question: to what extent do countries that attract foreign students benefit from an increased stock of educated foreign workers? Running theory-founded gravity models by conditional fixed effects Poisson Pseudo Maximum Likelihood methods, chapter 7 finds that, on average, an increase of 10 percent in the number of students increases the stock of tertiary educated workers in host countries by about 0.9 percent. That average effect is, however, entirely driven by Anglo-Saxon countries. On average, the results imply a student retention rate of about 70 percent. These findings suggest that the costs of educating foreign students are at least partially offset by increased availability of foreign talent.

While there is extensive literature investigating the determinants of student mobility from the perspective of one destination country–see for instance Rosenzweig (2008) for the United States and Bessey (2012) for Germany–there is little empirical work investigating the effects in a multi-source multi-destination setup. This, however, is crucial to precisely estimate the pull factors that attract students to a special destination country.

A study by Beine et al. (2014) investigates the determinants of student mobility using a dataset that covers 13 destination and almost all countries of origin for the years 2004 to 2007. They find a significant positive impact of the network effect and for the quality of universities and housing prices. Abbott and Silles (2016) also analyze the determinants of international student mobility in a gravity-based model for 18 destination and 38 origin countries for the years 2005 to 2011. Besides the usual variables, they include the EU dummy in their estimates and find a significant positive effect on student mobility. The strength of both studies is in the use of data on student mobility that define

international students more strictly. Furthermore, they use Poisson Pseudo Maximum Likelihood (PPML) estimates, which allow for the inclusion of zero student flows in the estimates. However, they do not use panel estimates and therefore cannot control for bilateral fixed effects which, however, is crucial to obtain consistent estimates (Baier and Bergstrand, 2007). Furthermore, the limited number of countries and years may cause a selection bias.

There are also several works that estimate the determinants of international student mobility between European countries (for examples, see Rodríguez González et al., 2011; Caruso and de Wit, 2013; Sánchez Barrioluengo and Filsi, 2017). While these works generally estimate the determinants of student mobility between European countries, they do not estimate the effect of programs on international student mobility.

This thesis is also closely related to gravity estimates of bilateral migration (for examples, see Hatton, 2003; Mitchell and Pain, 2003; Clark et al., 2007; Pedersen et al., 2008; Beine et al., 2009; Grogger and Hanson, 2011). These papers, however, do not address student mobility.

This work is also related to a large and insightful mainly theoretical literature that studies the role of national higher education systems in a world where highly educated workers and students are mobile. If high-skilled workers are mobile, it is individually rational for a country to cut investments in local public education (for examples, see Justmann and Thisse, 2000; Demange et al., 2008). The reverse scenario, however, can be true if students are mobile, too (Lange, 2009). In this situation, countries have an incentive to overinvest in education in order to attract students that may stay in the country after their studies and become high-skilled workers. The likelihood of a student staying in the host country is crucial for the policy-maker. So far, there is a clear scarcity of empirical work estimating the effect of student mobility on the stocks of highly skilled migrants. Chapter 7 tries to fill this gap, striving to estimate how high that likelihood is.

The rest of this introduction provides an overview of the thesis and how the chapters have been organized. Chapter 2 discusses the rationales for cross-border education, describing the four approaches of the OECD (2004b) for international student mobility and the challenges that result from international student mobility. In doing so, the chapter includes a detailed discussion on the challenges that arise when higher education is mainly publicly financed in a world where students and graduates are mobile.

Chapter 3 goes on to describe the data on international student mobility used in this work. Since data for years prior to 1998 are only available from printed UNESCO Statistical Yearbooks, I have constructed a new database entering the data manually for the years 1970 to 1997 for 29 destination countries and almost all countries of origin. The chapter demonstrates that student mobility increased sharply and is strongly concentrated on a few destination and origin countries.

In order to better understand this concentration, chapter 4 provides a descriptive analysis of destination and origin countries. Apart from the main Anglo-Saxon destination countries–the United States, the United Kingdom, Australia, and Canada–the European countries France and Germany have been among the most important destination countries since 1970. Furthermore, Russia and Japan have played an important role and some Asian, European, and Arab countries have also recently emerged as important destination countries. The countries that send the most students abroad are Asia Pacific Rim countries followed by European countries.

With this in mind, three groups of countries have had a major impact on student mobility: Europe, Asia-Pacific countries, and anglophone countries. In contrast to the other regions, student mobility in Europe is supported by policymakers and instruments which are backed by large investments. Therefore, chapter 5 tests the hypothesis of whether the student exchange program Erasmus increases student mobility between the member countries. Running panel estimates in a theory-grounded gravity model, the chapter finds that student mobility between Erasmus member countries is, on average, about 53 percent higher. Chapter 6 repeats these estimates controlling additionally for joint membership in the Bologna Process and finds that student mobility between Bologna Process members is, on average, about 50 percent higher. As mentioned above, both European programs–Erasmus and the Bologna Process–turn out to be significant determinants separately.

Since the skilled migration approach argues that countries attract international students hoping that they stay in the country of studies after graduation and increase the stock of highly skilled workers, chapter 7 investigates the question: to what extent do countries that attract foreign students benefit from an increased stock of educated foreign workers? Running theory-founded gravity models by conditional fixed effects Poisson Pseudo Maximum Likelihood methods, this chapter finds that, on average, an increase of students by 10 percent increases the stock of tertiary educated workers in host countries by about 0.9 percent. Finally, the last chapter 8 concludes.

Chapter 2

Hypotheses Derived from the Rationales and Challenges of International Student Mobility

2.1 Rationales for the Internationalization of Higher Education

When analyzing the rationales behind the internationalization of higher education, it is important to take into account the different groups of stakeholders involved. It is not only nations that are interested in fostering the internationalization of their higher education, but also institutions themselves are developing their own instruments and strategies to internationalize research and teaching (de Wit, 1999). From the perspective of a whole nation, so called "rationales at the national level" or "policy rationales" describe the factors that motivate nations to host international students or to send them abroad. The reasons that drive institutions to do this are referred to as "rationales at the institutional level" or "institutional rationales". As students at the individual level decide whether they want to spend a large amount of money to study abroad or not and therefore are the stakeholders that drive the demand for international higher education, it is also important to consider the factors that motivate students to study abroad. These factors are called "rationales at the student level" or "student rationales" (Knight, 2004; OECD, 2004b; Gürüz, 2011).

Rationales at the National and Institutional Level

At the national and institutional level, different rationales for the internationalization of higher education are discussed in the literature. Traditionally, the rationales that have driven cross-border education throughout history are presented in four groups:

social/cultural, political, economic, and academic (de Wit, 1995, 1999; OECD, 2004b; Knight, 2004).

After World War II, governments have seen internationalization mainly as a means of establishing and maintaining special relationships with specific countries, stimulating research, promoting peace and mutual understanding and helping other countries to build capacity. Although these non-economic rationales still exist today, new rationales have also arisen or have even sometimes replaced them. The rise of the global knowledge economy has meant that economic and revenue-generating rationales in particular have been emerging (de Wit, 1999; OECD, 2004b). Over recent years the four traditional groups mentioned above have been joined by new rationales, creating new groups of rationales and approaches to the internationalization of higher education.

The OECD (2004b) differentiates between four approaches to cross-border tertiary education: (i) mutual understanding (ii) skilled migration (iii) revenue generation, and (iv) capacity building. Although these four approaches have some distinctive characteristics, they also have overlapping motivations and can be regarded as different ways of reaching similar objectives. The four approaches do differ, however, in terms of the presence and importance of targeted policy measures.

In the mutual understanding approach, the primary motivations are cultural, political, academic, and developmental. Economic rationales are also important in this approach but are not specifically supported by targeted policy tools. Although this approach encourages the international mobility of domestic and foreign students, it does not strongly push to recruit international students. The other three approaches, on the other hand, place a greater emphasis on student mobility. The skilled migration and the revenue-generating approach use strategies to attract students, so their aim is to export higher education services. The capacity building approach, in contrast, aims to enable a country's domestic students to study abroad, and so they import higher education services.[1] In all three of these approaches, cross-border education is regarded as part of a wider economic strategy, but that does not mean that the other rationales (cultural, political, social, academic) are not also valued.

Countries can adopt one single approach, or a mix of approaches. For example, Malaysia is a country that sends a lot of students abroad. As such, in its role as an importer of cross-border education it uses the capacity building approach. In recent years, Malaysia has emerged as an important destination country for international students, so it

[1]The import of higher education services can also include the reception of foreign institutions. This is often referred to as "program and institution mobility" (PIM) and offers students the possibility to receive a foreign degree while living in the home country. Although the importance of PIM is growing–especially in the time of a global pandemic such as COVID-19–it is not easy to capture its extent as it is not part of the government data-gathering systems (OECD, 2004b). Therefore, internationalization of higher education only refers to the mobility of students in this work.

also applies the revenue-generating approach as an exporter of education (OECD, 2004b).

The four approaches mentioned above are driven to varying degrees by political, academic, economic, social, and cultural rationales. The reasons why private and public, new and traditional, profit and non-profit, local and international suppliers of higher education are engaging in cross-border education can differ greatly, meaning that the rationales of the participating stakeholders can overlap, complement, differ or even be in conflict with each other (OECD, 2004b). It is difficult, therefore, to identify the reasons at a national level that encourage a country to participate in cross-border education.

Before I describe the four approaches in more detail, I provide a brief overview of the rationales at the student level.

Rationales at the Student Level

The rationales at the national and institutional level can of course also be suitable at the individual level. Beyond the rationales for institutions and nations, however, students may also have personal reasons to participate in foreign educational study programs (OECD, 2004b). Two main reasons have been put forward in the literature to explain the mobility of students (Beine et al., 2014). From a human capital perspective, migration is regarded as an investment, and the decision on whether to study abroad is made to improve future expected income and/or job opportunities. From the second perspective, student migration can be regarded as a consumption choice where students do not only focus on the future returns of their studies abroad but also on the context in which they study. Rosenzweig et al. (2006) identified two major rationales for the human capital perspective. According to the school constrained model, students migrate due to a lack of educational facilities in their home country. In this model students acquire human capital abroad and go back to their home country after their studies where they reap the benefits of their educational investment. In contrast, the migration model regards the migration of a student as a means to enter a foreign country and stay there after their studies in order to escape from the low returns of education in their home country. The main determinant in this model is higher income. While the school constrained model is in line with the capacity building approach, where countries send students abroad to acquire advanced skills in the hope that they will return with a better education, the migration model is in line with the skilled migration approach where nations try to attract students hoping that they stay in their country and increase the number of highly skilled members in the work force.

Beyond those models, the OECD (2004b) explains a student's choice to study abroad and the choice of the country where they want to study as an outcome of a trade-off between the non-monetary and monetary benefits and costs of studying abroad. The most important factors that determine the student's choice, according to the OECD (2004b),

are the following:

Language of the country of studies and teaching language; cultural and geographical proximity and historical/economic ties between the sending and host countries; perceived quality of life in the destination country; networks between former and present students in the host country; accessibility and range of studies in the country of origin; perceived quality and reputation of the institutions in the host country in comparison to the home country; costs of studying abroad compared to the costs of studying in the home country; recognition of qualifications and skills in the home country and abroad; access to social cover and facilities for foreign students in the host country; host country policies on student immigration or visas; labor market opportunities in both the host country and the home country.

The above factors can be specific to the destination country, the home county, or bilateral. Factors that are determined by the host countries are referred to as push factors, such as lack of study places in the country of origin. Pull factors, on the other hand, are destination specific factors that attract a student, e.g. high-quality programs in the destination country or programs offered in English (Beine, 2013; Beine et al., 2014). Factors such as distance or same language are dyadic factors.

2.1.1 The Mutual Understanding Approach

The mutual understanding approach forms the common historical basis of policies relating to the internationalization of higher education. Countries using this approach strive to strengthen ties with other countries through the creation of international networks of business and political elites and seek to open their borders to the rest of the world (OECD, 2004b).

The policy instruments that are mostly used under this approach are programs to foster student mobility and academic partnership, as well as development assistance projects in order to foster relationships between developing and developed countries. In this approach, social, cultural, academic and political considerations are of major importance. The approach may also have some underlying economic rationales, but it does not consider cross-border education as part of a broad economic policy (OECD, 2004b; Vincent-Lancrin, 2009). Compared to the other three approaches, that consider international competition as important, it is cooperation that is much more important in the mutual understanding approach. The approach fosters student mobility in domestic and foreign countries, but there is no strong push to recruit students.

A prominent example of this approach is the student exchange program Erasmus which was established in the mid-1980s by the European Union (EU). The primary aim was to create and foster a European identity, so the program was a means of developing mutual

understanding and encouraging the learning of other languages and cultures (OECD, 2004b). To accomplish this, the main objective was achieving "[...] a significant increase in the number of students [...] spending an integrated period of study in another member state" (Council of the European Communities 1987, p. 21). In chapter 5 I will test the hypothesis of whether Erasmus has fulfilled its aim of increasing student exchange, and whether it has reached its goal of fostering mutual understanding.

2.1.2 The Skilled Migration Approach

The skilled migration approach shares the goals of the mutual understanding approach, but it also underlines the importance of recruiting international students (OECD, 2004b; Vincent-Lancrin, 2009). The aim of this approach is to increase the number of international students, and its underlying rational is to attract talented students to work in the host country's knowledge economy after completing their studies. If a student remains in the host country after their studies, student migration can be regarded as a "stepping stone" (Guellec and Cervantes, 2002) to later high-skilled migration and increase by that human capital in the host country. The retention of international students in the host country yields the additional benefit that they are already familiar with the culture, customs and foreign language of the destination country. As the number of high-skilled workers is of crucial importance for the knowledge economy, this approach is especially interesting for countries with an aging society, that face a decrease in the number of their own high-skilled workers (OECD, 2004b).

The policy instruments that are mostly used under the skilled migration approach aim to attract international students. This is achieved through a combination of marketing activities that actively promote the country's higher education abroad, scholarships or other special programs for international students, and relaxing visa and immigration regulations. Furthermore, special services can be provided in order to attract students from a wider range of foreign countries, such as programs of study in English. Through applying these policy instruments a country can attract specific groups of students depending on the needs of the country, such as students from selected areas, certain fields of study, postgraduates or research students rather than undergraduates (OECD, 2004b; Vincent-Lancrin, 2009). Furthermore, in this approach international students are a strategic means of stimulating competition in the higher education system and in doing so, contributing to economic growth in the knowledge economy of the host country. This is another reason why this approach results in an increase in the number of international students (OECD, 2004b).

As an example of this, in Europe in the 1990s there was a shift towards a more economic approach of cross-border student mobility. In 1999, 29 countries started the Bologna Process with the aim of establishing a European Higher Education Area (EHEA)

by 2010 in order to facilitate student mobility and to enhance the international appeal of the EHEA.[2] This raises the question of whether being a member in the Bologna Process increases student mobility between the participating member countries, especially since the establishment of the EHEA in 2010. Chapter 6 strives to test this hypothesis empirically. Furthermore, it provides a descriptive analysis at a country level to investigate whether the Bologna Process and the establishment of the EHEA have increased the appeal of studying abroad for international students. Since countries applying this approach attract students with the hope that they will stay in the country afterwards to work there, chapter 7 will test the hypothesis of whether student mobility between two countries increases the number of highly skilled workers further down the line.

2.1.3 The Revenue-Generating Approach

The revenue-generating approach shares the rationales of the mutual understanding approach, while placing a stronger emphasis on the recruitment of students through the international promotion of the host country's higher education system and the adaption of visa regulations. It also has these points in common with the rationales of the skilled migration approach. The revenue-generating and the skilled migration approach emerged in the 1990s. Both approaches represent two key developments in the international higher education market. These two approaches share the view that international higher education is an increasingly competitive market for resources and talent. Furthermore, both approaches are driven by an unmet demand of higher education in emerging economies where economic growth has led to an increased demand for higher education. As the capacity cannot be met in the host countries, it has led to an increase in the number of students studying abroad on a full-fee basis (OECD, 2004b).

In contrast to the skilled migration approach, the revenue-generating approach offers studies on a full-fee basis, meaning that public subsidies such as academic exchange programs and scholarships are not common policy instruments. As foreign students generate an additional income, private institutions are encouraged to become entrepreneurial in the international higher education market. In order to achieve this, governments give the institutions great autonomy. The policy instruments of the government focus on tools to lower obstacles to cross-border education and to secure the reputation of the country's higher education sector, for example by implementing international quality assurance standards. The revenue-generating approach results in an increase of fee-paying international students (Vincent-Lancrin, 2009). Famous examples of countries that adapt the revenue-generating approach are the Anglo-Saxon destination countries Australia, New

[2]It should be noted, however, that the economic rationale behind the target of increasing the appeal of the EHEA ranks third after improving the quality of the higher education system and enhancing graduate employability (OECD, 2004b).

Zealand, the United States, Canada and–as an exception among the European countries– the United Kingdom. These countries actively promote education as an export policy.

This raises the question of whether countries adapting this approach–such as the Anglo-Saxon countries–are attractive destination countries for international students. Chapter 4.1 will address this topic by providing a descriptive analysis on destination countries. Furthermore, an increasing number of European countries participating in the Bologna Process adopt the strategy of charging higher fees to non-EHEA international students. Chapter 6.4.1 will also address the effect of charging higher fees for students arriving from non-EHEA countries by means of a descriptive analysis.

2.1.4 The Capacity Building Approach

The capacity building approach is an importer perspective and is more prevalent in emerging countries that regard cross-border education as a means to build capacity for quality in a quick way, and to meet the unmet demand of higher education (OECD, 2004b; Vincent-Lancrin, 2007). Furthermore, this approach also aims to build a higher education system based on the spillovers resulting from partnerships with foreign higher education institutions. This approach can be pursued by encouraging domestic students to study abroad (and return afterwards) and by opening the borders to foreign higher education institutions, generally under regulated conditions. In this way, the capacity building approach results in a notable increase of outgoing students and of foreign revenue-generating institutions (Vincent-Lancrin, 2009). Countries that adapt this approach can benefit from the three other approaches described above. However, due to the different interests of countries that import versus those that export higher education, the capacity building approach can also be in conflict with the other approaches, especially that of skilled migration. The capacity building approach is applied in some Asia-Pacific countries which support imports of cross-border education, such as Malaysia, China, Vietnam, Indonesia, and Thailand (OECD, 2004b; Vincent-Lancrin, 2007). Some countries strive to turn from a net-importing country of cross-border education to a net-exporter. In this context, they adopt this approach to build capacities for their own cross-border higher education activities.

This approach therefore leads to the following thoughts: Asian countries are the most important countries that send students abroad. Some Asian countries send a high number of students abroad in the first stage as a means to increase their domestic capacities in higher education. In a second stage, these countries increase their domestic capacities. Chapter 4.2 will address these questions. It will demonstrate that the number of international students from Asia are the most important group of international students overall. Since China is the most important country that sends students abroad, chapter 4.2.4 will discuss the applied strategy of building domestic capacity in more detail by comparing

the development of the number of students sent abroad to the total number of tertiary students studying in China.

2.2 Policy Challenges Resulting from Cross-Border Education

This section addresses the traditional educational policy issues linked to student mobility, which include equal opportunities to access to higher education; financing of higher education; quality assurance; and the contribution of cross-border tertiary education to growth of talent in the domestic job market. These issues affect governments and education stakeholders in two ways. Firstly, these groups should consider how to address these issues in their local educational policy agendas by actively including and enhancing cross-border activities in tertiary education. Secondly, they should take into account how the cross-border activities of other countries affect their own domestic policies relating to the topics of access and equity, quality assurance and financing of tertiary education (OECD, 2004b). As this work strives to consider cross-border education from an economic point of view, it places a strong emphasis on the resulting financial challenges.

2.2.1 Capacity Building Through Cross-Border Education: Brain Drain, Brain Gain, and Brain Circulation

There is little doubt that a highly educated workforce is of major importance for the economic growth and development of a country. If access to higher education is restricted, countries are motivated to increase access to higher education, as it can be considered as a means of increasing future human capital. Apart from increasing access to higher education in the domestic market, importing higher education through participation in cross-border education is another way to improve access for domestic students. In order to know whether cross-border education has the same positive effect on domestic human capital as increasing access in the domestic higher education market, a comparison of the consequences of both scenarios is useful. For this, the economic situation of the importing country and the effect of cross-border education have to be considered. While the higher participation in tertiary education through cross-border education is obviously positive for an importing country, it may also be connected to costs and other negative consequences. This, for instance, is the case for the sending country if the student does not return after their studies abroad. Reasonably, students from developing countries might also wish to study in developed countries for migration-related reasons. Developed countries who suffer from a deficit in their high-skilled workforce capitalize on this motivation. Countries that adapt the high-skilled approach promote cross-border education as a means of attracting

high-skilled students and strive to keep them after their graduation so that they integrate into the work market, as discussed in section 2.1.2 (OECD, 2004b). In the literature investigating the mobility of workers, cross-border mobility of skilled workers has been identified as *brain circulation*–also called *brain exchange–brain drain*, or *brain gain* (see for instance OECD, 2004b; Beine et al., 2008; Docquier and Rapoport, 2012; Beine et al., 2014). As students go on to become high-skilled workers and are therefore a subgroup of the highly skilled, mobility of students is closely related to the brain circulation, brain drain, and brain gain phenomenon.

Brain circulation stresses that mobility of highly skilled individuals will lead to benefits in the short or long run for both countries, the sending and receiving. However, brain circulation does not mean a one-way exchange of human resources between the sending and receiving country. An Asian country that has sent a student abroad to the United States or Europe, for example, may lose human capital if the student decides to stay there after their studies but this country may also draw human resources from other Asian countries. Furthermore, flows go in both directions, as highly skilled workers that have left their country of origin still maintain active links to their country through sending remittances, reinvesting, and occasionally even migrating back home (OECD, 2004b).

Brain drain means a loss of highly skilled workforce for the sending country, while brain gain is the opposite scenario. Instead of returning to the country of origin after their studies and contributing to its academic, social or economic development, students may stay in the country where they studied or move to a third country. While the retention of a student in the destination country means the gaining of a highly skilled worker for the country of studies (brain gain), for the country of origin, in contrast, it represents a loss of a talented citizen (brain drain). In the country of origin, the brain drain effect is therefore reflected by the reduction of human capital stock, which is crucial for the productivity and growth of the student's home economy (OECD, 2004b; Beine et al., 2014). Furthermore, if higher education is mainly publicly funded, the non-return of a student or graduate from their studies abroad means a loss of a part of the initial education investment. In this case, the country of migration reaps the benefits and the country of origin covers the costs. However, sometimes countries may even favor students not returning after their studies when, for instance, in a developing country there is no demand for the student's skills in the labor market of the country of origin. In general, there are different factors that determine the return rate of the students, such as job opportunities in the country of origin and abroad, relative conditions and earnings, relative attractiveness of the quality of life, or migration policy of the sending and receiving country. Governments can influence the return rate by adapting their policies. Malaysia, for instance, secured a high return rate among publicly financed students through career prospects and bonding conditions attached to scholarships (OECD, 2004b).

The brain drain and brain gain phenomenon raise the question of whether students

that go abroad are more likely to stay in the country of studies after graduation to work there, and whether their likelihood of staying depends on the destination country. Chapter 7 will investigate this question empirically and will present the retention rate in different countries.

2.2.2 Access and Equity

Cross-border activities in tertiary education have an impact on access to higher education and equity of that access in three different ways. Firstly, in general international student mobility reflects an increasing access to tertiary education in countries where the demand exceeds the supply, mostly in developing (Asian) countries with a growing middle class. Cross-border education in these countries, therefore, is a way to meet this unmet demand as it increases access of students from the sending country to higher education and offers them a wider range of study opportunities than those that are offered in their countries of origin. Furthermore, higher education may also have an expanding effect on domestic students access to a wider range of programs in smaller developed countries such as Luxembourg or Iceland. As small countries cannot afford to offer all fields of studies to domestic students, they use international students to complement domestic capacity in certain fields. Countries facing an unmet demand for higher education should therefore facilitate access for their domestic students to cross-border education (OECD, 2004b).

Secondly, as cross-border activities open the domestic tertiary education market to international students, the growing number of international students might have an effect on the access and the equity of access of students in the domestic market. International students may reduce domestic students' access to tertiary education programs, especially those of elite institutions. The increase in the number of international students in the domestic market might, in turn, reduce capacity for local students, and in doing so reduce their access to tertiary education, or make it less equitable. Furthermore, the eligibility rules of some (prestigious) tertiary education institutions differ for international students and domestic students, meaning that the former may get access to some higher education programs easier than their counterparts. Where domestic students are displaced by international students by reasons other than academic merit, this can be regarded as unfair to local students. Furthermore, when domestic students cannot access high-quality tertiary education programs this may cause a potential loss of human capital in the domestic market. Finally, if the requirements to study in a certain field are less stringent abroad than in the home country, and if the degree is recognized in the home country, studying abroad can be used to bypass the requirements in the home country. This can also be considered as unfair for other students in the home country that cannot study abroad for financial or other non-academic reasons. Therefore, when developing internationalization policies on education, education stakeholders and governments should consider the impact on the

access of their domestic students (OECD, 2004b).

Thirdly, equity in participation in cross-border tertiary education can be improved. This participation is determined by non-academic factors such as gender, ethnicity, parents' education, and income. Apart from the fact that unequal access to tertiary education is unfair if it relates on factors others than the intellectual ability, it also leads to a potential waste of valuable human resources. Students from lower socioeconomic background participate less in tertiary cross-border education and their educational background also has an impact. Gender is also a determinant in student mobility. While mobility of students under the European student exchange program Erasmus is gender-neutral, most outgoing students coming from the United States are female (due to the fact that most outgoing students study humanities), while those from Asian countries of origin are male (which reflects the higher participation of male students in general in Asian countries, maybe due to the higher investments in males than in females). The effect that a minority background plays can vary depending on the region. In the United States, students from minority backgrounds have a lower participation rate in student mobility, whereas in Malaysia, students from minority backgrounds employ all possible means in order to increase their access to participate in tertiary education. Governments of both receiving and sending countries willing to address this equity issue could choose to improve the provision of information for students from less privileged socioeconomic and educational backgrounds, for example by informing them about the benefits and costs that are linked to cross-border education. Another instrument could be financial support through targeted student loan schemes or grants (OECD, 2004b).

2.2.3 Quality Assurance and Accreditation

Another important issue that arises through international student mobility is the quality of higher education in the different countries. This raises the question of who is assuring and monitoring the quality and relevance of the qualifications and education programs that are offered. Naturally, quality issues can arise in both countries, the country that delivers cross-border education as well as in the domestic education market. For the country that imports cross-border education, issues arise as they want to protect their students. The variety of tertiary education systems worldwide and the difficulty of the readability of these systems allows providers of low-quality education and even rogue providers (degree mills) or rogue accreditation quality assurance agencies to operate in the market. As a result, new policy challenges arise as learners have to be protected from the risk of misinformation, a questionable validity of their qualifications and low-quality services. Establishing high-quality accreditation and assurance systems can reduce this risk to students. Shifting the view to the exporting country of cross-border tertiary education, this country faces the issue of protecting and maintaining the attractiveness

and reputation of its tertiary education system. Therefore, both, the sending and receiving country will have an interest in reducing low-quality education programs and ensuring the quality of education services provided in order to meet quality assurance regulation. Due to the rising number of providers, new frameworks on international and regional level are a useful addition to the efforts of the accreditation and quality assurance agencies on national level. The additional cooperation at an international level can lead to an increase of mutual understanding between countries. Furthermore, in order to facilitate students studying abroad and to allow them to hold foreign degrees and work in an international market after their studies, the recognition of international degrees is of crucial importance. In order to increase the validity and recognition of qualifications at an international level they should be transparent and internationally understandable. This can be achieved by implementing user-friendly and reliable information sources on national education systems (OECD, 2004b,c).

One of the most famous examples addressing this issue is the Bologna Process. The aims listed in the Bologna Declaration (1999) all focus on creating a European Higher Education Area (EHEA) that facilitates student mobility within the EHEA through a European co-operation in quality assurance; a similar system of credits; the same two-cycle degree or promoting the recognition of periods spent abroad. Therefore, chapter 6 tests the hypothesis of whether the Bologna Process increases student mobility, and if there is a difference between the time before and since the establishment of the EHEA.

2.2.4 Financing Higher Education

International student mobility entails costs both for students that study abroad as well as for the institutions and host countries where they study. Students' costs consist of tuition fees and other general which are associated with studying and living abroad. For the higher education institutions and countries where the international students are enrolled, it is administrative and teaching costs that arise (OECD, 2004b).

From the perspective of the host country, the fees paid by international students generate revenue. Beyond these fees, international students are increasingly regarded as a source of revenue for the destination country through the living expenses that incur during their studies (European Commission, 2012b). In Canada, for instance, the sum of all expenses of international students (tuition fees, living expenses, accommodation) in 2010 generated more than CAD 8 billion in revenue for the Canadian economy. It is worth noting that this amount exceeded the "total Canadian export of unwrought aluminum (CAD 6 billion) or Helicopters, Airplanes and Spacecraft (CAD 6.9 billion)" (Canada, 2012). In the United Kingdom, Universities UK (2014) estimated that the higher education sector generated export earnings of 10.7 GBP billion in 2011 to 2012, of which 3.8 GBP billion were spent on tuition fees and accommodation from non-EU

students, and a further 3.4 GBP billion on goods and services by non-EU students. All this revenue has a short-term effect on the economy of the hosting country, but host countries can also benefit in the long term from international students. For example, if students decide to stay in the country following their studies, they affect the labor market and have a positive influence on the economy of the destination country (OECD, 2013).

Student mobility, therefore, affects the public provision and financing of higher education. Gérard and Uebelmesser (2014) address this financing issue that arises for governments by comparing what they call the "old paradigm" and the "new paradigm". Under the old paradigm, they describe the situation where students are born in one country, study and work in the same country, and finally die there. In this scenario, public financing of tertiary education without private contribution is like a contingent loan that is paid by students after their graduation in the form of income taxes. In a world where students and graduates are mobile, this paradigm, however, is no longer accurate. The mobile world is therefore described by the new paradigm, where a student receives their primary and secondary education in the country of origin, studies for their tertiary education in a host country, and then works in the destination country after graduation. In this case, the country of studies is not the same as the country where the student works after their graduation. Hence, if tertiary education were publicly financed, the first two countries would have to cover the costs while the country where the student ends up for work would reap the benefits from the skill of the worker and their contribution to GDP as well as through higher (income) taxes. Making the country of origin responsible for paying for studies abroad would only be reasonable if a sufficient number of graduates were to return to the home country after their studies to work there and either do not stay in the country of studies or move onto to a third country. The application of the origin country principle is reasonable when a country is both a net importer of international students and a net exporter of graduates (Gérard and Uebelmesser, 2014). As shown by Felbermayr and Reczkowski (2014), this is the case for most students from non-Anglo-Saxon continental Europe, whereas Anglo-Saxon countries are net importers of students with a high retention of their graduates. With a growing retention rate of graduates, however, the efficiency gains of the host country principle commensurately decrease.

Clearly, cross-border education raises the question of how to share the costs between i) countries and their taxpayers and ii) end-users of higher education. Broken down further, the question becomes how to share the costs between the taxpayers of the different countries and, with respect to the end-users, how to share the costs between the different forms of end-users (i.e. international versus domestic students) (OECD, 2004b; Gérard and Uebelmesser, 2014).

Although private and public scholarships have grown in recent decades, the increase in student mobility has outnumbered the increase of these investments. Therefore, cross-border mobility remains mainly self-financed by students or their families. Furthermore,

the share of private funds for tertiary education is increasing over time (OECD, 2004b; Gürüz, 2011; OECD, 2012b; Gérard and Uebelmesser, 2014). It is worth mentioning, however, that there is no negative correlation between the growth rate of private and public spending on tertiary education. Rather, both sources have different growth rates. Furthermore, a higher share of private expenditure does not mean reduced access to tertiary education for students from disadvantaged families at the country level, as students benefit from public support to cover their costs (OECD, 2012b, 2016b).

The OECD (2004b) differentiates between two broader strategies that OECD countries tend to adopt as fee policies for incoming international students. The first policy gives international students the same access to indirect subsidies as is given to domestic students, whereas the second charges them full tuition fees and, by doing so, places a greater emphasis on private resources. While the first strategy is mainly applied by European destination countries, the second is used by Anglo-Saxon destination countries.

Independently of the applied strategy, countries also have the possibility to provide students other financial support in order to cover their living expenses, such as scholarship programs (OECD, 2012a, 2016b). Furthermore, there are also other classes of concepts, such as the above-mentioned origin country principle that obliges the origin country to pay for the studies or the host country principle where the country of studies has to pay for the education (Gérard and Uebelmesser, 2014).

Indirect Subsidies to Cross-Border Tertiary Education

When it comes to supporting international students financially, governments face a trade-off between covering almost all costs for a small number of students (direct funding) or supporting a lot of students but covering only a small part of their costs (indirect funding). A large number of (mostly European) OECD countries opt to grant international students with indirect subsidies by giving them direct access to public universities. This strategy has several advantages, including that international students represent only marginal costs for universities; universities can maintain variety in their educational offers; and it induces fewer administrative costs than giving international students direct subsidies through a scholarship program (OECD, 2004b).

Most OECD countries are suffering from an ageing society which leads to a decreasing school-age population (5 to 29 years old), but they have large capacity in tertiary education. A large number of the institutions are publicly financed with a large share of fixed costs. If international students enter this established tertiary education system and teaching them does not require expanding current capacity, these students can be taught at a marginal cost. Even if incoming students do lead to increased capacity, in most cases universities can benefit from economies of scale. Through an increase of the teacher-student ratio, international students reduce the average costs of teaching in the

country of studies. If international students were to lead to an extreme expansion of capacity, however, teaching them would increase the average cost of higher education in the destination countries (OECD, 2004b). In these cases, in Belgium and Austria, for instance, there is set a quota: if the quota is reached, additional incoming students have to pay a different fee from domestic students (Gérard and Uebelmesser, 2014).

Furthermore, international students help the countries of study to maintain educational variety. In the United Kingdom and the United States, for example, institutions suffer from a lack of domestic applicants in the fields of science and engineering. In these cases, international students decrease the average costs of teaching for institutions. Without international students, teaching costs might be too high to maintain academic capacity in those fields (OECD, 2004b).

When governments opt for the indirect funding strategy, they rely on reciprocity. Under the reciprocity condition, another reason for governments to subsidize international students is that their own domestic students can benefit from the same conditions when they decide to study abroad. How international students are subsidized depends on the country of studies, but the subsidies are always the same as for domestic students in the country of studies. This reciprocity principle is sometimes part of bilateral agreements (OECD, 2004b). One famous example that applies the reciprocity principle is the EU and associated countries. In the EU, the principle of nondiscrimination obliges host countries to charge the same tuition fees to international students from within the EU as to domestic students (European Commission, 2010). This obligation, however, does not expand to other fields of financing students or to other benefits such as loans (OECD, 2004b). If mobility is unbalanced and teaching international students leads to an expansion of capacity for the institutions, cross-border education raises additional financing issues. This is especially true in the decentralized world of the EU with its Bologna Process, where cross-border education for EU students is mainly financed by the host country. This means that EU students cannot be charged higher tuition fees than domestic students and almost no tuition fees exist. It is therefore of crucial importance for the strategy that the mobility is balanced. Despite this, major imbalances do exist.[3] As such, unbalanced student mobility across the EU countries undermines the efficient functioning of the system of the Bologna Process. If a country is a net importer of international students but a student returns home after their studies, the country of origin reaps the benefits whereas the host country has to pay for the studies without gaining any long term benefits. This impact of these imbalances on the proper functioning of the system can be seen as an argument for expanding the responsibility of the EU to tertiary education. This is already the case as concerns cursus norms, but not when it comes to financing the higher educa-

[3]See chapter 6.4.3 that presents the imports and exports of students from within the EHEA for each Bologna Process member country.

tion system. Such imbalances of student flows within a region do not only exist in Europe. The figures also show imbalances between the different states of the United States or for interprovincial student exchange in Canada (Gérard and Uebelmesser, 2014).

The application of the indirect subsidy strategy facilitates students to enter cross-border tertiary education by giving them cheaper access to it. In addition to paying tuition fees, however, international students also have to pay living costs. Therefore, even though indirect subsidies facilitate access to higher education, they do not resolve the full financing of cross-border education for students. Another disadvantage of this type of fee policy is the fact that it does not give institutions strong incentives to attract international students (OECD, 2004b).

This strategy for financing higher education strives to cover the costs through a progressive tax regime, as it implies that graduates earn more money than workers with secondary education, so the former pay higher income taxes. If international students, however, do not stay in the host country to work there, the country of studies has to pay the costs for tertiary education without generating income taxes (OECD, 2016b; Gérard and Uebelmesser, 2014). Generating income through increased taxes has its limits, especially in an ageing society with a mobile workforce, as very high income taxes may push students to work in another country after graduation. In a worst-case scenario, both domestic and international students study in the country where no tuition fees are charged and both groups work afterwards in another country to avoid paying high income taxes. In this case, the country of studies would suffer from a loss of human capital as it results in both local and international graduates leaving the country.

Charging Full Tuition Fees to International Students

Another strategy that is widely applied by governments to finance cross-border education is charging full tuition fees to international students. This strategy is mainly used in Anglo-Saxon countries, i.e. Australia, Canada, the United States, and New Zealand. As countries in the EU are not allowed to charge higher fees to students from EU-international than from their domestic counterparts, the two Anglo-Saxon countries in the EU–the United Kingdom and Ireland–charge full fees only to non-EU-students. This is also the case for the Netherlands (OECD, 2004b). Sweden and Denmark also introduced tuition fees to non-EU students in 2011/2012 and 2006, respectively (OECD, 2017c). In general, it can be said that an increasing number of countries is adapting the strategy of charging higher fees from international students than from domestic students (Gürüz, 2011; OECD, 2016a,b, 2017c).

As chapter 4.1 will show, Anglo-Saxon destination countries account for a disproportionately high share of hosted international students. However, it has to be highlighted that the introduction of the full-fee policy in the 1980s in the United Kingdom, Australia,

and New Zealand was designed to supplement public funds for higher education and to generate export revenue (OECD, 2004b). In the United States and Canada (as well as in Japan and Korea) public institutions already charged tuition fees. Starting in the 1980s, public subsidies for public institutions were reduced in the United States, so that the share of tuition fees in their total income increased from 18.9 to 24.9 percent in 1980 and 1998, respectively (Gürüz, 2011). The massive increase of hosted international students in these countries can be regarded as a response to the introduction of this policy and not as a cause of it, as the policy was introduced first. However, the cases of Ireland and the Netherlands show that this policy does not necessarily lead to an increasing number of (non-EU) international students (OECD, 2004b).[4] The same is the case for the recent tuition fee reforms in Norway and Sweden, where the number of international non-EU students remained stable or even declined (OECD, 2016a, 2017c).

Charging international students full fees has positive effects for governments, higher education institutions, and international students. From the perspective of the government, it leads to several benefits for the domestic tertiary education system. In addition to the aforementioned advantages (section on indirect subsidies) of maintaining the capacities in some fields of education as well as scale and scope economies, charging fees to international students generates more income to finance the domestic higher education market while also providing fiscal equity. When governments refuse to redistribute public revenues to international students this can be construed as fiscal equity. Although international students pay some taxes in the country of studies, such as VAT, this amount is dramatically lower compared to the contribution of domestic students and their families. Furthermore, as domestic students are more likely to stay in the country after graduation, they are also more likely to contribute through their human capital and taxes to the economy of the country. Furthermore, it gives incentives to a more demand-driven and entrepreneurial mindset for the management of the institutions, as they have to compete worldwide with tertiary institutions to attract international students. However, the incentives are only effective if governments provide institutions with sufficient financial autonomy and if they let them control the use of the income generated (OECD, 2004b).

From the viewpoint of institutions, this strategy provides additional advantages to the cost and scope effects that are achieved by indirect funding. These include greater budgets for the institutions compared to being mainly publicly funded as well as fiscal equity. Charging full fees can make institutions more autonomous compared to their publicly funded counterparts as they are financially more independent. This means that institutions can invest the additional income that is generated through fees to improve their teaching and learning conditions by, for example, providing better libraries, or they can increase the wages for their teaching staff. All these investments also represent advantages

[4]See chapter 6.4.1 that presents the number of incoming students for each EHEA country across years.

for domestic students, while also generating comparative advantages in the international higher education market (OECD, 2004b). In Australia, for instance, applying this strategy has made it possible to improve teaching conditions in fields of high demand by reducing the student-staff ratio (Auditor General Victoria, 2002).

These improvements in education and associated services–both academically and non-academically–tailored to the demands of international students have increased the quality of cross-border education for international students in these countries. Thus, even though at first sight this strategy has led to an increase in costs for international students, it also delivers several advantages. This may partly explain the increase in international students hosted in Anglo-Saxon countries that all apply this full-fee tuition strategy for international students. The changes discussed also bring benefits to domestic students, in addition to the cultural enrichment that arises through the higher number of international students in the student population (OECD, 2004b).

The strategy of charging full fees from international students, however, also has various disadvantages; as students from disadvantaged backgrounds may not be able to afford to pay for studies, this strategy may have a negative effect on equity and access. If a country wants to address the equity issue, it can seek to target subsidies at disadvantaged students (OECD, 2004b).

In general, an effective method of providing access and equity and share the costs of higher education between students and the state is to combine the full fee strategy with a system that supports all students with loans with income-contingent repayments and means-tested grants (OECD, 2012a, 2016b).

Chapter 3

Data on International Student Mobility

3.1 Internationally Comparable Data

3.1.1 Definition of Student Mobility

When it comes to comparing the figures of student mobility across various countries, two issues arise. First, tertiary education programs differ both across countries and within them. In order to facilitate the comparison of data across countries, the UNESCO provides a global framework for classifying educational programs based on the International Standard Classification of Education (ISCED1997) (UNESCO Institute for Statistics, 2006, 2009). According to this framework that classifies education into 6 levels, tertiary education includes the ISCED levels 5 and 6. While level 5 refers to the first stage of tertiary education including bachelor's and master's degree, level 6 is the second stage of tertiary education that consists of advanced research programs which lead to the award of an advanced research qualification, such as PhD programs. As student mobility refers to students enrolled in tertiary programs, it includes levels 5 and 6 of the ISCED framework.[1]

Another difficulty can arise from the different definitions that are used for the term student mobility. Student mobility can be defined according to three characteristics: (i) permanent residence (ii) prior education, and (iii) citizenship (UNESCO Institute for Statistics, 2009). Using the criterion of permanent residence, students are considered to be mobile if they are not permanent residents of the country where they study. According

[1]Note that the ISCED1997 framework has been updated to the ISCED2011 framework (UNESCO Institute for Statistics, 2012). In this new framework, education is classified into 8 levels, where levels 5 to 7 cover the former level 5 of ISCED1997, and level 8 of ISCED2011 is equivalent to the former level 6 of ISCED1997. The data used in this work are still classified under the ISCED1997 framework, as data mostly refer to older years. Due to a revision of the ISCED classification, comparing data may present some inconsistencies.

to the criterion of prior education, mobile students are those who "[...] obtained the entry qualification to their current level of study in another country. Prior education refers typically to upper secondary education for students enrolled in tertiary programs". Using the criterion of their citizenship mobile students are those who "[...] are not citizens of the host country in which they pursue their studies" (UNESCO 2009, p. 36).

If student mobility is defined based on the criteria of residence and prior education, mobile students are those who move to another country purely for the purpose of education. In the literature, the term 'international students' is used for this closer definition. If the criterion of pure citizenship is used, it is not certain that students moved for the purpose of study as this also could capture students who have lived in the country their whole life. In this case, the term 'foreign students' is often used. Due to the wider definition for foreign students, international students are a subgroup of foreign students (UNESCO Institute for Statistics, 2009; OECD, 2013).

3.1.2 Available Data Sources for Student Mobility

There are three main institutions collecting and providing data on student mobility: the UNESCO Institute for Statistics (UIS), EUROSTAT (UOE), and the OECD. They define international students "[...] as those who are not residents of their country of study or those who received their prior education in another country. When data on international students are not available, data on foreign students are used" (OECD 2013, p. 1). The data situation on international student mobility is, therefore, suboptimal as the definitions of student mobility still vary between countries (UNESCO Institute for Statistics, 2009).[2] Furthermore, these data should only include exchange programs "which last a minimum of 1 semester full-time equivalent" what is not always the case (OECD 2004, p. 309). To solve this problem, the OECD started to report the data with a clearer precision between international and foreign students. However, these data are only available for years starting in 2004 and restricted to 30 destination countries (OECD.Stat, various years). As I want to show the variation of student mobility for a wide range of years and destination countries, I use the data provided by the UIS.

3.1.3 Data Used in this Work

In this work I present a new data set that spans the period from 1970 to 2015. For the years prior to 1998, data are only available in hard copy in the UNESCO Statistical Yearbooks (UNESCO, various years). I have therefore entered the data *manually*. Data for the years 1998 onwards are provided by the UNESCO online database (UIS.Stat,

[2]For definitions used by the reporting countries see OECD (2004b).

2018); for the year 1997 data are not available in the UNESCO Statistical Yearbooks nor in the online database. Data from the Statistical Yearbooks present the annual stock of foreign students enrolled in institutions at the tertiary level since 1950. The UIS provides the data for each destination country that reports the number of hosted students from each country of origin. Apart from the students with a known country of origin, the reporting destination countries also host students with an unknown country of origin. As most host countries are covered more consistently starting from the year 1970, the sample begins in 1970. For each year of the Yearbook the UIS reported the data for 50 destination countries of which 29 countries report the number of hosted students consistently, whereas the other destination countries report the data for only a few years or sometimes even only for one single year. I have therefore chosen the data for the 29 major destination countries with the most consistent data coverage. However, the destination countries did not report the number of hosted international students by source country for each year. As the number of reporting destination countries varies over years, the adequacy of the total number of hosted international students in a year depends on the number of reporting destination countries. If one of the major destination countries is not covered in a year, it is particularly noticeable. With respect to the country of origin, data are available for almost all countries. However, the total number of students sent from a country of origin depends on the number of reporting destination countries. In some chapters I will consider the total number of students, including those from unknown countries of origin where it makes sense e.g. when the destination countries are observed. When the countries of origin are analyzed, only known countries of origin can be considered, meaning that the total number of students excludes students from unknown countries of origin.

For most years, data belong exclusively to one specific year. In some cases, however, the number of students pertain to an academic year, e.g. 1994/1995. As a semester always ends in the second year, the number for an academic year is attached to the second year, hence in the example to 1995. If, however, data are already available explicitly for one of the two years, this number is kept in the data set and the data referring to the academic year are not taken into account.

Table 3.1 compares the data from the UNESCO to the estimated total number of international students that is provided by the OECD for selected years (OECD, 2017a). The data covered by the UNESCO vary from 17 percent in 1995 to 89 percent in 2015, where 14 and 101 destination countries reported the number of hosted international students. Clearly, the degree of coverage of the total estimated numbers of the OECD depends on the number of reporting destination countries. Therefore, I regard averages over various years rather than using yearly data in the remainder of this work. The estimates of the OECD which are presented in the table have imputed missing values with the closest data reports meaning that breaks in data coverage do not result in breaks in time series.

Table 3.1: Data on the total number of international students: UNESCO versus OECD estimates for selected years

Year	UNESCO data students in millions	UNESCO reporting destination countries	OECD estimates students in millions	Coverage UNESCO data [%]
1975	0.5	21	0.8	66%
1980	0.3	13	1.1	28%
1985	0.6	14	1.1	54%
1990	1.0	18	1.3	76%
1995	0.3	14	1.7	17%
2005	2.3	69	3.0	78%
2010	3.0	86	4.2	70%
2015	4.1	101	4.6	89%

Note: The table shows the total number of international students in millions for selected years. Data from the UNESCO cover a varying number of destination countries. The OECD provides estimates of the total number of international students for selected years where missing data were imputed with the closest data reports.
Source: OECD (2017) Education at a glance, UNESCO Statistical Yearbooks (years 1975 to 1995), UNESCO Institute for Statistics online database (years 2005 to 2015).

3.2 A First Glance at the Data

3.2.1 Long-term Development of International Students

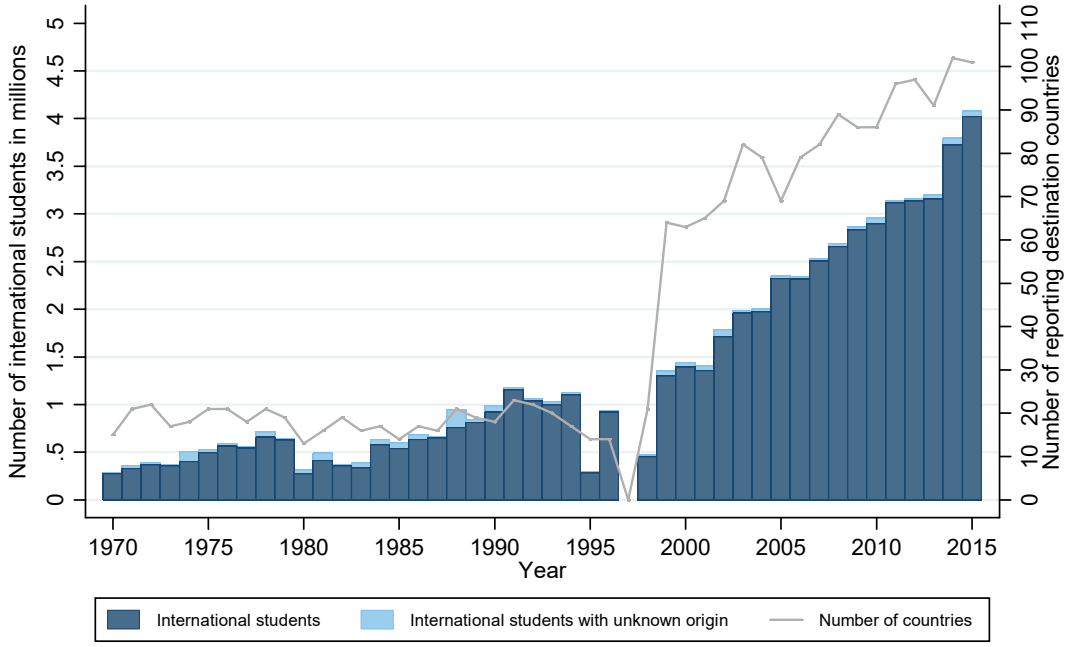
Figure 3.1 shows the development of the number of international students from 1970 to 2015. The bars demonstrate the total number of hosted students in all reporting destination countries by year. The dark blue bars refer to the number of hosted students from known countries and the light blue bars represent the number of hosted students from unknown countries of origin. As the number of reporting countries varies over years–which in turn has an effect on the total number of hosted students by year–the grey line also shows the number of reporting destination countries (right axis). In particular for the years 1970 to 1996 where data are taken from the UNESCO Statistical Yearbooks and therefore available for a limited number of destination countries, the number of reporting destination countries has a visible impact on the total number of hosted students. This effect is especially large if one of the top destination countries–the United States, France, Germany, the United Kingdom, Canada, or Australia–did not report the number of hosted students. This for example is the case for the USA in the years 1980, 1982, 1983, 1995 during the period where the data are taken from the UNESCO Statistical Yearbook.

The number of international students has experienced phenomenal growth over the past 45 years. It rose from 272 thousand in 1970 by a factor of 14.3 to 4.1 million students in 2015. As can be seen in the graph, the impact of the number of reporting countries can lead to a biased pattern when regarding the yearly data. Therefore figure 3.2 shows the development of the total number of international students looking at averages over five years (and six years for the last period) rather than yearly data.

Looking at the periods over time, the number of international students grew constantly. Starting with an average number of 460 thousand students in the first period covering the

years 1970 to 1974, the number grew by a factor of 8 to 3.7 million students in the last period.[3] This stands for an average growth rate of 31 percent for a five-year period.

Figure 3.1: Development of the reported number of international students from 1970 to 2015



Note: The figure shows the number of international students that are hosted in the reporting destination countries. Students with known country of origin are shown in dark blue and with unknown origin in light blue. The number of total international students is the sum over all reporting destination countries. The number of reporting destination countries for each year is shown by the grey line and refers to the right axis.
Source: UNESCO Statistical Yearbooks (until 1996) and UNESCO Institute for Statistics (UIS) online database (1998 onwards). Data for 1997 are not available.

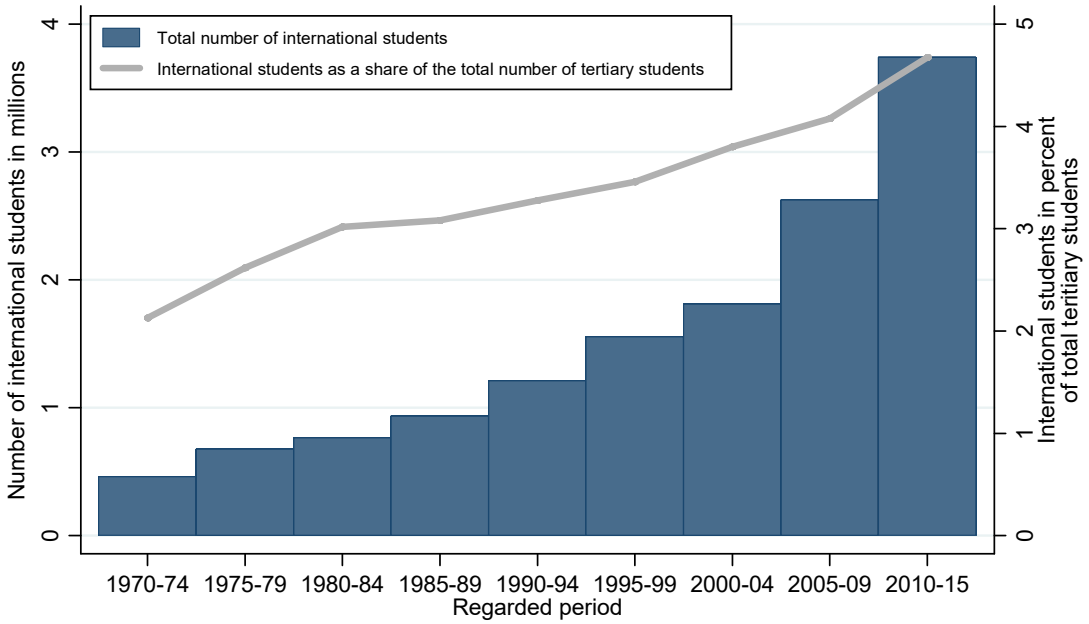
The increase in the number of international students is, however, not proportional over all periods, ranging from a 13 percent to a 47 percent growth. While the number of international students grew the most from the first to the second period (covering the years 1970 to 1974 and 1975 to 1979, respectively) the increase was the lowest from the second to the third period (1980 to 1984). In the following periods, the number grew moderately between 17 and 30 percent (periods from 1985 to 1989 and 2000 to 2004). Starting from the period covering the years 2000 to 2004, the increase was higher than average again, with the number of international students more than doubling from the period covering the years 2000 to 2004 to the period 2010 to 2015. This represents a growth from period to period of 45 and 42 percent.[4]

[3]The number is calculated as the sum of hosted students over the destination countries including students from unknown countries of origin.

[4]Note that Germany did not report the number of incoming students in the period from 2000 to 2004, meaning that data from Germany are missing in this period. For comparison, in the period before and after, Germany received about 160 thousand and 199 thousand students, respectively.

Note that from the sixth period (1995 to 1999) onwards, the number of reporting destination countries increased as in 1998 UIS online data became available. Surprisingly, the number only grew by 28 percent compared to the previous period that only covered a limited number of destination countries. This low increase can be explained by the high concentration of destination countries (see section 3.2.3), meaning that the increasing number of destination countries does not lead to a proportional increase in the number of international students.

Figure 3.2: Number of international tertiary students in comparison to the total tertiary sector



Note: The bars show the number of international students worldwide in millions that is calculated as the sum of hosted international students over all available destination countries (unbalanced dataset). Due to the patchy coverage, data are shown for the years 1970 to 2015 as averages over five years and six years for the last period. The grey line demonstrates international students as a share of the total number of tertiary students for a balanced dataset where data are available for all nine periods for the number of international students and the number of tertiary students enrolled. This is the case for the 16 destination countries Belgium, Denmark, France, Hungary, Ireland, Italy, Japan, Netherlands, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.
Source: International students: UNESCO Statistical Yearbooks (until 1996) and UNESCO Institute for Statistics (UIS) online database (1998 onwards). Data for 1997 are not available.
Total number of tertiary students: UIS.Stat (2019).

Looking at the development in absolute terms, the number grew on average by 410 thousand international students per period. The highest growth was achieved in the last period when the number grew by more than one million students. In comparison, an increase of one million students took place between the first and sixth period. This reflects the extraordinary growth in recent years.

3.2.2 Development of International Student Mobility in Comparison to the Total Tertiary Sector

Besides the development of the absolute number of international students over years, it is also important to see how the number of international tertiary students has developed in relation to the total tertiary education sector worldwide. This ratio allows us to conclude whether the increase in international students is due to the increase in the tertiary sector worldwide in general, that is, more students are enrolled in tertiary education in general, or whether the number of international students is increasing more than the tertiary sector. The latter case would mean that students have a greater tendency to study abroad rather than remain in the country of origin.

Figure 3.2 therefore also shows for each period the number of total international students as a share of the total number of all tertiary students enrolled worldwide (grey line). As data are not available for all years and all destination countries, the share is only calculated for the years where the destination country reported both the number of total tertiary students enrolled in the country as well as the sum of hosted international students, including students from unknown countries of origin. Due to the variation in the share over the different countries, a comparison over years requires a balanced data set where the same number of reporting destination countries is included. As the data from the Statistical Yearbooks are only available for a very limited number of countries, balancing the data set allows for the inclusion of 16 destination countries over time.[5]

The share of international students of the total number of tertiary students increased constantly over all periods. Starting with 2.1 percent in the first period, the share increased to 4.7 percent in the last period. As in the case of the absolute numbers, the highest growth was achieved between the last two periods, where the share increased by 0.6 percentage points. This suggests that the increase in international students in this period was notably higher than the rise in the number of tertiary students enrolled. As most of the reporting countries are among the top destination countries, the presented data can be biased and therefore has to be interpreted with caution.

3.2.3 Concentration of International Student Mobility

This section considers the concentration of destination and origin countries separately.[6] Due to the patchy coverage, I present the data for averages consisting of ten years rather than using data for selected years. The graphs compare the 1970s to the 1980s–regarding

[5]The countries that report both, the number of international students as well the number of tertiary students enrolled, over all nine periods are Belgium, Denmark, France, Hungary, Ireland, Italy, Japan, Netherlands, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the USA.

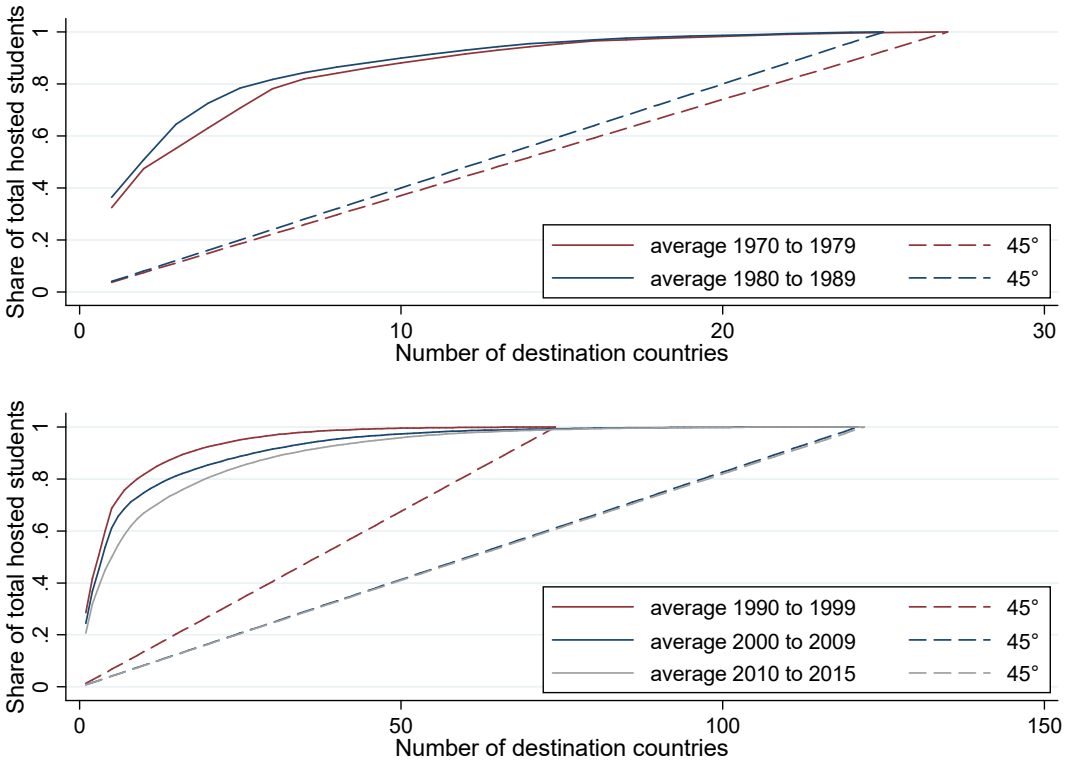
[6]The concentration of bilateral student exchange of country pairs is shown in Appendix A.2.

the average over the years 1970 to 1979 and 1980 to 1989, respectively–and the average over the years 1990 to 1999, 2000 to 2009 as well as the years from 2010 to 2015, which are the latest available years.

Concentration of Destination Countries

Figure 3.3 shows the concentration of the destination countries. The number of destination countries is shown on the x-axis and the share of the total hosted students of each destination country is aggregated on the y-axis in descending order. The numbers shown are the number of hosted students from both known and unknown countries of origin in the available destination countries. The dotted line demonstrates the case where each destination country accounts for the same share of hosted international students.

Figure 3.3: Concentration of destination countries



Note: The figure shows the concentration of the number of international students for the reporting destination countries. The data present the number of hosted students from known and unknown countries of origin for an average over ten years and six years for the last period. The dotted line presents the scenario where each country of destination hosts the same number of international students for each period considered.
Source: UNESCO Statistical Yearbooks (until 1996) and UNESCO Institute for Statistics (UIS) online database (1998 onwards). Data for 1997 are not available.

The top graph of figure 3.3 compares the 1970s (red line) to the 1980s (blue line), where 27 and 25 destination countries host 590 thousand and 952 thousand students, respectively. Interestingly, the graphs start on the y-axis at 32.5 and 36.4 percent for

the 1970s and 1980s. Hence there is a strong concentration on the top one destination country that is, in fact, increasing.[7] Including the next four biggest destination countries, the top five destination countries account for 77.0 and 78.5 percent in the 1970s and 1980s, respectively. The bottom graph in figure 3.3 compares the 1990s (red line) to the 2000s (blue line) and the average over the years 2010 to 2015 (grey line). The number of destination countries is higher, as these years include the data from the online UIS database, which are available for more years compared to the data from the UNESCO Statistical Yearbooks. The number of destination countries increases over the periods which have been included, from 74 in the 1990s to 121 destination countries in the 2000s and 122 in the last period.

Compared to the top graph, the share of the destination country that hosts the most students decreases over the three periods, from 28.6 percent in the 1990s to 24.4 percent and 20.7 percent in the two following periods.[8] The share of the top five countries also decreases over the years, from 68.7 percent in the 1990s to 61.2 percent in the 2000s and 49.9 percent in the last available period. Although the decrease of the concentration of the top countries from the 1990s to the 2000s could be due to the increasing number of reporting destination countries, this is not possible for the change from the 2000s to the last period. Thus, there is a strong concentration on a few destination countries that is, however, decreasing over time. This can be explained by the fierce competition of countries that strive to attract students.

Concentration of Countries of Origin

Figure 3.4 shows the concentration of the source countries. The number of countries of origin is shown on the x-axis and the share of the total number of students sent abroad from each country of origin is aggregated on the y-axis in descending order. The numbers shown are the number of students sent by known countries of origin to destination countries and therefore do not include the students from unknown countries of origin or zero student stocks. The dotted line demonstrates the concentration in the case of a linear concentration of students sent abroad by each country of origin for each period.

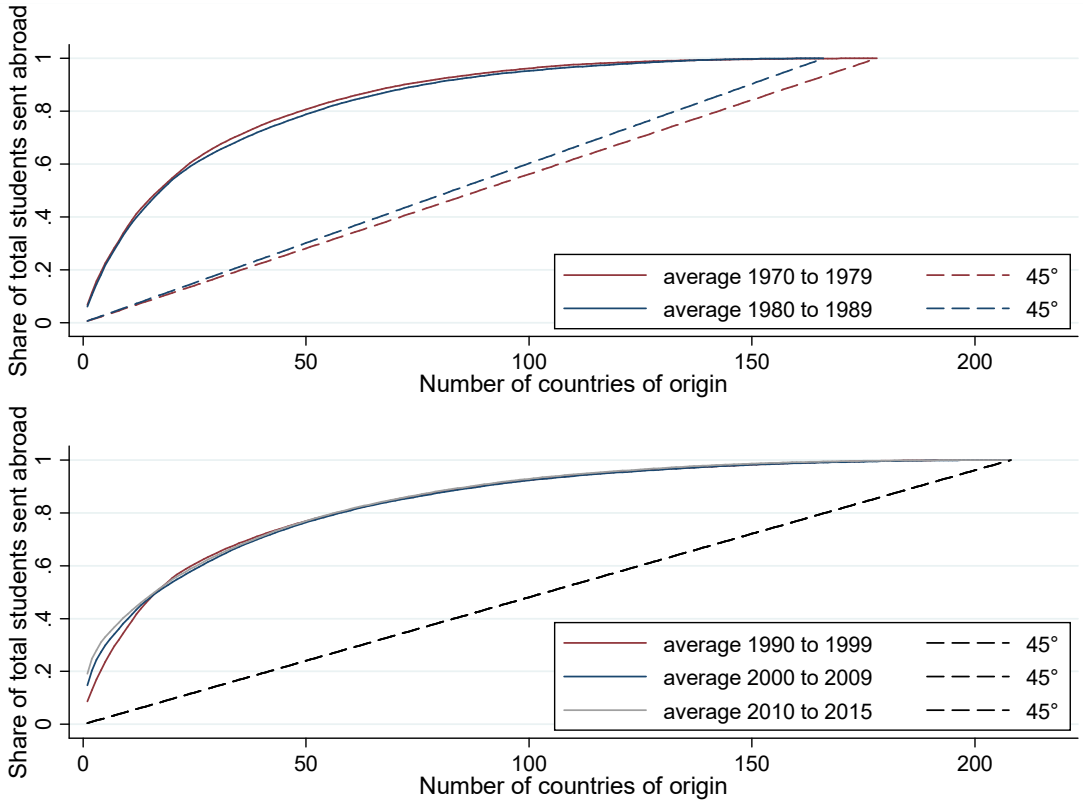
The red line and the blue line in the top graph in figure 3.4 present the concentration of countries of origin in the 1970s and 1980s, respectively. In the 1970s, 178 countries of origin are displayed on the x-axis that sum to a total of 533 thousand international

[7]Although the number of reporting destination countries is lower in the 1980s, the increase in the share of the top destination country is not due to this, as those countries that only reported in the 1970s (Mexico, Norway, Slovakia) accounted for only a small share of the total students. Without these countries, the share of the top destination country would be 32.7 percent in the 1970s.

[8]Note that for all decades the top destination country is always the USA, whereas the destination countries on the second to fifth rank vary over the considered periods. Chapter 4.1 demonstrates which countries rank the highest in the different periods.

students compared to 166 countries of origin in the 1980s that sent 828 thousand students abroad. The top country of origin accounts for a share of 6.7 percent in the 1970s and 6.0 percent in the 1980s.[9] The top five countries of origin send a total share of 22.5 and 21.7 percent in the 1970s and 1980s abroad and the top ten source countries account for a share of 36.4 and 35.5 percent, respectively. Clearly, the concentration of the origin countries is notably lower compared to the concentration of the destination countries in the 1970s and 1980s presented in figure 3.3.

Figure 3.4: Concentration of countries of origin



Note: The figure shows the concentration of the number of international students sent abroad from known origin countries for an average over ten years and six years for the last period. The dotted line presents the scenario where the same number of international students is sent abroad by each country of origin for each period considered.
Source: UNESCO Statistical Yearbooks (until 1996) and UNESCO Institute for Statistics (UIS) online database (1998 onwards). Data for 1997 are not available.

The bottom graph in figure 3.4 compares the 1990s (red line) to the 2000s (blue line) and the average over the years 2010 to 2015 (grey line). In all periods 208 countries of origin are displayed on the x-axis, which facilitates the comparison of the periods. These countries sent in total 1.4 million and 2.3 million students abroad in the 1990s and 2000s, respectively, and 3.7 million students in the last period. Over the periods, the share of

[9]Note that the top country of origin in the 1970s is Iran and from the 1980s onwards it is China, whereas China ranked in fourth place in the 1970s.

the top one source country is seen to be clearly increasing over time, from 8.7 percent in the 1990s to 14.8 percent and 19.1 percent in the 2000s and the last period, respectively. This stands in contrast to the decreasing share of the top destination country for the same period, shown in figure 3.3. However, despite the reverse trend of the concentration of the destination and source countries, the share of the top destination country (20.7 percent) is still slightly higher compared to the top country of origin. Furthermore, the share of the top five countries of origin increases over the years, accounting for 23.6 percent and 29.9 percent in in the 1990s and the 2000s, respectively, and a share of 33.1 percent in the last available period. Again, this trend stands in contrast to the decreasing share of the top five destination countries from the 1990s onwards, but the share of the top five destination countries is still higher than the share of the sending countries (the top five destination countries account for 49.9 percent versus a share of the top five sending countries of 33.1 percent in the last period). The increasing share of the origin countries can be due to the policy efforts of some nations that try to build capacity by sending their students abroad.

Chapter 4

Descriptive Analysis of the Destination and Origin Countries

4.1 Destination Countries

This section strives to give an overview of the destination countries of international students and to highlight those countries that are especially successful in attracting them. In doing so, the chapter will regard the countries that have always been among the top countries as well as those that have recently emerged as important destination countries.

4.1.1 Absolute Number of Hosted International Students

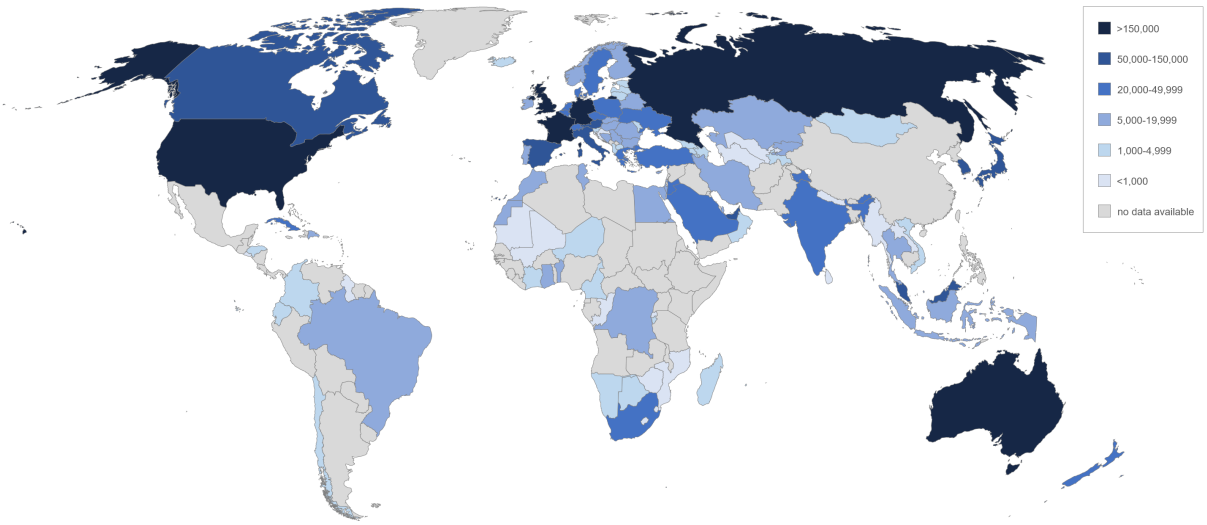
Figure 4.1 presents a map chart where the number of hosted international students including students from unknown countries of origin is shown. As data are not available for each destination country for each year, data are shown as an average over the years 2010 to 2015. For this period, data are available for 121 destination countries.[1]

Out of the 121 destination countries, 6 countries host more than 150 thousand students. These countries are in descending order the United States (778 thousand students), the United Kingdom (418 thousand students), Australia (256 thousand students), France (234 thousand students), Germany (190 thousand students), and Russia (165 thousand students). Furthermore, Japan, Canada, and Malaysia each hosted more than 100 thousand international students.[2]

[1] As the number of hosted international students is different when regarding the average or yearly data, figure B.1 in Appendix B.1 demonstrates the map for the most recent year 2015 where data are available for 89 destination countries.

[2] The number of hosted students in Malaysia is only available for the years 2014 and 2015, hence, the average does not include the years 2010 to 2013. As the number of hosted students increased sharply in Malaysia in recent years, the regarded average is likely to be upward biased.

Figure 4.1: Average number of hosted international students by destination country in the period 2010 to 2015



Note: The figure demonstrates the number of hosted international students, including students from unknown countries of origin, for each destination country where data are available. As data are not available for all destination countries for each year, data are shown as an average covering the years 2010 to 2015.

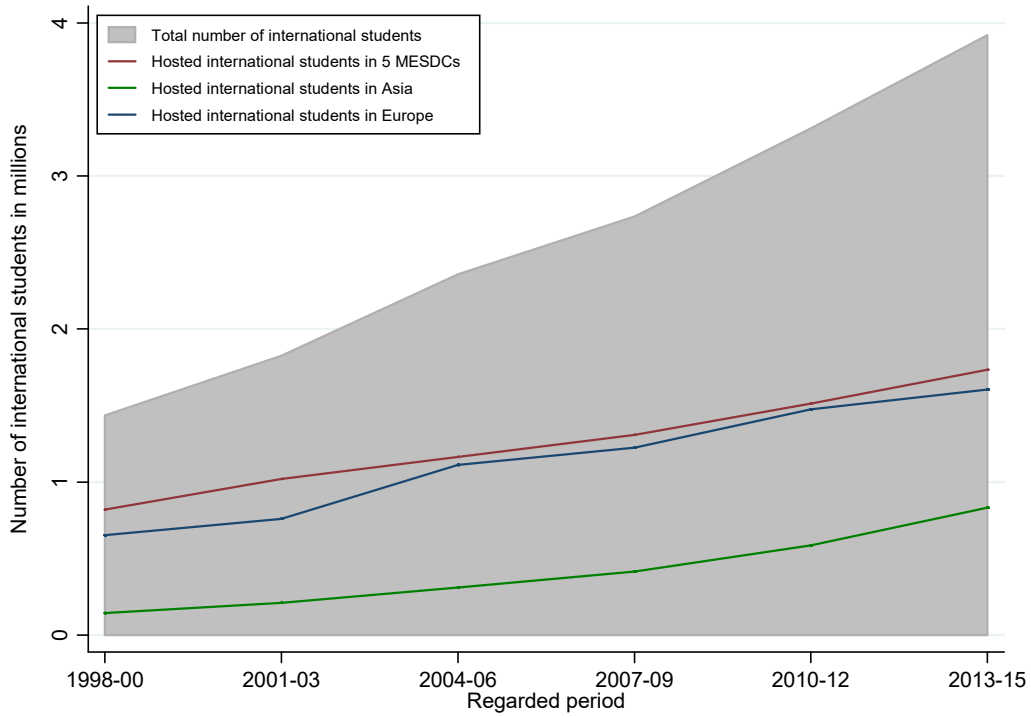
Note that 4 out of the 9 mentioned destination countries hosting more than 100 thousand students are English-speaking countries. In general, English-speaking destination countries can be regarded as a special destination region for international students as their education system at tertiary level is organized differently. Apart from the advantage that the language of instruction in these countries is the *lingua franca* of the world economy, they also host most of the world's top universities and the role of private institutions is much more important. A term has been established in the literature for the five major English-speaking destination countries–the so called MESDCs, the major English-speaking destination countries–which refers to the United States, the United Kingdom, Australia, Canada, and New Zealand (Gürüz, 2011). Four of these countries are among those considered as the typical destination countries and New Zealand has recently emerged as an important destination country, as section 4.1.4 will show.

Furthermore, a large number of the important destination countries are European countries. Apart from the above-mentioned English-speaking countries, France and Germany have also historically attracted a high number of international students, as the next section will describe in more detail. Another regional group that can be identified among destination countries that hosts a high number of international students are Asian countries. Therefore, figure 4.2 demonstrates the development of the destination regions covering Anglo-Saxon, European, and Asian countries.[3]

[3]Note that the United Kingdom is included both in the European countries and 5 MESDCs.

The figure shows the absolute number of international students worldwide as well as for each region. As data are not available for each year for each destination country, data are shown for periods over three years from 1998 onwards.[4] However, the number of reporting destination countries still varies over the time periods which have been considered, so a comparison between the periods has to be interpreted with caution. For instance, data for Germany are not available for the first two periods which in turn has a reducing effect for the share of Europe as can be seen in the graph.

Figure 4.2: International students in selected destination regions over time



Note: The figure demonstrates the total number of international students in millions worldwide as well as for special destination regions. Five MESDCs are the major English-speaking destination countries (Australia, Canada, New Zealand, USA, United Kingdom). As data are not available for all destination countries for each year, data are shown as averages over three years. Nonetheless, data for each destination country are not covered in each period, for instance, data for Germany are not available for the first two periods. Data are shown for the years 1998 onwards, as prior years only cover a limited number of destination countries.

Another important country that did not report the number of hosted students is China. China has emerged as one of the most important destination countries, hosting about 157 thousand students in 2017, and is therefore the second most important Asian destination country behind Japan with 164 thousand students (OECD, 2019).[5] Therefore, the number

[4]Data before 1998 are only available for a limited number of destination countries. Each country is assigned to a continent based on the UNESCO database. Therefore, Russia is part of Asia. However, as Russia joined the Bologna Process in 2003, it might also make sense to consider Russia as part of Europe, especially for recent years.

[5]The OECD and UNESCO provide data for the total number of hosted students in China for few single years, but not by country or region of origin. Therefore, the number of hosted students in China

for Asia is likely to be downward biased.

The absolute number of hosted students increases for all destination regions over all six regarded periods. The increase in the different destination regions, however, varies. While the total number of international students increased by a factor of 2.7 from the first to the last period, the number of hosted students in the five MESDCs increased only by a factor of 2.1, from 820 thousand students to 1.735 million students in the last period. In Asian countries, the number of hosted students increased by a factor of 5.7, from 145 thousand students to 832 thousand students, which represents the biggest percentage increase over the regarded regions. Also in absolute terms, the increase in Asian countries is remarkable given the relative low number in the first period compared to the other regions; the number of hosted students in Asian countries grew by 687 thousand students from the first to the last period, compared to a growth of 914 thousand students in the five MESDCs.[6] This disproportionately high growth rate of hosted students in Asian countries raises the question of if and when Asia will take over the role as the most important destination region.[7]

Regarding the figures for Europe, as previously mentioned, data for Germany are not available for the first two periods. Therefore, it makes sense to regard the figures for the third period onwards. In Europe, the number of international students grew from the third to the sixth period by a factor of 1.4. This increase is the lowest compared to the MESDCs, Asian countries, and worldwide, where the number in the same time span grew by a factor of 1.5, 2.7, and 1.7, respectively.

The disproportionate increase of Asian countries can also be seen calculating the share of each region of the total number of international students worldwide. As Germany accounts for a high share of the total number of international students and data are not available for the first two periods, the share of the regions for the first two periods is biased. Therefore, I consider only the development in the number of students for the third period onwards. While the share of European countries and the five MESDCs decreased from the third to the sixth period by 6.3 and 5.2 percentage points, respectively (47.2 to 40.9

cannot be included in my dataset.

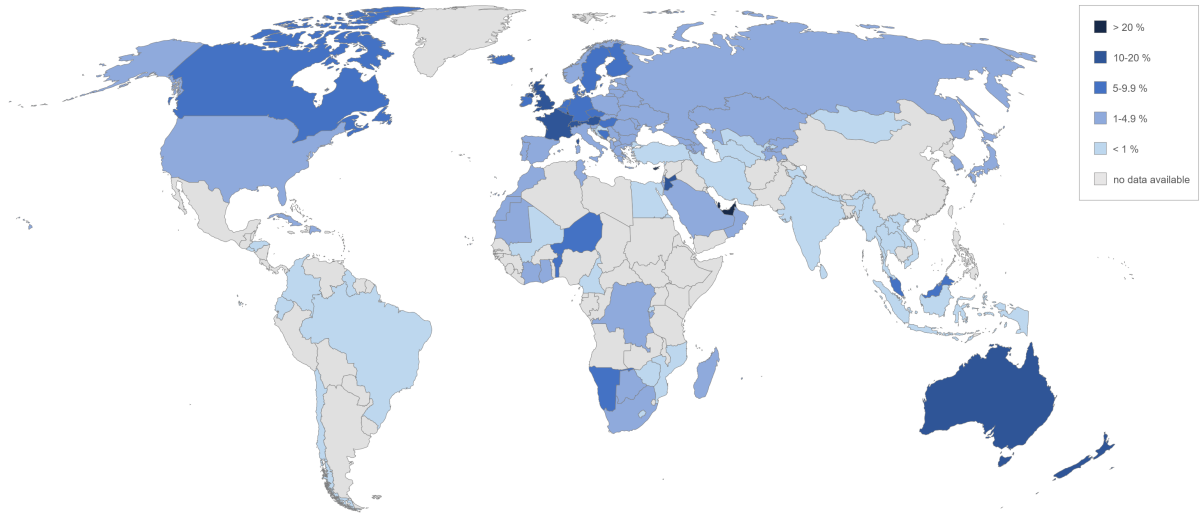
[6]Note, however, that data for Malaysia are only available in the last period when it hosted about 13 percent of the Asian total number (105 thousand students of the total 832 thousand hosted students in Asia).

[7]Assuming the same linear average growth rate over the last periods for Asian countries and the five MESDCs as in the last six periods (growth rate of 41.9 and 16.3 percent, respectively), Asian countries would host more students than the five English-speaking countries after four periods. Hence, in the period 2024 to 2027 the regions would host 3.4 and 3.2 million students, respectively. This scenario is based on calculations taking the average growth rate over all periods. Note that the growth rate in the five MESDCs decreased over the time periods from 24.6 to 14.7 percent, meaning that the scenario of Asian countries hosting more than the five MESDCs is likely to occur earlier. This is even more likely when considering that China as the second most important Asian destination country in 2017 is not included in the data.

percent and 49.4 to 44.3 percent, respectively), the share of Asian destination countries grew by 8 percentage points from 13.2 to 21.2 percent.

4.1.2 Relative Number of Hosted International Students

Figure 4.3: Hosted international students as a percentage of the total number of tertiary students enrolled by destination country in the period 2010 to 2015



Note: The figure demonstrates the number of hosted international students, including students from unknown countries of origin, as a percentage share of the total number of tertiary students enrolled in each country. As data are not available for all destination countries for each year, data are shown as an average covering the years 2010 to 2015. Some countries are not visible due to the small country size. For instance, countries hosting more than 20 percent that are not visible in the graph are Andorra, Grenada, Liechtenstein, and Quatar.

Among the countries that attract a high number of international students, it is worth noting smaller countries such as Malaysia, the United Arabian Emirates, the Republic of Korea, or Austria. Therefore, besides the total number of hosted students it is also important to regard the share of the hosted international students in the total number of tertiary enrolled students in a destination country. Figure 4.3 shows the map chart that is colored according to the relative share of hosted international students in each destination country where data are available.

Out of the 120 destination countries, 11 countries host international students that account for a share higher than 20 percent of the total number of tertiary students enrolled in the country. These countries in descending order are Liechtenstein, Grenada, the United Arabian Emirates, Luxembourg, Qatar, Macao Special Administrative Region, Andorra, Sint Maarten (Dutch part), Saint Kitts and Nevis, Palau, and Cyprus. They have in common that they are among the smallest countries and so cannot be properly seen in the map chart (with the exception of the United Arabian Emirates and Cyprus). This is in line with intuition, as small countries that have a small base of tertiary students

achieve a higher share more easily than countries with a high number of tertiary students. Furthermore, hosting students allows them to offer a wider range of study programs which is an incentive particularly for smaller countries to attract foreign students.

The next group consists of 11 destination countries with a share of international students standing between 10 and 20 percent. In contrast to the first group that consisted exclusively of very small countries, 3 countries out of 11 are also top destination countries in absolute terms as they hosted more than 150 thousand students in the same period: the United Kingdom, Australia, and France with a share standing at 17, 15, and 10 percent, respectively. Furthermore, Austria, Switzerland, and New Zealand all have a share of close to 16 percent. This is above the average share of 7.5 percent.[8] Hence, these countries are among the important destination countries in absolute as well as in relative terms.

In contrast, Germany, the United States, and Russia were among the top six destination countries in absolute terms. Regarding the share of incoming students among the total tertiary enrolment, the share of each destination country is 7, 4, and 2 percent, respectively, and therefore below average.

The remaining European countries mainly have a share ranging between 1 and 5 percent, with the exception of the Czech Republic, Denmark, Bosnia, Ireland, Iceland, Belgium, and the Netherlands (in descending order). Among the Asian countries, the share of international students among the total tertiary enrolment mainly stands below 1 percent or between 1 and 5 percent. An exception, as in the case of the absolute number of hosted students, is Malaysia with a share of 9 percent.

4.1.3 The Most Important Destination Countries

In order to see how the top destination countries have changed and developed over time, table 4.1 shows the top 20 destination countries looking at averages over a period of five years and six years for the last period.

The top table demonstrates the data taken from the UNESCO Statistical Yearbooks which means that the number of destination countries is limited. Also in the bottom table, where data are taken from the online database, data are not available for each destination country for each period. Therefore, other important destination countries may be missing in the table.[9]

[8]The average share in this case is calculated using the share of each destination country and dividing it by the number of destination countries. Hence, each country has the same weighting factor.

[9]According to Gürüz (2011), Egypt, Lebanon, and Saudi Arabia were also among the top 10 destination countries in the 1980s. These countries are not displayed in the table as the UNESCO Statistical Yearbooks do not provide data for all destination countries for all years (see chapter 3.1.3). Furthermore, China did not report the number of hosted students since data are available from the UNESCO online

Table 4.1: Top 20 destination countries over time

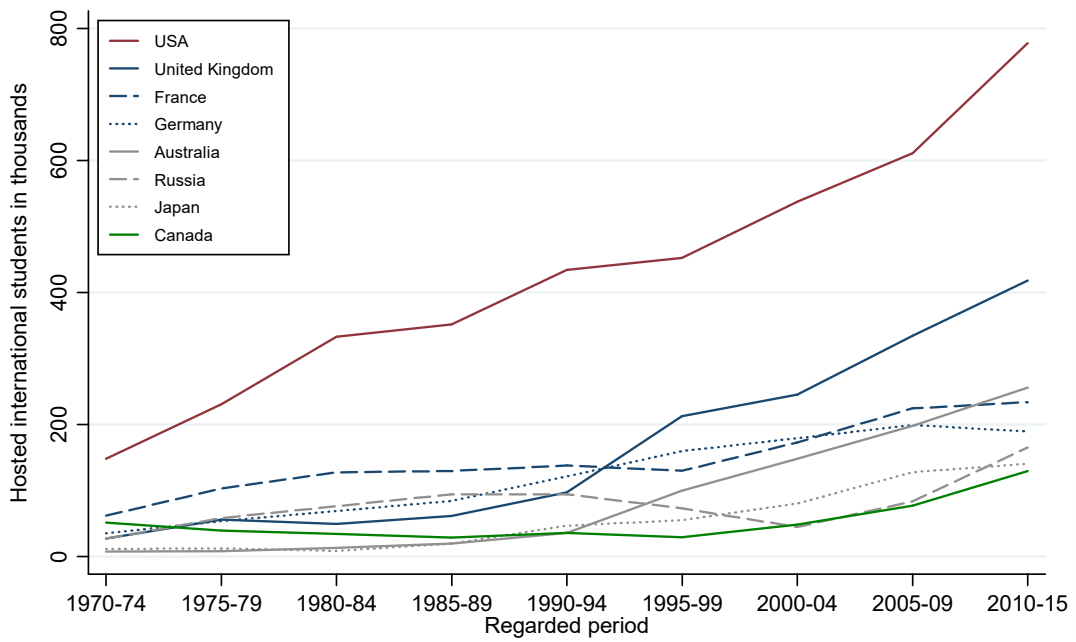
Number of hosted students in thousands										
Rank	**1970-74**		**1975-79**		**1980-84**		**1985-89**		**1990-94**	
1	USA	148	USA	231	USA	333	USA	352	USA	434
2	FRA	62	FRA	103	FRA	128	FRA	130	FRA	138
3	CAN	51	RUS	58	*RUS**	*76*	RUS	94	GER	122
4	GER	35	GBR	56	GER	69	GER	84	GBR	98
5	RUS	27	GER	54	GBR	49	GBR	62	RUS	94
6	GBR	27	CAN	40	CAN	34	CAN	29	JPN	47
7	ITA	19	ITA	25	ITA	28	BEL	25	CAN	36
8	JPN	12	BEL	14	CHE	16	ITA	21	AUS	36
9	CHE	10	JPN	13	BEL	15	AUS	20	BEL	30
10	ESP	10	CHE	12	AUT	14	JPN	20	CHE	24
11	BEL	9	AUT	11	AUS	13	AUT	16	AUT	22
12	AUT	9	GRC	9	ESP	11	CHE	16	ITA	22
13	AUS	8	ESP	9	SWE	10	ESP	14	CHN	18
14	GRC	7	AUS	9	JPN	9	SWE	11	SWE	14
15	TUR	6	SWE	7	GRC	7	NLD	8	ESP	12
16	SVK	3	TUR	6	TUR	6	TUR	8	NLD	11
17	POL	2	NLD	4	NLD	4	DNK	4	NOR	9
18	NZL	2	DNK	3	DNK	3	CHN	4	TUR	9
19	SWE	2	NZL	3	POL	3	PRT	3	DNK	7
20	HUN	2	HUN	2	IRL	3	POL	3	HUN	6

Number of hosted students in thousands										
									Δ % 2010-15 to	
Rank	**1995-99**		**2000-04**		**2005-09**		**2010-15**		**1995-1999**	**1970-1974**
1	USA	453	USA	538	USA	611	**USA**	778	72%	425%
2	GBR	213	GBR	245	GBR	334	**GBR**	418	97%	1437%
3	GER	160	*GER**	*180*	FRA	225	**AUS**	256	157%	3235%
4	FRA	130	FRA	173	GER	199	**FRA**	234	80%	278%
5	AUS	100	AUS	148	AUS	198	**GER**	190	19%	435%
6	RUS	73	JPN	81	JPN	128	**RUS**	165	126%	505%
7	JPN	55	CAN	49	RUS	84	**JPN**	141	155%	1088%
8	BEL	35	RUS	45	CAN	77	**CAN**	130	341%	152%
9	CAN	29	ESP	39	ITA	53	**MYS****	105	no data	no data
10	AUT	27	ZAF***	36	ZAF***	50	**ITA**	78	242%	308%
11	ESP	27	BEL	31	AUT	49	**AUT**	66	143%	619%
12	CHE	24	AUT	31	NZL	35	**ARE****	59	no data	no data
13	ITA	23	ITA	31	CHE	33	**KOR*****	57	2021%	no data
14	TUR	17	CHE	30	KOR***	32	**ESP**	57	113%	498%
15	ZAF***	17	NZL	21	ESP	28	**NLD**	49	259%	2589%
16	SWE	15	SWE	20	KGZ***	25	**SAU*****	48	688%	no data
17	NLD	14	NLD	16	CZE	24	**ZAF*****	48	182%	no data
18	ROM	13	JOR***	16	JOR***	23	**CHE**	44	83%	346%
19	HLS**	9	TUR	16	CUB***	23	**NZL**	42	589%	1607%
20	NOR	9	MAC***	15	UKR***	23	**TUR**	40	129%	544%

Note: The table shows the number of hosted students in thousands including students from unknown countries of origin.
Due to the patchy coverage, the numbers are shown as averages over five years and six years for the last period. Nonetheless, data are not available for all countries for each period. This is especially the case for the top table, as data from the UNESCO Statistical Yearbooks are only available for a limited number of destination countries. Data for China are only available for the periods 1980-84 to 1990-94.
For the years prior to 1990, data for Germany include the former German Democratic Republic. For the years prior to 1991, Russia includes all the countries that formerly belonged to the USSR.
* Data are not available for this period. The shown value is an estimate calculated as the average over the prior and following period.
** Data are only available for one period.
***Data are only available for the periods 1995-99 onwards as these data are taken from the UNESCO online database. Out of the top 20 destination countries shown, data for KGZ, MAC, and JOR are not available for the period 1995-99, data for UKR are only available for the periods 2005-09 and 2010-15.
Source: UNESCO Statistical Yearbooks (until 1996) and UNESCO Institute for Statistics (UIS) online database (1998 onwards). Data for 1997 are not available.

Although the number of hosted students has developed differently in the destination countries and the countries ranked among the top 20 have changed as a result, the top eight destination countries of the last period were among the top destination countries throughout the whole period that was analyzed: The United States, the United Kingdom, France, Germany, Australia, Russia, Japan, and Canada. While the United States, the United Kingdom,[10] France, and Germany were among the top 5 destination countries throughout all periods, Australia, Canada, Russia,[11] and Japan changed their rank over time.[12]

Figure 4.4: Number of hosted international students in the top destination countries over time



Note: Number of international students in thousands is calculated as the sum of hosted students in the destination countries including students with unknown origin. Countries that are displayed with a solid line are English-speaking countries; the navy lines refer to European countries. As data are not available for all destination countries for each year, data are shown for the years 1970 to 2015 as averages over five years and six years for the last period. Data for Germany are not available for the period 2000 to 2004. For the years prior to 1999, data for Germany include the German Democratic Republic. For the years prior to 1991, Russia includes all countries that belonged to the USSR.

Figure 4.4 demonstrates the development of these eight destination countries over the years 1970 to 2015, including periods over five years, and six years for the last period.

database so that China is missing in the bottom table. Note that China has emerged as one of the most important destination countries, hosting about 157 thousand students in 2017 according to the OECD (2019), meaning that it was the second most important Asian destination country in this year after Japan.

[10] With the exception of the period covering the years 1970 to 1974.

[11] Russia includes all former countries of the USSR prior to 1991.

[12] Appendix B presents the yearly number of hosted students by region of origin for the top 5 destination countries–namely the United States, the United Kingdom, Australia, Germany, and France.

Anglo-Saxon Destination Countries

Out of the 8 presented classical destination countries, 4 countries are English-speaking destination countries. As described in section 4.1.1, the tertiary education system in anglophone countries is especially attractive to international students as they host a large number of the best tertiary institutions worldwide and the language is the world's lingua franca.

The United States The country that attracted the highest number of international students over all periods is the United States. Over the nine regarded periods, the number of foreign students rose from 148 thousand to 778 thousand students. This represents a total growth by a factor of 5.3 and a compound average growth rate in each five-year period of 23 percent. Particularly in the first three periods which cover the years 1970 to 1974 until 1980 to 1984, the number of hosted students saw an extraordinary increase, with an average periodical growth of 50 percent. Given the high number of international hosted students in the first period and the high percentage increase in the first three periods, especially compared to the other countries, the gap between the United States and the remaining destination countries increased sharply during the years 1970 to 1984. In the time between the second half of the 1980s and the second half of the 2000s the number grew only moderately, with an average growth of 13 percent in each five-year period, whereas in the last period the number grew sharply again.

Looking more closely at the yearly development of the 2000s, the number of hosted students increased until 2003, decreased slightly in 2004 and remained almost stable until 2007. Note that after 9/11, security concerns increased, and visa procedures were tightened so that new applicants felt "less-than-welcome". Many blamed the decreasing number of international students on these tightened procedures. However, it is now recognized that the restrictive visa policy and its consequences are only part of the problem of the stagnating number of international students, as student mobility has to be regarded in a global context, where economic conditions and tertiary education systems are expanding and improving all over the world. In order to increase the attractiveness of the United States for international students again and to combat the fierce competition, in the years afterwards new policies and measures were implemented for the first time at the federal level (Gürüz, 2011).

The United Kingdom The second largest destination country in recent years is the United Kingdom. Even though it historically has attracted a high number of international students based on the reputation of UK institutions, colonial connections and British policies that were driven by cultural and political rationales (Gürüz, 2011), the United Kingdom did not always rank second among the top destination countries. Starting with

27 thousand students in the first period, the United Kingdom ranked behind the United States, France, Canada, Germany, and Russia. This number grew by a factor of 15.4 to 418 thousand students in the last period. Comparing the number of hosted international students in the United Kingdom to the United States, the United States hosted 121 thousand students more than the United Kingdom in the first period, in other words 5.4 times more students. This gap between the two countries increased until the period 1990 to 1994, where the United States hosted 336.9 thousand students more than the United Kingdom. In the following period, the United Kingdom experienced a phenomenal growth of roughly 120 percent compared to the previous period. Due to this sharp increase, the country ranked second behind the United States from this period onwards. Note that the United Kingdom radically reconstructed its universities during the second half of the 1980s. In this period, universities had to act like entrepreneurs to diversify revenue sources (Gürüz, 2011), so the economic rationale has been the main driver of British policies since the mid-1980s (Böhm et al., 2004). In the following periods, the delta to the United States decreased to 277 thousand students in the period 2005 to 2009 which means that the United States only hosted 1.8 times more international students than the United Kingdom. As the growth in the last period in the United States outperformed the growth in the United Kingdom, the gap between the two countries increased again. In this period, the United Kingdom hosted 418 thousand students and therefore 360 thousand students less than the United States.

Australia A third English-speaking country that can be regarded as one of the classically most important destination countries is Australia. This country hosted the lowest number of international students in the first period among the presented English-speaking countries. Starting with 7.7 thousand hosted international students in the first period, the number grew by a factor of 33.3 to 256 thousand students in the last period. This represents a compound average periodical growth rate of 55 percent, making Australia the anglophone destination country with the highest growth over all periods. As in the case of the United Kingdom, the number of hosted students saw its highest growth in the period covering the years 1995 to 1999, where it grew by 177 percent. Due to this high growth, Australia outperformed Canada and took over the rank as the third largest English-speaking destination country since this period.

Beyond the extreme growth in the 1990s, especially in the second half of the decade, Australia and the United Kingdom have in common that both introduced the full fee tuition policy in the 1980s (see also chapter 2.2.4). Being driven by mainly economic rationales, the country started with active recruitment practices in the late 1980s (Gürüz, 2011). As Australia is a country of immigrants (Ziguras and Law, 2006), the country introduced measures in 2001 to facilitate studies for foreign students and relaxed visa policies and the requirements to stay and work in the country (Holroyd, 2006). These

measures can be regarded as a sign that the policies of internationalization of higher education is also driven by the skilled migration approach (Gürüz, 2011).

Canada Looking at Canada, the growth pattern is different compared to the other regarded Anglo-Saxon destination countries, as the number of hosted students did not continuously increase over the regarded periods. Starting with the considerably high number of 51 thousand hosted international students, Canada was the second biggest English-speaking destination country worldwide behind the United States, which only hosted 2.9 times more students than Canada. In following periods, the number of hosed students, however, decreased. The number of hosted international students reached an all-time low of 29 thousand students in the period 1995 to 1999. This represents a decrease of 42.9 percent, whereas the number of hosted students in the United States more than trebled. In the following periods, the country started to attract more students again, with the number of hosted international students rising to 129.6 thousand. Despite the sharp increase in the last periods, over all periods the number only grew by a factor of 2.5. Given this low compound average periodical growth rate of 18 percent, Canada ranked behind Australia and the United Kingdom from the 1990s onwards. Much like the United States or Australia, Canada demographically depends on immigrants. As education policy is within the jurisdiction of the provinces and there is no national department of education at the federal level, the federal government has not long been active in implementing internationalization strategies. Starting in 1995, the Canadian Education Centers Network was set up with the initial funding provided by the federal government. The internationalization strategies in Canada are driven by a combination of the revenue-generating and the skilled migration approaches as well as by international branding. The Immigration and Refugee Protection Act aims at attracting foreign students to Canada and facilitates students to work and stay in the country after the studies (Holroyd, 2006; Gürüz, 2011).

The European Destination Countries France and Germany

The European countries France, Germany, and the United Kingdom[13] have historically attracted a high number of international students. These countries all are participating in European programs promoting student mobility. Two of the most important programs are the student exchange program Erasmus funded in 1987 and the Bologna Process that started in 1999. Due to the major importance of the programs, chapters 5 and 6 are dedicated to discussing them in more detail.

[13] As the tertiary education system in the United Kingdom has more in common with the other Anglo-Saxon destination countries, the UK is regarded in more detail in the section discussing Anglo-Saxon destination countries.

France France historically attracted a high number of international students. While France was the second largest destination country for international students in the first period, due to its lower growth rates compared to the other competing destination countries, France ranked fourth behind the United States, the United Kingdom and Australia in the last period. Starting with 62.0 thousand hosted students in the early 1970s, the number grew by a factor of 3.8 to 234.1 thousand students. While the number grew until the early 1990s, in the second half of the decade the number decreased and started to grow again afterwards. In 1998 the public agency Agence EduFrance was founded with the mission of improving the attractiveness of higher education and of providing useful information for students relating to the tertiary education system. There was a shift in the driving force behind the French internationalization strategy from one mainly driven by colonial connections and the cultural approach to a more skilled migration approach driven strategy. However, colonial links still are of major importance (Gürüz, 2011). This is most visible when looking at the major source countries. Despite the increasing role of China as a country of origin, Morocco is still the most important source country and Algeria the third largest (see Appendix B for the number of hosted students from the top 5 countries of origin).

Germany Germany has played an important role in the internationalization of tertiary education. In the nineteenth century, universities traditionally focused on teaching. The philologist and diplomat Wilhelm von Humboldt (1767 to 1835), however, had a different view on the structure of universities which are commonly seen as "the unity of teaching and research". His view led to the introduction of research as the second function of the university. In the years until World War I, the concept of the "German research university" emerged as an international model, which was of major importance for the growing internationalization of tertiary education in this period (Gürüz, 2011).

Looking at the development of the number of hosted students in Germany, the dotted blue line in figure 4.4 represents the numbers in Germany. For the years prior to 1990, data include the former German Democratic Republic. Starting with 35.5 thousand students in the period covering the years 1970 to 1975, the number grew by a factor of 5.3 to 190 thousand students in the period 2010 to 2015. This means that the percentage increase of hosted students exceeded the percentage growth in France in the same period. Comparing France and Germany over the analyzed time periods, Germany ranked behind France until the late 1990s, when the former grew by 31.6 percent compared to the previous period and France decreased by 5.8 percent. In the following periods, the French growth rate exceeded that in Germany again and ranked before Germany in all periods. Note that the number of hosted students in Germany decreased in the last period compared to the previous period, whereas in the remaining classical destination countries the number increased in all countries.

Other Major Destination Countries

Figure 4.4 also shows the destination countries Russia and Japan. As in the case of Canada, the growth of the number of hosted students in these countries varied over years, meaning that their rank changed over the considered time periods.

Russia and the former USSR The former USSR was among the top destination countries until its collapse in 1991. Driven by a political rationale, the USSR had a clear policy for recruiting foreign students, mainly from countries under Soviet influence (Gürüz, 2011). Starting with 27 thousand hosted students, this number grew by a factor of 3.5 to 94 thousand students in the period covering the years 1990 to 1994, showing a similar growth pattern as the United Kingdom in this period. With the collapse of communism, the number of hosted students in Russia, the successor of the USSR, decreased. From the 2000s, the number increased sharply again by a factor of 3.7 to 165 thousand hosted students, ranking behind the United States, the United Kingdom, Australia, France, and Germany. Note that in 2003, Russia became a member of the Bologna Process.[14] Furthermore, in his 2006 speech the Russian President Vladimir Putin called for further internationalization of Russia's education system. The rationale behind the policy is completely different from its predecessor, as it is mainly driven by the revenue-generating approach (Gürüz, 2011).

Japan Another country that can be regarded as a major destination country is Japan. Starting with 11.2 thousand students in the first period, the number grew by a remarkable factor of 11.9 to 140.7 thousand students in the last period covering the years 2010 to 2015. This represents a compound average periodical growth of 36.3 percent. Despite this phenomenal growth, Japan did not reach the target set in 1983 by the Ministry of Education, Science and Culture, to host 100 thousand international students by 2000 (Umakoshi, 1997). While the number of international students rose more than fivefold from the third to the fifth period (periods covering the year 1980 to 1984 and 1990 to 1994), in the following period the growth stagnated. Note that the Asian economic crisis was in 1998. In order to foster internationalization, visa policies were simplified for foreign students as well as the process to obtain part-time employment in 2000 (Gürüz, 2011). From the 2000s, the number of hosted students started to show a renewed growth.

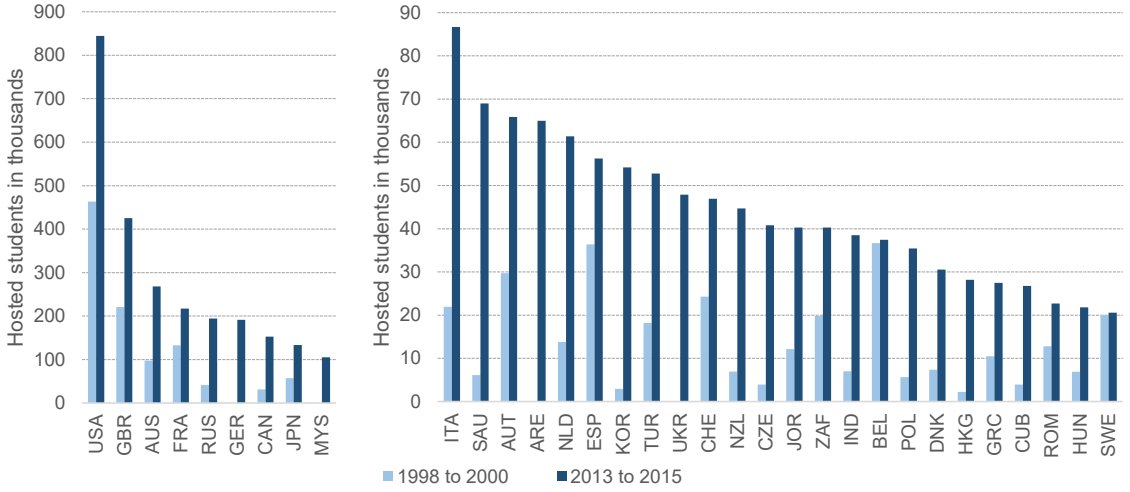
4.1.4 Emerging Destination Countries

While the above-mentioned countries historically attracted a high share of international students over all periods, some countries have recently emerged as important destination

[14] See table D.2 in Appendix D.2 for the full list of the members of the Bologna Process by entry year.

countries. As data for most of these emerging countries are only available for a limited number of years and most of them only reported the number of hosted students for recent years, this chapter regards averages over three years using data from the UNESCO online database.

Figure 4.5: Absolute number of hosted students in the most important destination countries: 1998 to 2000 versus 2013 to 2015



Note: The figure shows the number of hosted international students including students from unknown origin. The left-hand panel demonstrates the destination countries hosting more than 100 thousand students and the right-hand panel demonstrates the remaining destination countries that hosted more than 20 thousand students in the period covering the years 2013 to 2015. Data for Hong Kong and Greece are compared to the period covering the years 2001 to 2003, as data are not available for the period 1998 to 2000. For Greece and Cuba, the navy bars present the data for the period covering the years 2010 to 2012 as data are not available for the period 2013 to 2015. Data for Germany, Malaysia, the United Arabian Emirates, and Ukraine are not available for any of the two prior periods (1998 to 2000 or 2001 to 2003). No data are available for China and Shanghai.

Figure 4.5 presents the number of hosted international students by destination country comparing the periods covering the years 1998 to 2000 and 2013 to 2015. As the graph aims to regard countries that have emerged as important destination countries recently, the figure only regards the destination countries that hosted more than 20 thousand students in the last period. For ease of readability, the graph is separated into two graphs. The left-hand panel presents the countries that hosted more than 100 thousand students in the last period. These countries are the traditional destination countries and are shown in the graph for comparability, although they were already discussed in section 4.1.3.[15] The right-hand panel presents the data for the countries that hosted between 20 and 100 thousand students, which will be discussed in more detail in this section.

The number of hosted students of the countries in the right-hand panel grew by a

[15]As data for Malaysia are only available for recent years, unfortunately it is not possible to calculate the growth.

factor of 5.2 between the two presented periods, which is considerably higher than the growth factor of 2.9 of the destination countries shown in the left-hand panel.

Looking at the absolute increase, the number of hosted students of the countries in the right chart grew on average by 29 thousand students. The countries where the absolute increase was above the average are, in descending order: Italy, Saudi Arabia, Korea, the Netherlands, New Zealand, Czech Republic, Austria, Turkey, India, and Poland. Among these countries, it is possible to identify different country groups that have similar growth-rate patterns: Western European countries, eastern European countries, and Asian countries.

In the western European countries, namely Italy, the Netherlands, and Austria, the number of hosted international students was already high in the first period, meaning that the increase was above average in absolute terms, but not with respect to the percentage increase.[16] Despite the considerable growth in absolute terms, these countries cannot be regarded as new players, as they already hosted a high number of international students before and were among the important destination countries.

On the contrary, in the eastern European countries Poland and the Czech Republic, the number of hosted students was very low in the first period and grew above average by 29.8 thousand and 36.9 thousand students, respectively. Given the low number of hosted students in the first period, the number therefore also increased sharply in percentage terms (an increase of 525 percent in Poland and 936 percent in the Czech Republic). These countries can therefore be regarded as emerging destination countries.

Furthermore, in the Asian countries Korea and India, the number of hosted students was very low in the first period with 3 and 7 thousand hosted international students, respectively. These figures grew considerably by 51 thousand and 31 thousand students, which represents an increase of 1,752 and 450 percent in Korea and India, respectively. Another country that should be mentioned among this group is Hong Kong, where the number grew from 2.2 to 28.2 thousand students, which represents an increase of 1,159 percent. These Asian countries have, therefore, emerged among the most important destination countries in recent years.

Another group of countries that can be identified are Arab countries.[17] In Saudi Arabia the number of hosted students was very low in the first period, with 6.1 thousand students. This number grew by 63 thousand students, which represents an increase of 1,034 percent. The growth patterns in Jordan and Turkey are different, as the number

[16]The percentage increase varies between 122 and 346 percent, and is therefore below the average increase of the countries of 418 percent.

[17]Note that Malaysia also aims at attracting Muslim international students, although regionally the country should be grouped with the Asian countries. Since 9/11, however, Malaysia has taken advantage of the fact that Muslim students did not feel welcome in Western countries anymore (Gürüz, 2011).

of hosted students in the first period was already two and three times higher than the number of hosted students in Saudi Arabia. Even though the number grew by 28 and 34.6 thousand students until the period covering the years 2013 to 2015, the increase in these countries is remarkably lower compared to Saudi Arabia.[18]

Furthermore, New Zealand and Cuba emerged as important destination countries for international students. Similarly to the Central African Republic, these countries can be regarded as outliers within their region regarding their status as a destination country of international students.

While the number of hosted students of most of the countries shown in the right graph more than doubled between the two periods, in Belgium and Sweden the number remained almost stable. In Spain the number grew only moderately with an increase of 55 percent. Due to this low increase, these countries ranked lower over the considered periods, whereas Italy and the Netherlands achieved a higher rank among the top destination countries worldwide. This example demonstrates the fierce competition in attracting international students worldwide.

The remaining countries shown in the right graph are mainly European countries that had already hosted a moderate number of students in the first period and where the number grew less compared to the other countries shown.

4.2 Countries of Origin

As countries are not only incentivized to attract international students but also to send them abroad to study, this chapter strives to give an overview over the sending countries of international students and to highlight those countries that send the highest number of students abroad. In doing so, it will shed light on countries that have always sent a high absolute number of students abroad as well as those that recently emerged as important countries of origin.[19] Since the quality of the outward mobility data strongly depends on the number of reporting destination countries, this chapter strives to provide a brief overview and highlight the main trends.

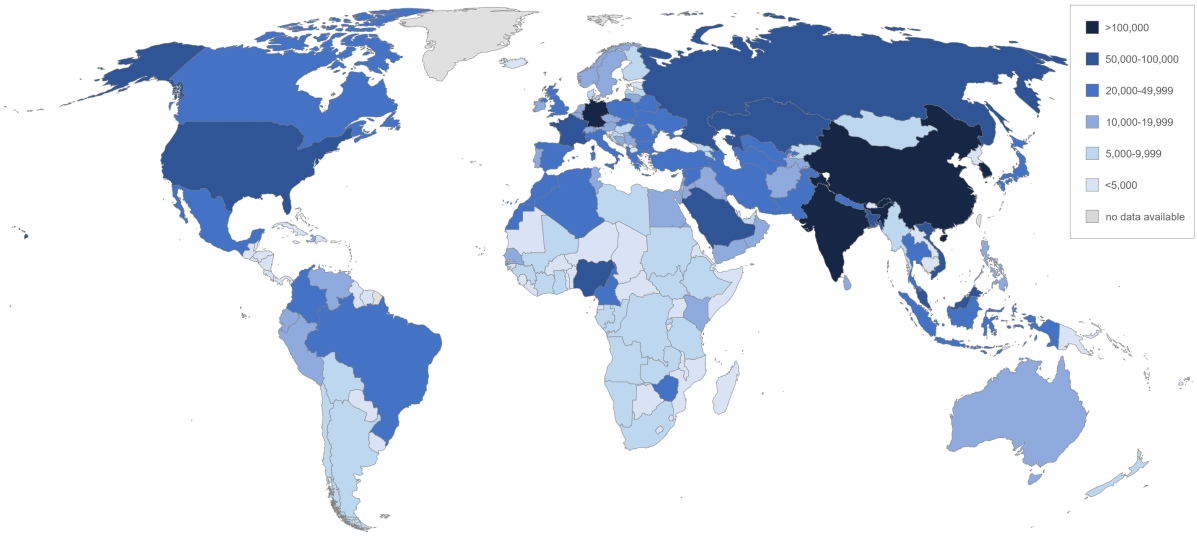
[18] As data for the United Arabian Emirates are not available for previous years, it is not possible to calculate growth between the periods.

[19] This chapter does not report data on the relative number of students sent abroad by country of origin. Since the reliability of the data of students sent abroad strongly depends on the number of reporting destination countries as well as data quality, and the data source of the number of tertiary students studying in a country is independent of that number, calculating the relative share of students studying abroad by country of origin does not provide a reliable picture.

4.2.1 Absolute Number of Students Sent Abroad

Figure 4.6 shows the world map where the countries are colored according to the absolute number of students sent abroad. As in the case of the map where the destination countries were regarded, data are not available for each reporting destination country for each year so that data are shown for an average over the years 2010 to 2015. For this period, data are available for 208 origin countries. The number of students sent abroad is calculated as the sum of the number of hosted students reported by the 121 destination countries.[20]

Figure 4.6: Average number of students sent abroad by country of origin in the period 2010 to 2015



Note: The figure demonstrates the number of international students sent abroad from each country of origin where data are available. The destination countries report the number of hosted students by country of origin meaning that the number of students sent abroad is calculated as the sum over all reporting destination countries. As data are not available for all destination countries for each year which influences the reliability of outward student mobility, data are shown as an average covering the years 2010 to 2015.

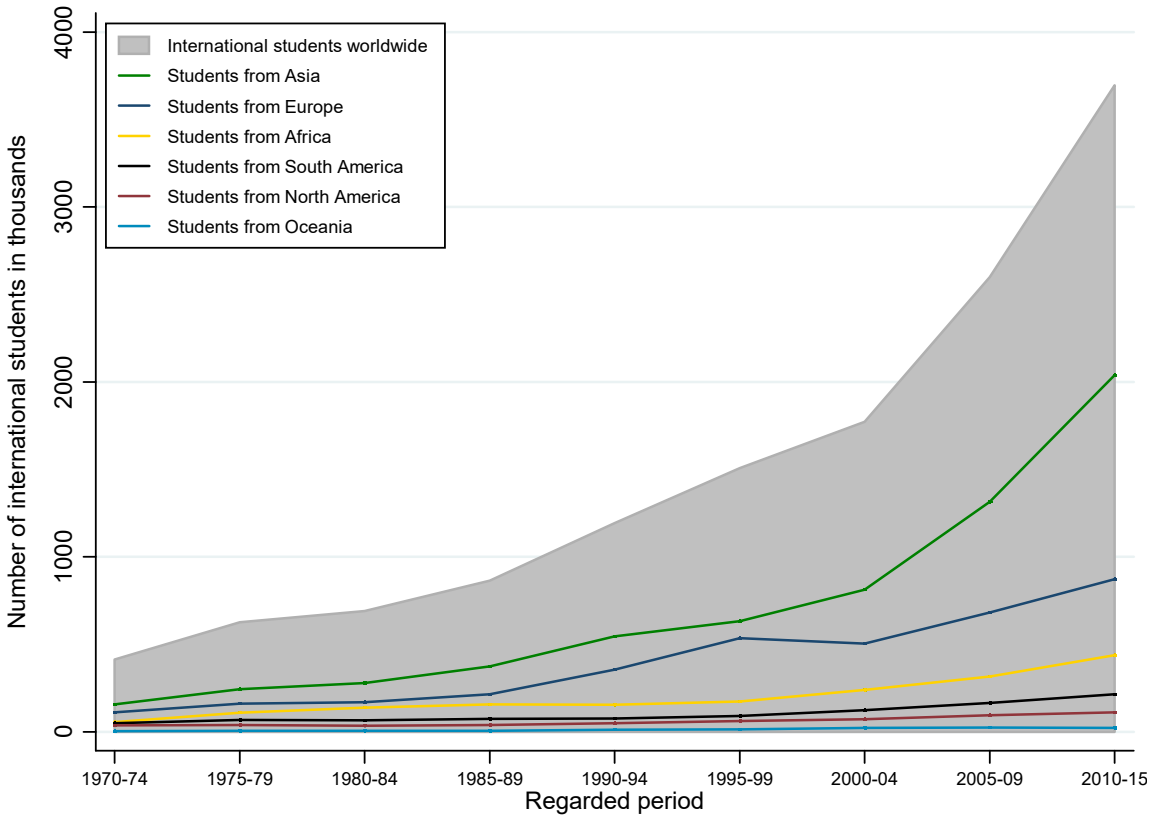
Out of the 208 origin countries, 4 countries sent more than 100 thousand students abroad. In descending order these countries are China (705 thousand students), India (212 thousand students), Korea (118 thousand students), and Germany (115 thousand students). Furthermore, nine countries had an absolute outward student mobility ranging between 50 and 100 thousand students (Nigeria, France, Saudi Arabia, the United States, Malaysia, Kazakhstan, Vietnam, Russia, and Bangladesh). Comparing these numbers to the top destination countries, it is worth noting that the absolute outward mobility of students is lower in the top origin countries. This lower concentration among origin countries compared to the concentration on few destination countries was already presented in

[20] As some origin countries cannot be identified and are labeled by the UIS as students from unknown countries of origin, data used for the map chart excludes unknown countries. As such the number of each sending country is likely to be higher than shown.

chapter 3.2.3. Furthermore, among the top source countries there is a disproportionately high number of Asian countries. This reflects the capacity building approach of Asian countries.

4.2.2 Regions of Origin

Figure 4.7: Regions of origin over time



Note: The figure demonstrates the total number of international students in thousands worldwide as well as by continent of origin. The number of international students in thousands is calculated as the sum of hosted students over all reporting destination countries for each country of origin. Students from unknown countries of origin are not included. The number of reporting destination countries varies over years, meaning that the presented numbers have to be interpreted with caution. This is especially the case if one of the major destination countries did not report the number of hosted students, e.g. Germany in the period 2000 to 2004. As not all destination countries reported the number of hosted students in each year, data are shown as averages over five years and six years for the last period.

Figure 4.7 demonstrates the development of the total number of students going abroad to study as well as for each continent of origin. In order to see how the number of students from specific regions of origin have developed over the years, the former have been divided into continents.[21] The development is shown for the period 1970 to 2015 looking at

[21]The division of the countries into the regions shown is based on the regional division conducted by the UNESCO.

averages over five years, and six years for the last period. Note that the reliability of the data strongly depends on the number of reporting destination countries. Hence, if one of the major host countries does not report the number of hosted students in a period, the data are biased.[22] Therefore, the figure and a comparison between the periods have to be regarded with caution. The number of students with unknown origin is excluded in both charts. Note that the number of reporting destination countries increases for the years 1998 onwards, since data for those years are provided by the UIS online database.

Across all the periods which were considered, the number of international students worldwide grew by a factor of almost 9, starting with 412 thousand in the first period and grew to 3.7 million students in the last period. This growth was mainly driven by Asian origin countries, where the number of students sent abroad grew from 156 thousand student in the first period to 2.1 million students in the last period. This represents an absolute growth of 1.9 million students over all periods, or a factor of more than 13. With an average growth rate in each five-year period standing at around 40 percent, the number grew in almost every period. The only instance where the number of students sent abroad increased by less than 20 percent compared to the previous period were the years 1980 to 1984 as well as the period covering the years 1995 to 1999. It is worth noting that the Asian economic crisis took place during the latter period in 1997/1998. After this period, the number started to grow sharply again, meaning that from the late 2000s onwards students from Asian countries continuously accounted for more than 50 percent of the total number of international students. This high share of Asian students is mainly due to the slower increase in other regions. Europe, the second most important region of origin for international students, started with an absolute number of 112 thousand students in the first period. This reflects a delta of 44 thousand students to the number of students from Asia. Over all periods European outward mobility increased by a factor of 7.8, reaching 873 thousand students in the last period. Hence, over all periods the number increased by 761 thousand students in European countries compared to a growth of 1.8 million students for Asian countries.[23] Since the importance of student mobility to and within Europe is an important topic for policy-makers, which is most visible as the student exchange program Erasmus and the Bologna Process are supported by the EU, chapters 5 and 6 are dedicated to these European programs.

The third most important region over all periods is Africa. The number of students

[22]This is the case, for example, for the period 2000 to 2004 when the destination country Germany did not report the number of hosted students. As Germany is one of the most important destination countries, mostly for European countries of origin (see Appendix B.2), the outward mobility for these origin countries is underestimated in this period. However, as the missing destination country does not report the number of hosted students for any country of origin, all source countries are affected by this lack. Regarding the development for the same number of destination countries using a balanced dataset over all years would lead to a more biased picture.

[23]The decline in the period 2000 to 2004 for students from Europe is likely due to the fact that the destination country Germany did not report the number of hosted students for this period.

sent from African countries of origin grew sharply by a factor of almost 8, from 55 thousand to 438 thousand students. There was particularly strong growth in the number of students sent abroad since the 2000s. In comparison, the role of the remaining continents as regions of origin of international students, namely South and North America as well as Oceania, is not as important. Summing up these three regions, their outward mobility accounted for 22 percent of total outward mobility in the first period and actually decreased over time to 9 percent in the last period. This means that the share of the three continents together is below the share of Asian, European, and African countries regarded separately.[24] Looking at the growth of students sent from South and North America as well as Oceania, the absolute number only grew by a factor of somewhat around 4, 3, and 5, respectively. These lower growth rates explain the decreasing share of these origin regions.

4.2.3 Top Countries of Origin

While the previous section demonstrated how outward mobility of the continents has developed over time, this section strives to give an overview at a country level. In order to see how the top origin countries have changed and developed over time, table 4.2 shows the top 20 origin countries looking at averages over a period of five years and six years for the last period. The top table demonstrates the data taken from the UNESCO Statistical Yearbooks so that the number of reporting destination countries is limited. Therefore, if important destination countries did not report the number of hosted students by country of origin, the presented list is biased. This is also the case for the bottom table. Note that China has emerged as an important destination country in recent years but it has not reported the number of hosted students since 1998. Therefore, the patterns of the other Asian origin countries might be downward biased.

Comparing the top 20 countries over time, several patterns become apparent. These have been listed below:

(i) The rise of Iran to become the top sending country, especially between the late 1970s and the early 1980s, immediately following the change of the regime which led to a widespread Iranian diaspora (Gürüz, 2011). Since the late 1980s, the absolute number of students sent abroad decreased and started to increase again in the second half of the 2000s. In the last period, Iran sent 47 thousand students abroad, which despite representing an increase by a factor of 2.7 compared to the first period, is a number still below the peak in the late 1970s, where the number of students sent abroad was around 52 thousand students.

[24]The share of African countries was higher from the period 1980 to 1985 onwards, whereas the share of Africa and Europe separately is higher in every period than the share of the South and North America taken together.

Table 4.2: Top 20 origin countries over time

Number of students studying abroad in thousands										
Rank	**1970-74**		**1975-79**		**1980-84**		**1985-89**		**1990-94**	
1	USA	24	IRN	52	IRN	46	CHN	65	CHN	122
2	GRC	19	GRC	29	MYS	33	MYS	34	JPN	54
3	IRN	17	USA	23	GRC	31	IRN	33	KOR	52
4	CHN	16	HKG	20	MAR	27	MAR	32	GER	40
5	HKG	15	NGA	20	IND	24	KOR	28	IND	39
6	IND	15	CHN	20	NGA	22	GER	27	MYS	34
7	VNM	14	MYS	20	HKG	21	GRC	26	HKG	33
8	GBR	14	CAN	16	CHN	21	HKG	24	MAR	33
9	CAN	13	GBR	16	GER	19	IND	24	GRC	30
10	MYS	11	VNM	15	USA	19	JPN	23	TUR	29
11	GER	10	GER	14	CAN	15	USA	20	IRN	29
12	CYP	8	MAR	14	JPN	15	CAN	18	FRA	28
13	CUB	8	IND	13	TUR	15	TUR	17	ITA	26
14	JPN	7	JPN	13	KOR	14	ITA	17	CAN	25
15	THA	7	TUR	11	GBR	14	FRA	15	USA	25
16	FRA	7	DZA	11	VEN	13	LBN	15	GBR	20
17	NGA	6	LBN	11	DZA	13	GBR	15	DZA	20
18	MAR	6	VEN	10	LBN	13	DZA	14	UKR	19
19	TUR	6	CYP	10	ITA	11	IDN	14	IDN	19
20	TUN	6	TUN	10	FRA	10	NGA	13	ESP	18

Number of students studying abroad in thousands										
									Δ % 2010-15 to	
Rank	**1995-99**		**2000-04**		**2005-09**		**2010-15**		**1995-1999**	**1970-1974**
1	CHN	111	CHN	215	CHN	437	**CHN**	705	535%	4274%
2	KOR	66	IND	87	IND	160	**IND**	212	371%	1340%
3	GRC	60	KOR	78	KOR	112	**KOR**	118	79%	2625%
4	JPN	58	JPN	59	GER	79	**GER**	115	125%	1092%
5	GER	51	GER	58	JPN	55	**NGA**	72	1002%	1013%
6	MYS	51	GRC	48	FRA	51	**FRA**	70	63%	898%
7	IND	45	FRA	45	USA	50	**SAU**	67	955%	4353%
8	FRA	43	MAR	41	MYS	48	**USA**	63	98%	167%
9	TUR	43	MYS	39	CAN	44	**MYS**	61	21%	483%
10	ITA	41	USA	38	TUR	43	**KAZ**	57	244%	-
11	HKG	35	CAN	34	RUS	43	**VNM**	56	643%	299%
12	MAR	35	ITA	33	MAR	42	**RUS**	53	253%	-
13	USA	32	HKG	31	KAZ	34	**BGD**	52	713%	6588%
14	CAN	29	IDN	27	GRC	33	**ITA**	49	20%	744%
15	GBR	28	KAZ	24	HKG	33	**TUR**	48	12%	689%
16	SGP	27	GBR	24	ITA	33	**CAN**	47	59%	267%
17	IDN	26	SGP	22	POL	32	**IRN**	47	120%	169%
18	ESP	25	TUR	22	VNM	30	**UKR**	46	100%	-
19	UKR	23	ESP	21	UKR	29	**PAK**	43	280%	848%
20	IRN	21	THA	21	UZB	29	**MAR**	43	24%	570%

Note: The table shows the number of students stuying abroad in thousands. For the years prior to 1990, data for Germany include the former German Democratic Republic. As the number of reporting destination countries varies over years, the numbers are shown as averages over five years and six years for the last period. Nonetheless, data have to be interpreted with caution as the reliability of outward student mobility strongly depends on the number of reporting destination countries. This is especially the case for the top graph, as data from the UNESCO Statistical Yearbooks are only available for a limited number of destination countries. Note that Germany did not report the number of hosted students in the period 2000 to 2004, meaning that the numbers in this period are likely to be biased, especially for countries that send a high number of students to Germany.
Source: UNESCO Statistical Yearbooks for the years prior to 1998. For the years 1998 onwards, data are taken from the UNESCO online database.

(ii) Greece and Morocco have always played an important role among the top sending countries of students. The tertiary education system in Greece can be regarded as one of the most strictly regulated in the world and is characterized by a demand-supply imbalance (Gürüz, 2011). The importance as a sending country, however, has decreased in recent years. In the last period, Greece sent about 33 thousand students abroad–which is about half the number of students sent abroad in the period 1995 to 1999–and it is no longer among the top 20 sending countries. Gürüz (2011) explains the drop since the new century with a demographic saturation of the demand. Morocco ranked as twenty in the last period, as the number of students sent abroad remained almost stable since the turn of the century, with an outward mobility standing at around 40 thousand students.

(iii) The United States of America featured continuously among the top 20 origin countries. Starting as the most important sending country in the early 1970s, its role had decreased by early 1990s, and by the late 1980s it was no longer among the top 10 countries. Since 2000, there was evidently a growing interest for study-abroad programs resulting in the United States once again being listed among the top 10 sending countries. In the last period, the United States sent 63 thousand students abroad. Note that the United States and Canada are the only countries of the five MESDCs listed in the top 20 sending countries in the last period, whereas the United Kingdom was not among the top 20 since the period covering the years 2005 to 2009.

(iv) The high share of Asia-Pacific Rim countries among the top sending countries, especially with the advent of globalization in the 1980s. These countries–led by China, India, Korea, Malaysia, and Japan–were driving worldwide student mobility. In the last period, however, Japan was no longer among the top 20 sending countries. This was mainly due to the decreasing number of Japanese students studying in the United States, which was the top destination country of Japanese students across all periods. The number of students sent to the USA decreased since the turn of the century, from 43 thousand students to 37 thousand and 20 thousand students in the last three periods.[25]

(v) The rise of the European countries Germany and France as major sending countries of students. While Germany was among the top 10 since the 1980s and among the top 5 sending countries since the 1990s, France was among the top 10 countries from the period 1995 to 1999 onwards. Note that the European programs Erasmus and the Bologna Process started in 1987 and 1999, respectively.

(vi) The emerging origin countries Saudi Arabia and Nigeria that are listed among the top 10 sending countries in the last period. While Saudi Arabia was not among the top 20 sending countries in any period before, Nigeria was among the top 20 countries until

[25]Note that the number of Japanese students studying in China is not covered in the lower part of the table, as China did not report the number of hosted students since then. Therefore, the number of Japanese students studying abroad is likely to be downward biased.

the late 1980s and appeared again in the last period covering the years 2010 to 2015.

(vii) The role of Russia and countries of the former USSR among the most important sending countries since the 2000s. Note that some of these countries are also members of the Bologna Process. Russia joined the Bologna Process in 2003, Ukraine in 2005, and Kazakhstan in 2010.[26]

Analyzing the policy of each of these countries is beyond the scope of this work. Since Asia-Pacific Rim countries account for a disproportionate share among the sending countries, I will discuss them in more detail in the next section.

4.2.4 Asia-Pacific Rim Countries

As the previous sections have shown, students from Asia account for a disproportionately high share of international students. Looking at the countries more precisely, the top sending countries are mainly from South-East Asia. Therefore, in the literature the term "Asia-Pacific Rim countries" is also widely used for South-East Asian countries and refers to China, India, Korea, Malaysia, Vietnam, Hong Kong, Indonesia, Singapore, and Thailand as well as occasionally Taiwan and Bangladesh. With the exception of Japan, these countries are characterized by a demand of places at high-quality universities that exceeds the supply. These countries have a growing middle class that is willing to invest in tertiary education. The unmet demand of tertiary education in these countries creates a major market for exporting nations that is a key factor for student mobility on a global scale. This region is, therefore, mainly driven by the capacity building approach (OECD, 2004b; Vincent-Lancrin, 2007; Gürüz, 2011).

There is, however, a strong heterogeneity among the Asia-Pacific Rim countries with respect to the socio-economic situation as well their internationalization strategy. The OECD (2004b) classified the cross-border education of these countries into different groups: (i) Developed countries with a strong domestic capacity which are also active as importers, such as Japan and Korea; (ii) Developed or intermediate countries with an inadequate domestic capacity that are active in imports as well as exports, such as Singapore and Hong Kong; (iii) Intermediate countries that are active as importers only as they have an inadequate domestic capacity, such as China, Vietnam, Thailand, Sri Lanka, Indonesia, and the Philippines. This last category is clearly the major customer for countries providing tertiary education to international students, especially courses in English. The most important policy dilemma for these Asian nations is the question of whether

[26] As Germany was the most important destination country in the last two periods for Russia and Germany did not report the number of hosted students in the period covering the years 2000 to 2004, the number for this period is likely to be biased and has to interpreted with caution (20 thousand Russian students studying abroad). For instance, in the periods 1995 to 1999 and 2005 to 2009, Russia sent 3 thousand and 11 thousand students to Germany, respectively.

to import tertiary education by sending students abroad–and in doing so face a potential brain drain–or to build domestic capacity. Some countries cannot be clearly classified as one of the above-mentioned categories and are therefore regarded as intermediate cases. Taiwan, for example, is regarded as an intermediate case between the first two groups whereas Malaysia and India are intermediate cases between the last two categories. Note that the classification was as of 2004 and that the strategies might have changed and developed since then. As China is the most important sending country worldwide, I will describe in more detail how the policy behind the internationalization of higher education has developed over time.

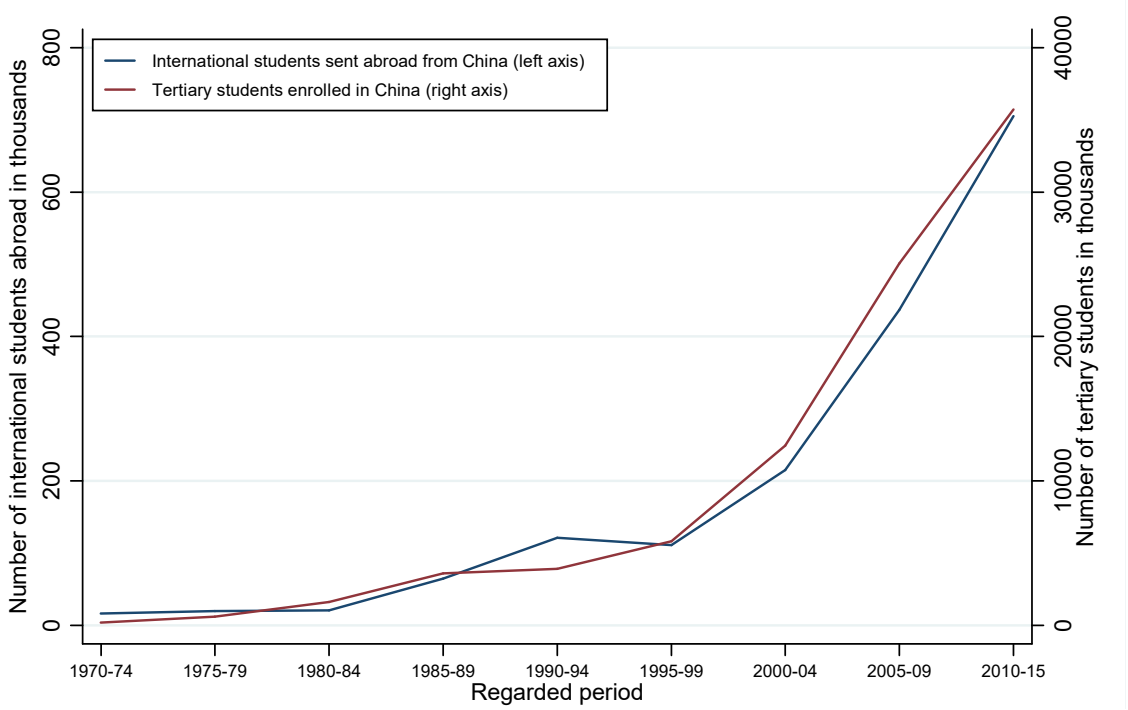
China: Internationalization Policy of the Most Important Source Country

By the early 1970s, Chinese policies were driven by the capacity building, know-how, and technology transfer rationales. When Deng Xiaoping became the Vice Premier of China in 1973, he started to open China to the West. In 1978, by this point in his role as the chairman of the Central Committee of the People's Liberation Army, he emphasized the importance of acquiring technology and know-how from the West and started reforms which were aimed at opening China to the West (Gürüz, 2011). In the late 1970s, Chinese leaders understood that China had to open its educational system even more (Guangqi, 1999). Huang (2003) identifies two stages of the internationalization of the Chinese higher education system. In the first stage covering the years 1978 to 1992, internationalization activities focused on inviting visiting scholars from abroad, sending students abroad, and learning English. The second stage started in 1993, when the emphasis became encouraging Chinese students who were sent abroad to return, to attract more international students, and to internationalize curricula.

In recent years Chinese policymakers have aimed to increase capacity in their own country by creating and increasing the number of high-quality universities. This strategy is believed to be more cost-effective than sending Chinese students abroad, while also providing the advantage that it reduces the threat of a possible brain-drain (Garrett, 2004; Gürüz, 2011). In order to implement the strategy, large investments were made to build universities. The success of the strategy is already visible in the increasing number of Chinese universities listed in the ARWU Shanghai Ranking–the Academic Ranking of World Universities (Shanghai Ranking, various years). Since the launch of the ranking in 2004, the number of Chinese universities among the top 500 has increased continuously, from 13 in 2004 to 38 in 2015. In contrast, in the same period the number of Japanese universities listed in the top 500 decreased from 36 in 2004 to 18 universities in 2015. Since 2010, the number of Chinese universities in the top 500 has exceeded Japan, meaning that China is the country with the highest number of universities listed in the ranking among all Asian countries. As of 2015, China is ranked third behind the United States and Germany. However, none of the Chinese universities were among the top 100 universities;

in terms of the average score of Chinese universities, China is ranked at number 21. The Asian countries that have a higher rank in terms of the average score per university are Singapore and Japan, which were listed at rank 7 and 13 in the year 2015, respectively. Looking at the total score of all universities listed in the top 500, China has also exceeded Japan since 2012.

Figure 4.8: Outward mobility of Chinese tertiary students versus tertiary students enrolled in China



Note: Number of international students in thousands is calculated as the sum of hosted students over all reporting destination countries excluding students with unknown origin. As not all destination countries reported the number of hosted students for each year, data are shown for the years 1970 to 2015 as averages over five years and six years for the last period. For instance, Germany is an important destination country for Chinese students but data on international students hosted in Germany are not available for the period 2000 to 2004.
Source: UNESCO Statistical Yearbooks (international students prior to 1997) and the UNESCO Institute for Statistics (UIS) online database (international students 1998 onwards and number of tertiary students).

In order to check the two stages of the Chinese internationalization strategy, figure 4.8 shows the development of the absolute outward mobility of Chinese tertiary students (left axis) compared to the number of domestically enrolled tertiary students (right axis). The number of Chinese students sent abroad increased by a factor of 43 across all periods from 16 thousand students in the first period to 705 thousand students in the last period. In the first three periods the number only grew by 25 percent in total. However, from the third period covering the years 1980 to 1984 onwards the number started to grow sharply by a factor of more than 3 until the next five-year period. Also in the following period, the number more than doubled again, so that in the three periods from the early 1980s

until the early 1990s, the number of outward mobility grew by a factor of more than 6. This reflects the first stage of the Chinese internationalization policy described above, as China mainly focused on sending students abroad between 1978 and 1992. With the exception of the period covering the years 1995 to 1999, the number almost doubled in each period from the early 1980s onwards.

Looking at the number of tertiary students enrolled in China (right axis), the number grew even more. Starting with 205 thousand students in the first period, the number grew by a factor of 173 to 36 million students in the last period. While outward mobility accounted for about 8 percent of the domestic tertiary enrollment in the first period, the share decreased to somewhat below 2 percent in the last period. As already explained, these numbers have to be regarded with caution due to the patchy coverage of the reporting destination countries. While the number of domestically enrolled students increased sharply in the first three periods, in the time between the late 1980s to the late 1990s this growth stagnated before increasing sharply again at the turn of the century. Hence, with the exception of the period 1995 to 1999, the period of the Asian economic crisis, the exponential growth rates also reflect the second stage of the Chinese strategy that focused on increasing the domestic capacity.

Chapter 5

Quantifying the Effect of the Student Exchange Program Erasmus on International Student Mobility[1]

Abstract This chapter investigates the question of whether the student exchange program Erasmus increases student mobility between its member countries. The chapter uses data on international student mobility for the years 1999 to 2015 obtained from the electronic UNESCO database for 155 host and 187 origin countries which are merged with a dummy variable on joint membership in the Erasmus program. Using these panel data in a gravity model by running fixed-effects methods, the chapter finds that student mobility between Erasmus member countries is, on average, about 53 percent higher. Quantifying the effect of the Erasmus membership on student mobility over different time periods, the effect is more stable for the time during and after the economic crisis. Furthermore, student mobility between Erasmus countries seems to occur more in favor of cultural experience and is not based on economic factors.

Keywords: International Student Mobility, Panel Data, Erasmus.

[1]This chapter is based on joint work with Gabriel Felbermayr. Status: Not submitted.

5.1 Introduction

There are several reasons why student mobility has a positive effect on an economy. From the perspective of the destination country, foreign students represent an additional income source as students have to pay fees and other living expenses. Very often the tuition fees paid by foreign students are even higher than the fees their domestic counterparts have to pay (OECD, 2017b). Half of the OECD countries for which the data are available charged higher fees for international students in 2011 (OECD, 2016a). Furthermore, student migration is very much related to later migration of tertiary educated workers. If students remain in the country where they studied, student migration can be regarded as a "stepping stone" (Guellec and Cervantes, 2002) for later high-skilled migration and, as a result, increase in human capital. The retention of foreign students in the host country yields the additional benefits that they are already familiar with the culture, customs, and foreign language of the destination country. Felbermayr and Reczkowski (2014) have found an overall elasticity of foreign student stocks on the stock of tertiary educated foreign workers of about 0.09, meaning that doubling the number of foreign students is associated with an increase in the stock of highly skilled migrants of 5.7 percent.

While the retention of a student in the destination country means gaining a high-skilled worker for the country of studies, for the country of origin, in contrast, it means a loss of a talented citizen and of a part of the initial education investment. Mobility of students is, therefore, highly related to the *brain drain* and *brain gain* phenomenon which has been identified in the recent literature investigating the emigration of workers (see for instance Beine et al., 2008; Docquier and Rapoport, 2012; Beine et al., 2014). In the country of origin, the brain drain effect is reflected by the reduction of human capital stock. However, beyond the risk of students migrating to remain in their country of studies, there are also benefits for the home country connected to student mobility. This reflects a brain gain effect. First, as the quality of education varies between countries, students can benefit from study programs of higher quality than the educational level in their home country (see for instance Hanushek and Kimko, 2000). If students do not stay in their country of studies, they return to their home country with a higher level of education. This knowledge transfer, in turn, means a growth perspective for the home country (Beine et al., 2014; OECD, 2017b). Second, beyond the quality of higher education, some skills cannot be acquired in the home country, as there are many countries in which there is, for instance, no engineering education program or medical school (Beine et al., 2014). In these cases, students going abroad does not reduce the number of the highly skilled in this sector. Furthermore, the number of study places is very often limited in the home country, meaning that it cannot meet the demand for study places. This, for instance, is the case in Germany with medical studies.

Independent of where a student lives and works after their studies, studying in a

foreign country always contributes to individual personal development, as the knowledge of foreign cultures and languages increases employability. This is even more important in times of increased internationalization of labor markets and a global demand for tertiary education (OECD, 2016a). Furthermore, the knowledge of foreign cultures also represents a source of export revenue (OECD, 2004b), fosters bilateral ties, and establishes social and business networks (OECD, 2016a). Spilimbergo (2009) also demonstrated that student mobility increases the democracy level in the country of origin, especially if the student went to a democratic country.

As policy-makers are aware of the benefits, they have a special interest in promoting student mobility. This is most obvious in the EU as one of their strategic goals for 2020 is to have 20 percent of EU graduates from higher education having experienced tertiary-level study or training abroad (Council of the European Union, 2011). One instrument that could increase student mobility is a student exchange program. Besides the Fulbright program, which is famous in the United States, there is another program of special interest: The program for the European Community Action Scheme for the Mobility of University Students (Erasmus) (Council of the European Communities, 1987). The program was named after the famous Renaissance "wandering student" Erasmus of Rotterdam (OECD, 2004b) and funded in 1987 with the main objective of achieving "[...] a significant increase in the number of students [...] spending an integrated period of study in another Member State" (Council of the European Communities 1987, p. 21). In order to increase the number of student exchanges, large investments are made. In the period 2007 to 2013 Erasmus had a total budget of 3.1 billion Euro for the mobility of 1.6 million students to study and train abroad and 300 thousand academic and administrative staff, i.e. an annual budget of 442.9 million Euro. In the academic year 2013/14, student exchange received a budget of 580 million Euro for 272 thousand students and 57 thousand staff, representing an annual budget for each participant of roughly 2 thousand Euro. Interestingly, about 3.6 percent–or 10 thousand students–of the total number of Erasmus students were "zero EU-grant students", i.e. they did not receive the monthly EU grant of 274 Euro, but by participating in the program they benefited of the leverage effect of the Erasmus "branding" such as non-payment of tuition fees (European Commission, 2015). For the period 2014 to 2020 the program was extended to more exchange activities and the budget was increased to a total of 14.7 billion Euro, at least 63 percent of which was invested in the student exchange "learning mobility of individuals" (European Commission, 2014b). In 2015, a budget of 548.1 million Euro was invested for higher education student and staff mobility within countries taking part in the program, which represents an annual investment of 1,613 Euro for each participant (European Commission, 2017).

In 2017 Erasmus celebrated its 30th anniversary. The number of students participating in the program has experienced a phenomenal growth. When Erasmus was founded 3,244 students went abroad under the scheme in 1987; this number grew dramatically over the

years to the point that in 2015, the last period of our observed data set, 339,799 Erasmus students went to another European country. This means that the number grew almost by a factor of 105. The European Commission itself calls Erasmus "the European Union's best known program" (European Commission, 2013a) and the "world's most successful student exchange" (European Commission, 2013b). But do we really know that the program fosters student mobility, or would students have studied abroad anyway? Are the student mobility patterns between participating countries different from non-members? To the best of our knowledge, there does not yet exist an empirical analysis addressing this topic.

In this work we use a database on bilateral student mobility covering the years 1998 through 2015 obtained from the electronic UNESCO database and merge it with a bilateral dummy for the participation in the Erasmus program. The data set with the yearly data covers 155 host countries and 187 source countries. Using this data set in a gravity-based model and controlling for other variables, we investigate how joint membership of the sending and receiving country in the Erasmus program affects international bilateral student mobility. Due to the patchy coverage of the student data for certain host countries, we construct averages typically over four years resulting in four periods. However, we conduct robustness checks with respect to this choice. As student data and the Erasmus dummy are bilateral and available for several years, we can conduct our analysis in a panel setup. The availability of within country-pair variation allows us to control for unobserved heterogeneity in countries' ties that affect both the bilateral student stocks and Erasmus membership. Furthermore, as we observe stocks from 187 source countries in 155 host countries, we can also control for country-specific time-varying variables by using dummies for both the destination and home country. To investigate whether the effect is causal, we follow Wooldridge (2002) and perform an F-test for strict exogeneity. In order to control for a selection bias that could arise as zero student stocks exist in the data and log-linearizing drops those observations, we address this issue in our robustness checks.

We report the following findings: (i) It is important to control for multilateral resistance by integrating a comprehensive set of country $\times$ year dummies and to control for unobserved heterogeneity. When this is done using fixed-effects estimates in a panel setup, the estimates for all bilateral time-varying variables remain stable compared to cross section estimates; (ii) The semi-elasticity of student mobility with respect to joint membership in the Erasmus program is about 0.43, meaning that if both countries are Erasmus members, student mobility increases by 53 percent; (iii) We perform a regression-based Wooldridge test for strict exogeneity and find a causal effect of joint Erasmus membership on student mobility; (iv) Regarding the Erasmus dummy for the period before, during, and after crisis, the effect of Erasmus is more stable in the period during and especially after crisis; (v) When both countries are Erasmus members, students prefer to go

to countries with a different language. Furthermore, economically attractive destination countries and those that are attractive for tourism do not attract more students. Hence, the *cultural experience* seems to be important, whereas economic factors do not increase student mobility.

There are several reasons why joint membership of the Erasmus program may have an impact on the bilateral stock of foreign students. First, Erasmus led to the launch of the Bologna Process, which introduced comparable and compatible study degrees and has also led to the establishment of the European Credit Accumulation and Transfer System (ECTS). As a result, students can earn credits for their degree when studying abroad within this area and the recognition of their studies achieved abroad is facilitated (European Commission, 2012a). Second, students might benefit from the network between higher education systems. As a university has to sign an Erasmus University Charter (EUC) to participate in Erasmus and the universities then cooperate with each other, Erasmus leads to the establishment of a network between universities. Therefore, if the university where a student is studying is cooperating with a lot of universities, it might facilitate the process of finding a university to study abroad. Third, students may also face advantages due to the social network established by former Erasmus students. If a student went abroad under the Erasmus scheme and shared the positive experience in their home country, this might affect another student's decision on going to the same country. The same is feasible if a student goes to another Erasmus country and promotes their country of origin. This network effect, of course, might also arise if a student goes to another country without a student exchange program. Fourth, Erasmus has helped to shape higher education in Europe and has led to new and improved services and methods of learning (European Commission, 2012a). Consequently, universities in an Erasmus member country might be more attractive for students due to the higher academic quality. Fifth, students that have already been abroad under Erasmus during their bachelor's degree might then go to another country to pursue a master's degree. If the student goes to a non-Erasmus country, this scenario, however, cannot be covered by our data.

Our work is closely related to a paper by Beine et al. (2014). They investigate the determinants of student mobility in general and consider the network effect of a former stock of immigrants in general and high-skilled immigrants. They find that the network effect has a significant impact, as does the quality of universities and accommodation prices. In contrast they do not find tuition fees to have a significant impact. The strength of their paper lies in the fact that the data are strictly restricted to international students.[2] Furthermore, they use a Poisson Maximum Likelihood estimator (PPML). Compared to the log-linear specification this method yields the advantage that they can deal with zero

[2]For the difference concerning the data, see section 5.2.1.

student stocks and with heteroskedasticity in the disturbances. A further strength of their paper is that they estimate an instrumental variable regression using the existence of a guest worker program in the 1960s and 1970s as an instrument for the stock of migrants. They find a positive elasticity of international students with respect to the stock of migrants. As Beine et al. (2014) use data for the years 2004 to 2007, data on international students are limited to 13 OECD destination countries, of which six are Anglo-Saxon. This could lead to a selection bias, as Anglo-Saxon countries seem to perform differently (Felbermayr and Reczkowski, 2014). Furthermore, as they want to investigate the effect of a lagged stock of high-skilled migrants on student mobility and these data are only available for one single year (the year 2000), they cannot apply panel estimates.

Another work by Abbott and Silles (2016) also analyzed the determinants of international student mobility in a gravity-based model for 38 origin and 18 destination countries for the years 2005 to 2011. They additionally include the EU dummy in their estimates and find a significant positive effect on student mobility. The strength of this study is in the use of data on student mobility that defines international students more strictly and in the use of PPML estimates, which allows them to include zero student flows in the estimates. However, as they do not use panel estimates they cannot control for bilateral fixed effects which, however, is crucial to obtain consistent estimates (Baier and Bergstrand, 2007). The limited number of countries and years may furthermore cause a selection bias.

There are also several studies that estimate the determinants of international student mobility between European countries in general (for examples, see Rodríguez González et al., 2011; Caruso and de Wit, 2013; Sánchez Barrioluengo and Filsi, 2017). While these works are limited to European countries, they estimate the determinants of mobility within Europe but do not estimate the effect of student exchange programs on international student mobility.

Beyond these studies, there is little empirical work in a multi-destination multi-source framework investigating the determinants of a destination country that attract foreign students. In contrast, there are several papers investigating the different determinants on student mobility looking at single host countries only. For instance, Rosenzweig (2008) investigates the factors in the origin countries that motivate foreign students to study in the USA, while Bessey (2012) analyzes the determinants for Germany. As these studies do only look at single host countries, it is not possible to control for multilateral resistance terms. However, a multi-origin multi-destination framework allows to investigate the pull factors that attract students, which is crucial for policy-makers in the destination country if they want to attract more students.

Our work is also very much related to a study by the European Commission (2014a) which analyzed the effect of Erasmus student mobility on students' employability and skill

enhancement. To address these questions, they use a mixed-methods approach, merging quantitative with qualitative surveys of different target groups and control groups of non-mobile and mobile individuals. They launched 5 online surveys in 2013 to which they received 78,892 individual responses. If students were mobile during this study, the survey consisted of an ex-ante and an ex-post survey. The study finds that Erasmus students and mobile students in general had higher-level skills than non-mobile students which are important for their employability. While these skills were already higher before going abroad, after being abroad their skills compared to non-mobile students increased by 42 percent for Erasmus students and by 118 percent for all mobile students. After their study abroad, the Erasmus students had average skill values that were higher than 70 percent of all students. Furthermore, the majority of mobile students increased their employability skills. The study also investigated the motivation to go abroad finding that over 90 percent of the students who went abroad wanted to experience living in another country, develop new skills, and improve their foreign language skills. In contrast, only 14 percent of non-mobile students did not go abroad because they were not selected by Erasmus which suggests that Erasmus is a nonselective program. With respect to long-term unemployment, students that went abroad for their studies were half as likely to experience long-term unemployment as students that never went aboard. Also, five years after graduation the unemployment rate of mobile students was 23 percent lower.

Finally, this work also relates to a large, mainly theoretical literature that discusses the challenges of financing higher education in a world with mobile students and workers. Gérard and Uebelmesser (2014) focus on the challenges resulting in Europe from its specific factors such as low tuition fees and nondiscrimination of other EU member countries, especially if mobility between countries is unbalanced. They argue that a decentralized education policy may cause an under- or overinvestment when students and graduates are mobile depending on the retention rate of graduates due to externalities. Since in a union such as the EU a centralized system that internalizes these externalities is not possible, they recommend finding a decentralized system that comes as close as possible to the outcome of an efficient centralized system. See also Justmann and Thisse (2000), Demange et al. (2008), and Lange (2009) discussing the challenges of financing higher education in a mobile world when education is financed publicly.

This chapter is organized as follows: Section 5.2 describes the data used in this paper and gives a first glance at our data set. Section 5.3 presents our econometric specification. In section 5.4 we demonstrate our baseline results, while section 5.5 and 5.6 discuss robustness checks and further results. Section 5.7 concludes.

5.2 Data

5.2.1 Student Data

For our dependent variable, the stock of student mobility, two different types of data are available. While foreign students are defined according to their citizenship, international students are those students who move to another country for the purpose of education. Hence, international students are a subgroup of foreign students. The data on student mobility are collected and provided by the UNESCO Institute for Statistics (UIS), EUROSTAT (UOE), and the OECD. They define international students "as those who are not residents of their country of study or those who received their prior education in another country. When data on international students are not available, data on foreign students are used" (OECD 2013, p. 1). Hence, the data situation on international student mobility is suboptimal as the definitions of student mobility still do vary over countries (UNESCO Institute for Statistics, 2009).[3] To make data more comparable, the OECD provides separate data for foreign and international students. Unfortunately, these data are only available from 2004 onwards and limited to 30 destination countries. As we want to investigate a wider range of destination countries and a longer period of time, for our work we use the data provided by the UIS. The data are available for almost all countries of destination and origin and for the years 1998 onwards.[4]

5.2.2 Erasmus

Our main independent variable is a bilateral time-variant dummy that is 1 if the sending and the home country participate in the Erasmus program and 0 otherwise. The variable is generated based on the entry year of each country (see table C.2 in Appendix C.2 for the entry year to the Erasmus program and the EU).

Erasmus is a student exchange program that offers students the possibility to study at another higher education institution (HEI) abroad for a period of three to twelve months (European Commission, 2013a). By giving students the possibility to study in another country, Erasmus contributes to building a pool of open-minded and qualified young people that are internationally experienced. In doing so, Erasmus also fosters improved cooperation between HEIs and enriches the educational environment (European Commission, 2015).

Erasmus has helped to shape higher education in Europe in several ways: (i) Erasmus

[3]For definitions used by the reporting countries see OECD (2004b), p. 309-310.

[4]Note that these data do not include student exchange programs or at least only those programs "which last a minimum of 1 semester full-time equivalent" what is not always the case (OECD 2004, p. 309). Hence, students studying in the Erasmus program are not included in the student data.

gives a better understanding of the opportunities that are available abroad and offers new services and cooperations; (ii) It fosters the internationalization of HEIs and higher education in general; (iii) Erasmus has led to the establishment of the European Credit Accumulation and Transfer System (ECTS) which enables students to get credits for their degree when they study abroad; (iv) Erasmus has led to the launch of the Bologna Process, which introduced compatible and comparable study degrees (European Commission, 2012a). As 5 out of 6 of the action lines are directly taken from the Erasmus program, Erasmus directly supports the achievement of reaching the goals of the Bologna Process (Vossensteyn et al., 2008).

Application Process

If a student wants to participate in the Erasmus program, they have to apply at their home institution usually several months before they want to go abroad and they also have to fill in a learning agreement at the international relations office at their home institution (European Commission, 2013b). The participation in the Erasmus exchange program is possible for all students that are studying at least in their second year at a higher education institution that holds an Erasmus University Charter (EUC) (European Commission, 2013a). If a country wants to participate in the exchange program, they have to sign a contract developed by the European Commission. The universities then cooperate with other universities and sign an EUC.

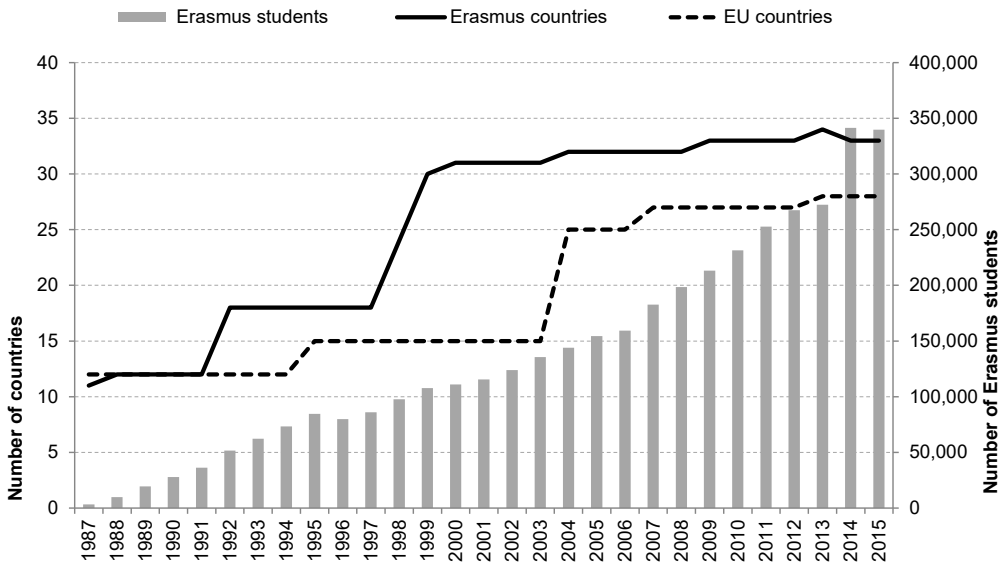
Number of Erasmus Countries and Students

Figure 5.1 shows the number of Erasmus students and the participating countries over a timeframe starting in the year 1987 until 2015, which is the last year of our observed period. Since Erasmus was funded in 1987, it has experienced phenomenal growth: In 1987, 11 countries with 3,244 students formed part of the program; this number has grown dramatically over the years. In 2015 Erasmus had 33 member states and 340,799 participants including higher education students and staff mobility took part in the program.[5] This represents an average annual growth rate of 3.7 percent from 1987 to 2015 and a total number of 3.9 million students. Over 3,731 organizations actively participated in the mobility projects in 2015, which represents 74 percent of the institutions awarded with the Erasmus Charter for Higher Education (ECHE) (European Commission, 2017).

It was not only the number of students and participating countries that has increased, however, as the Erasmus program also expanded in terms of the types of exchange pro-

[5]The scheme of higher education students and staff mobility within program countries (KA103) is supported under KA1, which is one of the key actions of the Erasmus+ program. Comparing the numbers over the years is difficult, as the Erasmus action schemes vary over years.

Figure 5.1: Member countries of the EU and Erasmus



Note: The figure demonstrates the number of students that participated in the Erasmus program in each year since its establishment in 1987. The black line demonstrates the number of Erasmus member countries and the dashed line presents the number of EU countries.
Source: Data on Erasmus students for the years 1987 to 2013 are taken from the European Commission (2015) and for the years 2014 to 2015 from the European Commission (2017)

grams it included. While most people associate Erasmus with just the student exchange program, Erasmus also offers–among other activities–placement exchange programs, thematic networks and intensive language courses, promotes various forms of cooperation and multilateral projects and supports the training and exchange of academic and other staff (European Commission, 2012a). With the development of these activities, the Erasmus student exchange program was part of several umbrella programs that covered different kinds of activities. The student exchange program Erasmus was part of Socrates I and II in the academic years 1995/1996 to 1999/2000 and 2000/2001 to 2006/2007, respectively. In the period from 2007/2008 to 2014, Erasmus was part of the lifelong learning Erasmus program, in which the placement mobility program was introduced. Since 2014, Erasmus student mobility has been part of the Erasmus+ program which combines 7 education, training and youth programs and also recently introduced sports for the first time (European Commission, 2014b). As a result of this, Erasmus+ has also led to the establishment of a master's degree loan scheme.

Erasmus versus EU Membership

As Erasmus is known as the EU's "Flagship program" (Wächter and Wuttig, 2006), one could reasonably assume that the member countries of the EU and Erasmus are identical. This, however, is not the case. Figure 5.1 shows the number of EU member states compared to Erasmus member states over time.

In 1987, when Erasmus was funded, the member states were almost identical to the existing EU members; the 11 founding members of Erasmus were all already members of the EU, with Luxembourg joining Erasmus one year later. During the following years, however, countries first joined Erasmus and afterwards the EU. While the eastern European countries joined the EU in 2004, most of them have already joined Erasmus in 1998 and 1999. Across all countries, 16 were first members of Erasmus before then joining the EU. Out of the 33 member countries of Erasmus in 2015, the following 5 countries are not members of the EU: Iceland, Liechtenstein, Macedonia, Norway, and Turkey.[6] The fact that 16 countries were first members of the Erasmus program and joined the EU afterwards indicates that Erasmus may be regarded as a first step towards EU, as membership is connected to less bureaucracy, whereas it takes longer to negotiate contracts for the EU. In our preferred estimate, we therefore control for both variables simultaneously.

5.2.3 Other Data

Beyond membership in the EU and Erasmus, we additionally control for regional trade agreements (RTA). During the development of the NAFTA, for example, several initiatives were created to foster academic cooperation: among others the North American Student Mobility program (OECD, 2004b). We therefore wish to investigate whether RTAs have an additional impact on student mobility. As a common currency eliminates the currency risk and so possible costs that may arise, we also include common currency in our econometric specification. Table C.2 in Appendix C shows that membership in the Euro area clearly differs from the membership of the EU and Erasmus. In section 5.6.1 we wish to investigate whether special groups of interest perform differently and control for other variables, such as a common language or economic factors.

Table C.1 in Appendix C shows the summary statistics as well as the data sources for all variables based on the data set regarding averages over four years.

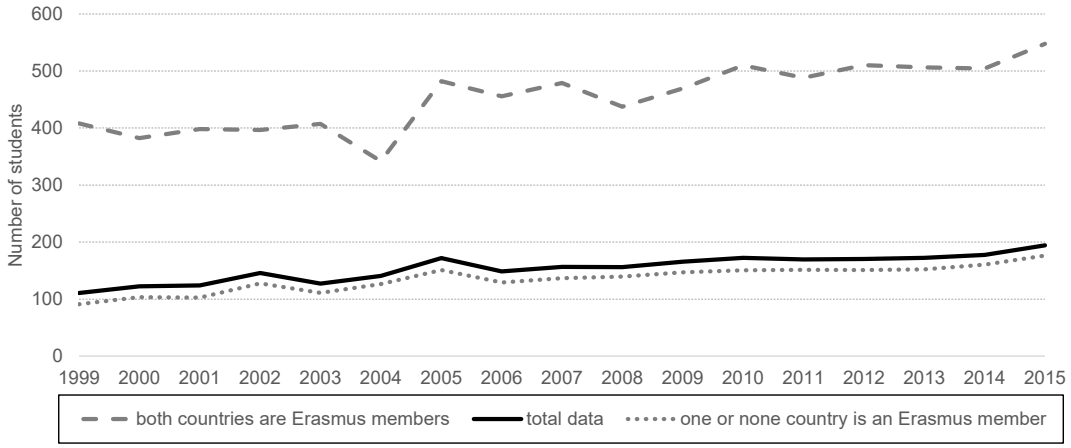
5.2.4 Descriptive Statistics

Combining the data described above results in a data set of 187 countries of origin and 155 destination countries. The sample spans the period 1999 to 2015.

Before we investigate the effect of joint Erasmus membership on student mobility, it is interesting to see how the number of foreign students developed over time and whether the number differs if the country of destination and origin are both Erasmus members.

[6] Switzerland, which is not an EU member either, joined Erasmus in 1992 for five years, was an indirect member afterwards, officially rejoined Erasmus in 2011 again and left it in 2014 under Erasmus+.

Figure 5.2: Development bilateral average annual student mobility



Note: The figure demonstrates the average bilateral student mobility for the total data set (black line), between two Erasmus member countries (dashed grey line), and between two countries where one or none country is an Erasmus member. Due to the patchy data coverage, data are to be interpreted with caution. For instance, data for the destination country Germany are not available for the years 1999 to 2004 and 2011 to 2012.

Graph 5.2 shows the annual average bilateral student mobility over all countries of origin and destination based on the data taken from the UIS before merging it with the other data. The black line demonstrates the average annual student mobility for all countries. In 1999 on average 111 students went to a foreign destination country. By 2015, this number rose by about 75 percent to a student mobility of 194 students, which represents an average annual growth of 4.7 percent. Looking at the student mobility between two countries where either the home or the destination country is participating in the Erasmus program or neither, the numbers are lower across the considered period. In 1999, the average number was 91 compared to 176 in 2015, which means a total growth of 94 percent and an average annual growth of about 5.9 percent. Shifting the view to the bilateral student mobility between two countries that are both participating in the Erasmus program, the numbers are clearly higher compared to the ones in the total data sample. In 1999, the average student mobility was 408 students, which is about 3.7 times higher compared to the total data set. This number rose to 547 in 2015, which means a total increase of 34 percent or an annual average growth of about 2.1 percent. Clearly, the growth rate of student mobility between the Erasmus countries is lower compared to the other two lines. Therefore, the gap between the average student mobility across all countries and that between Erasmus members also decreases over time. While in 1999, the student mobility between Erasmus countries was 3.69 times higher, in 2015 the factor decreases to 2.82. The lower growth rate could be due to fact that not all countries are covered in each year. As the number of reporting countries varies over years, we build averages rather than use annual data in our preferred estimates as described in the next section.

5.3 Econometric Specification

We strive to explain the link between $Stud_{jit}$, the stock of students from an origin country j in a destination country i at time t, and $Erasmus_{jit}$, the joint membership of country j and country i in the Erasmus program.

In the recent literature, gravity equations are increasingly applied to estimate the mobility of students (for example, see Beine et al., 2014; Abbott and Silles, 2016; Ramos, 2016). The equation can be derived from a very general theoretical model that captures the main motivations to study abroad as well as the arising costs.[7]

Therefore, we estimate the following gravity equation:

$$\ln Stud_{jit} = \alpha + \beta Erasmus_{jit} + \gamma Pol_{jit} + \delta Prox_{ji} + \upsilon_{jt} + \upsilon_{it} + \varepsilon_{jit} \tag{5.1}$$

where γPol_{jit} includes time-variant bilateral policy controls proxied by joint membership in RTA, EU, and common currency, $\delta Prox_{ji}$ includes time-invariant bilateral cultural and geographical variables, and υ_{jt} and υ_{it} represent an interaction of country $\times$ time dummies to control for all time-variant source and destination specific variables.

We assume the structure of the error term to be $\varepsilon_{jit} = \upsilon_{ji} + u_{jit}$, where υ_{ji} is a dyad-effect and u_{jit} is the idiosyncratic error term. As OLS cannot deal with additive error terms–and does therefore not control for unobserved bilateral factors–and this would lead to biased estimates, we follow Baier and Bergstrand (2007) and difference out the dyad-effect υ_{ji} by estimating our equation in a panel setup. In order to control for strict exogeneity, we also include the Erasmus dummy in the differenced version of equation (5.1) and perform an F-test for joint significance, as suggested by Wooldridge (2002). If we cannot reject the null we can interpret the effect as causal as differencing the equation has solved the endogeneity problem.

We estimate equation (5.1) as cross section estimates where $\upsilon_{jt} + \upsilon_{it} + \upsilon_{ji}$ is replaced by the country dummies υ_j and υ_i and in a panel setup, where υ_{ji} controls for bilateral fixed-effects. As a consequence, time-invariant bilateral variables are included in υ_{ji} in the panel setup and cannot be estimated separately anymore.

As OLS estimations do not correct for the endogeneity bias caused if countries self-select into the Erasmus program (Baier and Bergstrand, 2007), our preferred estimation is the panel setup. The estimates of γPol_{jit} and $Erasmus_{jit}$ can be interpreted as semi-elasticities. As we have seen in section 5.2.4, data on student mobility are not available for all destination countries in each year. Therefore we use an average typically over four years resulting in four different periods; the fourth period consists of five years. However

[7] For example, see Beine et al. (2012) for the description of the theoretical model.

we will also conduct several robustness checks in section 5.5 and estimate the equation in a panel setup with other averages and with yearly data.

5.4 Empirical Results

5.4.1 Cross Section versus Fixed-Effects Estimation

Before we present our baseline regressions using our preferred model, we compare cross section estimates with our preferred panel estimates. Table 5.1 shows the results of cross section estimates where $\upsilon_{jt}+\upsilon_{it}+\upsilon_{ji}$ of equation (5.1) is replaced by the country dummies υ_j and υ_i which control for unobserved time-invariant country-specific variables. Columns (1) to (4) present cross section estimates for each of the four periods separately where the Erasmus dummy is the only estimated variable. Over the four regarded periods, bilateral Erasmus membership has an economically and statistically relevant impact on the stocks of international students. The estimated semi-elasticities increase continually over time, from 2.2 in the first period to 2.8 in the last period. However, the number of observations almost doubles over time so that the difference in the point estimates of Erasmus may also be due to a selection bias. Therefore, we repeat the estimates of columns (1) to (4) with a balanced data set.[8] Since the coefficients also increase over time using the balanced data set, the higher estimates in later periods are likely not due to a selection bias. The fit of the model is good given that Erasmus is the only independent variable besides the country dummies υ_j and υ_i, with an adjusted R^2 standing at around 0.5.

Next we repeat the estimates controlling for additional variables in the fourth period, since this period captures the most recent years and the number of observations in this period is the highest. Note that this period covers the years 2011 to 2015 and therefore refers to the time after the economic crisis. Column (5) controls for time-invariant bilateral cultural and geographical variables (e.g. data on distance, common language, and contiguity) which replace $\delta Prox_{ji}$ in the model. Column (6) additionally controls for the time-variant bilateral policy control γPol_{jit} by including the bilateral variables of joint membership in the EU, RTA, and a currency union. Finally, column (7) controls for all variables simultaneously. Note that the unobserved time-variant country-specific variables υ_{jt} and υ_{it} are still replaced by the country dummies υ_j and υ_i, meaning that multilateral resistance is accounted for as long as it does not vary over time.

The results shown in columns (5) to (7) are in line with previous findings and intuition. While distance reduces student mobility between two countries, a common border and common language have a positive impact on the stock of international students. Furthermore, regional trade agreements and common membership in the EU also increase

[8] See Appendix C.3 for the estimates of columns (1) to (4) using a balanced data set.

Table 5.1: Erasmus and student mobility: cross section estimates

Dependent variable: Ln arithmetic average of student stocks							
	(1) Period 1 (1999-2002)	**(2)** Period 2 (2003-2006)	**(3)** Period 3 (2007-2010)	**(4)** Period 4 (2011-2015)	**(5)** Period 4 (2011-2015)	**(6)** Period 4 (2011-2015)	**(7)** Period 4 (2011-2015)
Erasmus (0,1)	**2.135*** (0.116)**	**2.401*** (0.100)**	**2.581*** (0.091)**	**2.767*** (0.077)**	**0.720*** (0.081)**	**1.077*** (0.136)**	**0.021 (0.127)**
EU (0,1)						0.423** (0.141)	0.556*** (0.130)
Regional trade agreement (0,1)						1.622*** (0.061)	0.582*** (0.054)
Common currency (0,1)						0.873*** (0.124)	0.185 (0.101)
Ln distance					-1.150*** (0.030)		-1.049*** (0.031)
Common language (0,1)					1.572*** (0.06)		1.550*** (0.059)
Contiguity (0,1)					0.934*** (0.116)		0.863*** (0.113)
Origin effects	YES	YES	YES	YES	YES	YES	YES
Destination effects	YES	YES	YES	YES	YES	YES	YES
R^2	0.482	0.499	0.500	0.482	0.643	0.525	0.648
Number of observations	5,790	6,999	7,815	10,283	10,283	10,283	10,283

Note: Columns (1) to (4) show the results for each period of cross section estimates including country dummies; columns (5) to (7) show the results for period 4 including country dummies as well as additional covariates. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

student mobility. In contrast, the currency union dummy is only positive and significant when the political variables are included, but it is not significant anymore in column (7) where bilateral time-invariant variables are controlled for additionally.

Most importantly for our purpose, the common membership in the Erasmus program has a positive effect on the stock of students that is economically and statistically relevant in columns (5) and (6), but point estimates decrease compared to column (4). The inclusion of time-invariant bilateral variables in column (5) cuts the Erasmus semi-elasticity by a factor of almost 4 to 0.7. In column (6), where time-variant bilateral policy variables are controlled for simultaneously to Erasmus, the estimated semi-elasticity is cut by a factor of about 2.5 to 1.1, compared to column (4). In column (7) where all variables are estimated simultaneously, the coefficient for Erasmus is not significant anymore. Compared to column (4), adjusted R^2 especially increases when geographical and regional variables are controlled for additionally, whereas time-variant variables increase it to a lower extent. In columns (5) to (7), adjusted R^2 stands between 0.53 and 0.65.

Table 5.2 demonstrates the results for our preferred panel estimates where bilateral fixed effects v_{ji} are included so that these estimates control for unobserved heterogeneity. Furthermore, destination $\times$ time and origin $\times$ time dummies are included which capture time varying country-specific effects and by that account for multilateral resistance. While we regard the Erasmus effect in column (1) separately, we also include the EU dummy in

column (2) and we additionally control for RTAs and common currency in columns (3) and (4), respectively. Finally, in column (5) we control for all variables at the same time.

Table 5.2: Erasmus and student mobility: panel estimates

Dependent variable: Ln arithmetic average of student stocks					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Erasmus (0,1)	**0.451****	**0.415****	**0.417****	**0.421****	**0.425****
	(0.158)	**(0.158)**	**(0.158)**	**(0.157)**	**(0.157)**
EU (0,1)		0.951***	0.951***	0.893***	0.893***
		(0.076)	(0.076)	(0.076)	(0.076)
Regional trade agreement (0,1)			-0.013		-0.019
			(0.044)		(0.044)
Common currency (0,1)				0.322**	0.323**
				(0.109)	(0.109)
Regression based F-test for strict exogeneity					
p-value	0	0.1002	0.0859	0.2502	0.2207
Bilateral fixed effects	YES	YES	YES	YES	YES
Destination x year effects	YES	YES	YES	YES	YES
Source x year effects	YES	YES	YES	YES	YES
Within R^2	0.402	0.410	0.410	0.410	0.410
Number of observations	30,887	30,887	30,887	30,887	30,887
Number of pairs	11,815	11,815	11,815	11,815	11,815

Note: All estimates demonstrate panel estimates that include country x time effects and bilateral fixed effects. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

All estimates show a positive statistical and economical significant impact of Erasmus on student mobility; in columns (2) to (5) Erasmus and EU membership are estimated simultaneously and both variables have a positive impact that is significant at the 1 percent level for Erasmus and at the 0.1 percent level for the EU.

Column (5) shows our preferred estimation, controlling for Erasmus, EU, RTAs, and common currency simultaneously. The estimated semi-elasticity of Erasmus membership is 0.425, hence, if two countries are members of the Erasmus program, international student mobility is, on average, $(e^{0.425} - 1)$ 100 percent = 52.96 percent higher. Even though the Erasmus program is mainly restricted to European countries, this number can nevertheless be regarded for more countries as Erasmus already includes some non-European countries and has expanded the number under Erasmus+.[9] Importantly, Erasmus and EU membership both turn out as determinants separately. The estimated semi-elasticity of EU is 0.89 and therefore the effect of joint EU membership is twice as big as that of Erasmus. As mentioned before, the existence of a currency union also has a positive significant impact on the bilateral stock of students. Hence, joint membership of the origin

[9]The European Commission (2013b) states: "Around 5 500 third-country nationals go abroad every year with Erasmus. This international dimension will increase in the future as Erasmus+ will support mobility to and from partner countries beyond Europe" (p. 11).

and destination country in the EU, Erasmus, and the existence of a currency union turn out to all have a significant impact separately. In order to control whether the causality goes from Erasmus membership to student mobility, we conduct a regression-based test for strict exogeneity (Wooldridge, 2002). We find a p-value of 0.22 and cannot reject strict exogeneity anymore. Hence, we interpret our findings as causal. Within R^2 stands at around 0.41.

5.4.2 Before, During, and After Crisis

As during our observed period the financial crisis started in 2007/2008 and we have seen in graph 5.2 and table 5.1 that the student mobility pattern differs over the periods considered, we want to estimate whether the effect also differs in a panel setup. Therefore we create three Erasmus dummies: the Erasmus dummy before crisis covers the two periods of each four years 1999 to 2002 and 2003 to 2006, the Erasmus dummy during crisis spans the years 2007 to 2010, and the Erasmus dummy after crisis consists of the five-year period 2011 to 2015.

Table 5.3: Erasmus and student mobility: before, during, and after crisis

Dependent variable: Ln arithmetic average of student stocks		
	(1)	**(2)**
Erasmus before crisis (0,1)	**0.257**	**0.398***
	(0.163)	**(0.158)**
Erasmus during crisis (0,1)	**0.552*****	**0.403***
	(0.158)	**(0.16)**
Erasmus after crisis (0,1)	**0.662*****	**0.472****
	(0.163)	**(0.165)**
EU (0,1)		0.875***
		(0.079)
Regional trade agreement (0,1)		-0.014
		(0.044)
Common currency (0,1)		0.306**
		(0.111)
Within R^2	0.403	0.410
Number of observations	30,887	30,887
Number of pairs	11,815	11,815

Note: Erasmus before crisis refers to the 2 periods 1999-2002 and 2003-2006, during crisis to the period 2007-2010, and after crisis to the period 2011-2015. All estimates demonstrate panel estimates that include country x time effects and bilateral fixed effects. Robust standard errors in parentheses. All regressions include a constant.
* p<0.05, ** p<0.01, *** p<0.001.

Column (1) of table 5.3 demonstrates the estimates where only the three Erasmus dummies are included whereas column (2) also includes the other bilateral political covariates known from our preferred estimates. Clearly, the effect of the Erasmus membership on the stock of students is higher during and after the economic crisis. In column (1), the estimated coefficient on Erasmus before crisis is positive but not significant. In contrast, during and after crisis the effect of joint Erasmus membership on the stock of students is highly significant with an estimated semi-elasticity of 0.55 and 0.66, respectively. In column (2), where the other bilateral covariates are controlled for, the estimated effect of Erasmus is positive and significant throughout all periods, though the level of significance differs. In the period before and during crisis, the effect is significant at the 5 percent level, and for the time after crisis the coefficient is significant at the 1 percent level. Compared to column (1), the estimated coefficients for the three time periods become more equal. in the time before, during, and after the economic crisis, the stock of students between Erasmus countries was about 39.8 percent, 40.3 percent, and 47.2 percent higher.

The estimated effect of the other political covariates–EU, common currency, and RTAs–are very similar to the estimates shown in table 5.2: EU membership and common currency remain economically and statistically significant determinants whereas RTAs do not matter to student mobility.

5.5 Robustness Checks

In this section we conduct a number of robustness checks. First, we investigate the effect for the balanced data sample, we define different averages for each period, and we also work with yearly data in a panel setup rather than using averages. Second, we check whether the estimates also hold for random-effects estimates. As zero student stocks exist in our data, we try to eliminate the possible bias by estimating the stock of students plus 1. As the results vary when we regard the period prior, during, and after crisis, we run each robustness check including one Erasmus dummy as well as the three dummies that capture the time before, during, and after crisis.

5.5.1 Variation of the Data Set

Columns (1) to (3) of table 5.4 demonstrate the results of fixed-effects panel estimates using a balanced data set. The basic massage is that balancing the data set has increased point estimates and the level of significance of all Erasmus dummies and the sign patterns remain unchanged. With the exception of the Erasmus dummy that refers to the time before crisis in column (2), all Erasmus dummies are now estimated with excellent precision. Regional trade agreements still do not matter for the stock of international students and the existence of a currency union has a positive impact, but the level of significance

decreases to 5 percent. Balancing the dataset reduces the number of pairs by more than a factor of 2 to 4,643 and the number of observations by a factor of 1.7 to 18,572.

Columns (4) to (6) present the results of the estimates where averages over three years are regarded. Compared to the preferred specification, the estimated coefficients of the Erasmus semi-elasticities decrease. Also the level of significance decreases for all Erasmus dummies with the exception of the time after crisis. In column (4) where only one Erasmus dummy is included, the coefficient remains positive but the estimated semi-elasticity falls by a factor of 1.7 to 0.26, estimated with satisfactory but not excellent precision. When we estimate the three Erasmus dummies simultaneously in columns (5) and (6), we find that the effect before crisis is not distinguishable from zero in both specifications and the effect during crisis is only significant in column (5), estimated at the 5 percent level. In contrast, we find a positive impact for the time after crisis that is economically and statistically relevant in both specifications. The sign and significance pattern of EU and common currency union remain unchanged but point estimates decrease. The coefficient of RTAs turns positive but remains not statistically significant. The number of observations increases by about 20 percent while the number of pairs remains almost stable.

Columns (7) to (9) show the results for fixed-effects panel estimates using yearly data. Compared to the specification where averages over four years were regarded, point estimates of all Erasmus semi-elasticities are substantially smaller. Using yearly data cuts the coefficient for the Erasmus semi-elasticity in column (7) by half to 0.22 and remains statistically significant at the 1 percent level. Erasmus membership before crisis has no significant impact on the stock of international students, whereas the effect is positive and statistically significant in the time during and after crisis. Using yearly data cuts the point estimates of Erasmus membership during crisis by more than half to 0.26 and 0.17 in columns (8) and (9), respectively and the coefficients on Erasmus after crisis decrease by about one third to 0.44 and 0.32. As in the previous estimates, the inclusion of bilateral time-varying covariates reduces the coefficients. EU and common currency remain statistically significant determinants of student mobility and the coefficients decrease slightly. The number of observations increases by factor of about 3 to 98,094 and the number of pairs remains stable.

Summing up, the choice of using averages over four years has no significant effect on the Erasmus dummy after crisis, whereas the level of significance for the dummy before and during crisis decreases and sometimes is not significant anymore. In the specifications where one Erasmus dummy is regarded, the coefficient remains positive and statistically significant.

Table 5.4: Erasmus and student mobility: variation of the data set

Dependent variable: Ln arithmetic average of student stocks in columns (1) - (6) and ln student stocks in columns (7) - (9)									
	Balanced dataset (1999-2015)			**Other averages: periods of 3 years (2001-2015)**			**Yearly panel (1999-2015)**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Erasmus (0,1)	**0.552*** **			**0.257***			**0.216****		
	(0.147)			**(0.111)**			**(0.084)**		
Erasmus before crisis (0,1)		**0.346***	**0.520*** **		**0.062**	**0.182**		**-0.014**	**0.129**
		(0.148)	**(0.150)**		**(0.117)**	**(0.116)**		**(0.089)**	**(0.089)**
Erasmus during crisis (0,1)		**0.630*** **	**0.488****		**0.252***	**0.192**		**0.258****	**0.173***
		(0.148)	**(0.151)**		**(0.115)**	**(0.116)**		**(0.086)**	**(0.087)**
Erasmus after crisis (0,1)		**0.820*** **	**0.642*** **		**0.413*** **	**0.327****		**0.437*** **	**0.323*** **
		(0.154)	**(0.157)**		**80.114)**	**(0.115)**		**(0.088)**	**(0.089)**
EU (0,1)	0.914***		0.895***	0.659***		0.622***	0.794***		0.747***
	(0.077)		(0.080)	(0.063)		(0.065)	(0.058)		(0.059)
Regional trade agreement (0,1)	-0.036		-0.031	0.016		0.024	-0.005		0.002
	(0.048)		(0.048)	(0.038)		(0.038)	(0.029)		(0.029)
Common currency (0,1)	0.322*		0.302*	0.333**		0.294**	0.246**		0.213**
	(0.129)		(0.130)	(0.105)		(0.106)	(0.079)		(0.080)
Within R^2	0.456	0.448	0.457	0.391	0.387	0.391	0.395	0.390	0.396
Number of observations	18,572	18,572	18,572	37,566	37,566	37,566	98,094	98,094	98,094
Number of pairs	4,643	4,643	4,643	11,655	11,655	11,655	11,815	11,815	11,815

Note: All regressions demonstrate panel estimates that include country x time and bilateral effects. Robust standard errors in parentheses. All regressions include a constant.
* p<0.05, ** p<0.01, *** p<0.001.

5.5.2 Random-Effects

Another method that is commonly applied using panel data is the random-effects estimator. Compared to the fixed-effects estimator, random-effects adds the assumption that the time-invariant component of the error term v_{ji} is distributed independently of the regressors.

Table 5.5: Erasmus and student mobility: random-effects

Dependent variable: Ln arithmetic average of student stocks in columns (1) - (3)			
	Random effects		
	(1)	**(2)**	**(3)**
Erasmus (0,1)	**1.072*** (0.088)**		
Erasmus before crisis (0,1)		**1.710*** (0.093)**	**1.019*** (0.092)**
Erasmus during crisis (0,1)		**2.042*** (0.084)**	**1.045*** (0.094)**
Erasmus after crisis (0,1)		**2.160*** (0.086)**	**1.177*** (0.096)**
EU (0,1)	0.886*** (0.071)		0.847*** (0.073)
Regional trade agreement (0,1)	0.734*** (0.039)		0.743*** (0.04)
Common currency (0,1)	0.683*** (0.087)		0.663*** (0.088)
Within R^2	0.392	0.395	0.392
Number of observations	30,887	30,887	30,887
Number of pairs	11,815	11,815	11,815

Note: All regressions demonstrate panel estimates that include country x time and bilateral effects. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Columns (1) to (3) present the results for the random-effects panel estimates where country $\times$ time dummies are included. All coefficients are positive and estimated with excellent precision. Interestingly, point estimates are dramatically higher for all Erasmus dummies whereas those of the EU are slightly lower. Surprisingly, RTAs are now economically and statistically relevant. Compared to the fixed-effects estimates, the Erasmus coefficients increase by a factor of more than 2 when one Erasmus dummy is estimated. When three Erasmus dummies are included in the specification, the estimated semi-elasticities increase by a factor of between 3.2 and 6.6 in column (2) and when other covariates are controlled for in column (3), by a factor of around 2.5.

As the fixed-effects estimator relies on weaker assumptions, we stick to our preferred estimates. However, applying the random-effects estimator showed that the results are robust to this choice.

5.5.3 Zero Student Stocks

Although we cannot clearly differ zero student stocks from missing observations, we strive to address the issue that arises in the presence of zero observations in a log-linear specification. Taking the log of the student stocks drops the observations with zero students which might induce a selection bias. A common method that prevents such bias is the estimation of the log of the observed student stocks plus 1, instead of the log of the student stocks (Beine et al., 2014).[10]

The UIS student data do not allow to clearly differ zero observations from missing observations. The UIS itself marks the data with"magnitude nil or negligible"–which we have considered as zero observations in our data set–or "not applicable"–which we have considered as missing values. Looking more precisely at the data, however, suggests that the student data where a clear number is not available is not always marked precisely, as sometimes the number on international student stocks is marked as "magnitude nil or negligible" although the number was above 100 over all other years.[11]

Table 5.6 presents the results where the log of student stocks plus 1 is used as the dependent variable. The inclusion of zero student stocks more than doubles the number of observations and pairs to 71.227 and 25,794, respectively. EU membership and the existence of a currency union are still statistically significant determinants for international student mobility, although point estimates are lower and common currency is only significant at the 5 percent level in column (3). The sign of the estimated RTA coefficient is still negative, but the effect is now statistically significant at the 5 percent level in column (1) whereas it is not distinguishable from zero in column (3).

Most interestingly for our purpose, the sign patterns of almost all Erasmus dummies remain positive but point estimates are substantially smaller. Also the level of significance is lower for almost all Erasmus dummies: only the effect of Erasmus in the time after crisis remains statistically significant at the 0.1 and 5 percent level in columns (2) and (3), whereas joint Erasmus membership during crisis is only significant in column (2).

[10] Another method that prevents such bias is the PPML estimate which is favored by Santos Silva and Tenreyro (2006). Compared to the log-linear specification this method yields the advantage that it can deal with zero student stocks. Furthermore, PPML can deal with heteroskedasticity in the disturbances causing an endogeneity problem as zero student stocks create some correlation between the covariates and the error term. This endogeneity problem also leads to inconsistent estimates. However, since we cannot clearly distinguish missing values from zero student stocks in the UNESCO data and the PPML panel results differ from our panel estimates, we stick to our preferred specification shown in section 5.4.1. For the sake of completeness, table C.4 in Appendix C.4 shows the PPML fixed-effects panel estimates but we do not explain the results in more detail.

[11] In the merged data sample where four averages are regarded, zero student stocks account for about 52 percent, observations higher than zero account for about 40 percent, and missing values account for about 9 percent of the observations. Hence, zero student stocks represent a disproportionately high share. In the yearly merged data set covering the years 1999 to 2015, zero student stocks account for about 52 percent and missing observations account for about 8 percent.

Including zero student stock cuts the estimated semi-elasticities of Erasmus for the time after crisis by a third and more than half to 0.4 and 0.2 in columns (2) and (3), respectively. The semi-elasticity for to the time during crisis falls by more than a half to 0.25 in column (2) and by almost a factor of 4 to 0.1 in column (3) and is not significant anymore.

Table 5.6: Erasmus and student mobility: zero student stocks

Dependent variable: Ln arithmetic average of student stocks			
	Ln (student + 1)		
	(1)	**(2)**	**(3)**
Erasmus (0,1)	**0.132**		
	(0.093)		
Erasmus before crisis (0,1)		**-0.054**	**0.034**
		(0.096)	**(0.094)**
Erasmus during crisis (0,1)		**0.250****	**0.106**
		(0.093)	**(0.096)**
Erasmus after crisis (0,1)		**0.400*****	**0.224***
		(0.093)	**(0.097)**
EU (0,1)	0.727***		0.646***
	(0.049)		(0.052)
Regional trade agreement (0,1)	-0.047*		-0.03
	(0.023)		(0.024)
Common currency (0,1)	0.224**		0.158*
	(0.068)		(0.07)
Within R^2	0.378	0.374	0.379
Number of observations	71,227	71,227	71,227
Number of pairs	25,794	25,794	25,794

Note: All regressions demonstrate panel estimates that include country x time and bilateral effects. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Since the UIS online data does not allow to distinguish zero observations clearly from missing observations, we stick to the preferred panel estimates. Nonetheless, using the log of the student stock plus 1 has shown that the estimates of the Erasmus semi-elasticities are robust to applying this method at least for the time after crisis.

5.6 Further Results

In this section we wish to address further questions: first, we want to investigate whether student mobility between Erasmus countries fosters foreign language skills. Second, we strive to explain whether economic factors matter and we regard how special country groups of Erasmus members perform concerning student mobility. We want to address these questions using panel estimates. If bilateral variables are stable over time–such as

common language–these variables cannot be estimated in the panel setup. One possibility to include these variables in a panel setup is to split the dataset and estimate, for example, the Erasmus dummy for countries with a common language compared to those that do not share a common language. This however, would cut the number of observations dramatically and does not allow to properly account for multilateral resistance. Another possibility is to include an interaction term of the Erasmus dummy with the bilateral variable. Since this yields the advantage that it safes degrees of freedom and the number of observations is higher, we decide to construct interaction terms of the Erasmus dummy with the bilateral variable. As we also want to include origin and destination country-specific time-varying variables, such as GDP, we construct a destination and origin specific variable interacted with the Erasmus dummy.

5.6.1 Linguistic Proximity

One of the aims of Erasmus is to increase student's knowledge of other European languages and cultures (OECD, 2004b). Therefore we wish to investigate whether student mobility between Erasmus member countries is higher for countries with a similar language. For this purpose we control for different variables: common official language (COL), common spoken language (CSL), and common native language (CNL). All data are provided by Melitz and Toubal (2012).

Table 5.7: Erasmus and student mobility: linguistic proximity

Dependent variable: Ln arithmetic average of student stocks			
	(1) Common official language (0,1)	**(2)** Common spoken language (0-1)	**(3)** Common native language (0-1)
Erasmus (0,1)	0.425**	0.785***	0.454**
	(0.161)	(0.177)	(0.15)
Erasmus x bilateral variable	-1.157*	-1.760***	-2.353
	(0.584)	(0.529)	(1.304)
Within R^2	0.415	0.415	0.415
Number of observations	27,209	27,209	27,209
Number of pairs	10,219	10,219	10,219

Note: All regressions demonstrate panel estimates that include country x time and bilateral fixed effects as well as the bilateral variables RTA, common currency, and EU dummy (here not shown). Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Table 5.7 presents the results. Beyond the variables that we regarded in our preferred panel estimates in section 5.4, we additionally control for the variable that is constructed as an interaction term of the bilateral Erasmus dummy with the bilateral cultural dummy of interest, as described above. Column (1) shows the estimates for common official

language, "implying that status as an official language means that all messages in the language are received by everyone in the country at no marginal cost, regardless what language they speak" (Melitz and Toubal, 2012). The number of languages is restricted to two official languages between a pair of countries. Column (2) demonstrates results for common spoken language, with common spoken language representing a probability (0-1) that two persons at random from a pair of countries understand one another in some language; the languages have to be spoken by at least 4 percent of the population of both countries. Column (3) shows the estimates for common native language, which is also expressed as a probability (0-1) "that a random pair from two countries speak the same native language. Therefore CSL embraces CNL and is necessarily equal or greater than CNL" (p. 16).

Over all specifications, the coefficient on joint Erasmus membership remains positive and significant. Regarding the interaction terms, the coefficients on Erasmus interacted with COL and CSL are negative and statistically significant and that of CNL is negative but not significant.

As common official language is a dummy variable, the coefficient of the interacted variable has the following meaning: if two Erasmus countries share a common official language, student mobility between these countries is about 42.5 percent - 115.7 percent= -73.5 percent lower relative to non-Erasmus countries. In contrast, if they do not share the same language, mobility between the Erasmus countries is about 78.5 percent higher.

Since the common spoken language variable is a expressed as a probability (0-1), the coefficient on the interacted variable has the following meaning: if the probability that two countries at random speak the same language exceeds a value of $0.785 \div 1.760 = 0.446$, student mobility between these Erasmus member countries is lower relative to non-Erasmus members. For instance, if the probability of common official language is 0.5, international student mobility between these countries is $78.5 - 176.0 \times 0.5 = -9.5$ percent lower if both countries are Erasmus members compared to non-Erasmus countries. In contrast, if the probability is 0.2, the student stocks between Erasmus countries is about 43.3 percent higher relative to non-Erasmus countries.

Interpreting the negative significant effect of the interaction terms of CSL and COL, we conclude that if two countries are Erasmus members, international students prefer to study in countries where it is not easy to understand one another so that students are willing to learn the language of the destination country. We therefore conclude that Erasmus fulfills its aim of fostering student's language skills. Hence, our findings are in line with the study of the European Union (EU) (European Commission, 2014a) which found that 90 percent of students go to a foreign country to improve their foreign language skills and experience living abroad.

5.6.2 Economic Factors and Academic Quality

In this subsection we wish to investigate whether students tend to go to countries that provide a higher academic quality or better economic conditions.

Table 5.8: Erasmus and student mobility: economic factors and academic quality

Dependent variable: Ln arithmetic average of student stocks								
	(1) Shanghai total score bilateral	(2) Shanghai total score	(3) Shanghai average score bilateral per	(4) Shanghai average score per country	(5) Ln GDP per capita bilateral	(6) Ln GDP per capita	(7) Ln number of arrivals bilateral	(8) Ln number of arrivals
Erasmus (0,1)	0.372*	0.429*	0.401*	0.052	0.426**	-0.754	0.425**	-3.007
	(0.158)	(0.189)	(0.156)	(0.269)	(0.159)	(0.918)	(0.156)	(1.555)
Erasmus x bilateral variable	-0.127**		-2.920**		0.097		0.04	
	(0.044)		(0.972)		(0.076)		(0.062)	
Erasmus x destination-specific variable		-0.164**		-1.322		0.151		0.131
		(0.055)		(1.12)		(0.09)		(0.075)
Erasmus x origin-specific variable		0.089		5.108**		-0.027		0.083
		(0.076)		(1.745)		(0.09)		(0.084)
Within R^2	0.410	0.410	0.410	0.410	0.412	0.412	0.414	0.415
Number of observations	30,303	30,303	30,303	30,303	30,547	30,547	29,085	29,085
Number of pairs	11,669	11,669	11,669	11,669	11,726	11,726	11,163	11,163

Note: All regressions demonstrate panel estimates that include country x time and bilateral fixed effects as well as the bilateral variables RTA, common currency, and EU dummy (here not shown). Robust standard errors in parentheses.All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Beine et al. (2014) have shown that students prefer to go to countries where the quality of universities is better. As Erasmus aims to foster quality of universities (Vossensteyn et al., 2008), we wish to control whether the quality of education influences a student's choice of country if both countries are members of Erasmus. To address this issue we follow Beine et al. (2014) and use the data provided by the ARWU Shanghai Ranking (Shanghai Ranking, various years). Different than Beine et al. (2014), who use the total number of universities classified in the top 500 Shanghai Ranking for the year 2007, we rather use the total score of the Shanghai Ranking over all universities in a country. For ease of readability of the estimated coefficient, we normalize the total score by dividing it through 100.[12] The interacted coefficient presented in table 5.8 in column (1) is negative and significant at the 1 percent level. Looking at the results for the sending and receiving country separately which is shown in in column (2), we find a negative and significant result for the destination country whereas the coefficient for the country of origin is positive and not significant. Hence, a high level of academic quality in a destination country surprisingly does not attract students if the home and destination countries are members of Erasmus.

Columns (3) and (4) show the results for the average score in the top 500 Shanghai

[12]Data for the Shanghai Ranking are available since 2003. However, if we want to use the score for the top 500 we can only reconstruct it since 2004 as the calculation method in 2003 was different. As our first period spans the years 1999 to 2002 and the Shanghai data are not available for any year in this period, we use the data for the year 2004 for the first period. For the other periods we construct an average in the same way as we did for the other data.

Ranking by each country, i.e. the total score in the top 500 ranking of each country is divided by the number of universities that are listed in the top 500 ranking. Surprisingly the coefficient of the origin country-specific interacted variable is positive and significant. Hence, a certain level of academic quality in the domestic country motivates students to study abroad.

As student mobility can be a "stepping stone" for later migration (Guellec and Cervantes, 2002), one could assume that students choose economically attractive destination countries. In columns (5) and (6) we show the estimates for the interaction term of the Erasmus dummy with the log of the GDP per capita. The coefficient on Erasmus remains positive and statistically significant whereas the interaction terms do not matter.

We also wish to investigate whether students tend to go to countries where people like to go on vacation. We use the number of arrivals shown in column (7) and (8) as a proxy for the attractiveness and the "fun factor" of a country. The coefficients on the interacted terms, however, are not significant.

5.6.3 Part of the Sample

In this subsection we wish to investigate the Erasmus effect for special groups of the sample. First, we wish to investigate whether net importing countries of students perform differently. The decision on whether a destination country is a net importer is made separately for each period. Columns (1) and (2) demonstrate the results for the interacted bilateral and the interacted country-specific variable, respectively. The bilateral effect is negative and significant at the 1 percent level. Looking at the country-specific estimates in column (2) shows that the estimated coefficient on the destination-specific variable is negative and significant at the 1 percent level, whereas the coefficient on the origin-specific variable is not significant. Since the estimated coefficient on the interacted Erasmus dummy is lower, the overall Erasmus effect is still higher compared to non-Erasmus members. This can be interpreted as follows: if two countries are Erasmus members and the destination country is a net importing country, the number of hosted students from a Erasmus country is roughly 18.4 percent lower compared to an Erasmus destination country that is a net exporter. Compared to the case where one or none country is a member in the Erasmus program, however, the number of international students is roughly 20.6 percent higher.

In columns (3) and (4) we investigate the effect for countries that joined the EU after 2004.[13] The coefficient on the bilateral variable in column (3) is positive and significant, and in column (4) the coefficient on the interacted origin variable is negative and

[13]See table C.2 in Appendix C for an overview of the entry year of each country to the EU.

Table 5.9: Erasmus and student mobility: part of the sample

Dependent variable: Ln arithmetic average of student stocks				
	(1) Net importer bilateral	**(2)** Net importer	**(3)** EU member since 2004 bilateral	**(4)** EU member since 2004
Erasmus dummy (0,1)	0.364*	0.390*	0.434**	0.572***
	(0.163)	(0.17)	(0.154)	(0.17)
Erasmus x bilateral variable	-0.147**		0.451*	
	(0.048)		(0.22)	
Erasmus x destination-specific variable		-0.184**		0.273
		(0.062)		(0.236)
Erasmus x origin-specific variable		0.094		-0.683*
		(0.079)		(0.318)
Within R^2	0.459	0.459	0.41	0.41
Number of observations	18,390	18,390	30,887	30,887
Number of pairs	8,453	8,453	11,815	11,815

Note: All regressions demonstrate panel estimates that include country x time and bilateral fixed effects as well as the bilateral variables RTA, common currency, and EU dummy (here not shown). Robust standard errors in parentheses.All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

significant.[14] Since the estimated coefficient is higher than that for Erasmus, countries that joined the EU after 2004 send less students to other Erasmus countries than those that already have been a member before. This might be due to the existence of a student exchange program between Eastern-European countries that is also organized by the European Commission (Vossensteyn et al., 2008).

5.7 Conclusion

In this chapter we investigated to what extent bilateral membership in the student exchange program Erasmus increases student mobility between its member countries. We investigated this question empirically. For this purpose, we used data on bilateral student mobility provided by the electronic UIS online database for the years 1998 through 2015 for 155 host and 187 origin countries and merged it with a bilateral dummy for joint membership in the Erasmus program and other variables. We used these data in a gravity-based model in a panel setup controlling for bilateral fixed effects to deal with unobserved country-pair heterogeneity. Furthermore, we made extensive use of country-specific time-varying dummies to account for unobserved multilateral resistance terms. We found that student mobility between Erasmus countries is about 53 percent higher on average. When the EU dummy was also included in the model, both turn out to be

[14]The estimated coefficient of the EU is 0.89 and significant at the 0.1 percent level. The EU overall effect is still positive, also for countries that are EU members since 2004.

significant determinants separately. However, that average hides substantial heterogeneity across the time periods which we regarded. Estimating the effect for the time before, during, and after the economic crisis in 2007/2008 we found that the effect was more stable for the time during and after the economic crisis. Furthermore, student mobility between Erasmus countries is higher when both countries do not share the same language, and economic factors do not increase student mobility. Based on the increasing effect that we found of Erasmus membership on student mobility, we conclude that the Erasmus program justifies its budget as it has fulfilled its goal of increasing student mobility between its member countries.

This higher effect of Erasmus membership on student mobility after the economic crisis can be attributed to various factors: (i) Post crisis, students may lack economic resources so studying in another Erasmus member country incurs lower costs than, for instance, studying in a country that is either not a member or is far from their home country; (ii) in the time during and after the crisis, psychological factors may have had an influence. In times of uncertainty, students who decide to study abroad may prefer to go to countries where they are more familiar with the culture and which is closer to their families. The 'European identity' that has been created through Erasmus (Mitchell, 2012) which fosters a sense of belonging to Europe and being a European citizen, may be pursued more during times of crisis and uncertainty; (iii) the period after the crisis spans the years 2011 to 2015 and therefore includes two years in which the program expanded its activities as investments under Erasmus+. Furthermore, the EHEA was launched in 2010 which further facilitated student mobility within the EHEA.

While our results are robust over a number of robustness checks, with better data, more precise implications would have been possible. For instance, bilateral data on the number of university cooperations which have been established through Erasmus would have enabled a more precise estimation of the effect on student mobility. Furthermore, data on the subject of studies would also be beneficial when, for instance, policy-makers strive to attract students studying a certain subject. Also, data on the amount of tuition fees paid over the years would have been beneficial. Beyond estimating the effect of the Erasmus program, constructing a variable that captures all student exchange programs would have allowed for the estimation of the effect of student programs in general.

Compared to the existing empirical literature, however, our analysis makes substantial headway: we exploit panel data for a large number of destination and origin countries, base our analysis on a very general econometric model, and include country $\times$ time dummies and bilateral fixed effects.

Chapter 6

The Bologna Process and Student Mobility: The Evidence[1]

Abstract This chapter investigates the question of whether the Bologna Process increases student mobility between the member countries. The chapter uses data on international student mobility for the years 1999 to 2015 obtained from the electronic UNESCO database for 155 host and 187 origin countries which are merged with a dummy variable on joint membership in the Bologna Process. Running fixed-effects panel estimates, the chapter finds that student mobility between Bologna Process member countries is, on average, about 50 percent higher. Importantly, both European programs–Erasmus and the Bologna Process–as well as EU membership turn out to be significant determinants separately. Estimating the effect of the Bologna Process membership for the time before and after the establishment of the European Higher Education Area (EHEA) shows that the impact is higher and more stable since the EHEA was established in 2010.

Keywords: Education, International Student Mobility, Panel Data, Bologna Process.

[1]Status: Not submitted. This chapter is written by Isabella Nicole Reczkowski.

6.1 Introduction

The Bologna Process can be considered as one of the main voluntary processes at a European level. Through the process countries, institutions, and stakeholders continuously adapt their higher education systems in order to achieve greater convergence between higher education systems in Europe, and in doing so have established the European Higher Education Area (EHEA) (OECD, 2004b; EHEA, 2019). Currently, the 48 countries that define the EHEA are participating in the process with the main goal being to "[...] increase staff and students' mobility and to facilitate employability" (EHEA, 2019). Furthermore, the Bologna Process was intended to make the EHEA more competitive and attractive, and to reinforce quality assurance policies and processes. In order to achieve this, the Bologna Process with its follow-up Ministerial Conferences has reduced obstacles to student mobility through the introduction of a common framework and tools that form the foundations of the EHEA (EHEA, 2015).

There are several reasons why among all the goals of the Bologna Process, student mobility has always been a core element conceived as an instrument to develop the EHEA (European Commission et al., 2012). As stated in the Berlin Communiqué (2003), mobility encompasses different dimensions–political, social, economic, academic, and cultural. Therefore, the promotion of student (and staff) mobility has been reiterated in all Ministerial Conferences of the Bologna Process. In 2009, the ministers further highlighted the importance of mobility by setting the specific target for EHEA countries that by 2020 at least 20 percent of those graduating in the EHEA shall have undertaken a tertiary-level study or training abroad (Leuven/Louvain-la-Neuve Communiqué, 2009). The importance of student mobility is also reflected in the fact that this target is also included in the European Union's (EU) strategic goal for 2020 (Council of the European Union, 2011). To achieve these goals, countries' budgets and activities vary widely. As stated in the Bologna Implementation Report (2012), half of the EHEA countries report that they have an action plan or a national strategy to increase student mobility. Some countries have also launched programs to stimulate mobility by implementing financial support (European Commission et al., 2012). Besides academic and cultural benefits, student mobility is also valued for its positive impact on employability and by extension the European labor market. Beyond increasing the employability of domestic workers, student mobility may also have a positive impact on the labor market if students decide to stay in an EHEA country where they have spent their studies abroad. According to this rational for student mobility, international students are a strategic means to stimulate competitiveness and, accordingly, the attractiveness of higher education institutions. Student mobility, therefore, contributes to economic growth in the knowledge economy of the receiving country (European Commission et al., 2012). European policy-makers are aware of these benefits and so are increasingly promoting student mobility. Apart from the

Erasmus student exchange program that was established in 1987, the Bologna Process which started in 1999 is the most important instrument to enhance student mobility at a European level. Compared to other regions, therefore, Europe is the region where student mobility receives the most attention and support from policy-makers.

The increasing demand for cross-border education resulting from the benefits for destination and origin countries alike are also reflected in the development of the worldwide number of international student mobility. The number increased dramatically from 0.8 million in 1975 to 2.1 million in 2000 and 5.6 million in 2018 (OECD, 2011, 2020). This number is strongly concentrated on few destination countries. Anglophone destinations are the most attractive countries for international students. In 2018, the four countries– the United States, the United Kingdom, Australia, and Canada–attracted more than 40 percent of global international students. The EU is another important region that attracted about 1.7 million students in 2018. The most important destination countries within the EU are the United Kingdom, Germany, and France with each accounting for 8 percent, 6 percent, and 4 percent of student mobility worldwide in 2018, respectively. The Russian Federation–which is not a member of the EU but has been a member of the Bologna Process since 2003–is also an important country that attracted about 5 percent of worldwide student mobility in 2018. Shifting the view to the relative outward mobility, the number increased only slightly from 5 percent in 2014 to 6 percent in 2018 across all OECD countries. However, there is strong heterogeneity across destination countries, ranging from 2 percent in Chile, Colombia, Costa Rica, Mexico, and Turkey to a share of at least 20 percent in Australia, Luxembourg, and New Zealand. The concentration of international student mobility is also high among sending countries. Asia is the most important region of origin, accounting for 57 percent of student mobility in OECD countries in 2018. The second largest region of origin is Europe. European students account for 23 percent of global student mobility in OECD countries in 2018, with 40 percent studying in EU23 countries (OECD, 2020). Hence, Europe can be considered as both an important destination and origin region for international students in general, as well as for mobility within Europe. Since student mobility in Europe is supported by policy-makers through the Bologna Process, this raises the question of whether common membership in the Bologna Process fosters student mobility between these countries and whether this effect differs for the time before and after the establishment of the EHEA.

In order to test this hypothesis, this chapter uses a database on bilateral student mobility spanning the years 1999 to 2015 obtained from the electronic UNESCO database. The data are merged with a bilateral dummy for the participation in the Bologna Process. The data set with the yearly data covers 155 host countries and 187 source countries. As a first step, I provide extensive descriptive analyses at a country level investigating whether the Bologna Process and the establishment of the EHEA have increased the attractiveness for international students, how student mobility within the EHEA has

developed, and whether it has increased the outward mobility of EHEA students. In the next step, using the data set and controlling for other variables, I investigate how joint membership of the sending and receiving countries in the Bologna Process affects international bilateral student mobility. Due to the patchy coverage of the student data for certain host countries, I construct averages typically over four years resulting in four periods. However, I conduct robustness checks with respect to this choice. As student data and the Bologna Process dummy are bilateral and available for several years, I can conduct the analysis in a panel setup. The availability of within country-pair variation allows to control for unobserved heterogeneity in countries' ties that affect both the bilateral student stocks and the Bologna Process membership. Furthermore, as I observe stocks from 187 source countries in 155 host countries, I can also control for country-specific time-varying variables by using dummies for both the destination and home country. To investigate whether the effect is causal, I follow Wooldridge (2002) and perform an F-test for strict exogeneity. This, for instance, was also applied by Felbermayr and Jung (2009).

I report the following findings: (i) Omitted variable bias due to a misspecification of the model can be very large. It is important to control for unobserved heterogeneity and multilateral resistance terms to obtain consistent estimates; (ii) Joint membership in the Bologna Process has a statistically significant positive impact on the stock of international students. Student mobility between Bologna Process member countries is, on average, about 50 percent higher; (iii) I perform a regression-based Wooldridge test for strict exogeneity and find a causal effect of joint Bologna Process membership on student mobility; (iv) Regarding the effect of the Bologna Process separately for the period before and after the EHEA was launched in 2010, the estimated semi-elasticity of the Bologna Process dummy is higher and more stable in the period after the EHEA was launched.

There are multiple reasons why being a member of the Bologna Process–and by that being a part of the EHEA established in 2010–may have a positive impact on student mobility between its member countries. The Bologna Declaration (1999) itself already declares that the Bologna Process aims to promote student mobility. This shall be achieved through the introduction of comparable and compatible study degrees and the establishment of the European Credit Transfer and Accumulation System (ECTS); by promoting the recognition of periods spent in the EHEA; through the improvement of students' access to study opportunities; the promotion of European cooperation in quality assurance; and the promotion of the European dimensions in higher education as regards institutional cooperation and mobility schemes. Another important benefit of studying in another EHEA country rather than in a non-EHEA country is the financial advantage due to the nondiscrimination principle for other EU students.[2] This advantage is especially notable

[2]More precisely, this principle refers to EU students, European Economic Area (EEA) students and Switzerland. Therefore, the EU nondiscrimination principle also includes students from Iceland, Liechtenstein, Norway, and Switzerland (Government UK, 2021; Edalo Education, 2021).

for students who strive to study in a country that charges higher fees for non-domestic students, such as the United Kingdom. Beyond these reasons, students might also benefit from social networks established by former students who studied in an EHEA country. Since the Bologna Process aims to increase student mobility, a higher number of students might go abroad. As such, over years more students can share their positive experience and motivate an increasing number of other students to live the same experience. Furthermore, students that have already been abroad to another EHEA country during their bachelor's degree might then go to another country to pursue a master's degree.

This chapter is closely related to the Bologna Implementation Report–a study published by the European Commission in cooperation with EACEA and Eurydice in the years 2012, 2015, and 2018 (European Commission et al., 2012, 2015, 2018). The reports demonstrate to what extent the Bologna Process has transformed the higher education sector and give an overview of the state of implementation of the Bologna Process from different perspectives. For this purpose, the reports provide qualitative as well as quantitative information for the years 2011, 2014, and 2017, respectively. Besides internationalization and mobility, the reports cover all main aspects of higher education reforms in all countries with the aim of a well-functioning EHEA. These topics are the European higher education landscape, degree structures and qualifications, quality assurance, the social dimension in higher education, effective outcomes and employability, as well as lifelong learning. With respect to student mobility, the report gives a detailed descriptive insight regarding outward and inward mobility. The strength of the Bologna Implementation Reports is that they provide a detailed descriptive overview at a country level at different points of time since the beginning of the Bologna Process. However, since the information they provide is only descriptive, the reports do not investigate a causal relationship between student mobility and the Bologna Process.

This work is also very much related to a wide range of studies investigating the determinants of student mobility. While most empirical studies focus on a single host country only–see for instance Rosenzweig (2008) or Bessey (2012) who analyze the factors that motivate students to study in the USA and Germany, respectively–there is little empirical work investigating the determinants in a multi-destination multi-source framework. Looking at one single host country, however, does not allow to control for multilateral resistance terms. There are two studies of special interest that include a wider range of destination and origin countries. The study by Beine et al. (2014) investigates the determinants of student mobility in a theory-grounded gravity model using a dataset that covers 13 destination and almost all origin countries for the years 2004 to 2007. Besides the usual dyadic cost variables distance, common language, and a colonial link, they also include the stock of migrants by educational attainment in order to control for a network effect and they also control for destination specific variables such as tuition fees and academic quality. Using Poisson Pseudo Maximum Likelihood (PPML) estimates for each year sep-

arately, they find a positive significant impact of language, the network effect, academic quality, and housing prices; the effect of distance is significant and of negative sign. In contrast, they do not find a significant impact of tuition fees. The strength of this study is in the use of the PPML estimator which allows for the inclusion of zero student flows. Furthermore, they combine PPML with instrumental variables estimators addressing the causality question when estimating the effect of tuition fees and the network effect in the year 2007. Furthermore, they use data on student mobility which is strictly restricted to international students and do not include foreign students. However, the limited number of years and destination countries may cause a selection bias. Furthermore, they do not estimate the effect of the Bologna Process or the EU. Another work by Abbott and Silles (2016) also analyzes the determinants of international student mobility in a gravity-based model for 18 destination and 38 origin countries for the years 2005 to 2011. Besides the usual variables that are used in gravity estimations, they additionally include a dummy variable on joint EU membership in their estimates and find a significant positive effect on student mobility. The strength of this study is, as in the study by Beine et al. (2014), in the use of PPML estimates and data on student mobility which is strictly restricted to international students. However, they do not use panel estimates and therefore cannot control for bilateral fixed effects which, however, is crucial to obtain consistent estimates (Baier and Bergstrand, 2007). Furthermore, the limited number of countries and years may cause a selection bias and does not allow to control for multilateral resistance terms. Moreover, they do not estimate the effect of joint membership in the Bologna Process.

Beyond these studies, there are also several studies that estimate the determinants of international student mobility for European countries (for examples, see Rodríguez González et al., 2011; Caruso and de Wit, 2013; Sánchez Barrioluengo and Filsi, 2017).

Finally, this chapter is also related to a large, mainly theoretical literature that discusses the challenges of financing higher education in a world where students and workers are mobile and education is financed publicly (for examples, see Justmann and Thisse, 2000; Demange et al., 2008; Lange, 2009). Another work by Gérard and Uebelmesser (2014) is of special interest, as they focus on challenges of financing higher education in the EU that result from low tuition fees and nondiscrimination of other EU member countries, especially if mobility between countries is unbalanced.

The chapter is organized as follows: The next section 6.2 provides an overview of the chronological background of the Bologna Process and gives a brief summary of each follow-up Ministerial Conference and the goals that were set during each of them. Section 6.3 describes the data used in this chapter and section 6.4 provides a detailed descriptive analysis investigating whether the different goals set throughout the Bologna Process were achieved. Section 6.5 presents the econometric specification. In section 6.6 I demonstrate the baseline results, while section 6.7 checks for robustness. Finally, section 6.8 concludes.

6.2 Chronological Background

6.2.1 The Sorbonne Declaration and the Bologna Declaration

On May 25, 1998 the ministers in charge of higher education in France, Germany, Italy, and the United Kingdom met in France at the University of Sorbonne in Paris where they signed the Sorbonne Declaration, which is regarded as the "joint declaration on harmonization of the architecture of the European higher education system". The main aim of the Sorbonne Joint Declaration (1998) is "[...] encouraging a common frame of reference, aimed at improving external recognition and facilitating student mobility as well as employability". In order to reach this aim, the ministers of the four countries invited "[...] other Member States of the Union and other European countries to join [them] in this objective and on all European universities to consolidate Europe's standing in the world through continuously improved and updated education for its citizens".

The aims of the Sorbonne Declaration were confirmed through the Bologna Declaration on June 29, 1999 when 29 higher education ministers met in Bologna, the site of the oldest university in the world. The ministers agreed on a common vision of an EHEA, which they translated into operational objectives that were listed in the Bologna Declaration (1999). All the provisions were set as measures of a voluntary process in the declaration and not as part of a binding contract (EHEA, 2019). The Bologna Declaration (1999) lists the following main goals:

- Adoption of a system of easily comparable and readable degrees, as well as the implementation of the Diploma Supplement, as a means to promote European citizens' employability as well as the international competitiveness of the European higher education system.
- Adoption of a two-cycle system, where access to the second cycle (graduate level) requires successful completion of the first cycle (undergraduate level) that lasts a minimum of three years. The degree that students are awarded after the first cycle shall be an appropriate level of qualification for the European labor market. The degree awarded after the second cycle should be a master's and/or doctorate degree, as in many European countries.
- Establishment of a system of credits–such as the ECTS–as a proper means for promoting student mobility.
- Promotion of mobility for students, teachers, researchers and administrative staff by overcoming the obstacles of free movement, such as promoting the recognition and valorization of periods spent in a European context researching, teaching and training, without prejudicing their statutory rights, and improving students' access to study and training opportunities and to related services.

- Promotion of European co-operation in quality assurance, including the development of comparable criteria and methodologies.
- Promotion of the necessary European dimensions in higher education, especially concerning mobility schemes, interinstitutional co-operation, integrated programs of study, training, research, and curricular development.

6.2.2 Bologna Follow Up: Ministerial Conferences

As a follow-up to the Sorbonne and the Bologna Declaration, ministerial meetings have taken place almost every two years and the ministers' will is expressed through the respective Communiqués.

In these Ministerial Conferences the agenda was broadened and tools which had already been developed were more clearly defined. As a result, the two-cycle degree system divided into the undergraduate and postgraduate degree was modified into a three-cycle structure, the recognition of qualifications became regarded as central to European higher education policies, and a concept of a social dimension of higher education was established (European Commission et al., 2015; EHEA, 2019). Up until the present time, the eight Ministerial Conferences listed below have taken place.[3]

The Prague Communiqué, 18-19 May 2001

With the first ministerial conference after the Bologna Declaration, the number increased to 33 countries. In the Prague Communiqué (2001), the objectives that were set in the Bologna Declaration were expanded in terms of lifelong learning, involving universities and students as active partners as well as promoting the attractiveness and competitiveness of the EHEA. Furthermore, the ministers committed to further developing quality assurance and national qualifications frameworks. Also, the social dimension was introduced for the first time.

The Berlin Communiqué, 18-19 September 2003

In the Ministerial Conference in Berlin 2003, the number of countries was increased to 40 members. The main provisions of the Berlin Communiqué (2003) were the expansion of the objectives concerning the promotion of linking the EHEA to the European

[3]Furthermore, the Ministerial Conference in Paris took place on 24-25 May 2018, 20 years after the Sorbonne Declaration was signed. It was opened to EHEA delegations and gave the possibility for a dialogue between EHEA member countries and nonmember countries, as it included a Bologna Policy Forum. The Paris Communiqué (2018) emphasizes the need to improve the implementation of values, especially of democratic values. As the data regarded in this chapter cover the years until 2015, the evaluation of the targets and contents set in this conference are not considered in this chapter.

Research Area and the promotion of quality assurance. Furthermore, the Berlin Communiqué defined the follow-up structures to support the process in-between two Ministerial Conferences: it established the Bologna Follow-Up Group (BFUG), the Board, and the Bologna Secretariat. The participating ministers also agreed that a national follow-up structure should be established in each participating country.

The Bergen Communiqué, 19-20 May 2005

In the Ministerial Conference in Bergen 2005, the number of participating countries was increased to 45. The Bergen Communiqué (2005) emphasized the importance of partnerships–including stakeholders with a special focus on students, HEIs, employers and academic staff–and the further enhancement of research, especially concerning doctoral programs as the third cycle. Furthermore, the ministers underlined their will to provide more accessible higher education combined with making the EHEA more attractive to other parts of the world.

The London Communiqué, 17-18 May 2007

In this Ministerial Conference in London 2007, the number of member countries increased to 46. The London Communiqué (2007) evaluated the progress of the process that was achieved by that time, especially concerning mobility, degree structure, recognition, the national and overarching qualifications frameworks, lifelong learning, quality assurance, and the social dimension. Furthermore, the Communiqué set the main priorities for 2009 which were mobility, social dimension, data collection, employability, the EHEA in a global context, and stocktaking. Furthermore, the need for further collaboration was emphasized for the years 2010 onwards, in order to use the opportunity to reformulate the values and vision of the EHEA.

The Leuven Communiqué, 28-29 April 2009

The Leuven/Louvain-la-Neuve Communiqué (2009) set the main focus areas for the next decade as the following: social dimension (equitable access and completion); lifelong learning; employability; student centered learning and the teaching mission of higher education; education, research and innovation; international openness; mobility; data collection; multidimensional transparency tools; and the funding of higher education. The focus on these new areas demonstrates a more in-depth approach to reforming the Bologna Process in order to ensure the completion of its implementation. Concerning mobility the Communiqué stated that "mobility shall be the hallmark of the European Higher Education Area" (The Leuven Communiqué 2009, p. 4). It set the goal that at least 20 percent of the students graduating in the EHEA in 2020 should have spent

a period abroad. Furthermore, an important change was made to the Bologna Process Chairing procedure: While previously the Process was chaired by the country that holds the EU Presidency, from July 1, 2010 it will be joint chaired by a non-EU country.

The Budapest/Vienna Declaration, 10-12 March 2010

In this Ministerial Conference, the number was expanded to 47 countries. This Conference was not only the Anniversary Conference of the Bologna Process, where a decade of the Bologna Process was celebrated, but it was also the official launching of the EHEA: the objective set in the Bologna Declaration (1999) with respect to a common European framework for the higher education was accomplished. As the action lines were implemented to different degrees and not all the objectives of the Bologna Declaration were achieved, the Bologna Process entered a new phase in 2010 (Budapest-Vienna Declaration, 2010; EHEA, 2019).

The Bucharest Communiqué, 26-27 April 2012

In the Ministerial Conference in Bucharest, the principle message of the 47 ministers was that in the face of economic crisis the reform of higher education could help Europe to get back on track, generate jobs, and achieve sustainable growth. The ministers agreed to focus on three main goals (Bucharest Communiqué, 2012): to provide quality higher education to more students, to better equip students with employable skills and to foster student mobility. Concerning increasing mobility, the ministers adopted a new Mobility Strategy of the EHEA as an addendum to the Ministerial Conference. This Mobility Strategy reaffirmed the mobility target of the Leuven/Louvain-la-Neuve Communiqué (2009) that at least 20 percent of the students graduating in Europe in 2020 should have been abroad, either for studies or for a period of training (Bucharest Communiqué, 2012; EHEA, 2012).

The Yerevan Communiqué, 14-15 May 2015

In this Ministerial Conference, the number was expanded to 48 countries. The Yerevan Communiqué (2015) recognizes that the vision of the EHEA of Bologna was a successful inspiration. However, in order to achieve the full potential of the EHEA, improvement of higher education systems is required, as is the involvement of academic communities. During the conference the ministers adopted the following policy measures: the revised Standards and Guidelines for Quality Assurance in the EHEA, the European Approach for Quality Assurance of Joint programs, and the revised ECTS Users' Guide. Furthermore, the ministers set common goals for member countries, which were to be implemented by 2020. These were that member countries had to foster quality and relevance of teaching

and learning, enhance employability, make higher education systems more inclusive, and implement previously agreed structural reforms.

6.3 Data

6.3.1 International Student Mobility

The data on bilateral student mobility are available for international students and foreign students. While international students are those students who move to another country for the purpose of education, foreign students are defined according to their citizenship. Therefore, international students are a subgroup of foreign students. The data on student mobility are collected and provided the UNESCO Institute for Statistics (UIS), EUROSTAT (UOE), and the OECD. These institutes define international students "as those who are not residents of their country of study or those who received their prior education in another country. When data on international students are not available, data on foreign students are used" (OECD 2013, p. 1). As the definitions of student mobility vary over countries, the situation on student mobility is not optimal. Therefore, the OECD started to provide separate data for foreign and international students for 30 destination countries for the year 2004 onwards (OECD.Stat, various years). As I want to investigate a wider range of years and countries, I use the data provided by the UIS. These data are available for almost all countries for the year 1998 onwards and therefore allow to control for the effects of the Bologna Process membership since the beginning in 1999.[4]

6.3.2 Bologna Process

The main independent variable is a bilateral time-variant dummy variable that is 1 if the destination and the sending countries are members of the Bologna Process and 0 otherwise. The variable is generated based on the entry year of each country. A list of the member countries by entry year is shown in table D.2 in Appendix D.2. There are three different levels of membership concerning the Bologna Process/EHEA: full members, consultative members, and partners (EHEA, 2019). The dummy on Bologna Process membership is based on full membership.

[4]Besides the data provided by the UIS online database, data are also available from printed UNESCO Statistical Yearbooks for the years 1970 onwards. Unfortunately, these data are only available for a limited number of destination countries and do not cover all member countries of the Bologna Process. Therefore, I do not use these data.

Full members

Currently, 48 countries and the European Commission are full members of the EHEA/ Bologna Follow-Up Group (BFUG). The BFUG is the executive structure that supports the Bologna Process between the Ministerial Conferences whose work is overseen by a board. BFUG membership is dependent on EHEA membership. If a country wants to become a member of the EHEA, it has to join the European Cultural Convention and to declare willingness to implement and pursue the objectives of the Bologna Process in its own higher education system (EHEA, 2019).

Apart from the 48 countries, the European Commission is the only "non-state" full member of the Bologna Process. Its participation is not limited to the BFUG, however, as it actively develops various activities in the Bologna Process, including financial ones. These activities mainly refer to areas such as quality assurance, the promotion of joint degrees and of the bachelor/master structure (OECD, 2004b; Keeling, 2006). Furthermore, various initiatives in the Bologna Process were first developed by the European Commission to raise the mobility of European students. The ECTS, for example, was first developed as a pilot project in the Erasmus program (Keeling, 2006). In general, there is a growing convergence between the agendas of the Bologna Process and the European Commission. This is also underlined by the Lisbon Strategy for economic growth and employment that aims on making the EU "the most competitive and dynamic knowledge-based economy in the world" (European Council, 2000). To achieve this, the European Commission and the Education Council (EU Education Ministers) were asked to examine the objectives of the education system. In doing so, they should focus on common concerns while also respecting national diversity. Despite this active enrolment of the European Commission in the Bologna Process and the Lisbon Strategy, the role of the EU has formally remained unchanged (OECD, 2004b).

Consultative members

The so-called consultative members are non-voting members that represent stakeholder institutions and organizations that are instrumental in the implementation of the Bologna Process and have a European scope to their work. Currently, the BFUG has eight consultative members (EHEA, 2019).

Partners

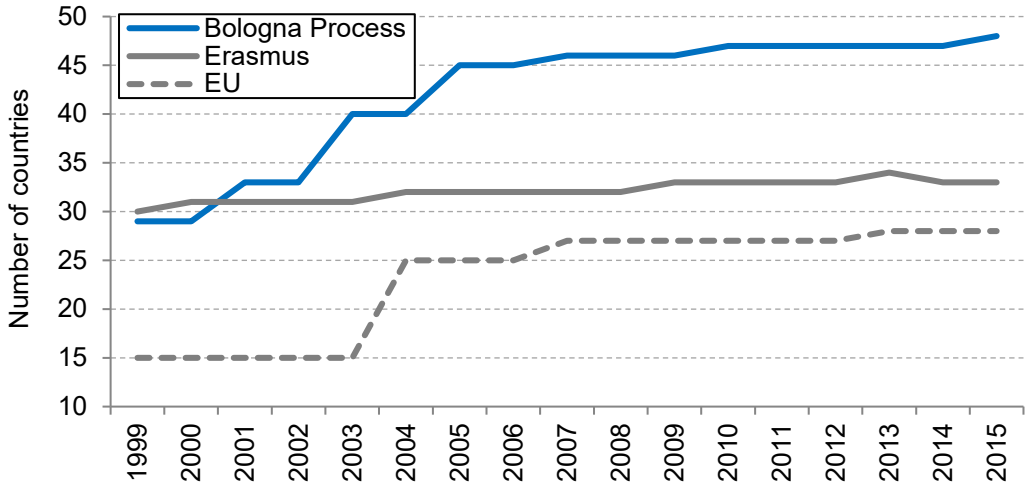
Partners are the third category of membership of the BFUG/EHEA. They are organizations which are not included in the category of consultative members but wish to be associated with the BFUG. They may be invited by a working group of the BFUG and can attend BFUG events upon request. Currently, four organizations are listed as BFUG

partners. Furthermore, technical experts that may be associated with the BFUG, such as Eurostudent, Eurydice or Eurostudent, may be invited to events upon specific request (EHEA, 2019).

Membership in the Bologna Process versus Erasmus and EU Membership

Figure 6.1 demonstrates the development of the member countries of the Bologna Process since its inception in 1999. Besides the Bologna Process, the student exchange program Erasmus is among the most important initiatives at a European level to promote student mobility. Therefore, it is interesting to see whether and to what extent the members of Erasmus differ from the Bologna Process member countries. Furthermore, as both programs are European initiatives, it is also of interest to regard the number of EU member countries.

Figure 6.1: Member countries of the Bologna Process, the EU, and the Erasmus program from 1999 to 2015



Note: The figure shows the number of member countries of the Bologna Process, the student exchange program Erasmus, and the EU since the beginning of the Bologna Process in 1999.

Clearly, the number of member countries in the Bologna Process, the Erasmus program, and the EU differs over the considered time period. In 1999, the year in which the Bologna Process started, the number of member countries was almost identical to that of the Erasmus program.[5] Starting with 29 countries in 1999, the number of Bologna Process members rose by 65.5 percent to 48 countries in 2015. In contrast, the number of participating Erasmus countries only increased from 30 countries in 1999 to 33 countries in 2015. As the Erasmus program was launched in 1987, it is reasonable that countries were first members of the Erasmus program and then joined the Bologna Process afterwards.

[5]Cyprus and Liechtenstein were member countries of Erasmus in 1999 but joined the Bologna Process in 2001 and Malta was a member of the Bologna Process and joined Erasmus in 2000.

This is true for all countries with the exception of Croatia, Macedonia, Malta, and Turkey. With Macedonia joining the Erasmus program in 2013, all countries that are members of the Erasmus program are also members of the Bologna Process. The countries that joined the Bologna Process in the following years but not the Erasmus program, can be grouped into countries that were members of the former Soviet Union and Southeastern European countries such as Bosnia, Montenegro, and Serbia.

6.3.3 Other Data

As shown in figure 6.1, the participating member countries in the Bologna Process, the EU, and the Erasmus program differ over the years. Due to the nondiscrimination principle in the EU, destination countries are not allowed to charge EU students higher fees than from domestic students. Studying in another EU country therefore reduces students' migration costs. Furthermore, joint membership in the student exchange program Erasmus may increase student mobility between its member countries as students might benefit from the network between universities or from a social network established by former Erasmus students. Therefore, I additionally control for common membership in the EU and the student exchange program Erasmus. Beyond these memberships, I additionally control for common currency, as it eliminates the currency risk and by that possibly arising costs, and I also include regional trade agreements (RTA) in the econometric specification. During the development of the NAFTA, for example, several initiatives were created to foster academic cooperation such as the North American Student Mobility program (OECD, 2004b).

Table D.1 in Appendix D.1 shows the summary statistics as well as the data sources for all variables based on the data set where averages over four years are regarded.

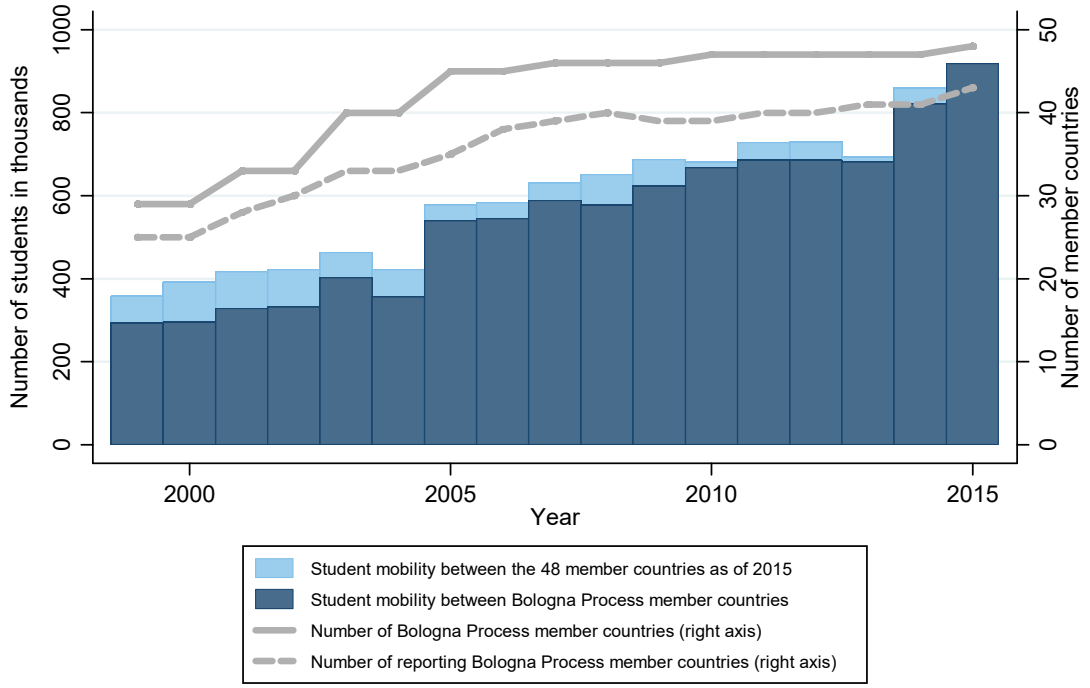
6.3.4 A First Glance at the Data of International Student Mobility Within the EHEA

This section strives to demonstrate how the number of international student mobility between Bologna Process member countries developed over time.

Figure 6.2 shows the development of the aggregated number of student mobility between the participating Bologna Process member countries for the period from 1999 to 2015 (dark blue bars) that reported the number of hosted students. The grey line shows the development of the member countries of the Bologna Process, starting with 29 countries in 1999 and rising to 48 members in 2015. As not all member countries reported the number of hosted students in each year, the dashed line demonstrates the number of reporting destination countries.

Since the increasing number of participating member countries naturally leads to an increase in the aggregated number of student mobility between the Bologna Process member countries, the graph also demonstrates the number of total student mobility between the 48 member countries as of 2015 over the considered period. This number is shown by the sum of the light blue bar and the dark blue bar; in 1999 the dark blue bar shows student mobility between the 29 member countries of the Bologna Process and the light blue bar demonstrates the number of the remaining 48-29=19 countries that go on to become member countries in the following years. Finally, in 2015, the light and dark blue bars account for the same student mobility between the 48 member countries. Thus, the integration of the light blue bar gives insight as to whether student mobility increased as more countries joined the Bologna Process.

Figure 6.2: Student mobility between the Bologna Process member countries from 1999 to 2015



Note: Data show the total international student mobility between Bologna Process member countries (dark blue bars). The dark and light blue bars together demonstrate the student mobility between the 48 Bologna member countries as of 2015 over all years. The grey line shows the number of Bologna Process member countries for each year; the dotted line shows the number of reporting Bologna Process destination countries for which data are available in each year

The number of student mobility between the Bologna Process member countries increased over the years from 293 thousand students in 1999 to 918 thousand students in 2015, which represents a total growth by a factor of more than 3 and a compound average annual growth rate of 7.4 percent. Looking at the development of the area consisting of the 48 member countries throughout the whole period, the number increased from 358 thousand in 1999 to 918 thousand in 2015, representing an average annual growth rate of 6.1 percent. Interestingly, the number of the 48-country area also increases commensurate

with the number of participating countries.

It is important to note that the number of reporting countries varies over the years. This is especially visible where one of the biggest host countries of student mobility within the EHEA does not report the number of hosted students. For instance, Germany reports the number of hosted students for the years 2005 onwards only (with a break for the years 2011 and 2012). As this leads to a biased picture, the graph has to be viewed with discretion. In general, it might be more meaningful to consider the average bilateral student mobility between the participating EHEA countries compared to the average bilateral student mobility worldwide. Furthermore, it would be interesting to regard the total number of student mobility between Bologna Process member countries as a share of total student mobility worldwide. However, due to the patchy coverage of the data it is unfortunately not possible to show a meaningful graph for these numbers over the years. In the following sections, I will therefore demonstrate data at a country level in order to give an accurate descriptive overview of the development of student mobility over the years.

6.4 Descriptive Analysis at a Country Level: The Impact of the Bologna Process on Student Mobility

This section strives to analyze data at a country level and give a descriptive overview of the development of student mobility under the influence of the Bologna Process. In doing so, I want to address the question of whether the Bologna Process has achieved its mobility goals in the different countries which were (i) to promote the mobility of students within the EHEA (Bologna Declaration, 1999; Bergen Communiqué, 2005); (ii) to increase the attractiveness of the EHEA to other parts of the world (Prague Communiqué, 2001; Bergen Communiqué, 2005), and (iii) to make good process towards the EHEA mobility target that at least 20 percent of those graduating in the EHEA should have been abroad to study by 2020 (Leuven/Louvain-la-Neuve Communiqué, 2009; Bucharest Communiqué, 2012). I will address these topics by means of descriptive statistics. For this purpose, I will demonstrate the figures from 1999–the year in which the Bologna Process started– to 2015, the latest year available. Due to data irregularities, I consider averages rather than yearly data. Nonetheless, it is not always possible to analyze data for each country in each period. Since the mobility goals were set in different years, I regard different averages depending on when the goal was set. When the numbers of incoming students are shown, it reflects the perspective of a destination country and can be considered as an indicator of the attractiveness of a country. Outward mobility, in contrast, takes the perspective of the country of origin and shows where the students come from. It can

either be considered as an indicator of a country's proactive policy for students to study abroad and acquire international experience or it may be an indicator of insufficiencies in the tertiary education system of the sending country (European Commission et al., 2015).

Furthermore, the financing system for student mobility within the EU relies on the principle of a balanced situation. Although the EHEA member countries do not equal the EU members, the EHEA also aims to achieve a balanced situation since the Bologna Process supports the EU targets. Therefore, section 6.4.3 demonstrates how balanced the situation of student mobility between EHEA member countries is.

6.4.1 Has the Bologna Process Increased the Attractiveness of its Member Countries?

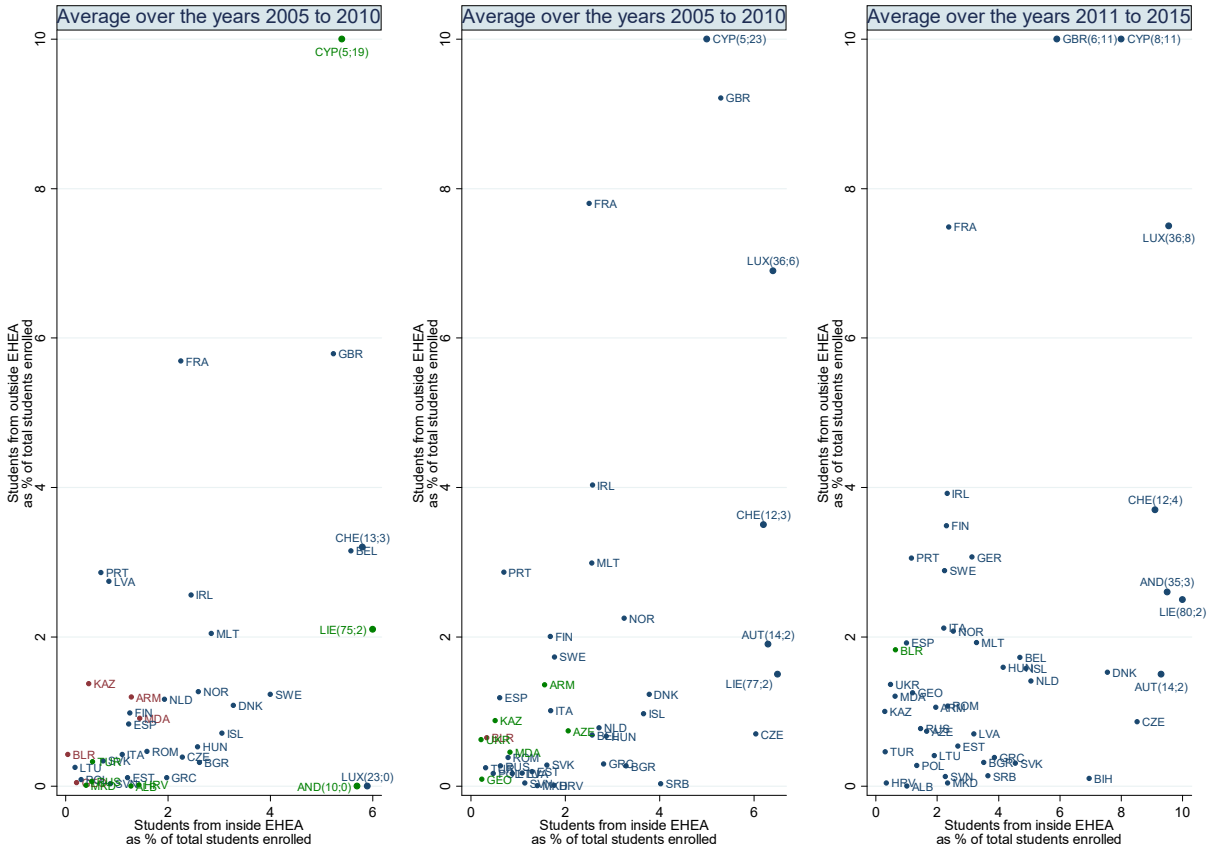
This section strives to demonstrate the attractiveness of an EHEA country to non-member countries as well as to other EHEA member countries. In order to do this, it considers the number of incoming students from outside the EHEA compared to the number of hosted students that come from EHEA countries. As a principle motivation of the EU is to increase the number of skilled workers, it is of crucial importance to attract a sufficient number of international students as some may remain in the country after their studies to work. Regarding the EHEA as one region, the number of incoming students from outside is therefore more important under the skilled migration approach, whereas the mobility from within the EHEA is important to foster mutual understanding within the area.

Figure 6.3 regards the stock of hosted students in each EHEA member country relative to a country's size of the tertiary education system using the total stock of enrolled tertiary students as a proxy. The relative number of hosted students from outside the EHEA is displayed on the y-axis and the relative number of hosted students from other EHEA member countries is shown on the x-axis.[6] As data are not available for all countries for all years, I build averages over three periods. This reveals whether the goal of the Bergen Communiqué (2005) was achieved, that is, whether the attractiveness of the EHEA has increased. This goal was mentioned again in the Mobility Strategy for the EHEA (EHEA, 2012). The years from 1999 to 2004 are displayed in the left chart, the period from 2005 to 2010 in the middle, and the years 2011 to 2015 in the right chart. The left chart, therefore, presents the data before the goal was set, the middle graph shows how the numbers have developed since the goal was set, and the right chart displays the mobility figures after the establishment of the EHEA in 2010, meaning that the effects of the EHEA can be seen in this chart.

[6]The data used are the number of hosted students excluding students from unknown origin, as this could include students from within or outside the EHEA. The share is calculated for the average over a period of five or six years. Data are only used for calculating the average for the period where both the number of tertiary enrolled students and international students is available for the year.

The number of member countries of the Bologna Process/the EHEA grew over the three periods which have been considered. Therefore, looking at a varying number of member countries in the graphs would not make it possible to say whether the increase of income mobility within the EHEA is related to an increase of student mobility between two member countries, or if the number of hosted students only grew as the EHEA contains more members and student exchanges with former countries remained stable. In order to make the graphs comparable in this regard and to be able to see if the change in inward mobility is due to a disproportionate increase of student mobility influenced by a country's membership, the EHEA is defined as the region as of 2015, consisting of 48 member countries in all three graphs.

Figure 6.3: Inward mobility in the EHEA as of 2015: share of hosted students from outside versus within the EHEA



Note: The number of hosted students from EHEA countries is displayed on the x-axis as a share of the total number of tertiary students enrolled in the destination country. The y-axis displays the number of hosted students from outside the EHEA as a share of the total number of tertiary students enrolled in the destination country. International students from unknown countries of origin are not included. Outliers are displayed within the graph but marked with rounded axial distances. The EHEA includes the same number of member countries (as of 2015) over all periods. Navy countries are members of the Bologna Process in the regarded period, green countries joined the Bologna Process in the considered period, and red countries are not members in the considered period but will become members afterwards. Data refer to an average over a period of five or six years. For some countries, data are not available for each period. Source: International students: UIS.Stat (2018); Total number of tertiary students: UIS.Stat (2019)

Inward Student Mobility from Outside the EHEA

Looking at the inward mobility from outside the EHEA (y-axis), the top countries with the highest share of incoming students are Cyprus, the United Kingdom, and France over all three periods. In Cyprus, the share rose from 19.0 percent in the first period to 23.3 percent in the second period and decreased in the third period to 11.4 percent. In the United Kingdom, the relative share increased from 5.8 percent in the first period, to 9.2 and 11.4 percent in the second and third period, respectively. Furthermore, the share in France rose over time, with a share of incoming students from outside the EHEA of 5.7, 7.8, and 7.5 percent in the first, second, and third period, respectively. Luxembourg and Ireland had a share around 4 percent or higher in the last two periods, whereas the share of the other countries was below 4 percent across all years.

Looking at the development of the share over time comparing the first to the third period, the increase of relative student income was greater than 2 percentage points in Luxembourg (+7.5), the United Kingdom (+5.6), Andorra (+2.6), and Finland (+2.5).[7]In France and Cyprus, the share rose by more than 2 percentage points from the first to the second period but decreased in the third period.

In some countries, however, the relative share even decreased, most notably in Belgium with a decrease from 3.1 percent in the first period to 0.7 and 1.7 percent in the second and third period, respectively.[8] Latvia showed a similar pattern, where the relative inward mobility decreased from 2.7 percent in the first period to 0.7 percent in the last period. In the remaining countries, the share remained virtually stable or changed by less than 2 percentage points.

Figure 6.4 demonstrates for each EHEA member country the absolute number of incoming students from outside the EHEA for the third period (grey bars). For comparison, the black lines and dots demonstrate the data for the first and second period, respectively. As in the case of the relative inward mobility from outside the EHEA, the United Kingdom also received the most students in terms of absolute numbers, followed by France and Germany. Separately, these countries account for 31, 20, and 11 percent of the total number of hosted students in the EHEA from non-EHEA countries, respectively, and together they account for 62 percent.[9] The high share of hosted students is to be expected as they are not only the top destination countries of the EHEA, but also among the top

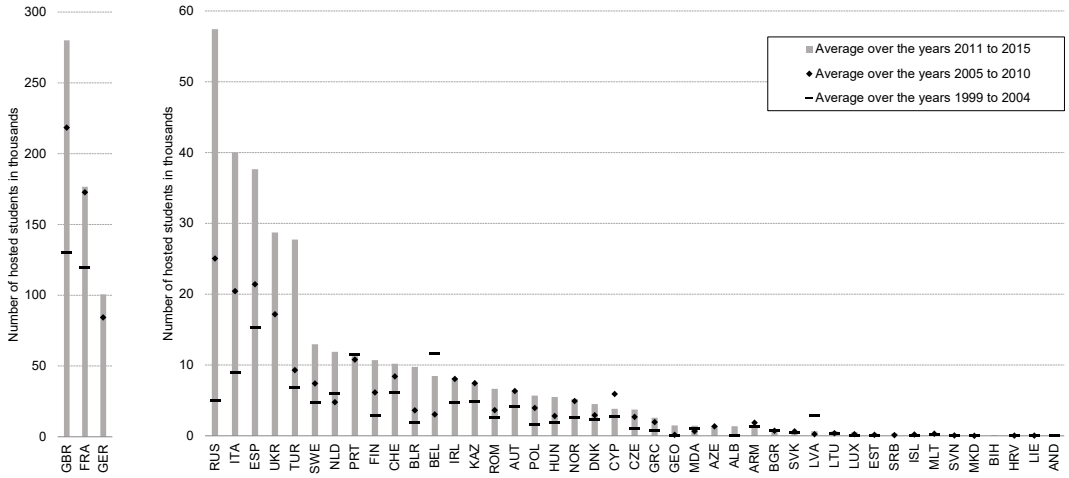
[7]For the first period, data for Andorra are only available for 2002 and for Luxembourg only for 1999. Hence, the increase might be smaller.

[8]Note that the reported number of hosted students in Belgium might be downward biased, as the number of hosted students by origin countries is sometimes marked with zero although the number was above 100 in previous years. This, for example, is the case for students from Germany in the year 2008.

[9]The number of students going to Germany is only available for the second and third period. As data for the total students enrolled are not available for the second period, the relative share can only be calculated for the third period.

5 destination countries worldwide. Concerning the countries of origin, these three countries differ as they attract students from different parts of the world.[10] While the United Kingdom mainly attracts students from Asia, the highest share of non-EHEA students studying in France are from French-speaking African countries with an increasing share coming from Asia, and the students studying in Germany from non-EHEA countries are mainly Asian, even though the majority of international students studying in Germany are still European.

Figure 6.4: Absolute number of incoming students from outside the EHEA by destination country



Note: The figure demonstrates for each EHEA country the number of hosted international students from non-EHEA countries. Students from unknown countries of origin are not included. Data refer to an average over a period of five or six years. For some countries, data are not available for each period. The EHEA includes the same number of member countries (as of 2015) across all periods.

Looking at the development of the absolute numbers over the three periods, the number of incoming students from outside the EHEA has increased by more than 10 thousand students in the United Kingdom (+150 thousand), France (+57 thousand), Russia (+52 thousand), Italy (+31 thousand), Spain (+22 thousand), Turkey (+21 thousand), Germany (+16 thousand from the second to the third period), and Ukraine (+12 thousand from the second to the third period).

Interestingly, out of the top destination countries that attracted more than 10 thousand students from outside the EHEA, the language of 8 out of 13 countries is widely spoken and read (English, French, Spanish, Russian, Portuguese). This supports previous findings and the statement of the OECD (2018) that suggests that the language of instruction is a strong pull factor for a student's choice of destination country. Clearly, historical links

[10]For more detailed information about the countries and regions of origin of the top destination countries, see Appendix B which provides figures about the development of hosted international students of each destination country by region of origin as well as the development of incoming students for the top 5 countries of origin of each destination country.

such as the Francophonie, the former Soviet Union, and the Commonwealth also seem to have a major impact as suggested by the OECD (2016a).[11]

Furthermore, most of the top destination countries rank highest among the European countries in the Shanghai Academic Ranking of World Universities (ARWU) (Shanghai Ranking, various years), suggesting that quality is important for non-EHEA students which justifies the large distance to the home country.[12]

The United Kingdom can be considered an exception among the European countries due to the fact that it regards student mobility as a means to generate revenue. As a member of the EU in the timeframe analyzed, however, the UK can only charge higher tuition fees to non-EU international students than domestic students, but cannot charge higher tuition fees to students from other EU countries (Gérard and Uebelmesser, 2014).[13] Therefore, the country aims to attract students from outside the EU. Both the relative share of non-EHEA international students as well as the absolute number grew strongly. This is worth noting given the fact that fees have also increased over time since the introduction of tuition fees in 1998.

Beyond the United Kingdom, the Netherlands has also adopted an economic-driven policy when it comes to attracting foreign students since the mid-1990s. Furthermore, the economic dimension is becoming more important in an increasing number of countries (OECD, 2004b, 2017c). Denmark and Sweden, for instance, have been charging tuition fees from non-EU students from 2006 and 2011/2012 onwards, respectively, whereas EU and domestic students have not been affected by this reform. In contrast to the UK, however, this tuition policy did not seem to be as effective in Denmark and the Netherlands, as the increase of incoming students from non-EHEA countries was lower compared to that of incoming students from within the EHEA (see next paragraph). The number was also lower compared to the average increase across all EHEA destination countries, where the number of incoming students from non-EHEA countries grew on average by 145 percent from the first to the third period, compared to 103 and 100 percent in Denmark and the Netherlands, respectively. This suggests that fees cannot be increased independently as the demand of non-EU students in a high competing global education market is likely to be elastic (Murphy, 2014).

[11]See also Appendix B where the number of incoming international students to the United Kingdom, France, and Germany is shown in a mapchart by country of origin for the year 2015.

[12]In descending order the following countries had the highest number of total universities that were among the top 500 universities listed in the ranking in 2015: the United Kingdom, Germany, France, Italy, Netherlands, Sweden, Switzerland, Spain, Belgium, Denmark, Finland, Austria, Norway Ireland, and Russia. These top 15 EHEA countries are stable over the last year of each regarded period (2004, 2010, and 2015) with few countries changing ranks within the top 15 EHEA in the given timeframe.

[13]Note that although the EHEA also includes countries that are not affected by this rule, such as Russia, this section analyzes EHEA countries meaning that the EU nondiscrimination principle cannot be strictly applied to all countries regarded.

Inward Student Mobility from within the EHEA

The share of inward mobility from other EHEA member countries, which is displayed on the x-axis in figure 6.3, is especially high in smaller central European countries. In Liechtenstein, Luxembourg, Austria, Switzerland, and Andorra the share exceeds 10 percent over all three periods.[14] The share of the remaining countries was below 6 percent over all periods, with a few exceptions.[15]

Comparing the relative student income from within the EHEA over the periods in the different destination countries, the increase was bigger than 4 percentage points in Andorra (+24.4), Luxembourg (+12.5), the Czech Republic (+6.2), Liechtenstein (+4.9), and Denmark (+4.3) and bigger than 2 percentage points in Slovakia (+3.8), the Netherlands (+3.1), Cyprus (+2.7), and Latvia (+2.3). In some countries, however, the relative share actually decreased, notably in Belgium, which saw a decrease from 5.6 percent in the first period to 2.6 and 4.7 percent in the second and third periods, respectively. Sweden and Croatia saw a similar pattern, where the relative student income from within the EHEA decreased from the first to the third period by 1.8 and 1.1 percentage points, respectively. In the remaining countries, the share remained almost stable or changed only slightly.

Figure 6.5 demonstrates for each EHEA member country the absolute number of incoming students from other EHEA member countries for the third period (grey bars). In order to see the development over periods, the black lines and dots demonstrate the data for the first and second periods, respectively. In absolute terms, the United Kingdom received the most students in the third period, followed by Russia and Germany. These three countries together account for 39 percent of the total hosted students from within the EHEA in the third period. Compared to the concentration of the top 3 destination countries for students from non-EHEA countries, which accounted for 62 percent, this concentration is considerably lower. Furthermore, out of 46 countries, 13 countries each received more than 20 thousand students, 4 countries received more than 10 thousand students, and the remaining 29 countries each received fewer than 10 thousand students from other EHEA countries.

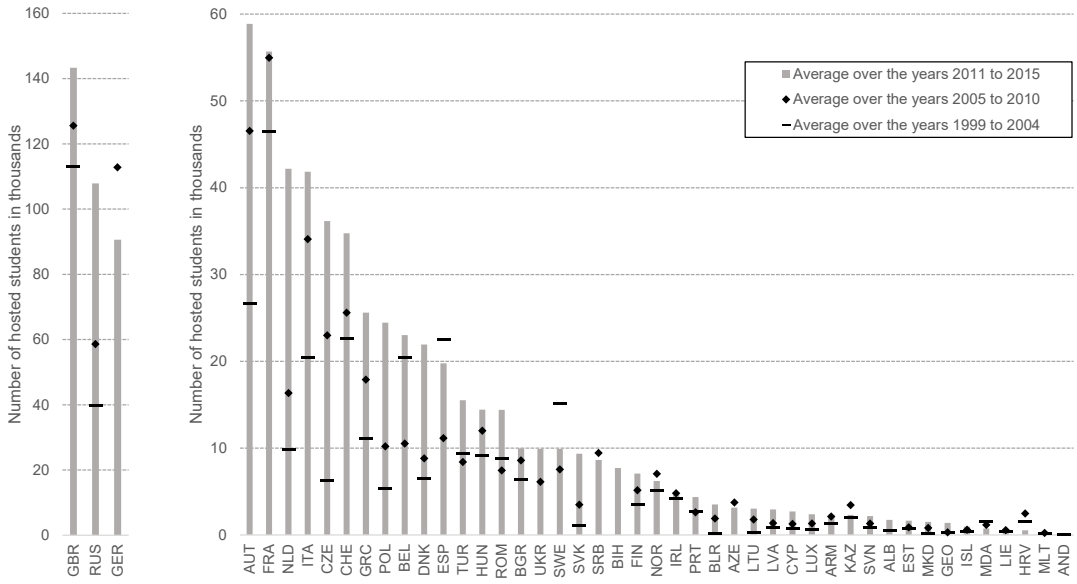
Regarding the increase from the first to the third period, the number of incoming students from within the EHEA grew by more than 10 thousand students in Russia (+68 thousand), the Netherlands (+32 thousand), Austria (+32 thousand), the United Kingdom (+30 thousand), Czech Republic (+30 thousand), Italy (+21 thousand), Poland (+19 thousand), Denmark (+15 thousand), Greece (+14 thousand), and Switzerland

[14] As data of the total tertiary student stock are not available for Austria for the first period, the share can only be shown for the second and third periods. Data for Andorra are only available for the first and third periods.

[15] Cyprus, Denmark, and Bosnia in the third period as well as the Czech Republic in the second and third periods.

(+12 thousand). Taking into account the size of the country and the domestic student population, the increase is especially high in the smaller countries such as Switzerland and Austria.

Figure 6.5: Absolute number of incoming students from within the EHEA by destination country



Note: The figure demonstrates for each EHEA country the number of hosted international students from other EHEA member countries. Students from unknown countries of origin are not included. The EHEA includes the same number of member countries (as of 2015) over all periods. For ease of readability, the top 3 countries are displayed separately in the left-hand panel. Data refer to an average over a period of five or six years. For some countries, data are not available for each period.

In contrast, in some countries the absolute number actually decreased. This was the case in Spain where the number decreased from 22 thousand in the first period to 11 thousand and 20 thousand students in the second and third periods, respectively. In Sweden the number also decreased from 15 thousand to 8 thousand students in the second period and increased to 10 thousand students in the third period. In Belgium the number of students decreased from the first to the second period, but the increase in the third period overcompensated the loss, meaning that overall the number increased (the number of hosted students from within the EHEA was 20 thousand in the first period, 11 thousand students in the second period and 23 thousand in the third period, respectively.)

As previously mentioned, Denmark introduced tuition fees for non-EHEA students of around 11 thousand USD. This change was announced in 2005 and took effect in 2006, that is the beginning of the second period. This effect might be reflected in the different growth rates of students coming from within versus from outside the EHEA. While the number of incoming students from within the EHEA increased by 15 thousand students (240 percent) from the first to the third period, the number from outside the EHEA only increased by 2 thousand students (103 percent). Although the increase of non-EHEA students was lower, the effect of the introduction of tuition fees is remarkable: in the

first period, 6 thousand international students from within the EHEA and 2 thousand students from outside the EHEA studied in Denmark, with neither paying any tuition fees, meaning that their education costs were completely covered by the government. In the second period, the tuition fee reform had already come into effect, so students from outside the EHEA were charged the roughly 11 thousand USD in fees (OECD, 2017c). In this period, on average about 9 thousand international students from within and 3 thousand from outside the EHEA studied per year in Denmark. Multiplying the fees by the number of hosted students means that around 32 million USD was generated on a yearly basis through tuition fees charged to students from outside the EHEA.[16] This number was even higher in the third period, where about 4 thousand students from outside the EHEA paid a total amount of 49 million USD per year based on this calculation. According to calculations of the OECD (2017c), the revenue generated from fee-paying international students was higher than the share of total students in 2014, meaning that they covered a disproportionate share of the costs. This means that although the number of non-EHEA students has grown at a lower rate than the number of incoming students from within the EHEA, the introduction of tuition fees can be regarded as an economic success.[17]

Has the Goal of the Bergen Communiqué (2005) Been Achieved?

As the goal of the Bergen Communiqué (2005) concerning the attractiveness of the EHEA was not precisely quantified, it is difficult to say whether the goal was achieved or not. It is helpful, therefore, to compare the figures of the whole EHEA region over time with how student mobility has developed worldwide. Furthermore, the United States is regarded as a major competitor destination for the EHEA (European Commission, 2001; OECD, 2004b).[18]

Figure 6.6 shows the development of the total number of hosted students worldwide–excluding the number of the EHEA and the USA–in the EHEA, and in the United States. As the goal was set in 2005, it compares the figures of these regions for 2005 onwards, regarding four-year periods (and three-years for the last period).[19] In order to compare

[16] 2,901 non-EHEA students * 11,000 USD yearly fees = 31,911,000.

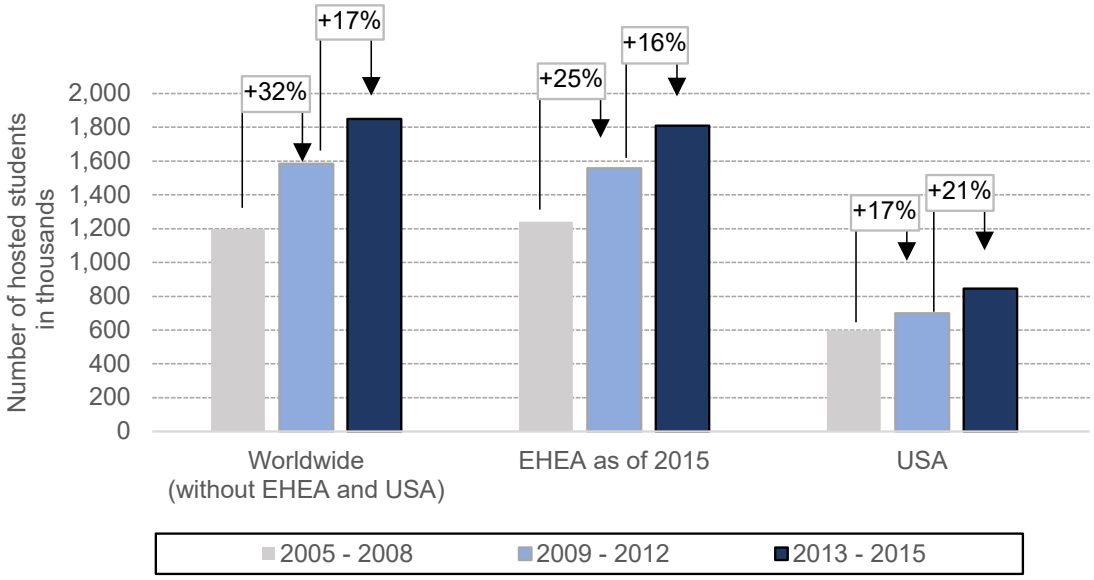
[17] Sweden also introduced tuition fees for non-EHEA students, which was preceded in 2011 and came into effect in the academic year 2011/12 (OECD, 2017c). However, as the introduction of the tuition fees did not affect the students that were enrolled before 2011, and the last period included in my analysis only covers the years 2011 to 2015, it is not possible to truly see the effect in the data. The OECD (2017c) finds a similar effect as in the case of Denmark.

[18] Viviane Reding, the Commissioner for Education and Culture of the EU, stated: "Competition between universities is a healthy thing. If our European universities, and I do not only mean those that are world-renowned, but the bulk of them, do not raise the quality of what they offer, then the race–that is already on–with universities from the United States and other countries will be lost" (EAIE, 2002).

[19] As Germany accounts for a disproportionately high share of the total number of hosted students

data over the three periods, I have used a balanced data set so that the number of countries for the EHEA is stable and covers 42 destination countries.[20] Data on the total number of hosted students worldwide are taken from the UIS.Stat (2021), as the bilateral data cover only a limited number of destination countries.

Figure 6.6: Number of incoming students over periods in the EHEA, USA, and worldwide



Note: The figure demonstrates the number of hosted international students including those with unknown country of origin. Data refer to an average over a period of three or four years for a balanced dataset. The EHEA includes the same number of member countries (as of 2015) over all periods. Due to the patchy coverage, EHEA contains 42 of the 48 member countries.
Source: Data worldwide: UIS.Stat (2021). EHEA and USA: own calculations based on the data provided by UIS.Stat (2018).

The number of hosted students in the EHEA from both within and outside the EHEA increased by 46 percent, from the first to the third period from 1.2 million to 1.8 million hosted students. Looking at the main competitor, the United States, where the number of hosted students rose by 41 percent from 599 thousand students in the first period to 845 thousand hosted students in the last period, the increase is 5 percentage points lower than in the EHEA. The main driver of this was the high growth from the first to the second period (+25 percent in the EHEA versus +17 percent in the USA), whereas the growth from the second to the third period was 5 percentage points higher in the USA than in the EHEA. The number of hosted students worldwide, excluding the EHEA and the United States, increased by 55 percent from 1.2 million to 1.9 million students in the

worldwide and in the EHEA, and data for Germany is only available for the years 2005 onwards, regarding the five-year periods as presented before would lead to biased patterns.

[20]The six countries that are not covered over all three periods for the EHEA are Albania, Andorra, Bosnia, Greece, Holy See, and Montenegro.

first and third periods, respectively. This means that the increases seen in the EHEA and in the USA were comparatively lower than in the remaining world. This worldwide growth is driven by recently emerging destination countries, which are mainly Asian or Arab countries, such as China, Malaysia, or Saudi Arabia. Hence, in order to evaluate the success as a destination region, it is important to regard a wider range of competitors and not only the traditional destination countries, such as the United States or other Anglo-Saxon destination countries (Canada, Australia, New Zealand).

6.4.2 Has the Bologna Process Increased Student's Outward Mobility?

This section strives to give a brief overview of how the outward student mobility of EHEA member countries has developed since the goal was set that at least 20 percent of those graduating in the EHEA should have been abroad for the purpose of studies or training by 2020 (Leuven/Louvain-la-Neuve Communiqué, 2009; Bucharest Communiqué, 2012).[21]

Figure 6.7 shows the share of students that have studied abroad for each EHEA country. The outward mobility refers to students studying in other EHEA member countries as well as in non-member countries. As the goal was set in 2009 and 2012, it would be interesting to look at yearly data since then. However, as the inconsistency in the coverage of the data particularly influences the reliability of outward mobility figures, I build averages instead of regarding yearly data.[22] These averages cover the three periods from 2005 to 2008, 2009 to 2012, and 2013 to 2015. The first period shows the pattern for the time before the goal was set in 2009, the second period includes the four years following the goal being set in 2009, and the third period presents the data after the goal was described again in 2012 in the Bucharest Communiqué (2012) and the Mobility Strategy for the EHEA set in 2012. While the numbers provide a rough picture of outward mobility, they have to be interpreted with extreme caution as the reliability of outward mobility data depends on the number of reporting destination countries, which varies strongly over years.

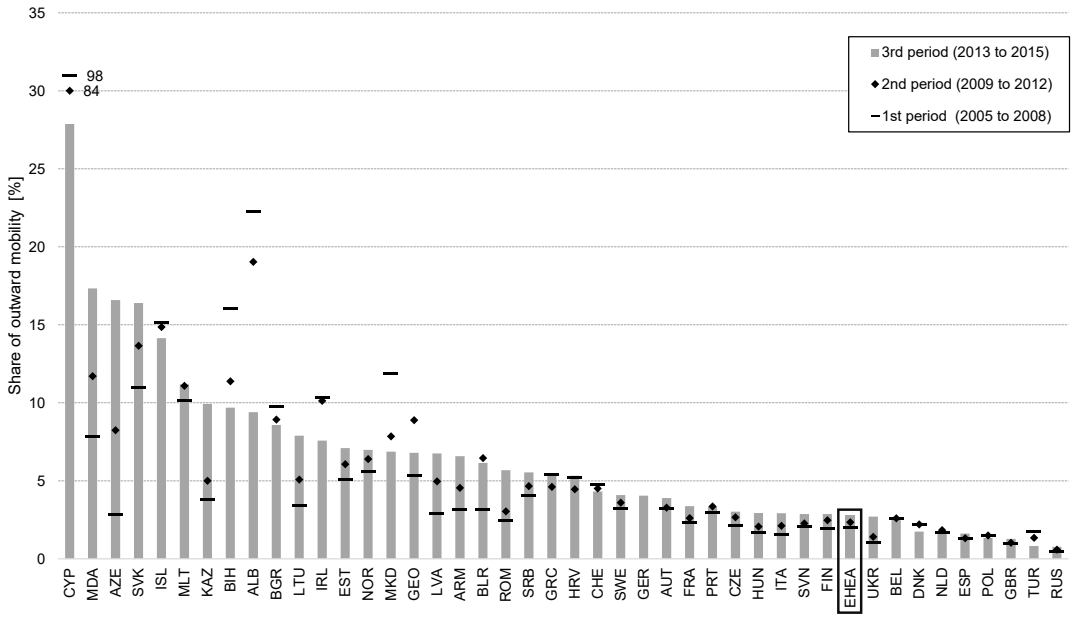
Looking at the development over time of all the EHEA countries, the average share–calculated as the weighted average over the available countries–increased from 2.0 percent in the first period to 2.3 and 2.8 percent in the second and third periods, respectively. In the last period covering the years 2013 to 2015, out of the 43 demonstrated countries, 6

[21] As this work considers the data of the mobility of students, the chapter can only describe the development of student mobility for the purpose of study, whereas the mobility of training cannot be shown.

[22] The average share per period is calculated as the average over a period for those years where both types of data were available, i.e. the number of students studying abroad and the total tertiary students enrolled in the country of origin. Where either was unavailable it has not been considered in this average as it would lead to a biased weight for calculating the average.

countries have a share higher than 10 percent, with Cyprus being the only country that had already exceeded the goal of a mobility rate of 20 percent in the previous period. Other countries with a share higher than 10 percent in the last period are in descending order Moldova, Azerbaijan, Slovakia, Iceland, and Malta as well as Albania, Bosnia, Macedonia, and Ireland for the previous periods. In the last period, the share of these 9 countries was below the average share of 2.8 percent. Among these countries is the United Kingdom, which has an outward mobility rate below average, despite it being among the top countries with respect to the inward mobility share (see figure 6.3 in section 6.4.1).

Figure 6.7: Share of students studying abroad by EHEA countries of origin



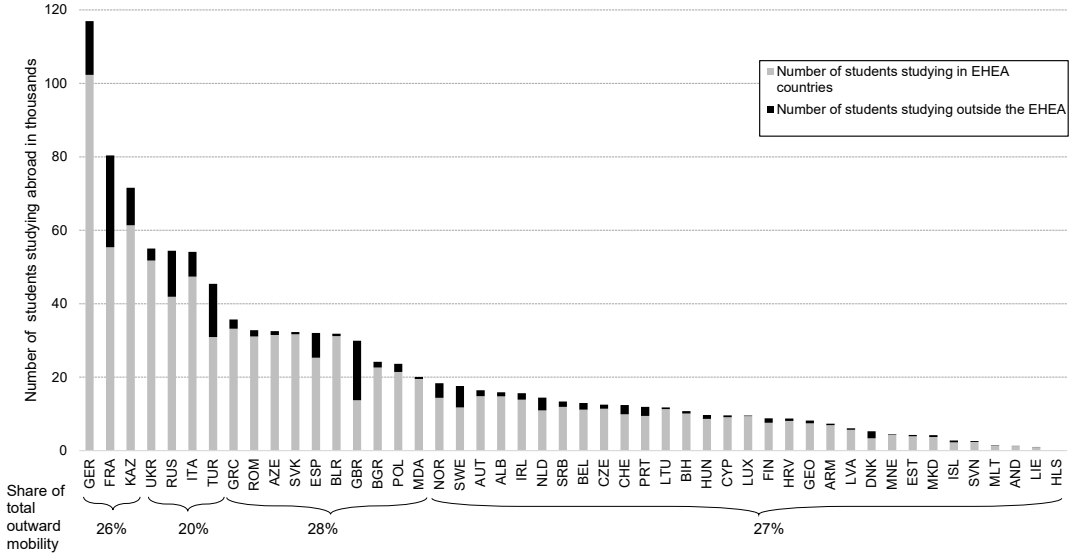
Note: The figure demonstrates for each EHEA country the number of international students studying abroad as a share of the total number of tertiary students enrolled in the country of origin. As the quality of the outward student mobility depends on the number of reporting destination countries, the numbers have to be interpreted with caution. The EHEA includes the same number of member countries (as of 2015) over all periods. The numbers for the EHEA are calculated as the weighted average over all 43 reporting member countries. Data refer to an average over a period of three or four years. For some countries, data are not available for each period.
Source: International students: UIS.Stat (2018); Total number of tertiary students: UIS.Stat (2019).

Looking at the development at a country level, the share of students studying abroad increased in 10 countries by more than 2 percentage points from the first to the third period; in 5 countries the share decreased by more than 2 percentage points. The share in the other countries remained stable or changed only marginally. 8 out of the 10 countries where the share increased by more than 2 percentage points were former USSR countries (apart from Slovakia and Romania). Out of the 5 countries where the share decreased, 4 of them are located in Southeastern-Europe (Albania, Bosnia, Macedonia, and Cyprus). Clearly, the countries with a higher outward mobility rate are countries with a small population suggesting that country size may play a role. This may be due to the limited

number of programs offered in certain fields of study meaning that these countries may also be motivated by the capacity building approach.

Figure 6.8 shows the absolute number of students sent abroad from each EHEA country of origin for the period covering the years 2013 to 2015. The number is separated into two regions of studies, the grey bar presents students studying in other EHEA member countries and the black bar those in non-EHEA member countries.

Figure 6.8: Outward mobility of EHEA member countries: number of students studying within and outside the EHEA in the period 2013 to 2015



Note: The figure demonstrates for each EHEA country the number of international students studying abroad in thousands. Data refer to an average over the years 2013 to 2015. As the quality of the outward student mobility depends on the number of reporting destination countries, the numbers have to be interpreted with caution. The EHEA includes the 48 member countries as of 2015.

As can be seen in the graph, EHEA students seem to prefer other EHEA countries over non-EHEA countries when it comes to studying abroad. On average, the number of students sent to other EHEA member countries account for 85 percent of the total number of students sent abroad from the 48 EHEA countries of origin. The preference of EHEA destination countries is true for most of the EHEA countries with some exceptions. The profile of the United Kingdom is almost balanced, with 54 percent of their students studying outside the EHEA and 46 percent within it. More than 30 percent of the students from Denmark (36 percent), Sweden (33 percent), Turkey (32 percent), and France (31 percent) studied in countries outside the EHEA. Furthermore, the share of students sent to non-EHEA countries is above average for the Netherlands, Russia, Norway, Spain, Switzerland, Portugal, and Iceland. Interestingly, most of the top countries are also among the countries that attract a high number of students from outside the EHEA (see figure 6.4 in section 6.4.1). A large number of these countries have a language that is widely spoken or read (English, French, Spanish, German, Russian, Portuguese) or have former

colonies such as the Francophonie, the former Soviet Union, and the Commonwealth. Another group among these countries are the four Nordic countries (Denmark, Sweden, Norway, and Iceland) where students are financially supported to study abroad (OECD, 2004b). In absolute terms, France sent the most students to non-EHEA countries followed by the United Kingdom, Turkey, Germany, Russia, and Kazakhstan. The other countries sent less than 10 thousand students to non-EHEA countries.

Looking at the absolute number of the total outward mobility, German students were the most mobile, with 117 thousand students studying abroad, which accounts for 11 percent of the total number of outward mobility of the EHEA. The next top countries with an outward mobility beyond 50 thousand international students are France and Kazakhstan, which each accounting for 8 and 6 percent of the total number of international students sent from the EHEA, respectively. The next group consists of 10 countries that have an outward mobility of between 20 and 40 thousand students accounting for 28 percent of the total number of the EHEA outward student mobility. Among the 16 countries that sent more than 20 thousand students abroad in the period that has been analyzed, 6 of them belonged to the former USSR. There were 10 EHEA member countries in this group and combined they sent a total of 294 thousand students abroad, accounting for 28 percent of the total outward student mobility of the EHEA.

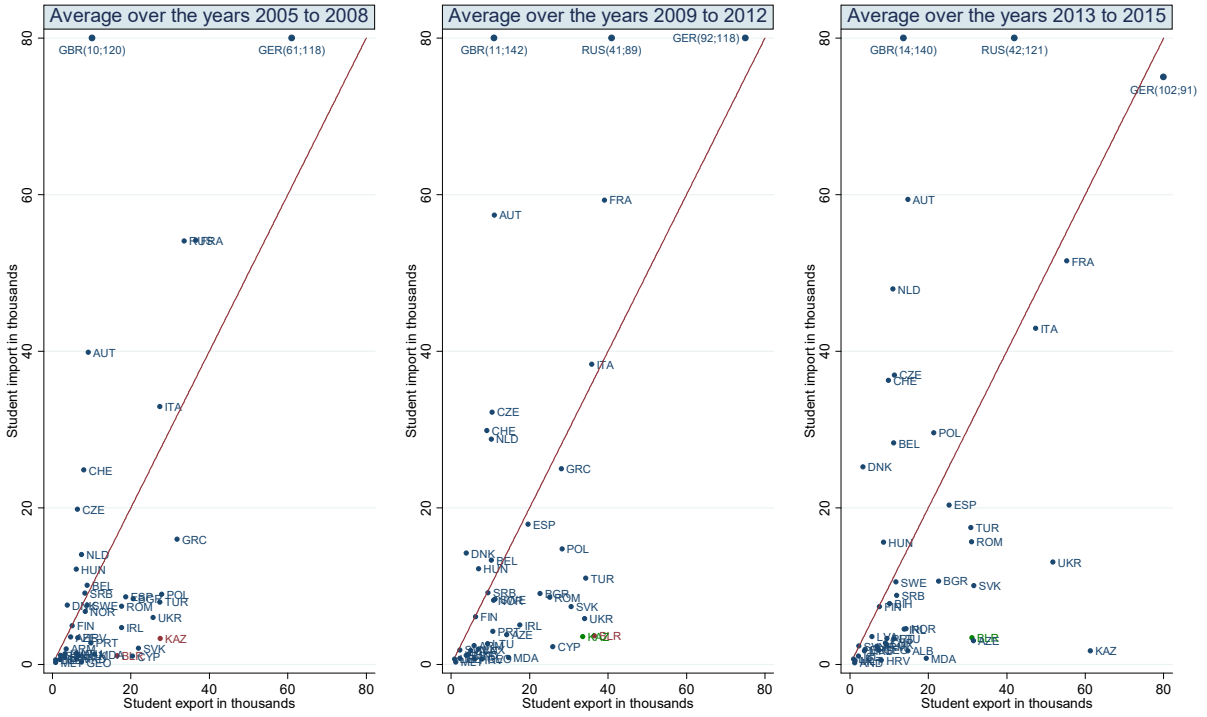
6.4.3 How Balanced is Student Mobility within the EHEA?

When higher education is financed mainly publicly and student mobility between two countries or within a region is not balanced, this induces major challenges for financing higher education. As student mobility in the EU is mainly publicly financed through indirect subsidies and this strategy strongly relies on reciprocity, it is important to understand whether mobility within the EHEA is balanced. This has also been highlighted by EHEA policy-makers who stated: "We strive for open higher education systems and better balanced mobility in the EHEA. If mobility imbalances between EHEA countries are deemed unsustainable by at least one party, we encourage the countries involved to jointly seek a solution, in line with the EHEA Mobility Strategy" (Bucharest Communiqué 2012, p. 4). In this context it has to be mentioned that the aspiration for more balanced mobility was reinforced by this statement, but there is no clear definition of a "balanced mobility" at a European level (Bucharest Communiqué, 2012; EHEA, 2015).

In order to demonstrate how balanced the student exchange of each EHEA member country is, the number of international students studying in a country (student imports) has to be compared to the number of students of the same country studying in other countries (student exports). As mentioned before, the number of student exports strongly depends on the number of reporting destination countries, which varies between years. Therefore, this section builds averages over periods of three and four years. As Germany

has reported data for the years 2005 onwards and the country hosts a large number of EHEA students, it is important to include Germany in all periods. Therefore, the periods cover the years 2005 to 2008, 2009 to 2012, and 2013 to 2015. The last period reflects the time after the goal was set, the second period includes the effect of the establishment of the EHEA in 2010, and the first period allows for any patterns which occurred before the considered timeframe to be demonstrated.

Figure 6.9: Mobility balance: student imports and exports within the EHEA by member countries



Note: The figure demonstrates the student mobility between EHEA member countries. Outliers are displayed within the graph but marked with rounded axial distances. The EHEA includes the same number of member countries (as of 2015) over all periods. Navy countries are members of the Bologna Process in the regarded period, green countries joined the Bologna Process in the considered period, and red countries are not members in the considered period but will become members afterwards. Data refer to an average over a period of three or four years.

Figure 6.9 presents the number of student exports for each country on the x-axis and the student imports on the y-axis. As the graph strives to demonstrate whether student mobility within the EHEA is balanced, the red line shows where the number of student imports equals the number of student exports, thus separating the net importing countries from the net exporting countries. Countries below the line are net student exporters, countries above the line are net importers. Although the graph includes averages, due to the fact that not all destination countries reported the number of hosted students in each year, the numbers have to be interpreted with caution.

The right graph shows the period covering the years 2013 to 2015 for 45 member countries. About 80 percent of the countries (35 countries) are net exporters of international

EHEA students to other EHEA countries and only 20 percent are net importers (10 countries). In this period, 7 countries had a net import of more than 20 thousand students with the top being the United Kingdom (126 thousand net imports) followed by Russia (79 thousand), Austria (45 thousand), the Netherlands (37 thousand), Switzerland (26 thousand), Czech Republic (26 thousand), and Denmark (22 thousand). Furthermore, Belgium, Poland, and Hungary had a net import between 7 and 17 thousand students. With the exception of Russia and the Czech Republic, these net importing countries are Western European countries.

While most countries are either net-importers or net-exporters of students over all periods, some countries changed their role from net importer to net exporter. This was the case for Germany, France, and Italy which were all net importers of students in the first two periods and converted into net exporters in the third period. Germany received net imports of 56.6 and 10.3 thousand students in the first two periods before shifting to a net export of 11.7 thousand students in the third period. The net exports in France and Italy in the last period are lower, standing at 3.9 and 4.4 thousand students, respectively. In Germany and France, this change was due to a decreasing number of incoming students in the last period, and conversely the number of student exports increased. In Italy, the number of student imports grew less than the number of student exports. In contrast, Poland was a net exporter in the first two periods and a net importer in the third period, which was due to the strong increase of student imports over all periods and a decrease of exports in the last period. The other countries remained either net importers or net exporters over all three periods.

Beyond the countries mentioned above, it is also worth highlighting the increase of net imports from the first to the third period in Russia (+58 thousand), the Netherlands (+30 thousand students), Denmark (+18 thousand), the United Kingdom (+16 thousand), Belgium (+16 thousand), Austria (+14 thousand), and the Czech Republic (+12 thousand).

As previously mentioned, there is no clear definition of balanced mobility. One proper figure to determine whether the mobility of a country is balanced or not might be the ratio of imports over exports (EHEA, 2015). As a ratio of 1 reflects a complete balanced situation, regarding a ratio of between 0.9 and 1.1 as balanced may prove helpful. Using this criterion, the situation can be regarded as balanced in 2, 5, and 4 countries in the first, second and third period, respectively. This is the case for Finland throughout all three periods, for Germany, Italy, Serbia, and Spain in the second period and for France, Italy and Slovenia in the third period.

Although student mobility should ideally be balanced, achieving a more balanced situation should not reduce student mobility. This argument is reflected by the statement of the Working Group on Mobility (2009 to 2012) who said that "even if there are specific imbalances, mobility itself is good and therefore should not be restrained" and "regulations

which limit mobility are very dangerous. Only awareness and capacity building in the home countries can sustainably reduce brain drain" (Working Group on Mobility, 2012).

Mobility Imbalances

Concerning the countries that import a higher number of international students than they host, there are some groups that deserve a special interest. Firstly, Austria, Belgium, the Czech Republic, the Netherlands, and Switzerland which can be considered as a group, and the United Kingdom separately.[23]

The countries of the first group all have in common that they are neighbors of large countries–France for Belgium, and Germany for the other countries. In these larger countries, students are not able to access certain study programs due to a limited number of places available, such as in the area of medical studies. These constrains mean that students are not able to study in their home country, and instead tend to enroll in the smaller neighboring countries that have the same or similar language. Furthermore, these neighboring countries have either no or low tuition fees and no entrance examination, meaning that access to studies is considered easier. As such, Germany and France can be considered as free-riders of higher education services of their neighboring countries' higher education services. This is even more the case, when considering that most European students return home after their studies. Consequently, Belgium and Austria have introduced quotas for international students, though such reluctant policies are not efficient per se (Gérard and Uebelmesser, 2014).

The second case is the United Kingdom, which is different from the other EHEA countries for various reasons. The language is the *lingua franca* of the world, the country's universities are historically considered to be of high quality and access to studies is highly restricted. Moreover, contrasting to most European countries, the United Kingdom charges tuition fees rising up to 9,000 GBP a year for residents of the United Kingdom and the EU (Murphy, 2014). Beyond this, almost 4 out of 10 international students studying in the United Kingdom stay there after their graduation (Felbermayr and Reczkowski, 2014).

Meaning of the Imbalances for the Financing System in the EHEA

As most European students return home after their studies in (non-Anglo-Saxon) European countries, the net importing countries of international students can also be considered as net exporters of enriched human capital or of graduates. This also makes them

[23]Another country that could be considered is Russia as a student importer and the former countries of the USSR. Since this section discusses the meaning of imbalances in the context of the EU nondiscrimination principle, Russia is not regarded in more detail within this section.

net exporters of higher education services (Gérard and Uebelmesser, 2014). As tertiary education for EU members is almost free in most countries–with the exception of the United Kingdom–and international students from other EU members cannot be charged higher fees than from the domestic students, the net importing countries of students bear the costs while the sending countries get the benefits.

These imbalances of student transfers undermine the efficient functioning of the Bologna Process. According to Gérard and Uebelmesser (2014), this can be seen as an argument to allocate the responsibility of tertiary education to the EU. They argue that this is already the case concerning cursus norms, but it seems to be impossible with respect to financing higher education. The main challenge is to find a decentralized financing system with an outcome as close as possible to a centralized one (Gérard and Uebelmesser, 2014).

6.5 Econometric Specification

I strive to explain the link between $Stud_{jit}$, the stock of students from a home country j in a destination country i at time t, and $Bologna_{jit}$, the joint membership of country j and country i in the Bologna Process. For this purpose, I follow the recent literature and base my estimates on a theory-grounded gravity equation (for example, see Beine et al., 2014; Abbott and Silles, 2016; Ramos, 2016). The gravity equation can be derived from a very general theoretical model that captures migration costs as well as the main motivations to study abroad.[24]

I estimate the following equation:

$$\ln Stud_{jit} = \alpha + \beta Bologna_{jit} + \gamma Pol_{jit} + \delta Prox_{ji} + \upsilon_{jt} + \upsilon_{it} + \varepsilon_{jit} \tag{6.1}$$

where γPol_{jit} includes time-variant bilateral policy controls proxied by joint membership in RTA, EU, the student exchange program Erasmus, and common currency, $\delta Prox_{ji}$ includes time-invariant bilateral cultural and geographical variables, and υ_{jt} and υ_{it} represent an interaction of country $\times$ time dummies to control for all time-variant source and destination specific variables.

I assume the structure of the error term to be $\varepsilon_{jit} = \upsilon_{ji} + u_{jit}$, where υ_{ji} is a dyad-effect and u_{jit} is the idiosyncratic error term. As OLS cannot deal with additive error terms it does not control for unobserved bilateral factors. This in turn would lead to biased estimates. Therefore, I follow Baier and Bergstrand (2007) and difference out the dyad-effect υ_{ji} by estimating the equation in a panel setup. In order to control for strict exogeneity, I also include the Bologna Process dummy in the differenced version of equation (6.1)

[24] See Beine et al. (2012) for the detailed description of the model.

and perform an F-test for joint significance–as suggested by Wooldridge (2002). This regression-based F-Test was, for example, also applied by Felbermayr and Jung (2009). If I cannot reject the null, differencing the equation has solved the endogeneity problem so I can interpret the effect as causal.

I estimate equation (6.1) as a cross section estimation for each period where $\upsilon_{jt}+\upsilon_{it}+\upsilon_{ji}$ are replaced by the country dummies υ_j and υ_i so that multilateral resistance is accounted for as long as it does not vary over time. This specification allows to estimate the effect of bilateral dyadic factors that are commonly used to proxy migration costs, such as distance, common language, or contiguity. Country-specific factors, in contrast, are captured by the country dummies υ_j and υ_i and cannot be estimated separately. I also estimate the equation in a panel setup, where υ_{ji} controls for bilateral fixed effects. Hence, in the panel setup time-invariant bilateral cultural and geographical variables are included in υ_{ji} and cannot be estimated separately anymore.

As OLS estimations do not correct for the endogeneity bias caused if countries self-select into the Bologna Process (Baier and Bergstrand, 2007), my preferred estimation is the panel setup. The estimates of γPol_{jit} and $Bologna_{jit}$ can be interpreted as semi-elasticities. As discussed in section 6.3, data on student mobility are not available for all destination countries in each year. Therefore, I use an average over typically four years resulting in four different periods; the fourth period consists of five years. However I will also conduct several robustness checks in section 6.7 and estimate the equation in a panel setup with yearly data as well as with other averages.

6.6 Empirical Results

6.6.1 Cross Section versus Fixed-Effects Estimation

Before I present the baseline regressions using the preferred panel model and distinguishing between the effect of membership in the Bologna Process in the time before and after the establishment of the EHEA, I demonstrate that omitted variable bias can have a major impact on point estimates. For this purpose, I show cross section estimates for each period where country effects are controlled for, and present afterwards the preferred panel estimates where bilateral fixed effects as well as country × year effects are included.

Table 6.1 shows the results for the cross section estimates where unobserved, time-invariant country-specific variables are controlled for by including the country dummies υ_j and υ_i. Columns (1) to (4) present the estimates for each of the four periods separately including the Bologna Process dummy as the only variable.

Over all periods, being a member of the Bologna Process has an economically and statistically significant impact on the stock of international students. The impact of

being a member in the Bologna Process increases continually over the given time periods, starting with an estimated semi-elasticity of 2.3 in the first period and rising to 2.7 in the last period. Note, however, that the number of observations is not constant over time, meaning that the increasing effect over time may well be due to a selection bias. As the point estimates of the balanced version of the data set also increase over time, the increase over time is likely not due to a selection bias.[25] The fit of the model is good given the fact that the model includes the Bologna Process dummy as the only variable besides the country dummies, with an adjusted R^2 varying between 0.48 and 0.51.

Table 6.1: Bologna Process and student mobility: cross section estimates

Dependent variable: Ln arithmetic average of student stocks							
	(1) Period 1 (1999-2002)	**(2)** Period 2 (2003-2006)	**(3)** Period 3 (2007-2010)	**(4)** Period 4 (2011-2015)	**(5)** Period 4 (2011-2015)	**(6)** Period 4 (2011-2015)	**(7)** Period 4 (2011-2015)
Bologna Process (0,1)	**2.254*** (0.118)**	**2.609*** (0.096)**	**2.615*** (0.088)**	**2.703*** (0.076)**	**1.554*** (0.117)**	**0.442*** (0.082)**	**0.046 (0.112)**
EU (0,1)					0.539*** (0.144)		0.517*** (0.133)
Erasmus (0,1)					-0.154 (0.173)		0.042 (0.158)
Regional trade agreement (0,1)					1.560*** (0.06)		0.578*** (0.054)
Common currency (0,1)					0.810*** (0.124)		0.187 (0.101)
Ln distance						-1.174*** (0.031)	-1.043*** (0.032)
Common language (0,1)						1.561*** (0.059)	1.549*** (0.059)
Contiguity (0,1)						0.910*** (0.116)	0.866*** (0.113)
Bilateral fixed effects	NO	NO	NO	NO	NO	NO	NO
Destination effects	YES	YES	YES	YES	YES	YES	YES
Source effects	YES	YES	YES	YES	YES	YES	YES
R^2	0.483	0.51	0.508	0.488	0.534	0.642	0.648
Number of observations	5,790	6,999	7,815	10,283	10,283	10,283	10,283

Note: Columns (1) to (4) show the results for each period in a cross section analysis including destination and origin country dummies; columns (5) to (7) show the results for period 4 including country dummies as well as additional covariates. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Columns (5) to (7) repeat the estimates for the fourth period that covers the years 2011 to 2015 and therefore captures the time after the EHEA was established. In column (5), the bilateral variables of joint membership in the Erasmus program, EU, RTA, and a common currency are included which stand for the time-variant bilateral policy control γPol_{jit}. Column (6) controls for time-invariant bilateral cultural and geographical variables (e.g., data on distance, common language, and contiguity) which replace $\delta Prox_{ji}$ in the model. Finally, column (7) controls for all variables simultaneously.

[25] Table D.3 in Appendix D.3 shows the results of the cross section estimates of columns (1) to (4) for the balanced data set.

The results reported in columns (5) to (7) are in line with intuition and previous findings. Distance reduces student mobility between two countries, while common language and a common border increase student mobility. Beyond these bilateral ties, regional trade agreements as well as common membership in the EU both increase student mobility between the countries separately. In contrast, the effect of Erasmus membership is not significant and currency unions only have a significant impact when the political variables are controlled for in addition to the Bologna Process dummy (column (5)), but not when cultural and geographical variables are also included in the model. Reasonably, the fit of the model increases when additional variables are controlled for. Compared to column (4), where the effect of Bologna Process membership was estimated separately, adjusted R^2 increases to 0.53, 0.64, and 0.65, in column (5), column (6), and column (7), respectively. Most important for my purpose, common membership in the Bologna Process has a positive effect on the stock of students in columns (5) and (6), but the point estimates decrease compared to column (4) where only the effect of Bologna Process membership was estimated. The inclusion of time-variant bilateral policies in column (5) cuts the estimated coefficient for joint Bologna Process membership by almost half to 1.6. In column (6), where the effect of time-invariant geographical and cultural variables is estimated simultaneously to the Bologna Process dummy, the estimate falls by a factor of roughly 6 to about 0.4 compared to column (4) and remains significant at the 0.1 percent level. Hence, ignoring geographical and cultural proximity in the specification leads to upward biased estimates. Note, however, that there might be other unobserved bilateral cultural factors that are not included in the model, meaning that these results may still suffer from endogeneity bias. In column (7) where all variables are controlled for simultaneously, the coefficient on the Bologna Process dummy is no longer significant. This is also the case for the existence of a currency union, whereas common membership in the EU and RTAs remain statistically significant, though point estimates decrease, especially for RTAs.

Table 6.2 presents the panel estimates that include origin $\times$ time and destination $\times$ time effects to control for unobserved multilateral resistance. The panel structure allows to account for unobserved heterogeneity as I can include pair-level fixed effects v_{ji} that difference out unobserved country-pair specific characteristics. Column (1) demonstrates the estimates where the effect of joint membership in the Bologna Process is estimated separately. Column (2) additionally controls for the EU dummy and columns (3) to (5) also include Erasmus, RTA, and common currency, respectively. Finally, column (6) includes all variables simultaneously.

Over all columns, joint membership in the Bologna Process has a positive impact on the stock of international students that is statistically significant at the 0.1 percent level. In columns (2) to (6) Bologna Process and EU membership are regarded simultaneously and both variables are economically and statistically relevant. Compared to column (1), the estimated semi-elasticity of joint Bologna Process membership increases from 0.3

to somewhat about 0.4, and the effect of EU membership is more than two times bigger than that of the Bologna Process membership, with an semi-elasticity of roughly 0.9. This supports the findings by Abbott and Silles (2016), that find an EU-student semi-elasticity of 0.8.

Table 6.2: Bologna Process and student mobility: panel estimates

Dependent variable: Ln arithmetic average of student stocks						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Bologna Process (0,1)	**0.323*** (0.096)**	**0.438*** (0.096)**	**0.400*** (0.098)**	**0.441*** (0.096)**	**0.439*** (0.096)**	**0.405*** (0.098)**
EU (0,1)		0.987*** (0.075)	0.980*** (0.076)	0.987*** (0.076)	0.930*** (0.075)	0.923*** (0.076)
Erasmus (0,1)			0.305 (0.157)			0.317* (0.156)
Regional trade agreement (0,1)				-0.021 (0.044)		-0.033 (0.044)
Common currency (0,1)					0.319** (0.109)	0.325** (0.109)
Regression based F-test for strict exogeneity p-value	0	0.0444	0.0627	0.0422	0.0984	0.1292
Bilateral fixed effects	YES	YES	YES	YES	YES	YES
Destination x year effects	YES	YES	YES	YES	YES	YES
Source x year effects	YES	YES	YES	YES	YES	YES
Within R^2	0.401	0.410	0.410	0.410	0.410	0.411
Number of observations	30,887	30,887	30,887	30,887	30,887	30,887
Number of pairs	11,815	11,815	11,815	11,815	11,815	11,815

Note: All estimates demonstrate panel estimates that include country x time effects and bilateral fixed effects. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Column (6) shows the preferred specification controlling for common membership in the Bologna Process, Erasmus, EU, and RTAs as well as the existence of a common currency simultaneously. Bologna Process and EU membership are still economically and statistically significant. Interestingly, apart from these two variables, joint Erasmus membership also turns out as a determinant of student mobility which is statistically significant at the 5 percent level. If two countries are Erasmus members, the stock of students is on average about 32 percent higher, estimated with satisfactory but not excellent precision, while the effect was not distinguishable from zero in column (3). Regional trade agreements do not turn out as explanatory determinants of the international student stocks, whereas the existence of a currency union has a positive impact that is economically and statistically relevant.

The estimated semi-elasticity of joint Bologna Process membership is 0.405 which means that student mobility between two member countries is, on average, $(e^{0.405} - 1)$ 100 percent = 49.9 percent higher. As mentioned before, common currency also has a positive significant impact on the bilateral stock of student mobility. Hence membership

in the Bologna Process, EU, Erasmus, and a common currency all turn out to have a significant impact separately.

In order to control whether the causality goes from being a member of the Bologna Process to student exchange, I conduct a regression-based F-test for strict exogeneity (Wooldridge, 2002) and find a p-value of 0.13 in column (6). Hence I cannot reject strict exogeneity anymore in column (6) and interpret the finding as causal. In the other specifications, however, the p-value is below the 10 percent level, meaning that endogeneity issues arise in these frameworks.

6.6.2 Before and After the Establishment of the EHEA

The establishment of the EHEA in 2010 can be regarded as one of the most important milestones since the beginning of the Bologna Process in 1999. It meant that the objectives set in the Bologna Declaration in terms of a common European framework for higher education were accomplished. Therfore, it is reasonable to assume that membership in the Bologna Process after the establishment of the EHEA has increased student mobility to a higher extent than before it was introduced. This section aims to estimate the effect of membership in the Bologna Process on student mobility before and after the launching of the EHEA in a panel setup. For this purpose I create two Bologna Process dummies. The dummy before the establishment of the EHEA refers to three periods, with each covering four years: 1999 to 2002, 2003 to 2006, and 2007 to 2010. The Bologna Process dummy after the launching of the EHEA consists of the five-year period 2011 to 2015.

Column (1) of table 6.3 demonstrates the estimates where only the two Bologna Process dummies are controlled for simultaneously, whereas column (2) also includes the other bilateral political covariates known from the preferred estimates. For ease of readability, column (3) demonstrates the estimates from column (6) of table 6.2. The effect of Bologna Process membership on the stock of students is more stable after the EHEA was established. In column (1), I find a semi-elasticity of 0.25 that is estimated at the 5 percent level. Bologna Process membership after the introduction of the EHEA affects the stock of students twice as much, with a semi-elasticity of 0.48 that is estimated with excellent precision. Testing the equality of the two coefficients shows that they are not equal. When the other covariates are also included in column (2), the significance level of the Bologna Process dummy before the EHEA increases so that both Bologna Process dummies are significant at the 0.1 percent level. Also the semi-elasticity for the time before the establishment of the EHEA increases by more than half to 0.38, whereas the semi-elasticity of joint membership in the EHEA decreases slightly to somewhat around 0.45. Testing the equality of the two coefficients in this specification shows, however, that I cannot reject the equality hypothesis, or at least not at any significance level below 19 percent.

Table 6.3: Bologna Process and student mobility: before and after launching the EHEA

Dependent variable: Ln arithmetic average of student stocks				
	(1)	**(2)**	**(3)**	
Bologna Process before EHEA (0,1)	**0.248***	**0.383*****	0.405***	Bologna Process (0,1)
	(0.096)	**(0.098)**	(0.098)	
Bologna Process after EHEA (0,1)	**0.476*****	**0.446*****		
	(0.104)	**(0.105)**		
EU (0,1)		0.910***	0.923***	EU (0,1)
		(0.076)	(0.076)	
Erasmus (0,1)		0.310*	0.317*	Erasmus (0,1)
		(0.156)	(0.156)	
Regional trade agreement (0,1)		-0.031	-0.033	Regional trade agreement (0,1)
		(0.044)	(0.044)	
Common currency (0,1)		0.314**	0.325**	Common currency (0,1)
		(0.11)	(0.109)	
Bilateral fixed effects	YES	YES	YES	
Destination x year effects	YES	YES	YES	
Source x year effects	YES	YES	YES	
Within R^2	0.402	0.411	0.411	
Number of observations	30,887	30,887	30,887	
Number of pairs	11,815	11,815	11,815	

Note: Bologna Process before EHEA refers to the three periods 1999-2002, 2003-2006, and 2007-2010. Bologna Process after EHEA refers to the period 2011-2015 as the EHEA was launched in 2010. All estimates demonstrate panel estimates that include country x time effects and bilateral fixed effects. Robust standard errors in parentheses. All regressions include a constant.
* p<0.05, ** p<0.01, *** p<0.001.

The estimated coefficients on the other covariates remain almost equal compared to the estimates shown in column (3): common currency, Erasmus, and EU membership remain economically and statistically significant determinants and regional trade agreements have no effect on the stock of students. Also within R^2 remains almost stable.

6.7 Robustness Checks

In this section I conduct a number of robustness checks. First, I investigate the effect in a balanced data sample, define different averages for each period, and I also work with yearly data in a panel setup rather than using averages. Second, I check whether the estimates remain stable using random-effects estimates. Furthermore, I try to eliminate the possible bias that can arise due to the existence of zero student stocks in the data.

As presented in section 6.5, the results can vary when the period before and after the establishment of the EHEA are regarded separately. Therefore, I check for robustness of the results presented where the effect of the general Bologna Process membership is estimated (column (6) of table 6.2) as well as for the time before and after the establishment of the EHEA separately.

Table 6.4: Bologna Process and student mobility: variation of the data set

Dependent variable: Ln arithmetic average of student stocks in columns (1) - (6) and ln student stocks in columns (7) - (9)									
	Balanced dataset (1999-2015)			**Other averages (1999-2015)**			**Yearly dataset (1999-2015)**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Bologna Process (0,1)	**0.420*** (0.106)**			**0.298*** (0.079)**			**0.220*** (0.061)**		
Bologna Process before EHEA (0,1)		**0.261* (0.105)**	**0.382*** (0.105)**		**0.102 (0.079)**	**0.227** (0.079)**		**0.03 (0.062)**	**0.139* (0.061)**
Bologna Process after EHEA (0,1)		**0.571*** (0.117)**	**0.498*** (0.118)**		**0.450*** (0.086)**	**0.408*** (0.086)**		**0.382*** (0.068)**	**0.352*** (0.068)**
EU (0,1)	0.940*** (0.077)		0.919*** (0.077)	0.820*** (0.064)		0.780*** (0.064)	0.805*** (0.058)		0.761*** (0.057)
Erasmus (0,1)	0.427** (0.148)		0.421** (0.148)	0.232* (0.11)		0.215* (0.11)	0.166* (0.078)		0.152 (0.078)
Regional trade agreement (0,1)	-0.052 (0.048)		-0.05 (0.048)	-0.02 (0.037)		-0.015 (0.037)	-0.009 (0.029)		-0.006 (0.029)
Common currency (0,1)	0.320* (0.129)		0.307* (0.129)	0.315** (0.102)		0.283** (0.103)	0.249** (0.079)		0.220** (0.079)
Within R^2	0.457	0.446	0.458	0.405	0.398	0.405	0.395	0.39	0.396
Number of observations	18,572	18,572	18,572	42,441	42,441	42,441	98,094	98,094	98,094
Number of pairs	4,643	4,643	4,643	11,815	11,815	11,815	11,815	11,815	11,815

Note: All regressions demonstrate panel estimates that include country x time and bilateral fixed effects. Columns (4) to (6) regard averages over three years and two years for the first period where the Bologna Process dummy before EHEA covers period 1 to 4 and the Bologna Process dummy after EHEA the periods 5 and 6. Columns (7) to (9) present yearly data where the Bologna Process dummyy before EHEA refers to the years 1999 to 2009 and the Bologna Process dummy after EHEA to the years 2010 to 2015. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

6.7.1 Variation of the Data Set

Columns (1) to (3) of table 6.4 present the estimates for the balanced data sample. In general, the results remain almost stable both in terms of point estimates and the level of significance. In the case of the Erasmus dummy and the currency union dummy, however, the significance level changes. For Erasmus, the level of significance increases from 5 to 1 percent, whereas the level of significance decreases from 1 to 5 percent for the estimates of common currency. Compared to the unbalanced data sample, the number of observed pairs decreases by more than a factor of 2 to 4,643 and within R^2 increases slightly to 0.45.

Columns (4) to (6) present the results of the estimates where six averages over three years (and two years for the first period) are regarded. Compared to the preferred estimates, point estimates of all coefficients decrease slightly. The level of significance remains stable for all variables with the exception of Bologna Process membership before the establishment of the EHEA: the estimated coefficient is no longer significant in column (5) and the level of significance falls from 0.1 to a significance level of 1 percent in column (6). The number of observations increases by more than a third while the number of pairs remains stable. Over all three estimates, within R^2 decreases slightly.

Finally, the results shown in columns (7) to (9) present panel estimates where yearly data of international student stocks are regarded rather than building averages. Compared to the results shown in table 6.3, the number of observations increases by more than a factor of 3 to 98,094 and the number of pairs remains stable. The estimated coefficient on joint Bologna Process membership remains statistically significant at the 0.1 percent level in column (7) and the semi-elasticity is cut by a factor of almost 2 to 0.22. Allowing for heterogeneity of the Bologna Process semi-elasticity across time, in the time when the EHEA was not yet established, membership does not have a significant impact on student mobility in column (8) and the level of significance reduces from 0.1 to 5 percent in column (9) where other covariates are controlled for simultaneously. In contrast, joint Bologna Process membership since the establishment of the EHEA remains statistically significant at the 0.1 percent level over both estimates and the estimated semi-elasticity is cut by about one fourth to 0.48 and 0.45 in columns (8) and (9), respectively. Also the coefficients on the other variables decrease compared to the estimates where averages were regarded and Erasmus is not significant anymore in column (9). Within R^2 remains almost stable standing at about 0.4.

In summary, the choice of using averages over four years has no impact on the estimated semi-elasticity of Bologna Process membership for the time after the EHEA was established, whereas the level of significance of the time before the establishment of the EHEA decreases in some of the conducted robustness checks.

6.7.2 Random-Effects Estimates

Columns (1) to (3) present the results for the random-effects panel estimates where country × time dummies are included, whereas the dummies are not included in columns (4) to (6). All coefficients are positive and estimated with excellent precision, with the exception of the Erasmus dummy. The estimated coefficient for Erasmus is no longer significant in column (4) and is only significant at the 5 percent level in column (6), which was also the case in the fixed-effects model. In contrast, RTAs are positive and highly significant determinants of international student mobility in the random-effects model, whereas the estimated coefficients on RTAs were not significant and of negative sign in the fixed-effects estimates.

Table 6.5: Bologna Process and student mobility: random-effects

Dependent variable: Ln arithmetic average of student stocks						
	Random effects (including country x time dummies)			**Random effects (without country x time dummies)**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Bologna Process (0,1)	**0.909*** (0.077)**			**0.662*** (0.057)**		
Bologna Process before EHEA (0,1)		**1.493*** (0.069)**	**0.855*** (0.079)**		**0.777*** (0.05)**	**0.456*** (0.058)**
Bologna Process after EHEA (0,1)		**1.772*** (0.072)**	**0.992*** (0.082)**		**1.416*** (0.051)**	**0.924*** (0.059)**
EU (0,1)	0.910*** (0.071)		0.886*** (0.071)	0.919*** (0.06)		0.769*** (0.059)
Erasmus (0,1)	0.499*** (0.103)		0.506*** (0.103)	0.125 (0.087)		0.181* (0.087)
Regional trade agreement (0,1)	0.687*** (0.039)		0.692*** (0.039)	0.461*** (0.034)		0.450*** (0.034)
Common currency (0,1)	0.660*** (0.087)		0.646*** (0.087)	0.579*** (0.082)		0.392*** (0.083)
Within R^2	0.394	0.391	0.394	0.050	0.048	0.066
Number of observations	30,887	30,887	30,887	30,887	30,887	30,887
Number of pairs	11,815	11,815	11,815	11,815	11,815	11,815

Note: All regressions demonstrate panel estimates. Robust standard errors in parentheses. All regressions include a constant.
* p<0.05, ** p<0.01, *** p<0.001.

Most importantly, the estimates of all Bologna Process dummies are positive and highly significant over all random-effects estimates. Compared to the fixed-effects method, all point estimates are notably higher; when country × year effects are included, the Bologna Process semi-elasticities increase by a factor of more than 2 in columns (1) and (3), and by a factor of up to 6 in column (2), which estimates the effect for the time before and since the establishment of the EHEA separately. In columns (4) to (6) where the country × times dummies are not included, the coefficients are also higher compared to the fixed-effects model but below the estimates presented in columns (1) to (3).

Applying the Hausman test in order to compare the fixed-effects and the random-effects estimators, the overall χ^2- statistic has a p-value of 0.99 for columns (1) to (3) and a p-value of 0.00 in columns (4) to (6). Hence the result for the model where country $\times$ time dummies are not included leads to strong rejection of the null hypothesis that random-effects provide consistent estimates. Since the random-effects model adds the additional assumption that the time-invariant component of the error term υ_{ji} is distributed independently of the regressors, the fixed-effects estimator is a more conservative method that is based on weaker assumptions. Therefore, I stick to the fixed-effects estimates shown in section 6.6. However, the results of the random-effects estimator have shown that the estimates are robust to this choice.

6.7.3 Zero Student Stocks

In this section, estimation methods are applied that allow for the inclusion of zero student stocks. In the presence of zero student stocks, taking the log of student stocks drops observations with zero students. This in turn leads to a selection bias, as country pairs with zero student exchange are likely to differ from the country pairs with a positive student stocks. Although the UNESCO data do not clearly differ zero student stocks from missing values in the student data, I strive to address the issue that arises in the presence of zero observations in the log-linear model.[26]

In order to include zero observations, different estimation methods can be applied. Using the log of the observed student stocks plus 1 instead of the log of the student stocks prevents such bias (Beine et al., 2014).[27] Table 6.6 presents these results estimated in a panel setup.

Columns (1) to (3) demonstrate the results where the average over the observed student stocks plus 1 is regarded. This converts zero student stocks in the data to a value of one and therefore allows for the inclusion of the logarithm of these observations. In doing so, the number of observations and pairs more than doubles to 71,227 and 25,794, respec-

[26]The UIS itself marks the data that are not available with "magnitude nil or negligible"–which I have considered as zeros in the data set–or "not applicable"–which I have considered as missing values in the data set. Looking at the data, however, lets assume that the countries have marked the data where a clear number are not available not always correctly, as sometimes the student stock is marked as "magnitude nil or negligible" even though the number was higher than 100 during all the other years. This, for example, is the case for the stock of German students hosted in Belgium that is zero in the year 2008.

[27]Another method is the PPML estimate which is favored by Santos Silva and Tenreyro (2006). Compared to the log-linear specification, besides the fact that it can deal with zero student stocks, this method yields the advantage that it can deal with heteroscedasticity in the disturbances which leads to an endogeneity problem as zero student stocks create some correlation between the covariates and the error term. However, as the UNESCO data do not clearly distinguish zero student stocks from missing values and the results differ completely from the preferred fixed-effects panel estimates, I stick to the results shown in section 6.6. Nonetheless, I show the PPML panel estimates in Appendix D.4 but I do not explain the results in more detail within this section.

tively. While EU and common currency are still statistically significant determinants for international student mobility–though point estimates are lower–the estimates of Erasmus and RTAs have changed. Being a member in the Erasmus program has no effect on the stock of students anymore, whereas RTAs now reduce student exchange, estimated at a significance level of 5 and 1 percent in columns (1) and (3), respectively. Most importantly, the coefficient for the Bologna Process dummy remains statistically significant at the same level over all estimates, but point estimates decrease. When one Bologna Process dummy is included in the regression in column (1), the estimated semi-elasticity falls by about one third to 0.29. When the effect for time before and after the establishment of the EHEA are estimated separately, the semi-elasticity of the time before the EHEA is cut by a factor of almost 3 to 0.09 and by more than a third to 0.22 in columns (2) and (3), respectively. The semi-elasticity that captures the time after the EHEA only falls by about 20 percent and 10 percent to 0.39.

Table 6.6: Bologna Process and student mobility: zero student stocks

Dependent variable: Ln arithmetic average of student stocks			
	Ln (student + 1)		
	(1)	(2)	(3)
Bologna Process (0,1)	**0.288*** (0.04)**		
Bologna Process before EHEA (0,1)		**0.092* (0.04)**	**0.219*** (0.04)**
Bologna Process after EHEA (0,1)		**0.391*** (0.044)**	**0.388*** (0.045)**
EU (0,1)	0.764*** (0.049)		0.719*** (0.049)
Erasmus (0,1)	0.061 (0.092)		0.019 (0.092)
Regional trade agreement (0,1)	-0.064** (0.024)		-0.053* (0.024)
Common currency (0,1)	0.215** (0.068)		0.163* (0.069)
Within R^2	0.379	0.373	0.38
Number of observations	71,227	71,227	71,227
Number of pairs	25,794	25,794	25,794

Note: All regressions demonstrate panel estimates that include country x time and bilateral fixed effects. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Since the UNESCO data do not allow to distinguish clearly zero from missing observations, I stick to the preferred panel estimates. However, using the log of the student stock plus 1 has shown that the estimates of the Bologna Process dummy are robust to applying this method, especially for the time since the establishment of the EHEA.

6.8 Conclusion

In this chapter I investigated whether the goals of the Bologna Process with respect to student mobility have been achieved. I investigated this question empirically. To do this, I constructed a data set of bilateral student mobility across 155 host countries and 187 source countries based on the UNESCO online database covering the years 1999–the year of the beginning of the Bologna Process–to 2015 and merged it with a binary dummy variable for joint membership in the Bologna Process. In a first step, I used these data for an extensive descriptive analysis at a country level. In doing so, I analyzed how the inward and outward mobility has evolved throughout the process. While the number of inward mobility increased in most countries, there is strong heterogeneity across country groups. Compared to the United States, which are traditionally considered as the most attractive destination for international students and therefore are regarded as the main competitor, the EHEA has performed well. In order to evaluate the attractiveness of the EHEA more accurately, better data are necessary, especially with respect to Asian destination countries. Asian countries have traditionally been among the most important sending countries of international students and are emerging as an attractive destination region for students. For instance, China is among the top destination countries in recent years, but data by country of origin are not available in the common data sources. It is crucial, therefore, to be aware of this emerging destination region for international students and to compare the inward mobility to Asian countries in order to evaluate the attractiveness of the EHEA.

Furthermore, I have compared the imports and exports of students in each country in order to demonstrate how balanced student mobility is in each Bologna Process member country. The descriptive analysis has shown that in some countries student mobility is almost balanced, whereas the situation in most countries is strongly unbalanced. This puts a strain on the financing system of the EU that is mainly publicly financed.

In a second step, I estimated to what extent being a member in the Bologna Process has led to an increase in student mobility between the participating member countries. I addressed this question by fixed-effects panel estimations. To ensure consistent estimates, I made extensive use of country $\times$ time fixed effects to dummy out unobserved multilateral resistance terms. The findings indicate that the semi-elasticity of bilateral Bologna Process membership on the international student stocks is about 0.4. Importantly, this effect also exists when both the Erasmus and EU dummy are included in the model and all three turn out as determinants separately. Looking at the time before and after the establishment of the EHEA, the semi-elasticity of Bologna Process membership is higher in the time after the EHEA was established, which is intuitive. With this in mind, the main aim of the Bologna Declaration to increase student mobility seems to have been accomplished when the effect for the EHEA as a whole region is regarded. However, as

the descriptive analyses have shown, there is a strong heterogeneity across countries.

While the results are robust over a number of sensitivity checks, better data would allow for more precise inference. As data are not available for each destination country for each year, I used averages rather than yearly data. A better data coverage, however, would make it possible to conduct estimates for different destination groups across years. Including economic and cultural factors in the econometric specification, for example, could also provide meaningful insights. Since student mobility in the EHEA is primarily driven by a few countries, analyzing country groups separately is necessary to adopt an efficient policy.

Compared to the existing literature, however, the analysis makes substantial headway, since I exploit panel data for a wide range of countries in a very general econometric model where I include country $\times$ time effects to dummy out unobserved multilateral resistance terms and measure the effect of the Bologna Process, the Erasmus program, and the EU on the stocks of international students. In the future, a better understanding of the main drivers of student mobility will make it possible to better deal with the remaining endogeneity issues that still arise in my framework.

Chapter 7

Student Mobility and High-Skilled Migration: The Evidence[1]

Abstract Using information from the UNESCO, this chapter constructs a new balanced panel database of bilateral international student mobility for 150 origin countries, 23 host countries, and the years 1970 to 2000. These data are matched with information on bilateral stocks of international migrants by educational attainment from Docquier et al. (2008), available for 1990 and 2000. Running theory-founded gravity models by conditional fixed effects Poisson Pseudo Maximum Likelihood methods, this chapter investigates the question: to what extent do countries that attract foreign students benefit from an increased stock of educated foreign workers? It finds that, on average, an increase of students by 10 percent increases the stock of tertiary educated workers in host countries by about 0.9 percent. That average effect is, however, entirely driven by Anglo-Saxon countries. On average, the results imply a student retention rate of about 70 percent. These findings suggest that the costs of educating foreign students are at least partly offset by increased availability of foreign talent.

Keywords: Migration, Education, International Student Mobility, Brain Drain, Panel Data, Poisson Model.

[1]This chapter is based on joint work with Gabriel Felbermayr. It is based on the article "Student Mobility and High-Skilled Migration: The Evidence", in: Marcel Gérard and Silke Uebelmesser, eds., *The Mobility of Students and the Highly Skilled: Implications for Education Financing and Economic Policy*, CESifo Seminar Series, MIT Press 2014, pp. 15 - 56. This is a revised version of our working paper that circulated under Ifo Working Paper No. 132, 2012.

7.1 Introduction

There is little doubt that the long-run growth perspectives of industrialized countries crucially depend on their ability to continuously develop new and better products and to improve production processes. This capacity is shaped in turn by the quality of the educated work force. Human resource recruiters have long understood this. Business consultants talk about a "war of talent" (Chambers et al., 1998). Awareness is growing that a successful position in the "global competition for talent" (OECD, 2009) is important.

The increasing mobility of highly educated workers puts strains on the workings of higher education systems, in particular if they are publicly financed. Countries that finance universities but see their graduates move to jobs in other countries have incentives to cut back spending as other countries reap the benefits. This is even more so if part of the student body is foreign. Indeed attracting talented foreign students and retaining them after graduation is an important strategy in the global competition for talent (Tremblay, 2005). However, to what extent imports of university students lead to a subsequent increase in the highly educated foreign workforce is an empirical question that has not received much attention so far.

Recent data published by the OECD (2011) show that the number of international students increased dramatically from 0.8 million in 1975 to 2.1 million in 2000 and 3.7 million in 2009. OECD countries attract a fairly stable 76 percent of this flow, about half that share goes to EU countries. Student flows are strongly concentrated in few destinations: The top 5 destinations (United States, United Kingdom, Germany, France, and Australia) attract about 50 percent of all international students. On average, about 6.2 percent of all students are international students, but there is strong heterogeneity across destinations: in Australia, more than 20 percent of all students are international; that share is about 15 percent in places such as the United Kingdom, Austria, or Switzerland. Survey results indicate that about 30 percent of international students wish to remain in their country of graduation after completion of their degree; but again, there is strong heterogeneity in that number. While the data situation on country-level of international student stocks is satisfactory, there are much less detailed data available on student flows by country of destination *and* origin.

Information on the stocks of highly skilled migrants across countries compiled by Docquier et al. (2008) reveals that the distribution of highly educated migrants across countries is similarly concentrated as the stock of students. The data also show a strong increase in the stock of tertiary educated individuals living abroad, from 12.5 million in 1990 to 20.5 million in 2000.

In this chapter we present a new database on bilateral student mobility covering the years 1970 through 2000, mostly obtained from printed UNESCO Statistical Yearbooks (and in more recent years, from electronic UNESCO data bases). Matching these data

with information about bilateral stocks of immigrants with age 25 or higher by educational attainment for the years 1990 and 2000 from Docquier et al. (2008), we obtain a data set that covers 23 host countries and 150 origin countries. Using this data sample, we study how international bilateral student mobility affects stocks of highly educated foreign workers. Since the student data have patchy coverage for certain host countries, in our regressions we work with averages typically constructed over ten years prior to 1990 and 2000, but we conduct extensive sensitivity checks with respect to this choice.

The Docquier et al. (2008) data allow us to conduct our analysis in a panel setup. The short time dimension notwithstanding, the availability of within country-pair variation makes it possible to control for unobserved heterogeneity in countries' ties that affect both the stock of students and those of migrants. Moreover, since we observe stocks from each destination country in 23 host countries, we can control for destination country-specific variables by using time-variant country dummies. The same is feasible for host countries. Existing studies look at single host countries only, so that this comprehensive dummy variable strategy is not applicable. We base our econometric strategy on a theory-founded gravity model for bilateral migration which shows that carefully controlling for multilateral resistance terms is crucial to obtain consistent estimates of average effects. Finally, unlike most of the existing literature, we employ a Poisson Pseudo Maximum Likelihood (PPML) estimation. Compared to the more conventional log-linear specification, this has the advantage that we can deal with zero immigrant stocks (which exist in the data), and with heteroskedasticity in the disturbances.

In order to investigate the causal effect more intensively, we also would have liked to add robustness checks running instrumental variables regressions (IV). Unfortunately we could not include IV, as it is difficult to find an instrument. One proper instrument could be bilateral data on the Inter-University Cooperation program (ICP) network. However, to the best of our knowledge, these data are not available for our data sample so we cannot make use of this method. To investigate the causality question as good as it is possible with the available data, we perform a regression-based test for strict exogeneity (Wooldridge, 2002). We find an economically and statistically significant *causal* effect of student mobility on later migration.

We report the following findings. (i) To combat omitted variables bias, it is crucial to use a comprehensive set of country $\times$ year dummies in the model. When this is done, the room for remaining omitted variable bias becomes very small, so our estimates can be interpreted as causal. In the log-linear model, the effect of student mobility falls by a factor of 12, but remains statistically significant at the 5 percent level. (ii) There are substantial problems related to heteroskedasticity in the disturbances and to aggregation bias in the data: using the PPML model, we find that if the heterogeneity in educational levels of migrants is disregarded, student mobility has no measurable effect on foreign worker stocks. Such an effect does, however, exist for tertiary educated migrants, and

it is statistically significant at the 5 percent level. (iii) The elasticity of student stocks on stocks of highly educated foreigners is about 0.09, so doubling the number of foreign students is associated to an increase in the stock of tertiary educated foreign workers of 5.7 percent. We find, on average, for EU countries a retention rate of about one-third.[2] (iv) Student mobility triggers higher migration of less than university-educated migrants, in particular of agents with secondary education, but the estimated elasticities are smaller than those obtained for the stock of highly skilled workers. (v) Importantly, the sample average is driven by Anglo-Saxon countries, among which the elasticity of high-skilled migrant stocks with respect to international students is about 0.12.

There are several reasons why one may expect student mobility to affect the stock of migrants in later periods. First, young persons who study abroad may decide to stay in that foreign country after graduation, or be more likely to return there after an intermittent spell in the home or a third country. This argument, of course, may explain stocks of highly educated migrants, but not of persons with less than university education. Second, it is possible that the presence of the first mechanism entails migration of secondary and primary educated persons. If a former student decides to work after graduation in the foreign country, she may facilitate the migration of other workers from her home country, such as when she has family members join her or when she sets up an enterprise that has business ties to her home country.

Our work is closely related to a recent paper by Dreher and Poutvaara (2011). These authors use panel data for 78 countries of origin to study the effect of student flows into the USA on migration. They find an elasticity of student mobility on migration around 0.094, which is very similar to what we find. The strength of their approach is that they work with yearly data from 1971 to 2001 while we have only two observations per country pair. The disadvantage of their study lies in the fact that they (i) only observe total immigration and have no breakdown according to education classes; this invites aggregation bias, and blurs their 'brain gain' argument; (ii) they focus on a single host country; this makes it impossible to control for that country's unobserved multilateral resistance term as mandated by theory; (iii) they employ a log-linear model which cannot deal with zero migration stocks that do, however, exist even in the US data.[3] Our model complements survey exercises on the propensity to stay after graduation (e.g., see Baruch et al. (2007)).

Another work by Parey and Waldinger (2011) also investigates the effect of studying abroad on later labor market mobility. The authors develop a new data set combining the number of exchange places of each subject at every German university with survey data of German university graduates. They find that studying in another country raises

[2]The 5.7 percent and the retention rate of one-third are explained in more detail in chapter 7.4.2.

[3]Zeros (or missing information) amount to about 20 percent of the migration data.

the probability of working abroad by about 15 percentage points. The advantage of their work is that they use the variation in scholarship availability for the European exchange program Erasmus as an instrument for studying abroad.

Unfortunately, these data are not available for our work, as we want to cover more countries. Another strength of their work is that the sample observes the same people during and after their studies. However, their sample is restricted to one single country of origin–Germany–and German graduates who participated in an exchange program. Furthermore the response rate to the survey was only 25 percent, which could lead to a selection bias.

Our work is also closely related to gravity estimates of bilateral migration stocks. Important contributions to this body of research are Hatton (2003), Mitchell and Pain (2003), Clark et al. (2007), Pedersen et al. (2008), Beine et al. (2009) and Grogger and Hanson (2011). These papers do not address student mobility, they use a different motivating theory, and they do not use Poisson techniques for estimation purposes.

Finally, our work also relates to a large, mainly theoretical, literature that discusses the role of national higher education systems in a world with mobile students and workers. It is well known that international (or interregional) mobility of educated workers can cause an underinvestment in local public education when political entities independently decide on spending to maximize local welfare–see Justmann and Thisse (2000) or Demange et al. (2008) for excellent examples. Lange (2009) has shown that this can reverse if students are mobile too. Then countries have an incentive to overinvest to attract students who have a certain proclivity to stay in the country in which they graduate. Another work by Haupt et al. (2014) presents a model for student migration from a developing country to developed countries. They show that a higher permanent migration probability provides incentives to the host country to improve its education quality in order to attract more foreign students. Furthermore, if the proclivity to stay is not too high, the investment in higher education systems in the developed host country can have a positive effect for the sending countries as the access to improved education raises the human capital of the returning students. Clearly, the proclivity to stay in the host country is crucial for the policy-maker. In this chapter, we try to assess empirically how big that likelihood is. While there is substantial theoretical work on the provision of public education under interregional mobility, there is a clear scarcity of empirical work.

The chapter is organized as follows. The next section 7.2 describes the data. Section 7.3 sketches a simple multiple-country migration model that yields a gravity equation and discusses its consistent estimation. Section 7.4 presents our baseline results, and section 7.5 discusses robustness checks. The final section 7.6 highlights policy implications and concludes.

7.2 Data

7.2.1 Bilateral Migration Data

The data on international migration used in this work are based on the data provided by Docquier and Marfouk (2006). They developed a data set on migration to OECD countries by educational level for 174 countries of origin for the year 1990, and 195 countries for the year 2000.

This data set has been updated by Docquier et al. (2008). They use new sources, homogenize the concepts for both years 1990 and 2000, and construct new stocks and rates of bilateral emigration by level of education.[4] The resulting data, which are used in this paper, refer to the years 1990 and 2000 for 195 sending and 31 host countries. Different than most available data on bilateral migration, this sample shows not only the number of migration in general but also more detailed by educational attainment: Low-skilled migrants attained less than upper secondary education, medium-skilled migrants completed upper secondary education, and high-skilled migrants are those with all post-secondary education levels, even those with only one year of a US college. The data set only takes into account OECD nations as receiving countries.[5] Furthermore in this data set migration is defined as foreign-born adult migrants that are 25 and older. Hence students as temporary migrants are not included. However, as the data considers immigrants independently of their age of entry, it does not appear where education has been acquired. Beine et al. (2007) use the age of entry as a proxy for where education has been attained. Even though the rates calculated without age-of-entry restriction are higher than the corrected rates, the correlation between the two rates is very high. Hence empirical work is "likely to be robust to the choice of corrected or uncorrected skilled emigration rates" (Beine et al. 2007, p. 253).

7.2.2 Data Sources

To the best of our knowledge, bilateral student data for a large cross-country sample from an electronic data base are not available yet. As we want to cover a large sample of countries for a long period, we have taken our main explanatory variable–the stock of students from abroad which study in a foreign host country–from the UNESCO Institute for Statistics (UIS). The data show the annual stock of foreign students enrolled in institutions at the tertiary level since 1950. Unfortunately, for most years sample data are

[4]They further introduce a gender breakdown. As data on student exchange are only available in general and not by gender, this dimension is not taken into account for the empirical work of this paper.

[5]Even though the number of high-skilled immigrants in other than OECD-countries is expected to be low and skilled migration to OECD countries covers about 90 percent of the total number, high-skilled migration from some developing countries may be underestimated.

only available from *printed* UNESCO Statistical Yearbooks; for the years after 1998 data are available at the UNESCO homepage.[6] Hence the data we use in this work had to be entered manually. As most host countries are covered more consistently starting from the year 1970, the sample begins in 1970. As for the dependent variable–immigrants–data are only available for 31 host countries and the student data overlap with 26 of these countries, so the sample is restricted to 26 host countries.[7] With respect to the country of origin, data are almost available for all countries.

For most years, data belong to one calendar year. In some cases the number of students refer to an academic year, for example 1994 to 1995. Therefore we generate two different datasets: our preferred data set consists of data where the number for an academic year is attached to the second year, hence in the example to 1995. This makes sense as a semester always ends in the second year. We generate a second data set to check for robustness. For this data set the number is allocated to the first year, which would be in the example 1994. If, however, data are already available explicitly for one of the two years, this number is kept in the data set and the data referring to the academic year are not taken into account.

Data on cultural and geographical proximity are taken from the CEPII gravity data set developed by Head et al. (2010). The data set covers the years 1948 to 2006 and 224 countries. For our purpose we only use data for the years 1990 and 2000.

Data on GDP, population, and unemployment come from the *World Development Indicators* database.

7.2.3 Descriptive Statistics

As the resulting data set spans the years 1970 to 2000, due to secessions, reunifications and dependency changes, various countries change over the considered period. To make the data comparable, assumptions have to be made. While data like GDP, population, and the number of students can be aggregated, the assumptions are more complicated for data described in the CEPII data set such as dummies on regional trade agreement or common currency. Therefore we use the CEPII data set in our decision on whether to aggregate countries in order to maintain as many countries as possible. If data in the CEPII data set are only available individually though aggregated in the other data sources, such data are not taken into account for our data set. If data in the CEPII data set are available only aggregated, data will be aggregated for the whole data set.

Combining these data according to the described decision rules results in a data set of 26 destination countries and 159 countries of origin. However, these countries are only

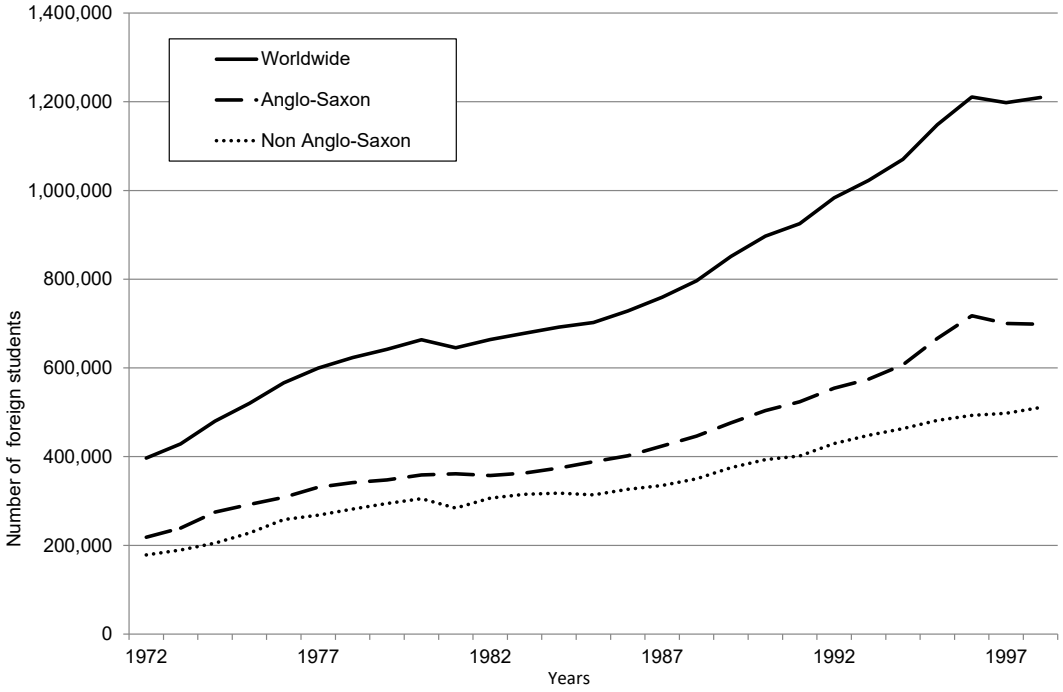
[6] For the years 1997 and 1998 unfortunately no data are available.

[7] After balancing the data set, the sample is restricted to 23 destination countries.

covered in the unbalanced data set. The balanced version contains only 23 destination countries and 150 origin countries. The sample spans the period 1970 to 2000 for the dependent variable on student exchange; the other variables are considered for the years 1990 and 2000 (see table E.1 in Appendix E.1). Table E.3 in Appendix E.2 shows the countries of origin as well as the host countries that are represented in the sample.

Figure 7.1 presents the development of student mobility over years. The data are taken from our resulting sample consisting of 26 destination countries after matching it with the other data.[8] As data are not available for all years for all countries, the numbers are shown as moving averages over five years for different groups: the total sample, the number of Anglo-Saxon countries (United States, United Kingdom, Ireland, Canada, Australia, and New Zealand), and the remaining countries. It is easy to see that the six Anglo-Saxon countries account for a large part of the total number and that the number is growing faster than in the other countries. For the year 2000 our sample (1.23 million students) equates to about 70 percent of the total number of foreign students (1.76 million students).

Figure 7.1: Evolution by region of destination in the total number of foreign students



Note: Numbers for 1997 and 1998 are calculated as the moving average over five years for all countries. Missing numbers are replaced by moving averages over five years where possible.
Source: UNESCO Institute for Statistics (UIS)

Before we investigate the effect of student mobility on the stock of high-skilled migrants, it is interesting to first see how both numbers developed over the years.

[8]Before matching, the total number contains 50,000 more students for the year 2000, as all countries of origin are included.

Table 7.1: Average annual numbers for a host country

Year	1970-1979	1980-1989	1990-1999	1990	2000
Students	39,499	55,830	81,696		
Migrants				1,388,598	1,962,120
High-skilled migrants				424,980	693,199

Note: The table shows the average annual number of students in a destination country for periods of ten years and the number of migrants in 1990 and 2000.
Source: Student mobility data: UNESCO Institute for Statistics, migration data: Docquier, Lowell, and Marfouk (2008)

Table 7.1 presents the annual average number of students in a destination country for periods of ten years and the number of migrants in the years 1990 and 2000. While in the 1970s a country had an average stock of almost 40,000 students, in the 1990s the number is more than twice that number. But also the number of migrants increased: while in 1990 the average stock of total migrants was about 1.4 million, ten years later the number increased by about 41 percent to almost 2 million migrants. For highly skilled migrants, the pattern is even more dramatic: from 1990 to 2000 the stock of high-skilled migrants in a country increased from about 425,000 to 693,000, which is an increase of around 63 percent.

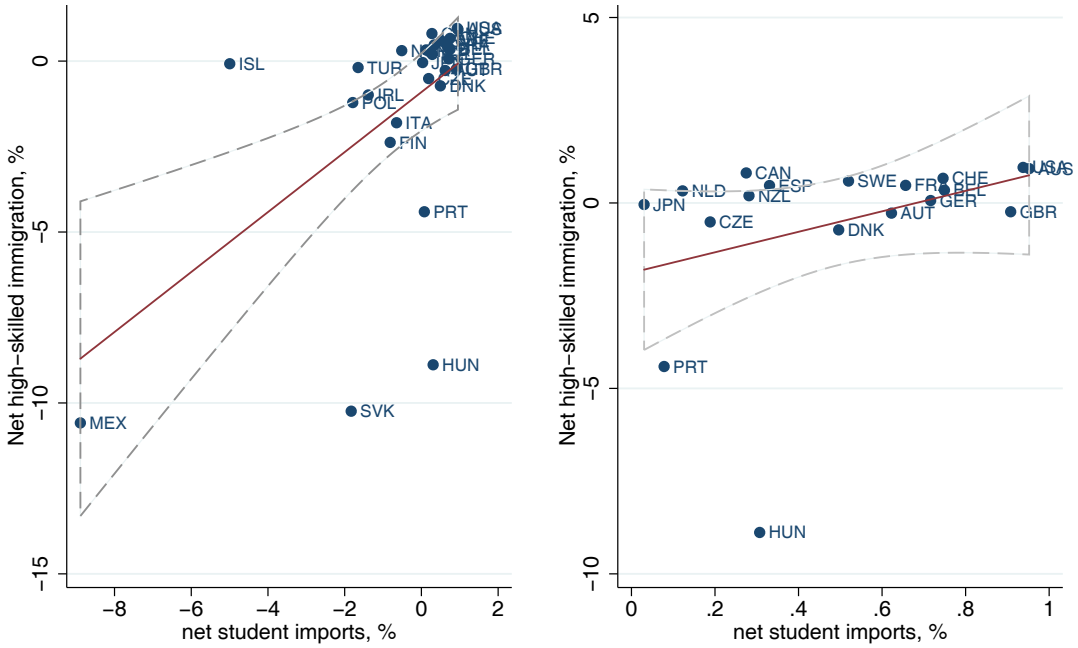
7.2.4 Overview of the Data

The patterns shown in table 7.1 suggest that there is a high correlation between student migration and later migration in general, and likewise for the highly skilled.

Figure 7.2 plots net student imports at the country level against net immigration of high-skilled workers. Both measures are normalized by gross inflows for the year of 2000. The left-hand panel shows that most reporting host countries are net importers of both, students and highly skilled immigrants. Clearly, a brain gain or a brain drain of a country manifests itself early on in the pattern of student mobility. There are nevertheless some notable exceptions: Hungary, for example, is a net importer of students but, in 2000, the net loss of educated workers is about 9 percent of the gross inflow of highly skilled individuals. Also Portugal is a net importer of students but a net exporter of talent. Fitting a linear regression to the data reveals a strong and statistically significant positive correlation between the two variables.

The right-hand side diagram looks at net importers of students only. There is substantial heterogeneity in terms of net student mobility but less so in terms of net migration. Countries such as the United Kingdom or the United States have net imports of students that are almost identical to total imports of students, while Japan and the Netherlands

Figure 7.2: Correlation between net student and high-skilled immigrant stocks



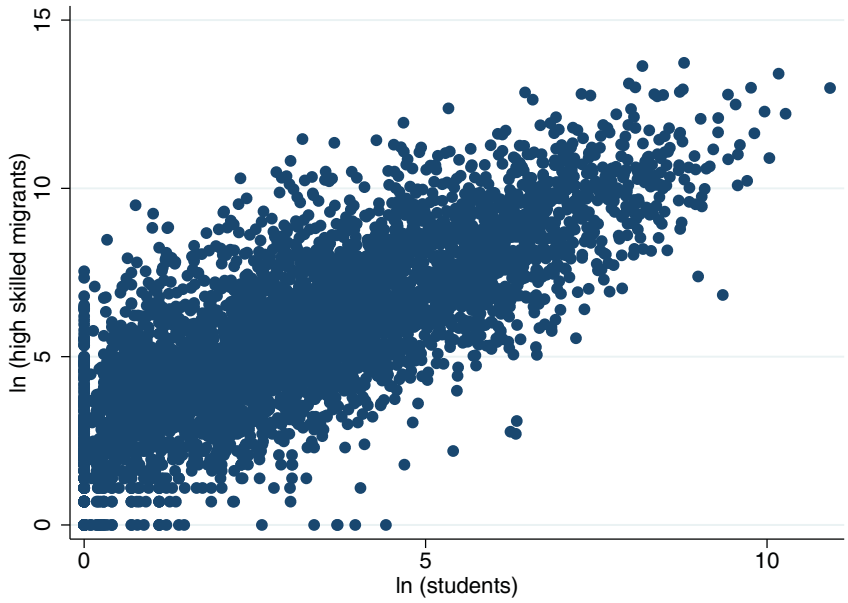
Note: All data are for the year 2000. The left-hand panel shows all available host countries; the right-hand panel only those with nonnegative net student inflows. Variables are expressed as percentage of inflows. Linear regression fitted, with 95 percent confidence intervals.

have much more balanced positions. In this subsample, there is also a positive link between net migration of talent and net student mobility but the relation is only moderately statistically significant.

While figure 7.2 presents monadic data (i.e., bilateral stocks cumulated over all source countries), figure 7.3 provides a scatterplot of the raw bilateral data. The average stock of students over the period 20 years to 1 year prior to measuring the stock of highly skilled migrants is correlated with the total stock of highly educated workers in the years of 1990 and 2000. There is a very clear and fairly strong positive association between the two variables; the slope of the relationship is larger than unity.

While figures 7.2 and 7.3 provide interesting illustrations, they only show raw correlations. We will see later that upon controlling for a wide range of determinants of high-skilled mobility, the link between students and workers becomes much weaker, and even disappears for a wide subsample of countries.

Figure 7.3: Bilateral gross stocks of students versus stocks of highly-educated migrants



7.3 Model and Empirical Strategy

7.3.1 A Stylized Theoretical Framework

We wish to investigate the link between student mobility and migration. For this purpose we need a simple model of migration choice that aggregates to the bilateral country level and that can be implemented empirically. To keep things simple, we differentiate between three education classes: low, medium, and high, indexed by $s \in \{L, M, H\}$.

While much modeling attention has been devoted to bilateral trade flow equations on the aggregate level ('the gravity literature'), there has been much less work on worker flows; recent exceptions are Beine et al. (2009) or Grogger and Hanson (2011). Here we follow the recent model by Anderson (2011). In contrast to a firm's decision to export, the decision to migrate is a discrete choice from a set of possible destinations. The flow costs of migration are destination specific, but they may additionally have an idiosyncratic component reflecting the costs or utility from the move.

Let w_s^i denote the real wage paid in country i to a worker of education s and w_s^j the real wage paid to a similar worker in the home country j. The systematic flow costs of migration are captured by an iceberg discount factor $\zeta_s^{ji} \leq 1$,[9] so that the effective net wage is reduced: $w_s^i \zeta_s^{ji} \leq w_s^j$. The diminution factor ζ_s^{ji} may be education-specific (e.g., lower for highly educated workers due to their knowledge of languages), and also incorporate geographical frictions such as captured by distance. Worker h idiosyncratic utility component is ϵ_s^{jih}; that shock is unobserved to the econometrician. In these derivations

[9]Whether these costs are flow costs or fixed costs does not make a difference in the present setup.

we view ϵ_s^{jih} as idiosyncratic. In reality, it may also contain the effect of $h's$ prior exposure to country i, possibly through a stay as a student. So worker h leaves his home country j if $w_s^i \zeta_s^{ji} \epsilon_s^{jih} \geq w_s^j$ for at least some i. He chooses the country with the highest net wage.

McFadden (1974) shows that if utility is logarithmic so that the observable gain from migration is $u_s^{ji} = \ln w_s^i + \ln \zeta_s^{ji} - \ln w_s^j$, and if $\ln \epsilon$ is distributed according to a type-1 extreme value distribution, then the probability that a randomly drawn individual would choose any specific destination country is given by the multinomial logit form. At the aggregate level, the likelihood of a randomly picked individual to migrate from j to i is given by $\left(w_s^i \zeta_s^{ji}\right) / \left(\sum_k w_s^k \zeta_s^{jk}\right)$. Let N_s^j be the mass of natives educated at level s in j; then the predicted stock of migrants is

$$M_s^{ji} = \frac{w_s^i \zeta_s^{ji}}{\sum_k w_s^k \zeta_s^{jk}} N_s^j. \tag{7.1}$$

To derive a gravity equation, one needs to factor in the aggregate labor market-clearing conditions. Let $L_s^i = \sum_j M_s^{ji}$ denote the total labor supply available to region i and let $N_s = \sum_j N_s^j = \sum_i L_s^i$ denote the world labor supply. Finally, define $W_s^j \triangleq \sum_k w_s^k \zeta_s^{jk}$, the migration-cost weighted wage faced by an $s-$type worker from country j. Then, the labor market-clearing condition can be restated as

$$L_s^i = w_s^i \sum_j \frac{\zeta_s^{ji} N_s^j}{W_s^j} \tag{7.2}$$

which can be solved for the equilibrium wage rate w_s^i that prevails in i for skill s

$$w_s^i = \frac{L_s^i}{\Omega_s^i N_s} \text{ where } \Omega_s^i \triangleq \sum_j \frac{\zeta_s^{ji}}{W_s^j} \frac{N_s^j}{N_s}. \tag{7.3}$$

We can now substitute out w_s^k from the definition $W_s^j \triangleq \sum_k w_s^k \zeta_s^{jk}$ so that

$$W_s^j = \sum_k \frac{\zeta_s^{jk}}{\Omega_s^k} \frac{L_s^k}{N_s}. \tag{7.4}$$

The final step consists in using equation (7.3) to substitute the endogenous wage rate out from (7.1). This yields Anderson's structural gravity equation of migration

$$M_s^{ji} = \frac{L_s^i N_s^j}{N_s} \frac{\zeta_s^{ji}}{\Omega_s^i W_s^j}. \tag{7.5}$$

The first term in the gravity equation (7.5) would represent the bilateral pattern of migration in the complete absence of migration costs (hence $\zeta_s^{ji} = 1$). Then the distribution of workers across countries would be entirely independent from their respective countries of origin. The second term captures the losses due to migration. Clearly, the

higher those losses (the smaller ζ_s^{ji}), the smaller will be the flow M_s^{ji}. However, in a world where workers can choose from a whole set of destinations, the migration flow does not only depend on the bilateral cost ζ_s^{ji}, but also on multilateral terms Ω_s^i and W_s^j. These resistance indexes reflect all bilateral migration costs in the world. The larger W_s^j, the larger the average net wage that a worker can expect in country j, which reduces emigration incentives out from j. The larger Ω_s^i, the lower are outflows from j to i.

7.3.2 Empirical Model

Equation (7.5) constitutes the backbone of our empirical model. Since we will work with aggregate bilateral data, we model the discount factor ζ_s^{ji} that reduces the attractiveness of destination i for a $s-$type worker from country j as dependent on the likelihood that such a worker has studied in that country prior to the date at which we observe that person as a migrant. Moreover, our data have a time dimension which we will use to identify the effects of international student mobility on migration stocks.

Introducing time indices t, we view the discount factor ζ_s^{ji} as a function of several determinants:

$$\zeta_s^{ji}(t) = \Gamma\left[Geo^{ij}, Cult^{ij}, Pol^{ij}(t), MPol_s^i(t), MPol_s^j(t), Stud^{ij}(t-\tau), \nu_s^{ji}, t\right] \quad (7.6)$$

where Geo^{ij} collects time-invariant geographical determinants of migration costs such as distance or adjacency. $Cult^{ij}$ approximates cultural proximity and contains variables such as common language and common colonizer.

These variables are identical over s, but they may affect different education classes differently. $MPol_s^i(t)$ is an education class and time-specific control for migration policy in country i. $Pol^{ij}(t)$ controls for the general stance of political ties between countries i and j. $Stud^{ij}(t-\tau)$, where $t \geq \tau$, measures the stock of international students from i in country j at a period (or interval) of time sufficiently far from t in the past so that the current stock of students is not per se accounted for in the stock of migrants. Moreover, ζ_s^{ji} may depend on unobservable bilateral determinants of migration costs, such as historical affinity between countries, preexisting networks of businesses or ethnicities, and so on. The costs also may have a common time trend t.

In our baseline regressions, we define $Stud^{ij}(t-\tau)$ as the bilateral stock of international students averaged over the years $t-\tau$ to $t-1$. Our student data covers a longer time period than the migration data, which comes either from year 2000 or 1990. For this reason we can use several student stock averages in our migration gravity equations. When we work with ten-year averages, with some abuse of notation, we refer to the first average (defined from $t-1$ to $t-10$) as the first lag and the second average (defined from $t-11$ to $t-20$) as the second lag.

To turn (7.5) into an estimable expression, we need to specify the error term υ_s^{ji}. We follow Santos-Silva and Tenreyro (2006) and assume that υ_s^{ji} is generated from a Poisson process. We choose this specification, because in the presence of heteroskedastic errors, log-linearizing (7.5) with a normal disturbance term and estimating by OLS leads to *inconsistent* estimates. If there are zeros in the data, the disturbance term cannot be normally distributed. And even if there are none, standard OLS cannot deal with additive error structures. For these reasons we apply the Poisson pseudo maximum likelihood technique.[10]

Besides the problem of heteroskedasticity, estimation of (7.5) requires information about the multilateral resistance indices Ω_s^i and W_s^j. Omitting them from the model can severely bias the estimates. However the indices cannot be easily constructed from observed data because they involve ζ_s^{ji}, which needs to be estimated. For these reasons, and following the international trade gravity literature (e.g., surveyed in Anderson and van Wincoop (2004)), we work with destination and source country-specific fixed effects.

Embedding (7.5) into the Poisson model, and substituting a log-linear form of (7.6) leads to

$$\begin{aligned} M_s^{ji}(t) &= \exp\left\{\alpha_s + \ln\zeta_s^{ji}(t) + \ln L_s^i(t) + \ln N_s^j(t) - \ln\Omega_s^i(t) - \ln W_s^j(t)\right\} + \upsilon_s^{ji} \\ &= \exp\left\{\alpha_s + \gamma_s \ln Stud^{ij}(t-\tau) + \pi_s Pol^{ij}(t) + \nu_s^i \times v_s(t) + \nu_s^j \times v_s(t) + \nu_s^{ji}\right\} + \upsilon_s^{ji}(t) \end{aligned} \tag{7.7}$$

where the constant $\alpha_s = -\ln N_s$ and $\nu_s^i \times v_s(t)$ and $\nu_s^j \times v_s(t)$ are interactions of country dummies with time dummies to control for all country-specific time-variant variables such as the (unknown) multilateral resistance terms, country variables such as $N_s^j(t), L_s^i(t), MPol_s^i(t)$ or any other such variables (GDP per capita, controls for the quality of the university system, etc.). All time-invariant bilateral variables are taken care of by the fixed effect ν_s^{ji}; time-variant bilateral policy controls $Pol^{ij}(t)$ remain, and are proxied by joint membership in regional agreements (possibly including provisions on the free mobility of workers) and in GATT/WTO. In terms of interpretation, model (7.7) is similar to a standard log-linear OLS model. As usual, the estimate of γ_s can be interpreted as an elasticity.

While equation (7.7) is our preferred econometric model, we also estimate versions of it where the term $\nu_s^i \times v_s(t) + \nu_s^j \times v_s(t)$ is replaced by $v_s(t)$ and the bilateral fixed effects take care of the time-invariant components of country-specific variables. For comparison

[10]Note that efficiency of the estimator requires that variance of the error term is proportional, not necessarily equal, to the conditional mean. This allows both for under- and over-dispersion. The proportionality assumption is not always realistic; it is, however, not needed for consistency of the estimation. Also, it is important to understand that for the estimator to be consistent it is not necessary that the data follow a Poisson distribution. For that reason the estimator is called a pseudo maximum likelihood estimator.

we also present models where $\nu_s^i \times v_s(t) + \nu_s^j \times v_s(t) + \nu_s^{ji}$ is replaced by $v_s(t)$, and these models may therefore suffer from omitted variable bias. Similarly, we provide results from OLS estimation. Clearly, by treating labor as homogeneous and abstracting from education classes, equation (7.7) can be assumed to hold on the aggregate. Similarly, by letting $T = 1$, the model describes a cross section.

7.4 Results

7.4.1 OLS versus Fixed-Effects Estimation

Before we show our baseline regressions using the preferred model and distinguishing across education groups, we show that omitted variable bias due to a misspecification of the model can be very large. To this end, we compare the OLS model with Poisson pseudo maximum likelihood (PPML) estimation, accounting for an increasing number of fixed effects.

Table 7.2 provides the results. Columns (1) to (3) report OLS models, columns (4) to (6) show estimates based on Poisson regressions. Column (1) is a naïve pooled regression, which includes bilateral geographical (e.g., contiguity or distance) and cultural variables as well as the log of population, GDP per capita, and the unemployment rate for the destination and origin countries, respectively. The population data replaces $L^i(t)$ and $N^j(t)$, respectively. Unemployment and GDP per capita are often-used proxies of multilateral attractiveness of countries, and therefore also included. Importantly, the unobserved variables $\Omega^i(t)$ and $W^j(t)$ are omitted from the model.

The results reported in column (1) align well with intuition and earlier findings in the literature. High unemployment in the origin country increases migration, while high unemployment in the destination decreases it. Higher GDP per capita in the destination countries increases migration by much more than higher GDP per capita in the source country. However, the point estimate is strictly positive in the origin country too, as a sufficient level of income is required to engage in migration. Hence the stocks of workers in both countries affect bilateral stocks of migrants positively, as predicted by theory. Distance reduces migration stocks, while contiguity and common language increases migration. Beyond these bilateral ties, cultural links captured by a common legal system or current colonial ties do not matter separately. Also regional trade agreements or currency unions do not increase stocks of migrants. The fit of the model is good, adjusted R^2 standing at about 71 percent. Most interestingly for our purposes, the average stock of international students–ten years to one year before regarding the stock of migrants–has a substantial and positive effect on the stock of migrants: increasing the number of students by 1 percent leads to slightly more than a 0.5 percent increase in migrants.

Table 7.2: Student mobility and aggregate bilateral migration stocks: comparison of methods

Dependent variable.: (Ln) bilateral stock of total migrants	OLS			PPML		
	(1)	(2)	(3)	(4)	(5)	(6)
ln avg. stock of students (t-1 to t-10)	**0.530*** **	**0.099** **	**0.045***	**0.381*** **	**0.024**	**0.017**
	(0.022)	**(0.036)**	**(0.019)**	**(0.056)**	**(0.037)**	**(0.017)**
ln POP, destination	0.168***	-2.059*		0.134	-1.610*	
	(0.036)	(0.891)		(0.070)	(0.798)	
ln POP, origin	0.531***	1.314***		0.409***	1.900***	
	(0.030)	(0.368)		(0.064)	(0.288)	
ln GDP per capita, origin	0.076**	0.045		-0.081	0.409***	
	(0.026)	(0.095)		(0.078)	(0.055)	
ln GDP per capita, destination	0.202*	0.370		0.323	0.130	
	(0.088)	(0.208)		(0.185)	(0.154)	
Unemployment rate (%), destination	-0.029**	0.001		-0.020	-0.026*	
	(0.010)	(0.013)		(0.021)	(0.011)	
Unemployment rate (%), origin	0.024***	0.005		0.028*	0.015	
	(0.006)	(0.006)		(0.013)	(0.008)	
ln Distance	-0.158**			-0.249		
	(0.059)			(0.185)		
Contiguity (0,1)	0.470**			0.953		
	(0.152)			(0.490)		
Common language (0,1)	0.756***			0.243		
	(0.099)			(0.221)		
Common legal system (0,1)	0.126			-0.143		
	(0.072)			(0.207)		
Current colonial relationship (0,1)	-0.551	0.365***	-0.685	-0.104	0.328***	0.204**
	(0.546)	(0.083)	(0.652)	(0.628)	(0.065)	(0.062)
Regional trade agreement (0,1)	0.211	0.155	0.310***	0.666	0.042	0.150*
	(0.114)	(0.154)	(0.069)	(0.447)	(0.084)	(0.074)
Common currency (0,1)	-0.205	0.173	0.113*	-0.368	0.018	0.201***
	(0.113)	(0.108)	(0.055)	(0.304)	(0.069)	(0.060)
Bilateral fixed effects	NO	YES	**YES**	NO	YES	**YES**
Destination x year effects	NO	NO	**YES**	NO	NO	**YES**
Source x year effects	NO	NO	**YES**	NO	NO	**YES**
R^2	0.707	0.519	0.98			
Number of observations	2,092	2,092	3,882	2,449	1,528	3,932
Number of pairs		1,342			764	1,966
Wald χ^2					1,134.968	280,250

Note: All regressions use a balanced panel of country pairs (T=2). Robust standard errors in brackets. All Wald χ^2 tests significant at the 1% level. * p<0.05 ** p<0.01 *** p<0.001

Column (2) is more restrictive in that it identifies all effects on within variation alone. The inclusion of pair-level fixed effects (and their subsequent elimination via the within transformation of the data) matters dramatically for point estimates. Quite visibly, the elasticity of 0.5 obtained in column (1) on the stock of students is massively upward biased if unobserved bilateral ties (e.g., related to history or culture) are not appropriately controlled for. The estimate falls by a factor of 5 to about 0.1. Note that specification (2) nests time-invariant country effects as well, so that multilateral resistance is accounted for as long as it does not move over time. Monadic variables such as GDP per capita or unemployment lose their relevance, most likely because of the lack of substantial time variation. The logs of population remain statistically significant, but the sign pattern changes relative to column (1). Thus conditional on country size, destination countries with lower population growth will attract more migrants than countries with higher growth. Finally, now the colonial dummy appears important while it was insignificant before (and of negative sign).

In a last step for the OLS model, column (3) adds destination $\times$ year and origin $\times$ year effects to control for unobserved multilateral resistance. One additional benefit of replacing all monadic variables with dummies is that the number of observations is maximized; compared to model (1) the number almost doubles. This cuts the student-migrants elasticity by half. Not surprisingly, the explanatory power of the model goes up to 98 percent, so there is little scope left for additional omitted variable bias. But surprisingly, economic union, such as captured by common currency or regional trade agreement, starts to matter in an economically and statistically relevant way.

Next, we repeat the exercise presented in regressions (1) to (3) for the Poisson model. The basic message transpiring from column (4) is that compared to column (1), the sign and significance pattern remains unchanged but point estimates are substantially smaller in the Poisson model for all statistically significant variables. In particular, the elasticity of the student stock on migration is 0.38. Note that the number of observations is potentially higher in the Poisson model because the dependent variable is not in logarithms, so zero migration stocks can be included in the regression. To the extent that zeros persist in both years of observations, the pair has to be dropped, of course. However, the effects of first including pair-level fixed effects (column (5)) and then adding country $\times$ year effects (column (6)) reduces the elasticity of the student stock quite dramatically. Under Poisson, in both specifications, the effect is not distinguishable from zero. Column (6) presents our most general model with a maximum number of observations (based on a balanced sample of 1,966 country pairs).

7.4.2 Benchmark Results for Different Education Classes

Now we allow for heterogeneity across educational classes. One issue with the aggregate equation shown in table 7.2 is that results could suffer from aggregation bias. By focusing on tertiary, secondary, and primary educated migrants, our study distinguishes itself from the work by Dreher and Poutvaara (2011), who only investigate aggregate data. In contrast, we do not run dynamic models because the short time dimension of our data does not allow this, and we use PPML as our preferred estimation technique.

Table 7.3: Student mobility and bilateral migration stocks by education

Dependent variable: Bilateral stock of migrants	Tertiary			Secondary			Primary		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln avg. stock of students (t-1 to t-10)	0.079*		0.090**	0.001		0.009	-0.002		0.018
	(0.032)		(0.030)	(0.023)		(0.023)	(0.021)		(0.021)
ln avg. stock of students (t-11 to t-20)		0.084***	0.091***		0.063**	0.063**		0.067**	0.070***
		(0.022)	(0.022)		(0.023)	(0.023)		(0.022)	(0.024)
Current colonial relationship (0,1)	-0.126	-0.086	-0.136	0.535***	0.540***	0.533***	0.406***	0.408***	0.394***
	(0.080)	(0.097)	(0.093)	(0.124)	(0.106)	(0.108)	(0.103)	(0.088)	(0.087)
Regional trade agreement (0,1)	0.039	-0.021	-0.018	0.243*	0.166	0.167	0.299***	0.266**	0.268***
	(0.069)	(0.066)	(0.065)	(0.099)	(0.090)	(0.091)	(0.099)	(0.087)	(0.087)
Common currency (0,1)	0.368***	0.337***	0.354***	0.252**	0.251**	0.253**	0.209***	0.210**	0.213***
	(0.072)	(0.071)	(0.070)	(0.087)	(0.081)	(0.081)	(0.074)	(0.072)	(0.072)
Number of observations	3,918	3,616	3,616	3,892	3,590	3,590	3,908	3,602	3,602
Number of pairs	1,959	1,808	1,808	1,946	1,795	1,795	1,954	1,801	1,801
Wald χ^2	2.99E+07	1.93E+09	180,262	23,894	58,186	1.08E+09	688,267	9,193,691	356,869
Wooldridge F-Test for strict exogeneity									
p-value	0.771	0.201		0.188	0.224		0.436	0.243	

Note: All regressions use a conditional fixed-effects Poisson model on a balanced panel of country pairs (T=2). All regressions include a complete array of interaction terms between country effects and year effects and the following additional pair-specific time-variant dummy variable controls: current colonial relationship, regional trade agreement, and common currency. Robust standard errors in brackets. All Wald χ^2 tests significant at the 1% level.
* p<0.05, ** p<0.01, *** p<0.001.

The first three columns in table 7.3 use the level of tertiary educated migrants as the dependent variable. All regressions are conditional fixed-effects Poisson models and contain destination and origin country dummies interacted with year dummies. Column (1) is our preferred specification. It uses an average over the stock of bilateral students obtained over ten years prior to the year in which the stock of migrants is measured. We find an elasticity of 0.08, estimated with satisfactory but not excellent precision. The Wald χ^2- statistic of joint significance of all variables is highly significant at the 1 percent level. Colonial ties or trade agreements do not turn out as explanatory determinants of the stock of tertiary educated migrants; the existence of a common currency, in contrast, is economically and statistically relevant: in a currency union, the stock of well-educated migrants is about 36.8 percent higher.

The estimated elasticity of 0.08 has the following quantitative implications: A doubling of the international student body leads to an increase in the stock of highly educated foreigners by $(2^{0.08} - 1)\,100\% = 5.7\%$. Evaluated at sample averages for the year 2000, where the average stock of tertiary educated migrants in selected countries was approximately 732,293 (see column (1) in table 7.4) and the stock of international students was

Table 7.4: Quantitative interpretation of results

Country	Stock of highly educated foreigners	Stock of international students	Increase in highly educated stock	Retention rate	Retention rate (based on total numbers)*
	(1)	(2)	(3)	(4)	(5)
Anglo-Saxon countries:	$\hat{\gamma}_H = 0.094$				
Australia	1,454,211	86,863	97,905	113%	104%
Canada	-	-	-	-	454%
Ireland	108.273	7,140	7,290	102%	105%
New Zealand	204.672	7,042	13,780	196%	179%
United Kingdom	1,211,537	211,648	81,567	39%	37%
United States	9156.363	381,865	616,455	161%	147%
Average	**2,427,011**	**138,912**	**163,399**	**118%**	**128%**
Other countries:	$\hat{\gamma}_H = 0.012$				
Austria	75,394	24,875	630	3%	3%
Belgium	174,050	37,203	1,454	4%	4%
Denmark	35,298	6,196	295	5%	3%
Finland	11,664	4,067	97	2%	3%
France	585,334	128,173	4,889	4%	4%
Germany	793,426	149,071	6,627	4%	5%
Hungary	-	-	-	-	1%
Iceland	-	-	-	-	14%
Italy	126,986	19,202	1,061	6%	5%
Japan	172,452	40,963	1,440	4%	4%
Mexico	-	-	-	-	50%
Netherlands	366,510	13,177	3,061	23%	23%
Norway	58,785	5,770	491	9%	6%
Poland	17,166	2,397	143	6%	28%
Portugal	23,000	10,949	192	2%	2%
Spain	277,480	39,894	2,318	6%	6%
Sweden	161,580	18,413	1,350	7%	6%
Switzerland	237,762	22,917	1,986	9%	9%
Turkey	126,210	9,072	1,054	12%	7%
Average	**202,694**	**33,271**	**1,693**	**5%**	**5%**
Grand average	**732,293**	**58,424**	**41,741**	**71%**	**77%**

Notes: All data for the year 2000. Scenario: doubling of stock of international students. Average estimated increase of skilled migrants 6.7% in Anglo-Saxon countries, 0.8% in the rest of the world, and 5.7% for the grand average, as implied by our econometric estimates. High-skilled migrants are all migrants with post secondary education.
*The stock of students and high-skilled migrants that is used for the calculation of this retention rate is not shown here. Calculation is based on the same elasticities as used in column (4).

on average 58,424 (column (2)), doubling the student intake increases the stock of foreign high skilled by $5.7\% \times 732,293 = 41,741$. The increase in high-skilled workers is then about $41,741 \div 58,424 = 71.4\%$ of the increase in international students. This number is being driven by the huge stock of highly educated migrants in the United States, so we look at the European average (including United Kingdom and Ireland) and find a retention rate of 35 percent. The last column of table 7.4 shows a retention rate that is based on the total number of students and high-skilled migrants, that is, before merging them with the other data. Hence they include all countries of origin and are therefore higher than the numbers in columns (1) and (2). Furthermore the retention rate in column (5) is also calculated for the host countries Canada, Hungary, Iceland, and Mexico.[11] Here the numbers in general are higher with an overall retention rate of 77 percent. This higher retention rate again is mainly driven by Anglo-Saxon countries and among these Canada has a very high rate of 454 percent. However, since our empirical exercise identifies only average effects, but there is substantial heterogeneity across countries, these findings are to be interpreted with caution.

Column (2) of table 7.3 looks at student mobility between 11 and 20 years before the observed migration stock. Interestingly, that distant student exchange has a lasting and statistically significant effect on contemporaneous stocks. The elasticity is 0.084; relative to column (1), coefficients on other covariates are very similar. Column (3) includes both student lags, which turn out to be statistically significant with elasticities of around 0.09.[12]

Columns (4) to (6) repeat this exercise for secondary educated workers. The hypothesis is that mobility of students–between countries with the purpose to obtain a university degree–increases the stock of highly educated foreigners in the country to the extent that they stay for work. Whether exchange of students triggers increased mobility of less than university educated workers is, however, not clear. There could be knock-on effects, maybe with a lag. Column (4) shows that the first ten-year lag of student mobility does not induce higher stocks of secondary migrants. The picture is similarly when looking at migrans with primary education (column (7)). Interestingly, the second lag of students does affect contemporaneous migration of secondary and primary educated migrants with an elasticity of somewhat above 0.06. Including both lags of students simultaneously, we find that the first lag does not matter, but the second does, again with elasticities between 0.06 and 0.07.

To investigate whether the observed effect is causal, we perform a regression-based test for strict exogeneity (Wooldridge, 2002). For this purpose we also include the stocks

[11] In our merged data set, data on student mobility is not available in a bilateral structure for these countries and therefore not taken into account for our estimation in table 7.3 and the retention rate shown in column (4).

[12] Elasticities are statistically significant at the 1 and 0.1 percent level for the first and second lag, respectively.

of students in the differenced version of our equation and perform an F-test for joint significance. If we cannot reject the null, then the differencing has solved the exogeneity concern and there is a causal effect of student mobility on migration. The final raw contains the p-values of our F-test for strict exogeneity. As all p-values are higher than 0.1, we cannot reject strict exogeneity at conventional levels of significance.[13] Hence our findings can be interpreted as the causal effect of student migration on high-skilled migration.

7.4.3 Heterogeneity Across Country Groups

Next we want to investigate the effect of student migration for selected groups of destination countries. Table 7.5 provides the results dividing the data set into two destination regions: Anglo-Saxon–including the host countries Australia, New Zealand, United States, United Kingdom, Canada, and Ireland–and a second group consisting of the remaining destination countries. We distinguish between these two groups as English-speaking countries that have a similar education system at the tertiary level are organized differently than in most of the other countries: the role of private institutions is much more important, they host most of the world's top universities, and the language of instruction is identical to the *lingua franca* of the world economy. The countries also differ with respect to their immigration policies. However, the extensive use of fixed effects should allow us to control for these determinants of migration.

Table 7.5: Anglo-Saxon versus non-Anglo-Saxon education systems

Dependent variable: Bilateral stock of tertiary migrants	**Anglo-Saxon**			**Non-Anglo-Saxon**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ln avg. stock of students (t-1 to t-10)	**0.094***		**0.119*****	**0.012**		**0.028**
	(0.044)		**(0.036)**	**(0.042)**		**(0.041)**
ln avg. stock of students (t-11 to t-20)		0.111***	0.128***		-0.025	-0.028
		(0.025)	(0.025)		(0.049)	(0.046)
Number of observations	1,254	1,204	1,204	2,664	2,412	2,412
Number of pairs	627	602	602	1,332	1,206	1,206
Wald χ^2	655,355.9	1.96e+08	4.60e+08	102,457.6	6.39e+10	1.12e+10

Note: All regressions use a conditional fixed-effects Poisson model on a balanced panel of country pairs (T=2). All regressions include a complete array of interaction terms between country effects and year effects and the following additional pair-specific time-variant dummy variable controls: current colonial relationship, regional trade agreement, and common currency (here not shown). Robust standard errors in brackets. All Wald χ^2 tests significant at the 1% level.
* p<0.05, ** p<0.01, *** p<0.001.

Again all regressions are conditional fixed-effects Poisson models and contain origin

[13] When both lags are regarded simultaneously, variables are omitted due to collinearity.

and destination dummies interacted with years. Columns (1) to (3) show the results for Anglo-Saxon host countries. Our preferred specification shown in column (1) demonstrates the effect for the first lag–the average over the period ten years to one year prior to the measured stock of high-skilled migrants. The estimation provides an elasticity of 0.10 which is statistically significant at the 1 percent level. Column (2) presents the estimates for the second lag of students, building an average of student mobility for the period 11 to 20 years prior the observed stock of tertiary educated migrants: Again the estimated elasticity is 0.1 and highly significant at the 0.1 percent level. In column (3) both lags on student mobility are considered simultaneously: both are economically and statistically significant with an elasticity of around 0.2, and the coefficient on the first lag now even turns to be significant at the 0.1 percent level. Columns (4) to (6) repeat the results for the remaining countries of the data set. Interestingly, the coefficient on the first lag is a lot smaller with an elasticity of about 0.01 and it is not statistically significant anymore. In column (5) the second lag on student mobility is investigated. Here the coefficient even turns negative but remains not statistically significant. Column (6) again includes both lags on student migration. The coefficient on the first lag is higher compared to column (4) but remains not significant; the same is the case for the second lag, with a negative elasticity of 0.03. These results let us assume that non-Anglo-Saxon countries seem to have a problem keeping highly skilled students after graduating in their country while Anglo-Saxon countries seem to be more successful.

7.5 Robustness Checks

In this section we conduct a number of robustness checks. First, we specify dynamic equations, which contain lags of the dependent variable as well as further lags of the student mobility averages. Second, we work with different definitions of the international student variable. We use a slightly different definition of the student mobility averages, and rather than using averages, we work with yearly student data. Third, we investigate the effect for the unbalanced data sample. Finally, we differentiate between net student importer countries and net student exporters.

7.5.1 Dynamic Equations

Our theoretical model does not include dynamic considerations. However, the results in table 7.3 beg the question why the second lag of students turns out relevant for secondary and primary educated migrants but the first lag does not. One hypothesis is that the presence of highly educated workers from a foreign country, possibly formerly students, may lead to an additional inflow of migrants, who need not be highly educated themselves. To test this prediction, we include the lag of tertiary educated migrants into our PPML

regressions.[14] Since $T = 2$, with lagged variables in the regression, we can no longer work with pair fixed effects. So all regressions shown in the table contain destination and source country dummies, as well as bilateral variables such as the log of distance and dummies for the presence of a common language or a currency union. The equation has an excellent fit (R^2 of 0.99), leaving minimum space for omitted variables.

Table 7.6: Dynamic regressions

Dependent variable: Stock of migrants	**Tertiary**	**Secondary**	**Primary**	**Tertiary**	**Secondary**	**Primary**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Lagged dependent variable	0.824***	0.836***	0.869***	0.823***	0.845***	0.870***
	(0.020)	(0.030)	(0.026)	(0.020)	(0.030)	(0.026)
Lagged stock of tertiary educated		0.079*	0.071*		0.053	0.061
		(0.037)	(0.031)		(0.039)	(0.032)
ln avg. stock of students (t-1 to t-10)	0.088***	0.040*	0.005	0.085**	0.000	-0.017
	(0.021)	(0.018)	(0.021)	(0.031)	(0.023)	(0.024)
ln avg. stock of students (t-11 to t-20)				0.005	0.057**	0.032
				(0.026)	(0.022)	(0.020)
R^2	0.991	0.991	0.999	0.991	0.991	0.999
Number of observations	1,881	1,836	1,853	1,881	1,836	1,853
Pseudo log likelihood	-421,558.9	-345,272.5	-530,269.3	-421,526.0	-342,445.2	-528,573.7

Note: All regressions use a Poisson model with migration stocks from 2000. All regressions include a complete array of destination and origin fixed-effects as well as bilateral variables such as log of distance, common language, colonial relationship, regional trade agreement, and common currency. Robust standard errors in brackets. T-tests on coefficient of lagged dependent variable to be equal to unity reject in all models.
* p<0.05,** p<0.01, *** p<0.001.

Column (1) in table 7.6 shows that the bilateral stock of tertiary educated migrants is highly persistent; the coefficient on the lagged stock being 0.82. That coefficient is statistically different from unity at the 0.1 percent level. The first lag of international students is again highly significant and close to the elasticity estimate of 0.09 that we have found before. Column (2) turns to secondary educated migrants. It includes the lagged dependent variable and the lag of the highly educated migrants to disentangle the effect of student exchange from that of a preexisting stock of tertiary educated foreigners. We find that the latter has a positive influence on the stock of secondary educated migrants, with an elasticity of 0.08. The picture is somewhat different in column (3), where we look at primary educated workers. There it still is true that a lagged stock of tertiary educated workers spurs migration of unskilled workers; the effect of student mobility, however,

[14]Estimates of that equation suffer from a variant of the Nickel Bias when disturbances are serially correlated. There is no easy way to correct for this in a non-linear setup such as the Poisson framework. Moreover the fact that $T = 2$ limits our possibilities quite considerably. For these reasons, estimates in this section have to be treated with caution and are to be seen as sensitivity checks rather than as baseline results.

turns to zero. Columns (4) to (6) also include the second lag of student mobility. It is quite striking that the first lag of student mobility is only relevant for tertiary educated migrants.

7.5.2 Alternative Measurement of International Student Stocks

The regressions reported in table 7.7 investigate the robustness of our results shown in table 7.3 for the second data set, where students of an academic year are attached to the first year.

Table 7.7: Student mobility and bilateral migration stocks by education: alternative definition of student stock variable

Dependent variable: Bilateral stock of migrants	**Tertiary** (1)	**Secondary** (2)	**Primary** (3)
ln avg. stock of students (t-1 to t-10)	**0.092**** (0.030)**	**0.012 (0.023)**	**0.021 (0.021)**
ln avg. stock of students (t-11 to t-20)	0.092*** (0.022)	0.064** (0.023)	0.071** (0.023)
Number of observations	3,612	3,584	3,596
Number of pairs	1,806	1,792	1,798
Wald χ^2	1.22e+09	3.04e+09	363,322.6

Note: All regressions use a conditional fixed-effects Poisson model on a balanced panel of country pairs (T=2). All regressions include a complete array of interaction terms between country effects and year effects and the following additional pair-specific time-variant dummy variable controls: current colonial relationship, regional trade agreement, and common currency (here not shown). Robust standard errors in brackets. All Wald χ^2 tests significant at the 1 % level.
* p<0.05, ** p<0.01, *** p<0.001.

Compared to table 7.3, the results in general remain almost equal and the number of observations is only slightly smaller. The estimated elasticities of the stock of students remain statistically and economically significant at the same level: for estimations on high-skilled migrants, regarding both lags simultaneously, the elasticities for both lags are 0.09. The results for the other groups of migrants, medium- and low-skilled migrants, are also similar to the ones presented and described in section 7.4. Hence, the choice of attaching the stock of students to a certain year in the case of study years does not affect the results.

In table 7.8 analyses of the stability of the effect over time are reported. For this purpose, rather than using averages defined over a longer period, we use student stocks as pertaining to a specific year. Since academic years and calender years do not coincide, and the exact timing of international student mobility is not obvious from reported UNESCO data, there is some measurement issue here. However, since we are not interested in the

contemporaneous effect of student mobility on migration (which could well be a pure accounting relation), we allow for a sufficient time lag between the measurement of the migrant stock and that of the international student body.

Table 7.8: Year-specific effects

	Dependent variable: Stock of highly educated, t=2000					
	International students in	$\hat{\gamma}_H$	standard error	R^2	N	LL
(1)	1995	0.148**	(0.046)	0.976	603	- 47,546.7
(2)	1994	0.091***	(0.022)	0.996	1295	-288,776.3
(3)	1993	0.061**	(0.020)	0.991	1309	-307,922.9
(4)	1992	0.062**	(0.019)	0.990	1518	-385,931.8
(5)	1991	0.045**	(0.017)	0.990	1510	-385,351.6
(6)	1990	0.074***	(0.020)	0.992	1347	-344,875.4
(7)	1989	0.027	(0.031)	0.992	1197	-305,699.5
(8)	1988	0.062**	(0.021)	0.992	1432	-366,995.4
(9)	1987	0.069**	(0.022)	0.996	1156	-245,574.3
(10)	1986	0.051*	(0.021)	0.995	1139	-277,120.6

Note: Each line corresponds to a separate regression. Each regression includes a full set of destination and origin dummies, the lag of the dependent variable (t-1=1990), time-invariant bilateral controls such as the log of distance, contiguity and common language dummies. Additional pair-specific time-variant dummy variable controls are current colonial relationship, regional trade agreement, common currency. Robust standard errors in brackets. All models estimated with PPML.
* p<0.05, ** p<0.01, *** p<0.001.

Table 7.8 reports regressions containing the first lag of the dependent variable, and the complete array of bilateral variables as well as destination and source country-specific fixed effects. Starting with more recent students, we find that the effect on highly educated migration falls as we move back in time with student mobility from an elasticity close to 0.15 to one of 0.05 in 1986. With the exception of one year, all years reported yield coefficients that ar statistically significant at least at the 5 percent level.

We conclude that our practice of averaging ist not crucial for obtaining statistically relevant estimates but improves coverage and precision.

7.5.3 Unbalanced Data Sample

Table 7.9 reports the checks for robustness of the results presented in table 7.3 for the unbalanced data sample.In general, again the results are almost equal to the ones presented

Table 7.9: Student mobility and bilateral migration stocks by education: unbalanced data sample

Dependent variable: Bilateral stock of total migrants	Teriary (1)	Secondary (2)	Primary (3)
ln avg. stock of students (t-1 to t-10)	0.090**	0.009	0.018
	(0.030)	(0.023)	(0.021)
ln avg. stock of students (t-11 to t-20)	0.091***	0.063**	0.070**
	(0.022)	(0.023)	(0.024)
Number of observations	3,616	3,590	3,602
Number of pairs	1,808	1,795	1,801
Wald χ^2	2,221,643.0	5.87e+08	356,562.2

Note: All regressions use a conditional fixed-effects Poisson model. All regressions include a complete array of interaction terms between country effects and year effects and the following additional pair-specific time-variant dummy variable controls: current colonial relationship, regional trade agreement, and common currency (here not shown). Robust standard errors in brackets. All Wald χ^2 tests significant at the 1% level.
*p<0.05, ** p<0.01, *** p<0.001.

before.[15] For estimations on tertiary educated migrants, the elasticities for the student lags remain equal: when both lags are investigated at the same time, the elasticities, again, both are 0.09. Also the results for the other two migrant groups remain almost equal. Hence balancing the sample has no significant effect on the results.

7.5.4 Net Student Importers versus Exporters

Table 7.10 provides results for net importers and exporters of students.[16] The decision on whether a destination country is a net importer or not is made separately for the two years where the stock of migrants is considered, 1990 and 2000. If a destination country received more students aggregated over the period 20 years to 1 year prior to considering the stock of migrants, this country is considered as a net importer.[17]

Columns (1) to (3) demonstrate the results for net importers: both lags are statistically and economically significant with an elasticity of around 0.1, independently if they are regarded simultaneously or separated. Columns (4) to (6) present results for net exporters of students. Different than for net importers, the coefficient for the first lag now turns out to be negative, but is not statistically significant. The next column demonstrates the effect of the second lag. Even though the coefficient now is positive, the estimated

[15] In some cases, the significance level falls from 0.1 percent to 1 percent.

[16] All regressions are conditional fixed-effects Poisson models and contain origin and destination dummies interacted with years.

[17] Table E.2 in Appendix E.2 shows the net importing and exporting countries of students for both considered years.

Table 7.10: Robustness check: student mobility and bilateral tertiary migration for net importers and net exporters of students

Dependent variable: Bilateral stock of high-skilled migrants	Net importer			Net exporter		
	(1)	(2)	(3)	(4)	(5)	(6)
ln avg. stock of students (t-1 to t-10)	**0.099****		**0.114*****	**-0.043**		**-0.025**
	(0.037)		**(0.032)**	**(0.068)**		**(0.072)**
ln avg. stock of students (t-11 to t-20)		0.102***	0.113***		0.030	0.030
		(0.023)	(0.023)		(0.045)	(0.044)
Number of observations	2,854	2,710	2,710	790	652	652
Number of pairs	1,427	1,355	1,355	395	326	326
Wald χ^2	1.57e+07	73,027.11	91,510.58	3,950,696.00	1.47e+09	1.12e+09

Note: All regressions use a conditional fixed-effects Poisson model on a balanced panel of country pairs (T=2). All regressions include a complete array of interaction terms between country effects and year effects and the following additional pair-specific time-variant dummy variable controls: current colonial relationship, regional trade agreement, and common currency (here not shown). Robust standard errors in brackets. All Wald χ^2 tests significant at the 1% level. * p<0.05**, p<0.01, *** p<0.001.

elasticity again is not significant. The last column provides the results estimating the effect of both lags at the same time. Both lags perform similar results as before when investigating the effect separately: the first lag still is negative with an elasticity that is slightly smaller and the second lag remains equal; both are not statistically significant. These results do especially well for net importers. Even in the case that education for foreign students is financed publicly by the host country, they can expect a positive return on financing them as it has a positive effect on the later stock of high-skilled migrants.

7.6 Policy Implications and Conclusions

In this chapter we investigated to what extent net imports of students lead to net immigration of high-skilled migrants in later periods. We investigated this question empirically. To that end, we have constructed a data set of bilateral student mobility across 23 host countries and 150 origin countries from UNESCO year books going back to the year of 1970. We used these data in a theory-grounded gravity equation of migration that we estimated with Poisson pseudo maximum likelihood procedures. To ensure consistent estimates, we made extensive use of country fixed effects to dummy out unobserved multilateral resistance terms. Moreover, we controlled for bilateral effects to deal with unobserved country-pair heterogeneity that may lead to a spurious correlation between stocks of highly educated foreigners and foreign students.

Our findings indicate that the elasticity of the stock of highly educated migrants with respect to the international student body is about 0.09 on average. However, that average hides substantial heterogeneity across country groups: it is driven exclusively by the Anglo-Saxon countries Ireland, United Kingdom, United States, Canada, Australia, and New Zealand. These countries strongly benefit from student mobility: doubling the international student intake would lead to a disproportionate increase in the stock

of high-skilled foreigners in the respective destination countries. Hence, from a single country perspective, our findings constitute a rationale for public subsidies to higher education. From a world perspective, however, there is the threat of overinvestment in higher education, as countries compete for international talent by making their universities more attractive.

The higher elasticity in Anglo-Saxon countries could be due to various facts: (i) Compared with other countries, the financing system in Anglo-Saxon countries is different, and these countries have a different visa policy for former students as well as for high-skilled workers in general. In New Zealand, Australia, and Canada former foreign students have a preferred treatment for permanent immigration. The United States provides for highly skilled workers various opportunities to enter the labor market temporarily. Even though it was not designed for this purpose, it is a stepping stone to permanent residence for many immigrants. On the contrary, in France, until 1993 restrictive immigration policies deterred foreign students from staying there. Between 1994 and 1996 only 9 percent of foreign students attained a visa to stay in France (Tremblay, 2005). This number is similar to our retention rate for the year 2000 shown in table 7.4. Even though in 1998 the immigration law was revised and inspired by the US visa provisions for highly skilled workers, according to Guiraudon (2002), France still lies behind the United Kingdom, the United States and Germany.[18] (ii) Anglo-Saxon countries seem to be more attractive in both aspects–studying and working. As universities and companies cooperate more intensively and the placement job in universities is taken more seriously, it is easier for graduates to find a job. (iii) Students who come to Anglo-Saxon countries do not face language problems when applying there for a job after graduation. This is not only an essential factor for the integration in the labor market and the country in general; it also makes it easier to compete with graduates from the host country Tremblay (2005). On the contrary, in non-Anglo-Saxon countries graduates face the language problem. At universities, classes are mostly held in English, so students do not need to learn the native language to do their studies. Those interested in applying for a job must, however, speak the language.

While our results are robust over a number of sensitivity checks, with better data, more precise inference would be possible. However, relative to the existing, mostly survey-based empirical literature, our analysis makes substantial headway: we exploit panel data, use information on high-skilled immigrants, and base our analysis on a very general econometric model. In the future, a better understanding of student mobility itself will make it possible to better deal with the remaining endogeneity issues in our framework.

[18]Unfortunately, the effect of the reform of German immigration policy from 2000 an 2004 and the changes of the immigration program of the United Kingdom from 2002 and 2003 cannot be seen in our data.

Chapter 8

Conclusion

In this work I undertook an empirical analysis of the mobility of international students. This included discussing the rationales and challenges resulting from international student mobility. In doing so, I was able to demonstrate the importance of international student mobility for the economic growth of a knowledge-based economy. Since countries are confronted with a lack of high-skilled workers, they have incentives to attract students from other countries as these students have a certain proclivity to remain in the country after their studies and, as a result, contribute to the economic growth of the country. Furthermore, international students represent an additional source of income as they often pay higher fees. I provided an extensive discussion about the challenges surrounding student mobility and discussed those that drive investment into higher education in a world where both students and graduates are mobile. If a student studies in a country where education is publicly financed and leaves the country after graduation, the country of studies bears the cost and the country where the student works reaps the benefits. To avoid overinvestment in higher education it is crucial to understand a student's proclivity to stay in the country of studies. This is especially an issue for European countries where higher education is mainly publicly financed.

In chapter 3 I provided a detailed description about data on international student mobility that I used in this work. Since data by country of destination and origin are only available for the years 1998 onwards, and for the years prior to this only for single destination countries, conducting an empirical investigation of international student mobility is difficult. Therefore, I constructed a new data base for the years 1970 onwards for 29 destination countries and almost all countries of origin. I entered the data *manually* from printed UNESCO Statistical Yearbooks. This new data set allowed me to conduct extensive descriptive analyses about the development and concentration of international student mobility. The chapter demonstrated the sharp increase of student mobility: starting with an average number of roughly 460 thousand students in the period covering the years 1970 to 1974 this number grew to roughly 3.7 million students in the last time pe-

riod which was considered for the purpose of this analysis, that covers the years 2010 to 2015. A comparison of these numbers to the total tertiary education sector demonstrated that international student mobility showed stronger growth over the periods considered. The chapter than addressed the question of whether this number is concentrated on a few countries or whether it is evenly distributed among the destination and origin countries and how this concentration has developed over the time periods regarded (1970s, 1980s, 1990s, 2000s, and the last period spanning the years 2010 to 2015). I found that student mobility is strongly concentrated on both destination and origin countries. Different to the destination countries where the concentration decreased over the aforementioned time periods–with the top 5 countries accounting for 77 percent in the first period and 50 percent in the last period regarded–the concentration of sending countries among the top 5 countries increased from 23 to 33 percent. I interpret this development as an indicator of the fierce competition of destination countries which all strive to attract a high number of international students.

Chapter 4 then presented the countries where the highest number of international students is concentrated and whether these countries changed over time. I again used my new data base for this purpose. The chapter highlighted that the most important destination countries throughout the periods regarded are anglophone–namely the United States, the United Kingdom, Australia, and Canada–as well as the two European countries France and Germany. Beyond these countries, Russia and Japan are found to have played an important role, too. The chapter also addressed the topic of whether some countries have recently emerged as important destination countries and showed that the number of hosted international students in some Asian countries, western and eastern European, and Arab countries grew considerably, with the result that these countries are now among the most important destination countries. Looking at destination regions, the chapter provided a descriptive analysis demonstrating that the number of hosted students in Asian countries grew to a higher extent than in Anglo-Saxon countries. Asian countries which were confronted with a lack of capacity in higher education in former years are shown to have considerably increased their capacities over time. Though anglophone countries are traditionally considered as the most attractive destination countries, it is important to be aware of the growing importance of Asian countries that have the potential to take over the role as the most important destination region for international students.

Analyzing the countries of origin more precisely, the chapter showed that the most important regions of origin are Asia-Pacific Rim and European countries. The chapter showed that China, which was lacking capacity in tertiary education and therefore student mobility was primarily driven by the capacity building approach, has increased its capacity for tertiary education, explaining China's role as an emerging destination country for international students while remaining the most important source country. These descriptive analyses identified that three regions are of major importance for the global

level of international student mobility: Europe, Asia, and English-speaking countries. Student mobility in Europe is strongly supported by policy-makers and this is reflected by the fact that two programs aiming to promote student mobility between the participating countries were established. The next two chapters, therefore, were dedicated to those programs.

In chapter 5, which is a joint work with Gabriel Felbermayr, we empirically investigated the question of whether Erasmus has increased student mobility between its participating member countries. Using data on international student mobility for the years 1999 to 2015 provided by the electronic UNESCO database for 155 host and 187 source countries and merging them with a dummy variable on joint membership in the Erasmus program, the chapter estimated the effect of the Erasmus program using a gravity-based model in a panel setup controlling for other variables. The time variation of the Erasmus dummy and data on student mobility allowed us to conduct the regression in a panel setup controlling for bilateral fixed effects to deal with unobserved country-pair heterogeneity and including country-specific time-varying dummies to account for unobserved multilateral resistance terms. We found that student mobility between Erasmus countries is about 53 percent higher on average and that both membership in the Erasmus program and the EU turn out to be significant determinants of international student mobility separately. To address the causality question, we performed a regression-based F-test on strict exogeneity. Finding a p-value above 0.1 we cannot reject strict exogeneity and therefore interpret our findings as causal. We estimated the effect for the time before, during, and after the economic crisis in 2007/2008 and found the effect to be more stable for the time during and after the economic crisis. Furthermore, the chapter found that student mobility between Erasmus countries is higher when both countries do not share the same language; economic factors, conversely, do not increase student mobility. Based on these findings we concluded that the Erasmus program justifies its budget as it fulfills its overall goal of increasing student mobility between its member countries and it fosters the cultural experience.

Chapter 6 started with a descriptive analysis addressing the question of whether the different goals that were set throughout the Bologna Process with respect to international student mobility were achieved. These goals were aimed at increasing the attractiveness to other parts of the world and the outward mobility of EHEA graduates, while also ensuring that student mobility within the EHEA is balanced. With respect to the first goal, the chapter found that the increase in the number of students attracted to study in the EHEA is similar to that of the USA and the five MESDCs. These countries are traditionally considered as the main competitors. Compared to the global level of student mobility, the growth patterns lack behind. It is important, therefore, to be aware of the growing importance of Asian destination countries which are not adequately represented in the data set. With respect to outward mobility, the chapter found strong heterogeneity among countries and that smaller countries in particular have a high relative outward

mobility rate. The goal of achieving an outward mobility rate of 20 percent has only been achieved by a few countries as of 2015. The chapter then found that some countries are net importers of students and therefore net exporters of higher education if students do not stay in the country after graduation. This reflects the risk of an overinvestment in higher education in trying to attract international students.

The chapter then repeated the estimates which were applied in the Erasmus chapter controlling additionally for joint membership in the Bologna Process and found that student mobility between member countries is, on average, about 50 percent higher. When both dummies capturing joint membership in the Bologna Process and Erasmus program were included in the estimates simultaneously, both European programs turned out to be significant determinants separately. Since the EHEA was established in 2010, the chapter addressed the question of whether the effect differs for the time before and after its establishment and finds that the impact is higher and more stable for the time after. I therefore conclude that the Bologna Process also fulfilled its goals of increasing student mobility. These findings therefore provide a rationale for policy-makers to invest in student mobility programs.

While these results for the European exchange programs are robust over a number of robustness checks, with better data, more precise inference for policy-makers would be possible. However, relative to the existing, mostly survey-based empirical literature that mainly focuses on the general determinants of international student mobility within Europe or addresses the question of whether the programs have increased student mobility based on descriptive analyses only, the findings provided in chapters 5 and 6 make substantial headway. The chapters use panel data for a wide range of destination and origin countries which allows to account for multilateral resistance and unobserved country-pair heterogeneity; the analysis is based on a very general econometric model and estimates the effect of the programs on international student mobility. While these findings showed that the programs increased student mobility, the question of whether these students also remain in the country after their studies and as a result contribute to the country's economic growth remains unsolved.

Since data on the bilateral stocks of international migrants by educational attainment were only available for the years 1990 and 2000, the data on international student mobility available for the years 1970 to 2000 that I entered manually from the UNESCO Statistical Yearbooks allowed to investigate the question: to what extent do countries that attract foreign students benefit from an increased stock of educated foreign workers? In a joint work with Gabriel Felbermayr, we used these data in a theory-grounded gravity equation of migration that we estimated with Poisson pseudo maximum likelihood procedures. We included country fixed effects to dummy out unobserved multilateral resistance terms and controlled for bilateral effects to deal with unobserved country-pair heterogeneity. Our findings indicate that the elasticity of the stock of highly educated migrants with respect

to the international student body is about 0.09 on average. This effect, however, is driven by the English-speaking destination countries the United States, the United Kingdom, Canada, Australia, New Zealand, and Ireland. Our findings therefore provide a rationale for public subsidies for these countries, whereas from a global perspective the risk exists of overinvesting in higher education.

As the number of study programs taught in English has increased also in non-English-speaking countries since 2000–the latest year for which bilateral data on high-skilled migration was available–and English is increasingly accepted as the language of the workplace meaning that it is no longer necessary to speak the native language of the country, repeating these estimates for recent years will provide more insights about the recent development of high-skilled migration. However, compared to the existing, mostly survey-based empirical literature, our analysis makes substantial headway: we exploit panel data, use information on high-skilled immigrants, and base our analysis on a very general econometric model.

In the future, a better understanding of the main drivers of international student mobility will allow to better address the endogeneity bias that still arises within the applied frameworks. This increased understanding would mean that precise policy instruments could be defined in order to attract international students and increase countries' competitive edge in attracting talent.

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Appendix A

Data

A.1 Countries Covered in the Dataset taken from the UNESCO Statistical Yearbooks

Table A.1: List of countries: part 1

Country	Source	Host	Country	Source	Host
Afghanistan	x		Ecuador	x	
Albania	x		Egypt, Arab Rep.	x	
Algeria	x		El Salvador	x	
Andorra	x		Equatorial Guinea	x	
Angola	x		Eritrea	x	
Antigua and Barbuda	x		Ethiopia	x	
Argentina	x		Fiji	x	
Australia	x	x	Finland	x	x
Austria	x	x	France	x	x
Bahamas, The	x		Gabon	x	
Bahrain	x		Gambia, The	x	
Bangladesh	x		Germany[e)]	x	x
Barbados	x		Ghana	x	
Belgium	x	x	Greece	x	x
Belize	x		Grenada	x	
Benin[a)]	x		Guatemala	x	
Bhutan	x		Guinea	x	
Bolivia	x		Guinea-Bissau[f)]	x	
Botswana	x		Guyana	x	
Brazil	x		Haiti	x	
Brunei Darussalam	x		Honduras	x	
Bulgaria	x		Hong Kong SAR, China	x	
Burkina Faso[b)]	x		Hungary	x	x
Burundi	x		Iceland	x	
Cambodia[c)]	x		India	x	
Cameroon[d)]	x		Indonesia	x	
Canada	x	x	Iran, Islamic Rep.	x	
Cape Verde	x		Iraq	x	
Central African Republic	x		Ireland	x	x
Chad	x		Israel	x	
Chile	x		Italy	x	x
China	x	x	Jamaica	x	
Colombia	x		Japan	x	x
Comoros	x		Jordan	x	
Congo, Dem. Rep.	x		Kenya	x	
Congo, Rep.	x		Kuwait	x	
Costa Rica	x		Lao PDR	x	
Cote d'Ivoire	x		Lebanon	x	
Cuba	x		Lesotho	x	
Cyprus	x		Liberia	x	
Denmark	x	x	Libya	x	
Djibouti	x		Luxembourg	x	x
Dominica	x		Macao SAR, China	x	
Dominican Republic	x		Madagascar	x	

Table A.2: List of countries: part 2

Country	Source	Host	Country	Source	Host
Malawi	x		Senegal	x	
Malaysia	x		Seychelles	x	
Maldives	x		Sierra Leone	x	
Mali	x		Singapore	x	
Malta	x		Slovakia[k)]	x	x
Mauritania	x		Somalia	x	
Mauritius	x		South Africa	x	
Mexico	x	x	Spain	x	x
Mongolia	x		Sri Lanka	x	
Morocco	x		St. Kitts and Nevis	x	
Mozambique	x		St. Lucia	x	
Myanmar (Burma)	x		St. Vincent and the Grenadines	x	
Namibia	x		Sudan	x	
Nepal	x		Suriname	x	
Netherlands	x	x	Swaziland	x	
New Zealand	x	x	Sweden	x	x
Nicaragua	x		Switzerland	x	x
Niger	x		Syrian Arab Republic	x	
Nigeria	x		Tanzania	x	
Norway[**]	x	x	Thailand	x	
Oman	x		Togo	x	
Pakistan	x		Tonga	x	
Panama	x		Trinidad and Tobago	x	
Papua New Guinea	x		Tunisia	x	
Paraguay	x		Turkey	x	x
Peru	x		Uganda	x	
Philippines	x		United Arab Emirates	x	
Poland	x	x	United Kingdom	x	x
Portugal	x	x	United States	x	x
Qatar	x		Uruguay	x	
Romania	x		Venezuela, RB	x	
Russia[j)]	x	x	Vietnam[g)]	x	
Rwanda	x		West Bank and Gaza	x	
Samoa	x		Yemen, Rep.[h)]	x	
San Marino	x		Zambia[i)]	x	
Sao Tome and Principe	x				
Saudi Arabia	x		Zimbabwe	x	

[a)] Includes former Dahomey.

[b)] Includes former Upper Volta.

[c)] Includes the former Khmer Rouge as well as the People's Republic of Kampuchea.

[d)] Includes the former Federal Republic of Cameroon and the United Republic of Cameroon.

[e)] For years prior to 1990: Germany=West Germany and unknown.

[f)] Includes former Portuguese Guinea.

[g)] Considered as one nation for all years.

[h)] Considered as one nation for all years.

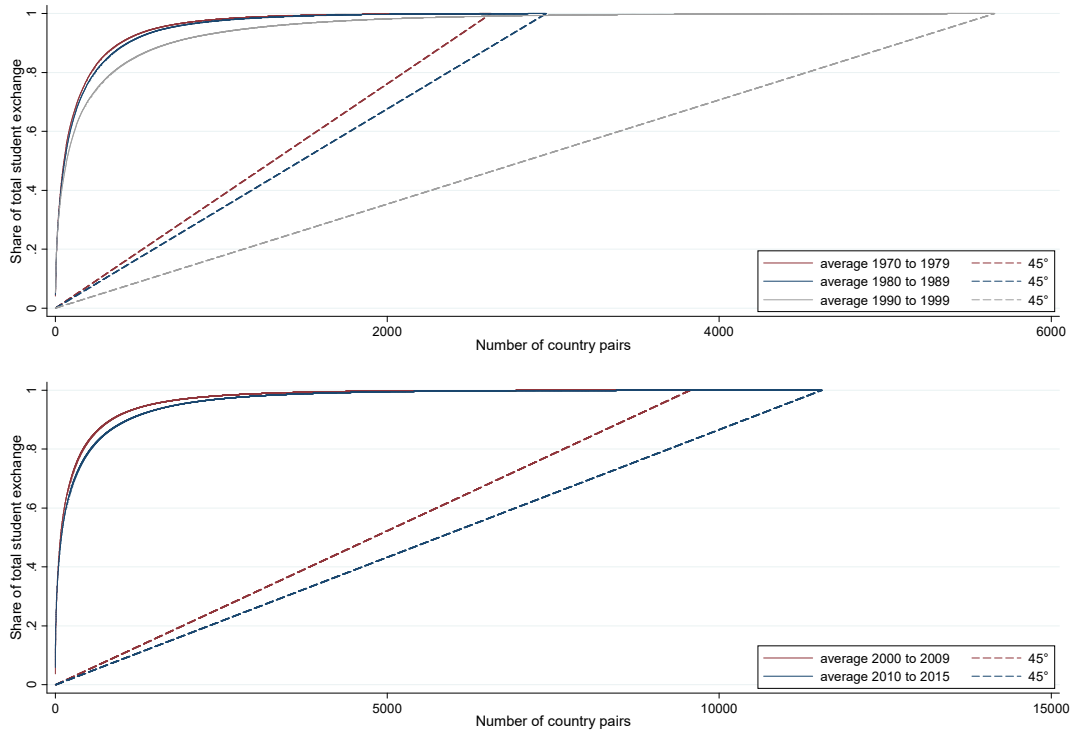
[i)] Includes former Southern Rhodesia.

j) Includes former UDSSR.

A.2 Concentration of Bilateral Student Mobility

Figure A.1 shows the concentration of the bilateral student exchange between a destination country and a country of origin. The number of country pairs is shown on the x-axis and the share of the total student exchange of each country pair is aggregated on the y-axis, starting with the highest share. The numbers shown are the student exchange to known countries of destination, hence, the zero student exchanges between two countries and hosted students from unknown countries of origins are not regarded. The dotted line demonstrates the case where the total bilateral student exchange is equally concentrated on each country pair.

Figure A.1: Concentration of bilateral student mobility



Note: The figure shows the concentration of the bilateral international student mobility for an average over ten years and six years for the last period. The dotted line represents the case where the number of bilateral student mobility is equal across all country pairs for each period considered. Source: UNESCO Statistical Yearbooks (until 1996) and UNESCO Institute for Statistics (UIS) online database (1998 onwards). Data for 1997 are not available.

The top graph in figure A.1 shows the concentration for the 1970s (red line), where 2,624 country pairs are shown on the x-axis that sum up to a total student exchange in this period of 532,539 students compared to the 1980s (blue line) and the 1990s (grey line), where 2,955 and 5,656 country pairs sum up to a total student exchange of 828,455 and 1,399,967 students, respectively. In the 1970s, the student exchange between the first five and ten country pairs accounts for 12.9 and 21.1 percent, respectively. The concentration of the top 5 country pairs is slightly higher in the 1980s and 1990s with a share of 13.6

and 14.6 percent, respectively, and the share of the top 10 country pairs is almost equal in the three decades, accounting for 21.3 percent in both the 1980s and 1990s. Furthermore, the remaining total student exchange is strongly concentrated on few country pairs, as 50 percent are reached with the student exchange between 53 and 58 country pairs in the 1970s and 1980s, respectively, and 70 country pairs in the 1990s. In the three decades that have been considered, 80 percent of the total student exchange is reached with 216, 239, and 345 country pairs in the 1970s, 1980s, and 1990s, respectively. Hence, 80 percent of the total student exchange in the 1970s, 1980s, and 1990s is concentrated on 8.2 percent, 8.1 percent, and 6.1 percent of the total country pairs, respectively.

The bottom chart in figure A.1 compares the concentration for the period that regards the average over the years 2000 to 2009 (red line) to the 2010s, hence, the period from 2010 to 2015 (blue line). 9,557 and 11,538 country pairs are shown on the x-axis which represent a total student exchange of 2,319,444 and 3,695,258 students in the 2000s and 2010s, respectively. In the 2000s, the student exchange between the first five and ten country pairs accounts for 13.8 and 20.4 percent, respectively. The concentration of both, the top 5 and top 10 country pairs, is slightly higher in the last period, accounting for 15.5 and 21.6 percent, respectively. Furthermore, the remaining total student exchange is strongly concentrated on a few country pairs, as 50 percent are reached with the student exchange between 79 and 93 country pairs in the 2000s and 2010s, respectively. In the two decades considered, 80 percent of the total student exchange is reached with 416 and 528 country pairs, hence it is concentrated on 4.4 and 4.6 percent of the total country pairs in the period of the 2000s and 2010s, respectively.

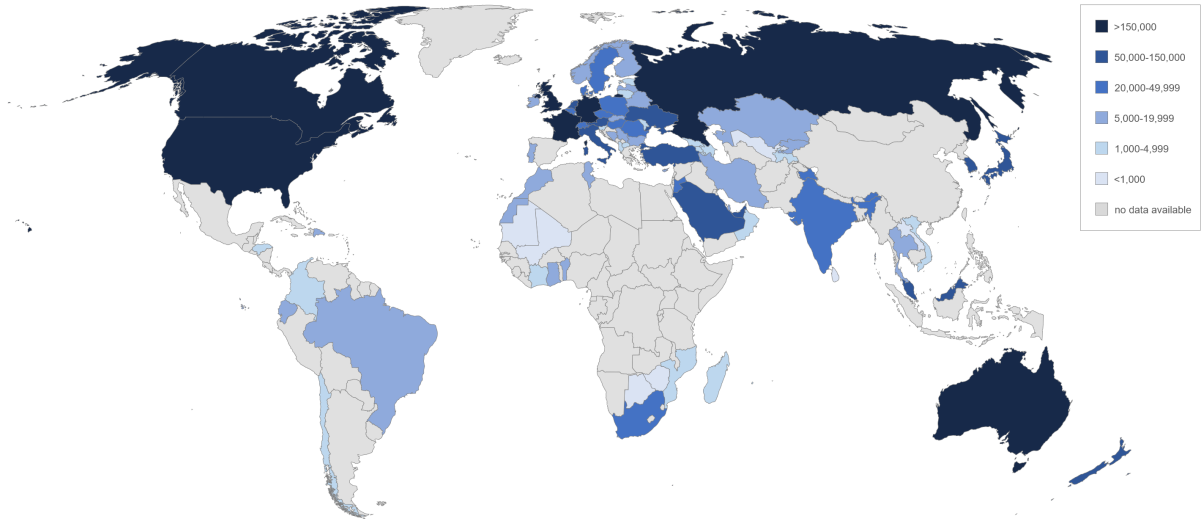
Over all periods, the concentration on a few country pairs increased over time. This can be seen in the share of the top 5 country pairs, which increases from 12.9 in the 1970s to 15.5 percent in the last period. Furthermore, 80 percent of the total student exchange are concentrated on 8.2 percent of all country pairs in the 1970s, compared to 4.4 and 4.6 percent in the last two periods.

Appendix B

Destination Countries

B.1 Absolute Number of Hosted International Students in 2015

Figure B.1: Hosted international students by destination country in 2015



B.2 Most Important Destination Countries: Where do the Students Come From?

This chapter regards each top destination country separately. The chapter is organized as follows: for each of the destination countries that is regarded in this chapter, I show the development of the hosted students for the period 1970 to 2015 in a stacked bar chart. The bar charts consist of hosted international student from the regions of origin Asia, Europe, Africa, South America, North America, and Oceania. The decision of which region each country belongs to, is based on the UNESCO data base. As described already in chapter 3.1.3, in some cases the country of origin is unknown. These students are also considered in the graph and shown in grey. As the data for the top destination countries are available for almost all years for the period from 1970 to 2015 with some exceptions, the bar charts present yearly data. For the year 1997, there are no data available for no country. Beyond the bar chart with the absolute number of students, I also present a stacked bar chart with the percentage share that each region of origin accounts for of the total value of hosted countries in this year.

Furthermore, for each destination country I show a mapchart that provides an overview of the countries of origin as of 2015. I then show the development for the top 5 origin countries (based on the figures of 2015) for each destination country.

The United States of America: Top Regions and Countries of Origin

Figure B.2: Students in the United States from 1970 to 2015 by region of origin

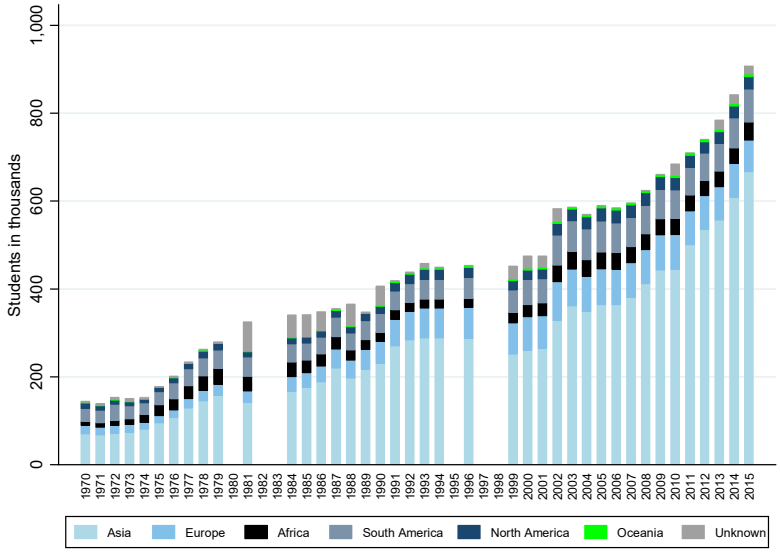


Figure B.3: Students in the United States: percentage share by region of origin from 1970 to 2015

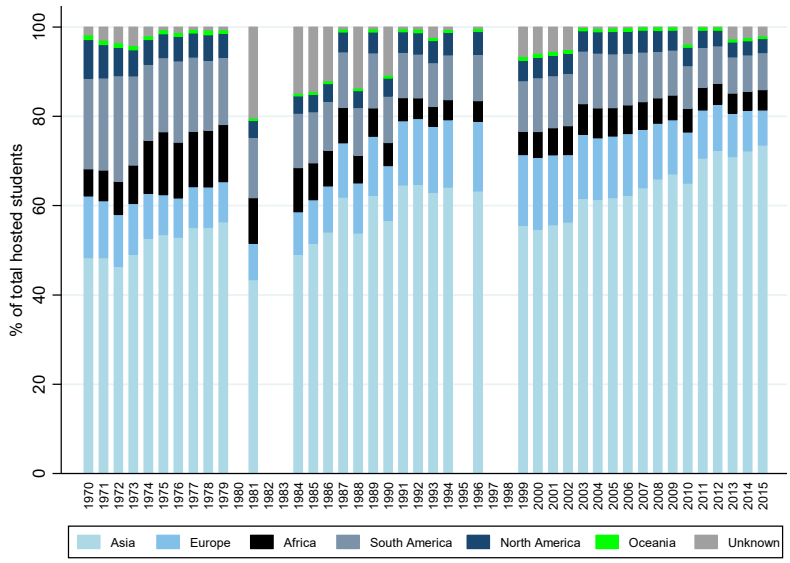


Figure B.4: Students in the United States by country of origin in 2015

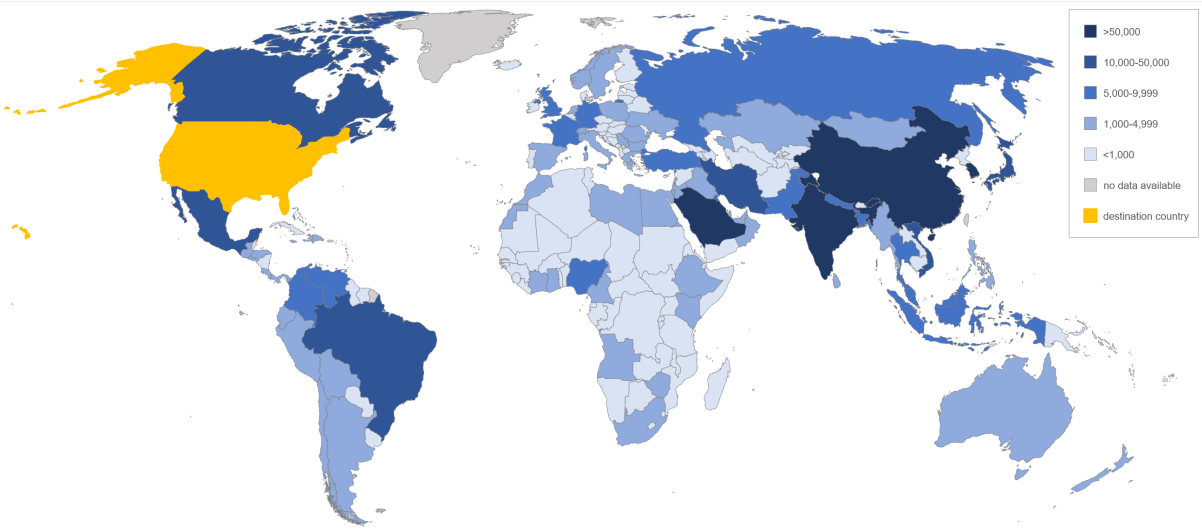


Figure B.5: Students in the United States of America from China

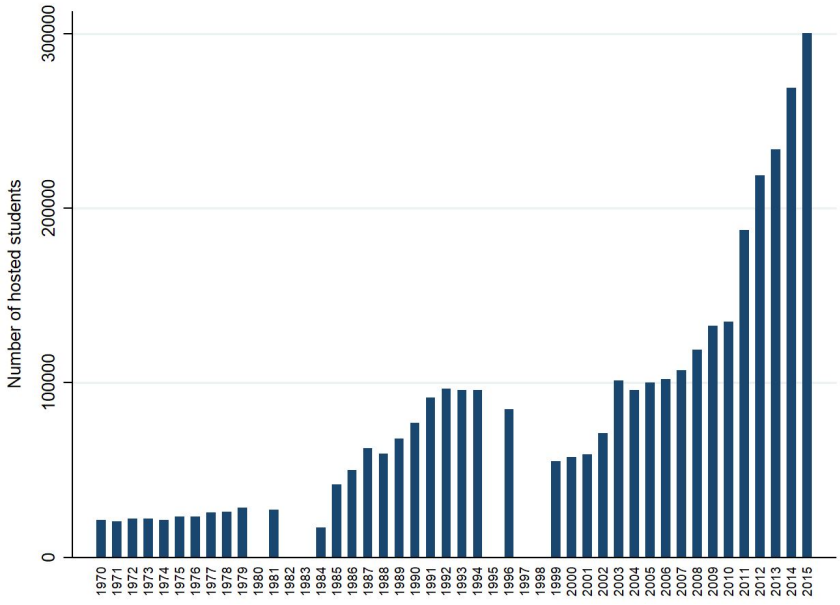


Figure B.6: Students in the United States of America from India

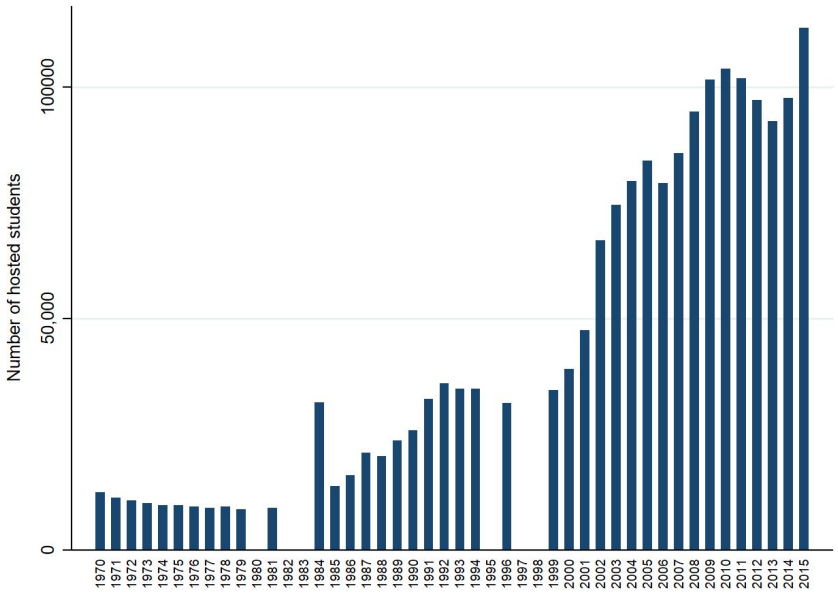


Figure B.7: Students in the United States of America from the Republic of Korea

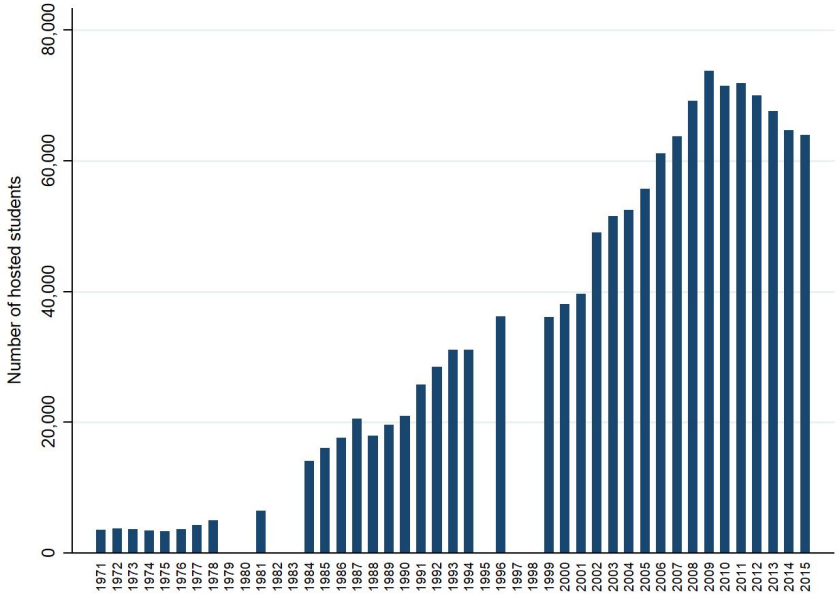


Figure B.8: Students in the United States of America from Saudi Arabia

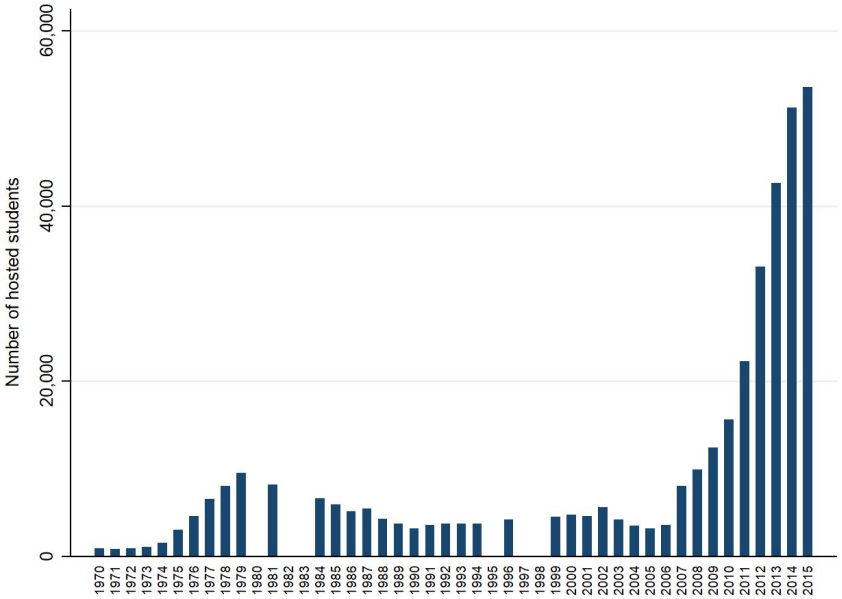
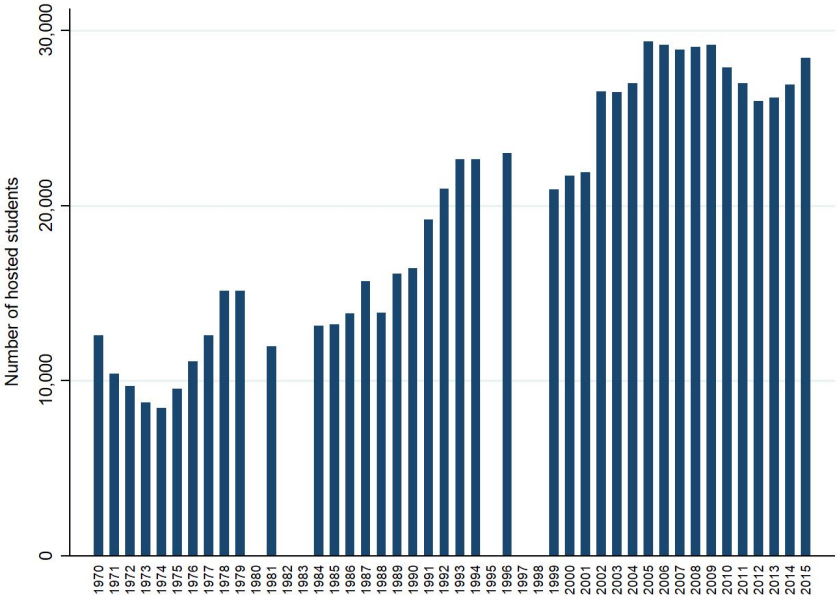


Figure B.9: Students in the United States of America from Canada



The United Kingdom: Top Regions and Countries of Origin

Figure B.10: Students in the United Kingdom from 1970 to 2015 by region of origin

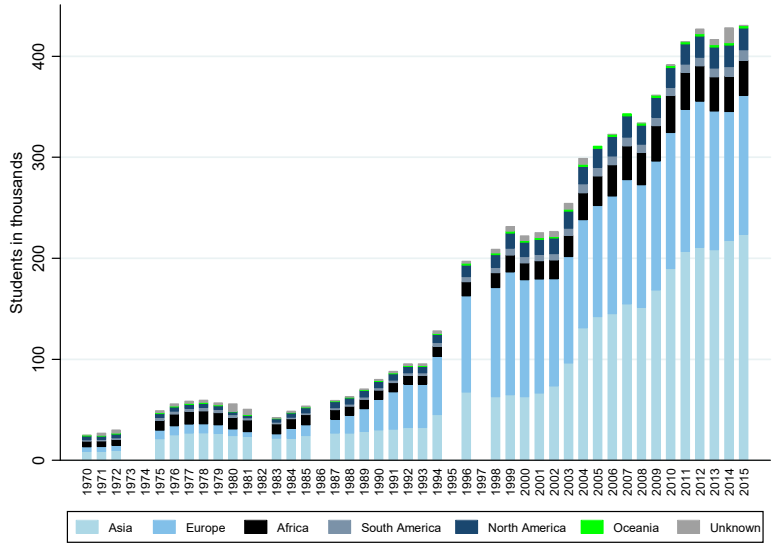


Figure B.11: Students in the United Kingdom: percentage share by region of origin from 1970 to 2015

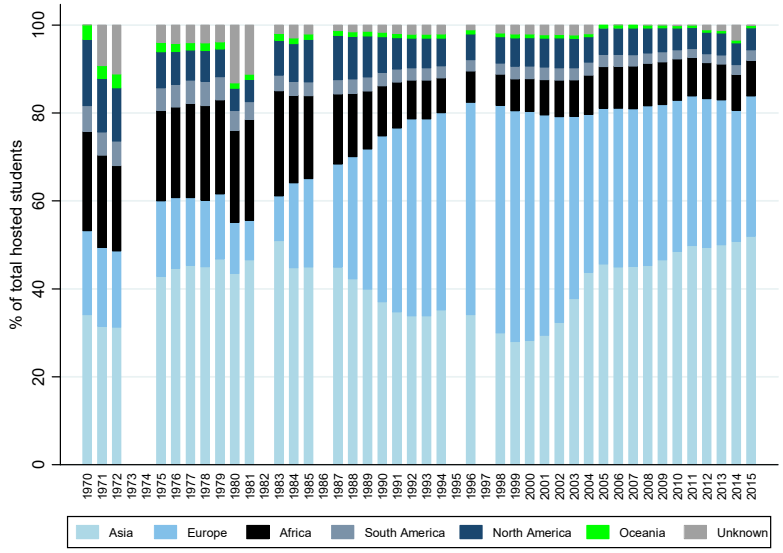


Figure B.12: Students in the United Kingdom by country of origin in 2015

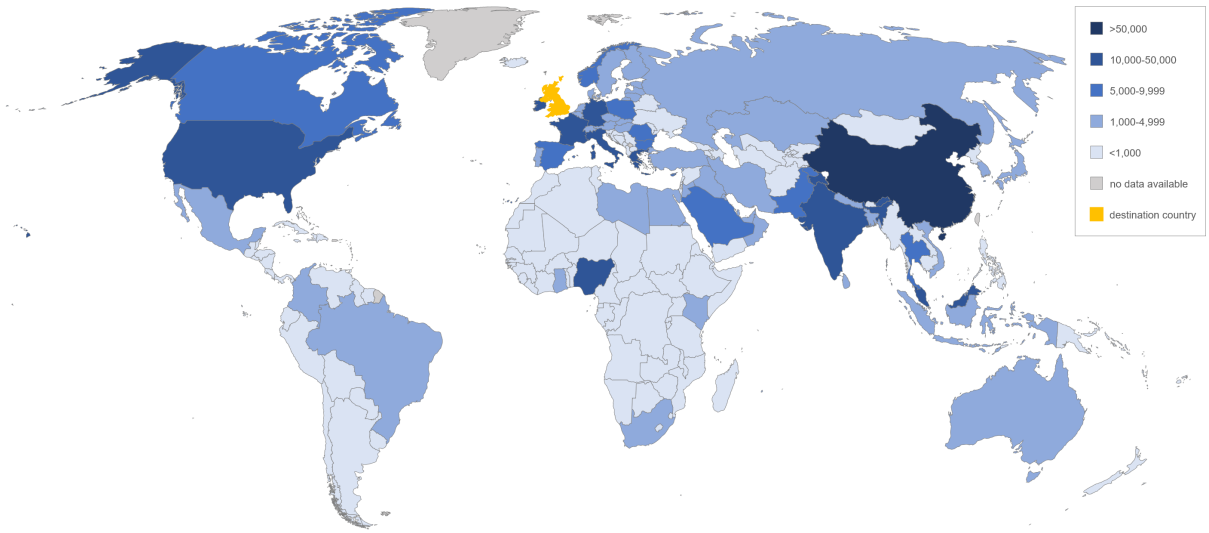


Figure B.13: Students in the United Kingdom from China

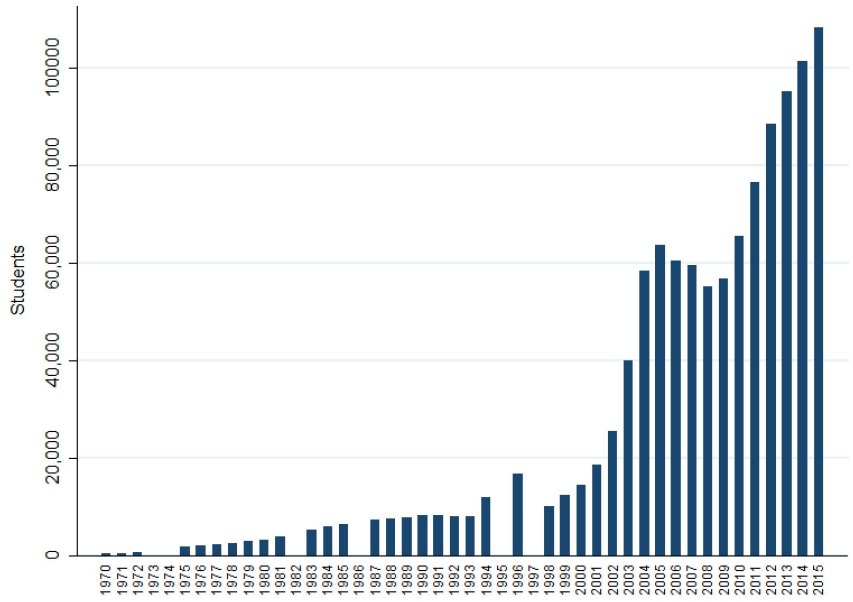


Figure B.14: Students in the United Kingdom from India

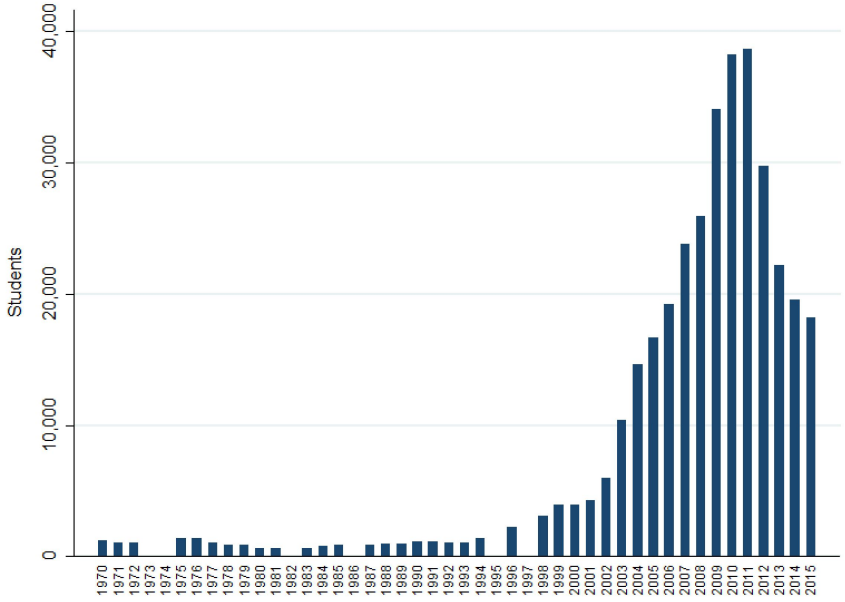


Figure B.15: Students in the United Kingdom from Nigeria

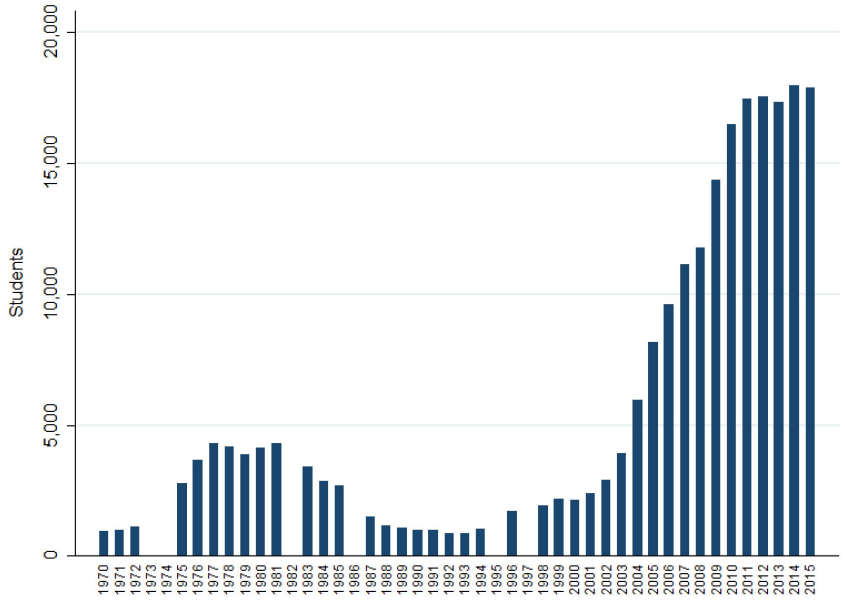


Figure B.16: Students in the United Kingdom from Malaysia

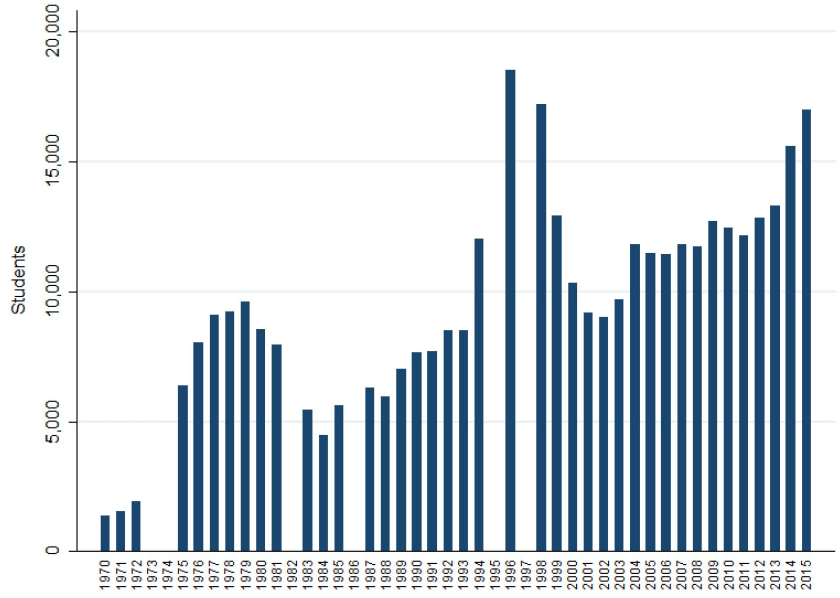
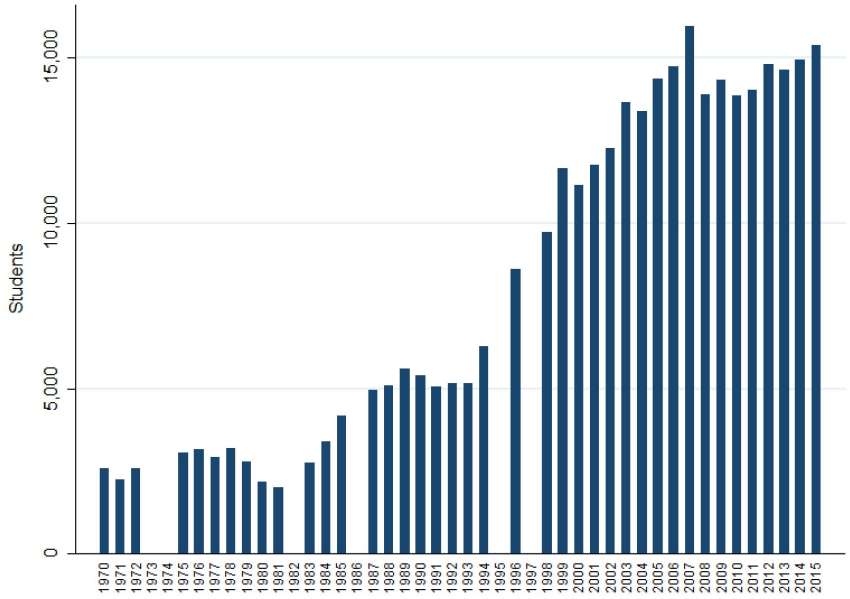


Figure B.17: Students in the United Kingdom from the United States



Australia: Top Regions and Countries of Origin

Figure B.18: Students in Australia from 1970 to 2015 by region of origin

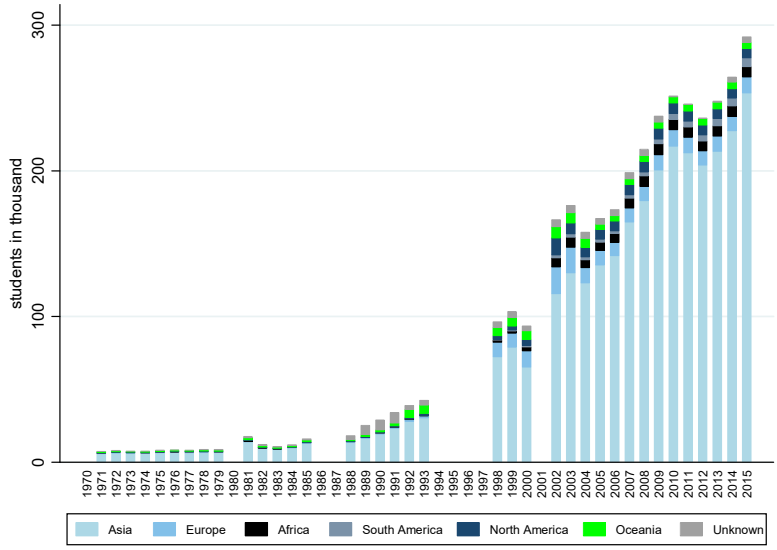


Figure B.19: Students in Australia: percentage share by region of origin from 1970 to 2015

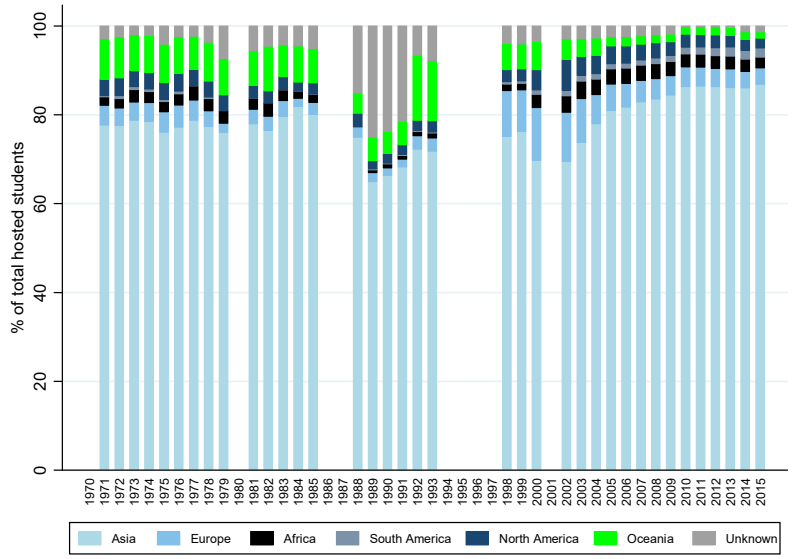


Figure B.20: Students in Australia by country of origin in 2015

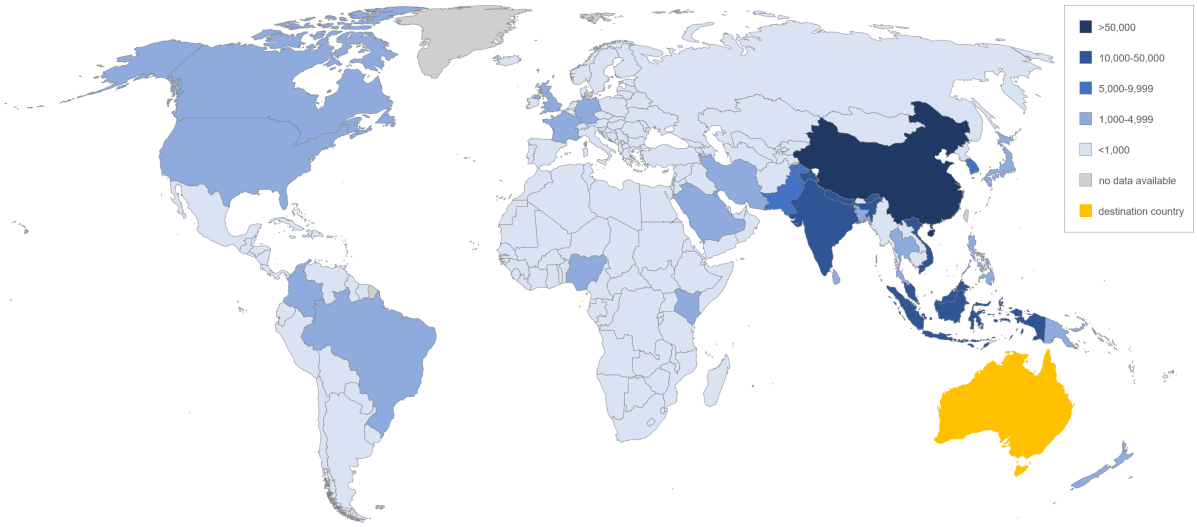


Figure B.21: Students in Australia from China

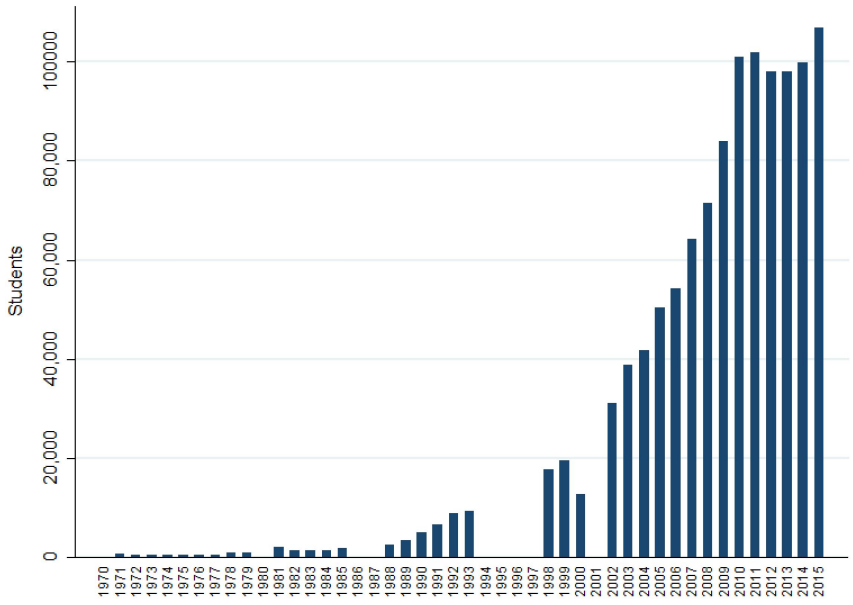


Figure B.22: Students in Australia from India

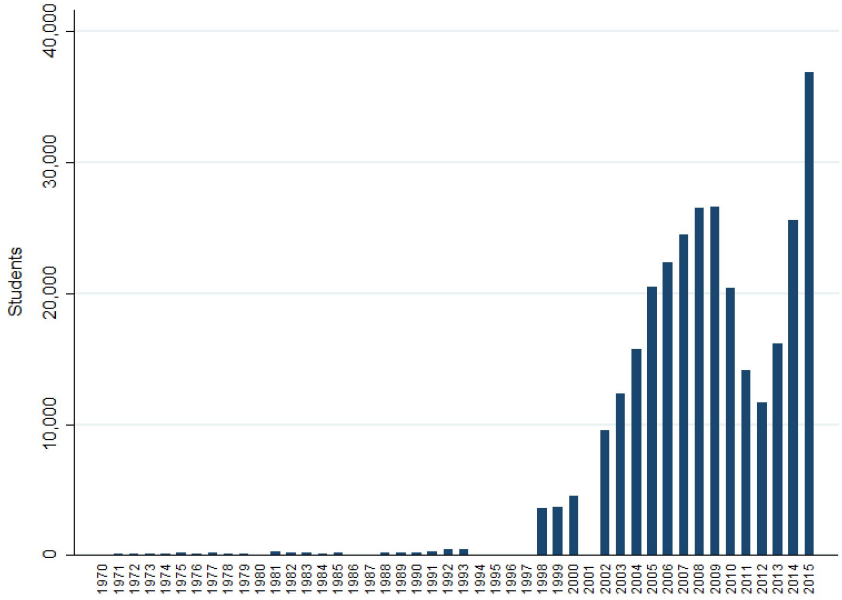


Figure B.23: Students in Australia from Malaysia

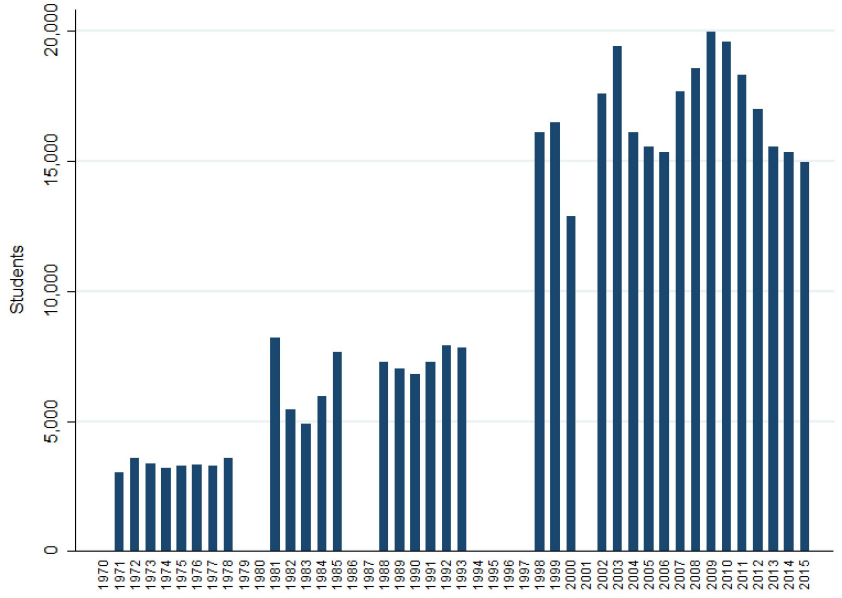


Figure B.24: Students in Australia from Vietnam

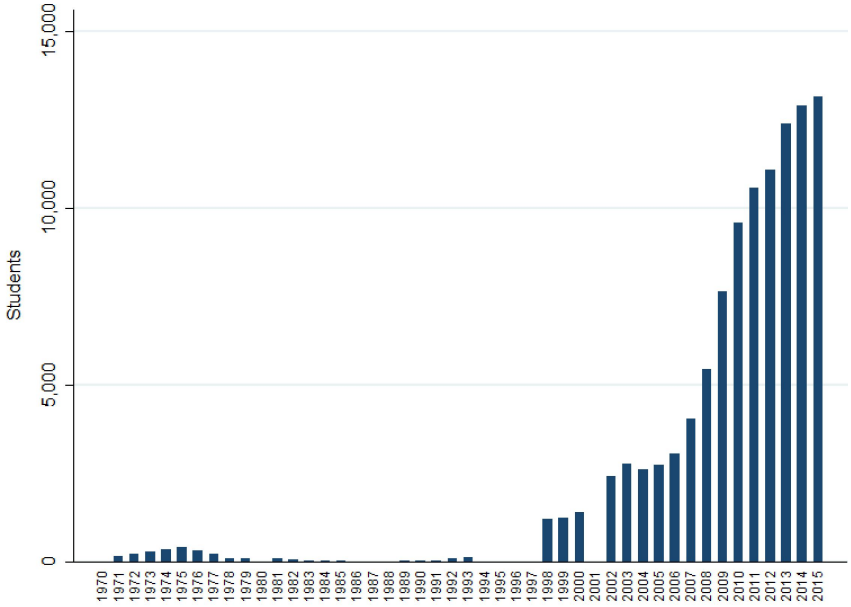
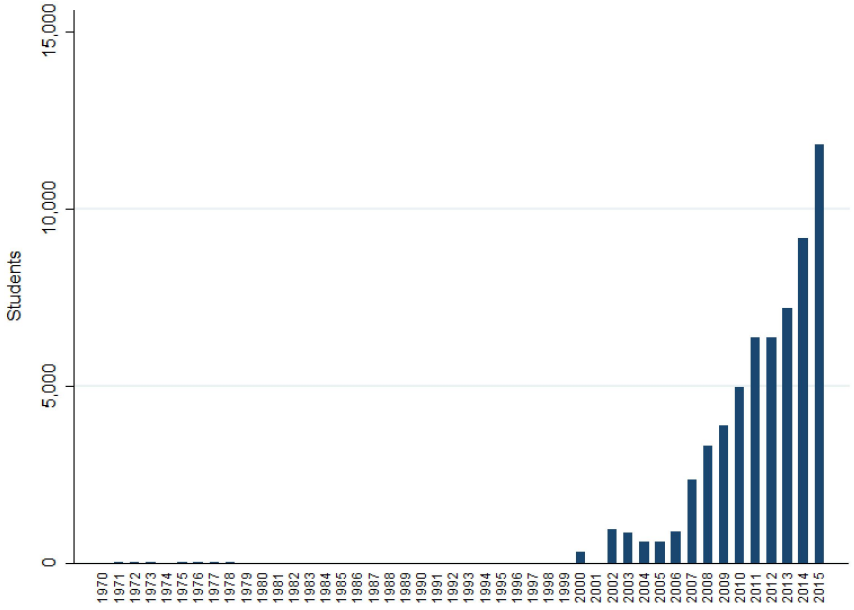


Figure B.25: Students in Australia from Nepal



France: Top Regions and Countries of Origin

Figure B.26: Students in France from 1970 to 2015 by region of origin

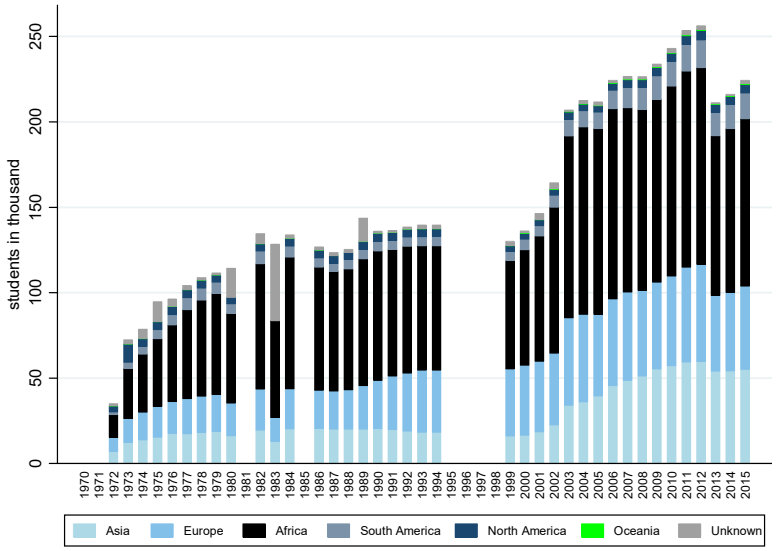


Figure B.27: Students in France: percentage share by region of origin from 1970 to 2015

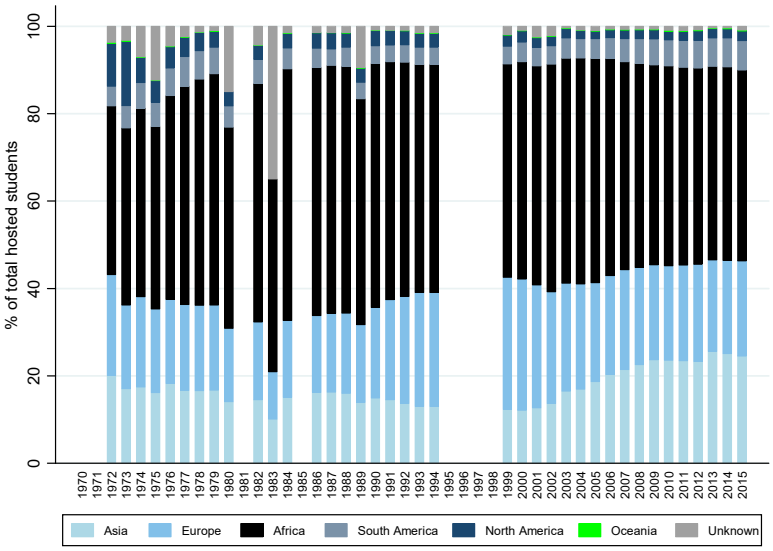


Figure B.28: Students in France by country of origin in 2015

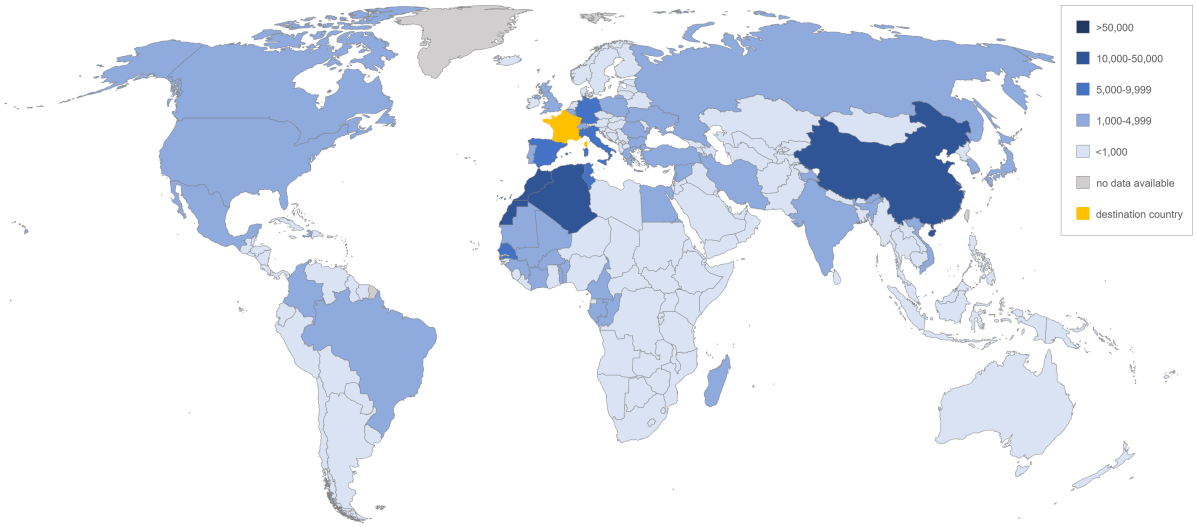


Figure B.29: Students in France from Morocco

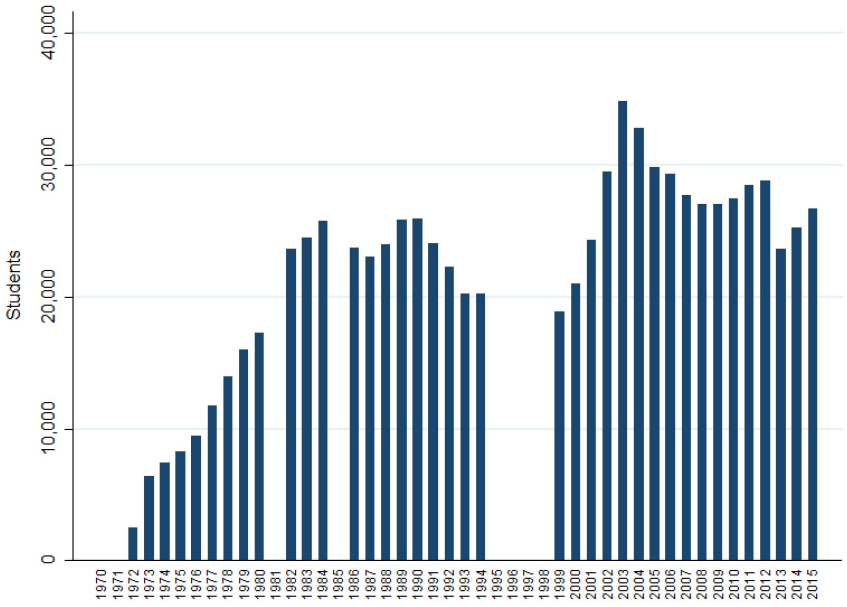


Figure B.30: Students in France from China

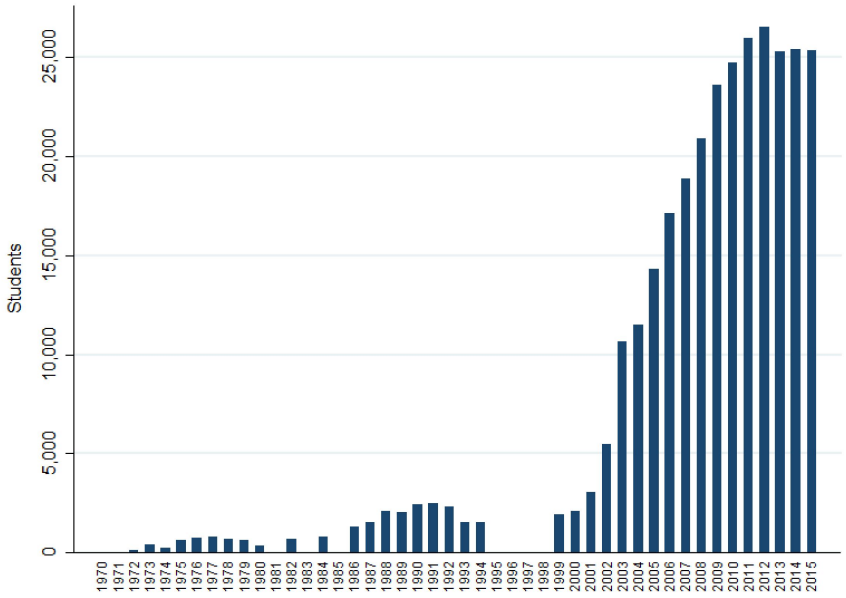


Figure B.31: Students in France from Algeria

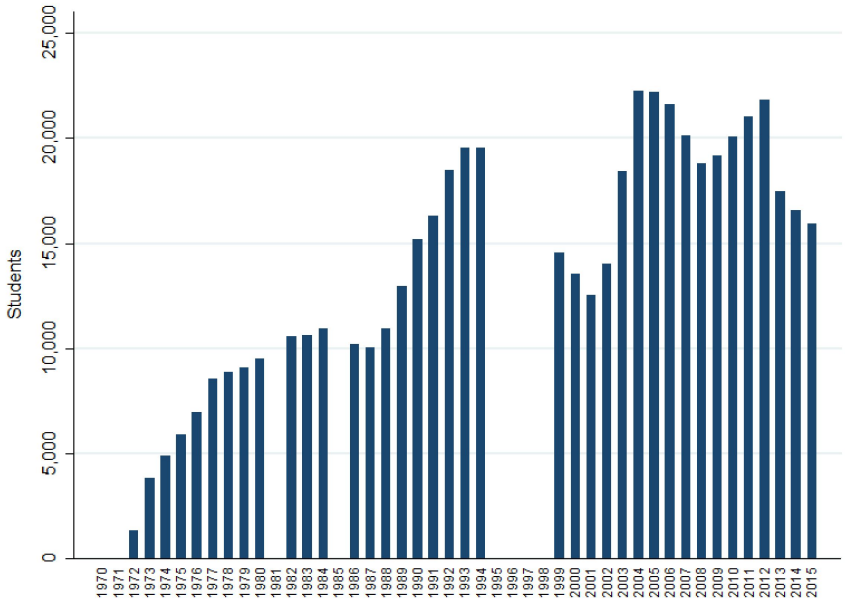


Figure B.32: Students in France from Tunisia

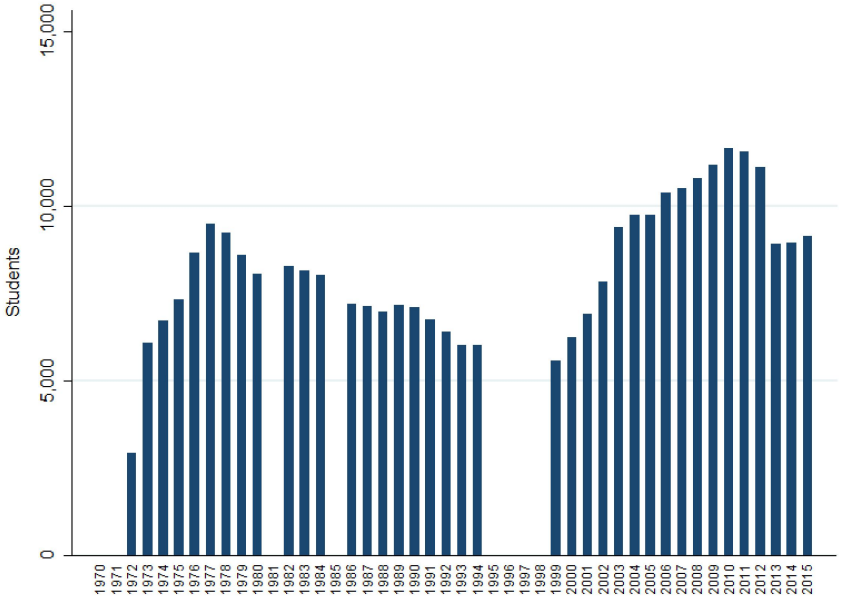
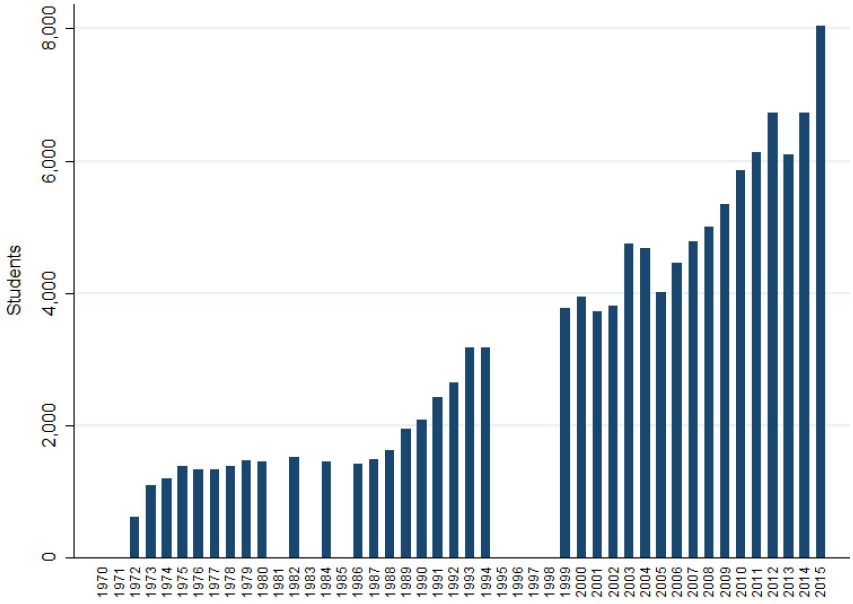


Figure B.33: Students in France from Italy



Germany: Top Regions and Countries of Origin

Figure B.34: Students in Germany from 1970 to 2015 by region of origin

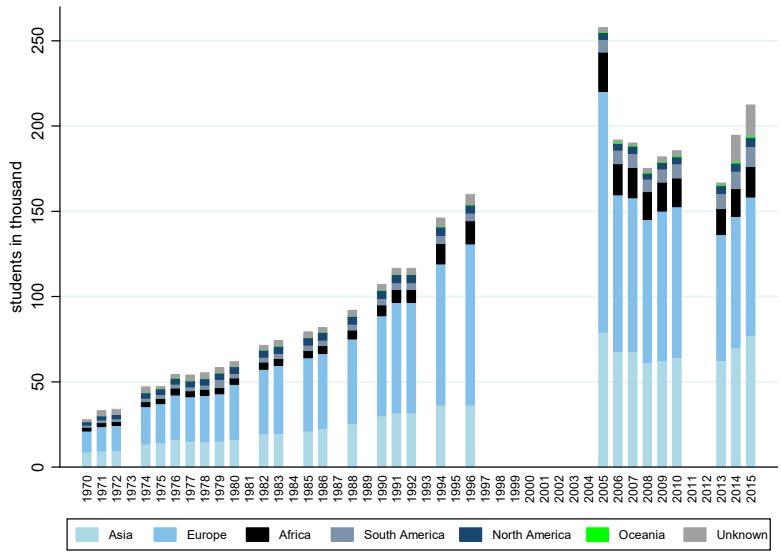


Figure B.35: Students in Germany: percentage share by region of origin from 1970 to 2015

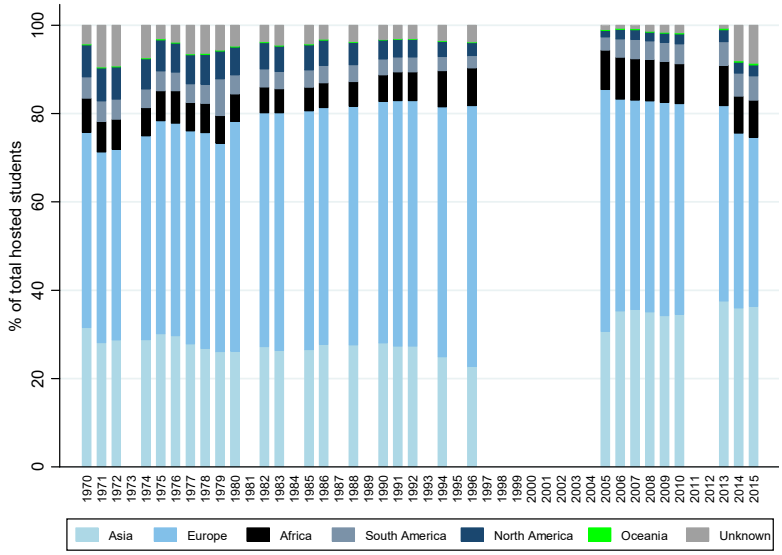


Figure B.36: Students in Germany by country of origin in 2015

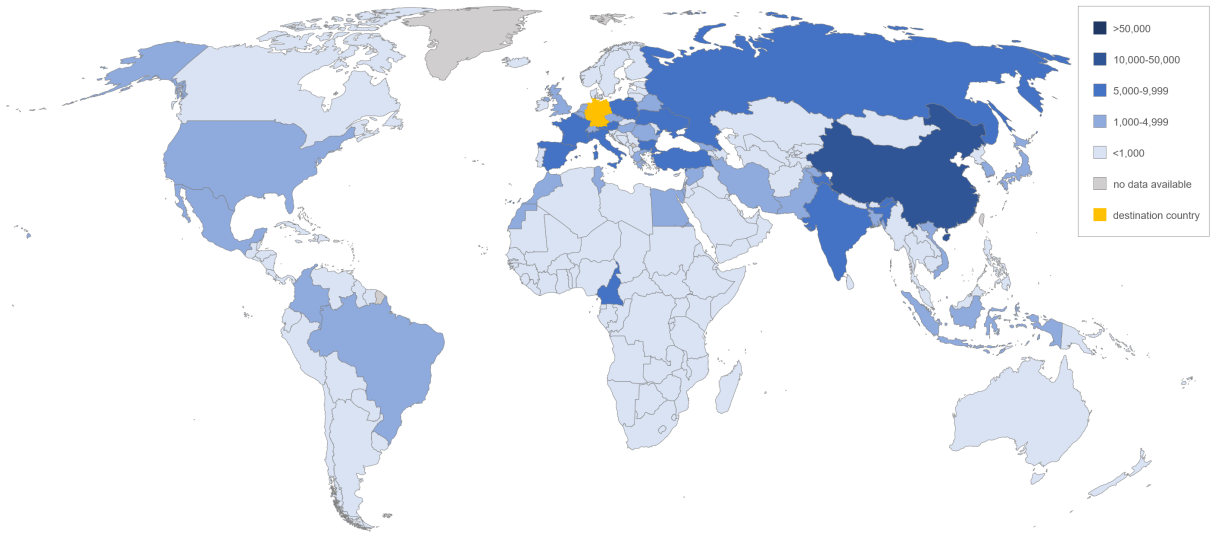


Figure B.37: Students in Germany from China

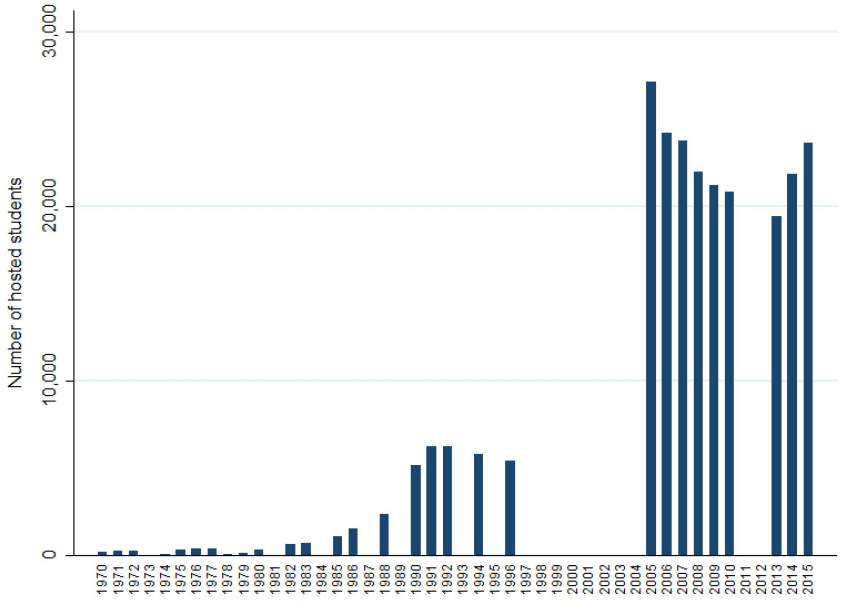


Figure B.38: Students in Germany from Russia

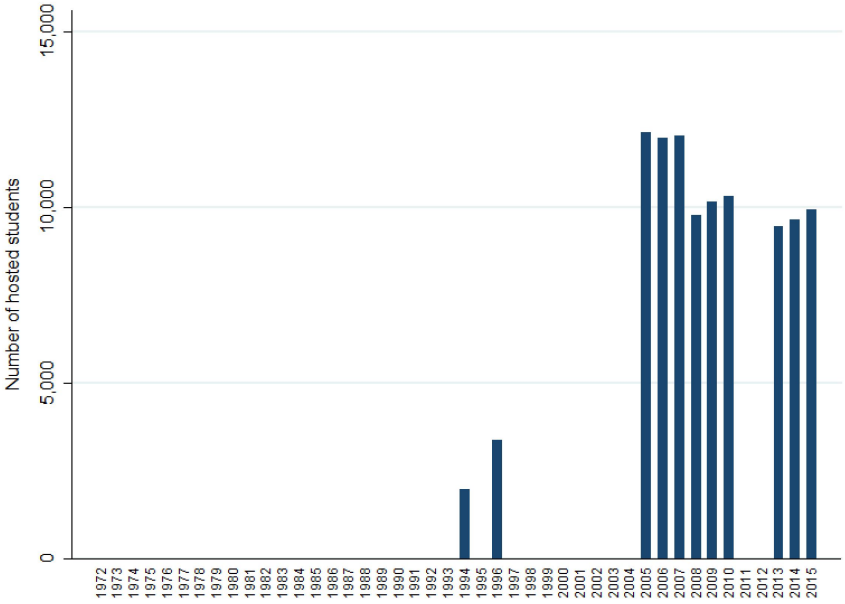


Figure B.39: Students in Germany from India

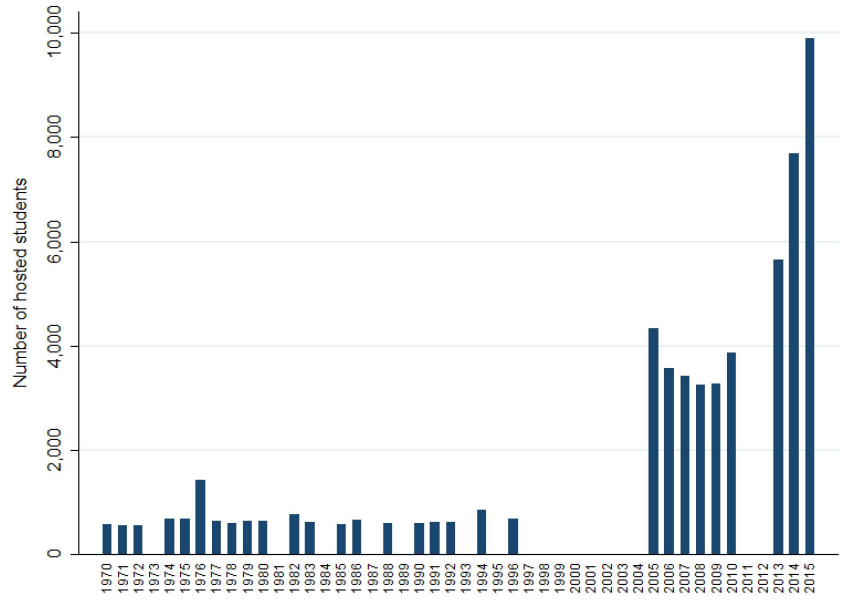


Figure B.40: Students in Germany from Austria

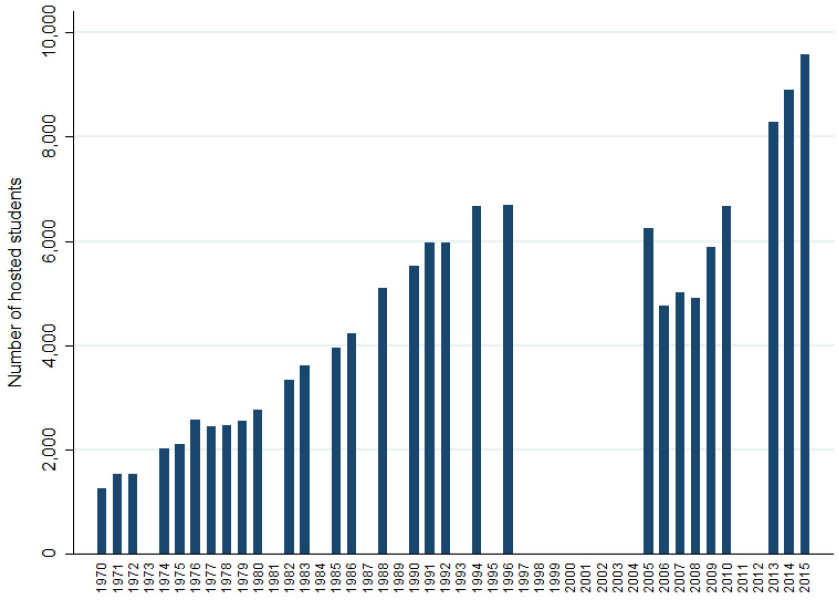
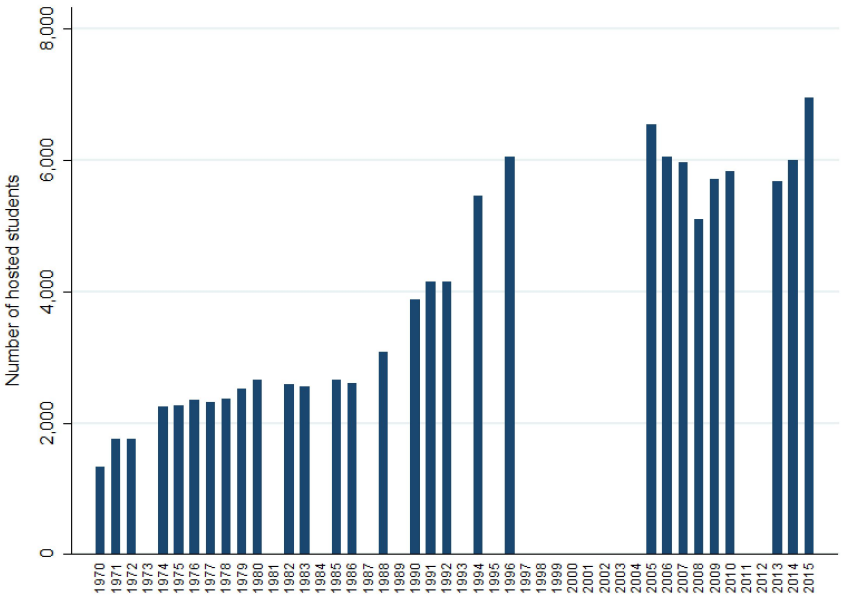


Figure B.41: Students in Germany from France



Appendix C

Quantifying the Effect of the Student Exchange Program Erasmus on International Student Mobility

C.1 Summary Statistics

Table C.1: Summary statistics and data sources

	Mean	Std. Dev.	Source
Ln bilateral stock of students	2.43	2.50	UIS (2018)
Erasmus dummy (0,1)	0.05	0.21	own calculation
EU dummy (0,1)	0.03	0.16	own calculation
RTA (0,1)	0.13	0.32	de Sousa (2016)
Common currency (0,1)	0.02	0.12	de Sousa (2016)
Ln distance	8.73	0.80	CEPII (2010)
Contiguity (0,1)	0.02	0.13	CEPII (2010)
Religious proximity	0.15	0.22	Melitz, Toubal (2012)
Common official language (0,1)	0.12	0.33	Melitz, Toubal (2012)
Common native language (0,1)	0.03	0.13	Melitz, Toubal (2012)
Common spoken language (0,1)	0.13	0.23	Melitz, Toubal (2012)
Shanghai total score, destination	83.45	381.31	Shanghai Ranking (2018)
Shanghai total score, origin	47.06	279.88	Shanghai Ranking (2018)
Shanghai average score, destination	4.54	7.11	Shanghai Ranking (2018)
Shanghai average score, origin	2.89	6.09	Shanghai Ranking (2018)
Ln number of arrivals, destination	14.23	2.11	WDI (2018)
Ln number of arrivals, origin	13.69	2.11	WDI (2018)
Ln GDP per capita, destination	8.68	1.58	WDI (2018)
Ln GDP per capita, origin	8.21	1.59	WDI (2018)
Ln population, destination	15.65	1.99	WDI (2018)
Ln population, origin	15.55	2.09	WDI (2018)

C.2 List of Erasmus Members

Table C.2: Entry year EU, Erasmus and Eurozone

	Entry year EU	Entry year Erasmus	Erasmus membership prior to EU membership	Entry year Eurozone
Austria [3]	1995	1992	x	1999
Belgium [1] [2] [3]	1952	1987		1999
Bulgaria	2007	1999	x	
Croatia	2013	2009	x	
Cyprus	2004	1998	x	2008
Czech Republic	2004	1998	x	
Denmark [2]	1973	1987		
Estonia	2004	1999	x	2011
Finland [3]	1995	1992	x	1999
France [1] [2] [3]	1952	1987		1999
Germany [1] [2] [3]	1952	1987		1999
Greece [2]	1981	1987		2001
Hungary	2004	1998	x	
Iceland		1992		
Ireland [2] [3]	1973	1987		1999
Italy [1] [2] [3]	1952	1987		1999
Latvia	2004	1999	x	2014
Liechtenstein		1999		
Lithuania	2004	1999	x	2015
Luxembourg [1] [3]	1952	1988		1999
Macedonia		2013		
Malta	2004	2000	x	2008
Netherlands [1] [2] [3]	1952	1987		1999
Norway		1992		
Poland	2004	1998	x	
Portugal [2] [3]	1986	1987		1999
Romania	2007	1998	x	
Slovakia	2004	1998	x	2009
Slovenia	2004	1999	x	2007
Spain [2] [3]	1986	1987		1999
Sweden	1995	1992	x	
Switzerland*		1992		
Turkey		2004		
United Kingdom [2]	1973	1987		

Note: *Switzerlands joins Erasmus in 1992 for 5 years, is an indirect member afterwards, officially rejoins Erasmus in 2011 again and leaves it in 2014 under Erasmus +
1) Founding member EU 2) Founding member Erasmus 3) Founding member Eurozone

C.3 Cross Section Estimates Balanced Data Set

Table C.3: Cross section estimates for each period with the balanced data set

Dependent variable: Ln arithmetic average of student stocks				
	(1) Period 1	**(2)** Period 2	**(3)** Period 3	**(4)** Period 4
Erasmus (0,1)	1.868***	1.898***	2.039***	2.199***
	(0.128)	(0.123)	(0.117)	(0.115)
R^2	0.467	0.485	0.508	0.514
Number of observations	4,643	4,643	4,643	4,643

Note: Columns (1) to (4) show the results of cross section estimates for each period of the balanced data set. All estimates incude country dummies. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

C.4 Robustness Checks

Table C.4: Robustness check: zero student stocks

Dependent variable: Ln arithmetic average of student stocks			
	(1)	**PPML (2)**	**(3)**
Erasmus (0,1)	**0.115**		
	(0.199)		
Erasmus before crisis (0,1)		**0.076**	**0.218**
		(0.214)	**(0.203)**
Erasmus during crisis (0,1)		**-0.03**	**-0.03**
		(0.208)	**(0.199)**
Erasmus after crisis (0,1)		**0.087**	**0.088**
		(0.212)	**(0.202)**
EU (0,1)	0.857***		0.948***
	(0.142)		(0.147)
Regional trade agreement (0,1)	-0.145		-0.14
	(0.092)		(0.092)
Common currency (0,1)	-0.211		-0.206
	(0.244)		(0.244)
Number of observations	38,043	38,043	38,043
Number of pairs	10,384	10,384	10,384

Note: All regressions demonstrate panel estimates that include country x time and bilateral effects. Robust standard errors in parentheses. All Wald Chi2 tests significant at the 1 % level. All regressions include a constant.
* p<0.05, ** p<0.01, *** p<0.001.

Appendix D

The Bologna Process and Student Mobility: The Evidence

D.1 Summary Statistics

Table D.1: Summary statistics and data sources

	Mean	Std. Dev.	Source
Ln bilateral stock of students	2.4287	2.4954	UIS (2018)
Bologna (0,1)	0.0745	0.2591	own calculation
EU (0,1)	0.0475	0.2107	own calculation
Erasmus (0,1)	0.0267	0.1578	own calculation
RTA (0,1)	0.1271	0.3243	De Sousa (2016)
Common currency (0,1)	0.0156	0.1222	De Sousa (2016)
Ln distance	8.7276	0.8025	CEPII (2010)
Common official language (0,1)	0.1331	0.3397	Melitz, Toubal (2012)
Contiguity (0,1)	0.0161	0.1260	CEPII (2010)

D.2 List of Members of the Bologna Process

Consultative members: Council of Europe (CoE), UNESCO, European University Association (EUA), European Association of Institutions of Higher Education (EURASHE), European Students Union (ESU), European Association for Quality Assurance in Higher Education (ENQA), Education International (EI) and BUSINESS EUROPE. Furthermore, the EQAR is also a non-voting member of the BFUG and has therefore a similar status to the consultative members, even though it has so far not been officially named a consultative member.

Partners: the European Association for International Education (EAIE), the Council of European professional and managerial staff (Eurocadres), Eurodoc, the European Association for Promotion of Science and Technology (Euroscience).

Table D.2: List of full members of the Bologna Process/EHEA by entry year

Country	Entry year Bologna Process	Country	Entry year Bologna Process
Albania	2003	Kazakhstan	2010
Andorra	2003	Latvia	1999
Armenia	2005	Liechtenstein	2001
Austria	1999	Lithuania	1999
Azerbaijan	2005	Luxembourg	1999
Belarus	2015	Macedonia	2003
Belgium	1999	Malta	1999
Bosnia	2003	Moldova	2005
Bulgaria	1999	Montenegro	2007
Croatia	2001	Netherlands	1999
Cyprus	2001	Norway	1999
Czech Republic	1999	Poland	1999
Denmark	1999	Portugal	1999
Estonia	1999	Romania	1999
Finland	1999	Russia	2003
France	1999	Serbia	2003
Germany	1999	Slovakia	1999
Georgia	2005	Slovenia	1999
Greece	1999	Spain	1999
Holy See	2003	Sweden	1999
Hungary	1999	Switzerland	1999
Iceland	1999	Turkey	2001
Ireland	1999	Ukraine	2005
Italy	1999	United Kingdom	1999

D.3 Cross Section Estimates Balanced Data Set

Table D.3: Cross section estimates for each period with the balanced data set

Dependent variable: Ln arithmetic average of student stocks				
	(1)	**(2)**	**(3)**	**(4)**
Bologna dummy (0,1)	1.911***	2.165***	2.379***	2.466***
	(0.131)	(0.118)	(0.109)	(0.108)
R^2	0.466	0.495	0.523	0.528
Number of observations	4,643	4,643	4,643	4,643

Note: Columns (1) to (4) show the results for each period in a balanced cross section analysis including country dummies. Robust standard errors in parentheses. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

D.4 Robustness Check Zero Student Stocks

Table D.4: Robustness check: zero student stocks

Dependent variable: Arithmetic average of student stocks			
		PPML	
	(1)	**(2)**	**(3)**
Bologna Process (0,1)	**-0.064**		
	(0.168)		
Bologna Process before EHEA (0,1)		**-0.121**	**-0.037**
		(0.165)	**(0.164)**
Bologna Process after EHEA (0,1)		**-0.138**	**-0.11**
		(0.183)	**(0.183)**
EU (0,1)	0.851***		0.868***
	(0.142)		(0.143)
Erasmus (0,1)	0.099		0.096
	(0.197)		(0.195)
Regional trade agreement (0,1)	-0.145		-0.143
	(0.092)		(0.092)
Common currency dummy (0,1)	-0.215		-0.212
	(0.244)		(0.245)
Number of observations	38,043	38,043	38,043
Number of pairs	10,384	10,384	10,384

Note: All regressions demonstrate panel estimates that include country x time and bilateral fixed effects. Robust standard errors in parentheses. All Wald Chi2 tests significant at the 1 % level. All regressions include a constant. * p<0.05, ** p<0.01, *** p<0.001.

Appendix E

Student Mobility and High-Skilled Migration: The Evidence

E.1 Summary Statistics

Table E.1: Summary statistics and data sources

	1990		2000		
Variable	Mean	Standard deviation	Mean	Standard deviation	Data source
ln avg. stock of students (t-1 to t-10)	3.0425	2.2093	3.4397	2.2296	UNESCO
ln avg. stock of students (t-11 to t-20)	2.9736	2.1450	3.0425	2.2093	UNESCO
ln bilateral stock of total migrants	6.9840	2.5146	7.5211	2.3674	Docquier, Lowell, and Marfouk (2008)
ln bilateral stock of primary migrants	6.0456	2.5119	6.3789	2.3845	Docquier, Lowell, and Marfouk (2008)
ln bilateral stock of secondary migrants	5.6052	2.3862	6.1578	2.2869	Docquier, Lowell, and Marfouk (2008)
ln bilateral stock of tertiary migrants	5.7654	2.5191	6.4162	2.4133	Docquier, Lowell, and Marfouk (2008)
Bilateral stock of total migrants	14,324.6400	80,535.2400	20,293.9200	148,481.1000	Docquier, Lowell, and Marfouk (2008)
Bilateral stock of primary migrants	7,016.7530	51,913.5700	8,793.7660	97,244.9200	Docquier, Lowell, and Marfouk (2008)
Bilateral stock of secondary migrants	2,894.2930	16,511.1500	4,316.4910	25,826.6900	Docquier, Lowell, and Marfouk (2008)
Bilateral stock of tertiary migrants	4,413.5850	24,414.5400	7,183.6670	39,423.8200	Docquier, Lowell, and Marfouk (2008)
ln POP, destination	16.9321	1.1986	16.9857	1.2030	World Bank (2010)
ln POP, origin	16.0771	1.7157	16.2458	1.7156	World Bank (2010)
ln GDP per capita, origin	7.5451	1.6207	7.7492	1.7112	World Bank (2010)
ln GDP per capita, destination	9.6596	0.7580	9.8708	0.6028	World Bank (2010)
Unemployment rate (%), destination	7.0284	3.6708	6.9177	3.4323	World Bank (2010)
Unemployment rate (%), origin	7.9844	4.8795	8.2229	5.5065	World Bank (2010)
ln Distance	8.5593	0.8345	8.5593	0.8345	cepii (2010)
Contiguity (0,1)	0.0225	0.1482	0.0225	0.1482	cepii (2010)
Common language (0,1)	0.1585	0.3653	0.1585	0.3653	cepii (2010)
Common legal system (0,1)	0.2917	0.4546	0.2917	0.4546	cepii (2010)
Current colonial relationship (0,1)	0.0012	0.0350	0.0008	0.0286	cepii (2010)
Regional trade agreement (0,1)	0.1115	0.3148	0.1920	0.3939	cepii (2010)
Common currency (0,1)	0.0020	0.0452	0.0429	0.2027	cepii (2010)

E.2 List of Countries

Table E.2: List of net importing and exporting countries of students

Country	2000		1990	
	Net importer	Net exporter	Net importer	Net exporter
Australia	x		x	
Austria	x		x	
Belgium	x		x	
Canada	x		x	
Switzerland	x		x	
Denmark	x		x	
Spain		x	x	
Finland		x		x
France	x		x	
United Kingdom	x		x	
Germany	x		x	
Greece		x		x
Hungary	x		x	
Ireland		x	x	
Italy	x		x	
Japan		x		x
Luxembourg		x		x
Mexico		x		x
Netherlands		x		x
Norway	x			x
New Zealand	x		x	
Poland		x		x
Portugal		x		x
Sweden	x		x	
Turkey		x		x
United States	x		x	

Note: For every year the net imports and exports for a destination country are calculated based on the data presented in the UNESCO Statistical Yearbooks. The Yearbook shows the stock of students for the 50 principal destination countries by their country of origin, based on the last year for which these numbers are available. The annual data represents about 95 percent of the known total world number.

Table E.3: List of countries: part 1

Country	Source	Host	Country	Source	Host
Afghanistan	x		Ecuador	x	
Albania	x		Egypt, Arab Rep.	x	
Algeria	x		El Salvador	x	
Andorra*	x		Equatorial Guinea	x	
Angola	x		Eritrea*	x	
Antigua and Barbuda	x		Ethiopia	x	
Argentina	x		Fiji	x	
Australia	x	x	Finland	x	x
Austria	x	x	France	x	x
Bahamas, The	x		Gabon	x	
Bahrain	x		Gambia, The	x	
Bangladesh	x		Germany[e)]	x	x
Barbados	x		Ghana	x	
Belgium	x	x	Greece	x	x
Belize	x		Grenada	x	
Benin[a)]	x		Guatemala	x	
Bhutan	x		Guinea	x	
Bolivia	x		Guinea-Bissau[f)]	x	
Botswana	x		Guyana	x	
Brazil	x		Haiti	x	
Brunei Darussalam	x		Honduras	x	
Bulgaria	x		Hong Kong SAR, China	x	
Burkina Faso[b)]	x		Hungary	x	x
Burundi	x		Iceland	x	
Cambodia[c)]	x		India	x	
Cameroon[d)]	x		Indonesia	x	
Canada	x	x	Iran, Islamic Rep.	x	
Cape Verde	x		Iraq	x	
Central African Republic	x		Ireland	x	x
Chad	x		Israel	x	
Chile	x		Italy	x	x
China	x		Jamaica	x	
Colombia	x		Japan	x	x
Comoros	x		Jordan	x	
Congo, Dem. Rep.	x		Kenya	x	
Congo, Rep.	x		Kuwait	x	
Costa Rica	x		Lao PDR	x	
Cote d'Ivoire	x		Lebanon	x	
Cuba	x		Lesotho	x	
Cyprus	x		Liberia	x	
Denmark	x	x	Libya	x	
Djibouti*	x		Luxembourg**	x	x
Dominica	x		Macao SAR, China*	x	
Dominican Republic	x		Madagascar	x	

Table E.4: List of countries: part 2

Country	Source	Host	Country	Source	Host
Malawi	x		Senegal	x	
Malaysia	x		Seychelles	x	
Maldives*	x		Sierra Leone	x	
Mali	x		Singapore	x	
Malta	x		Somalia	x	
Mauritania	x		South Africa	x	
Mauritius	x		Spain	x	x
Mexico**	x	x	Sri Lanka	x	
Mongolia	x		St. Kitts and Nevis*	x	
Morocco	x		St. Lucia*	x	
Mozambique	x		St. Vincent and the Grenadines	x	
Myanmar (Burma)	x		Sudan	x	
Namibia*	x		Suriname*	x	
Nepal	x		Swaziland	x	
Netherlands	x	x	Sweden	x	x
New Zealand	x	x	Switzerland	x	x
Nicaragua	x		Syrian Arab Republic	x	
Niger	x		Tanzania	x	
Nigeria	x		Thailand	x	
Norway**	x	x	Togo	x	
Oman	x		Tonga	x	
Pakistan	x		Trinidad and Tobago	x	
Panama	x		Tunisia	x	
Papua New Guinea	x		Turkey	x	x
Paraguay	x		Uganda	x	
Peru	x		United Arab Emirates	x	
Philippines	x		United Kingdom	x	x
Poland	x	x	United States	x	x
Portugal	x	x	Uruguay	x	
Qatar	x		Venezuela, RB	x	
Romania	x		Vietnam[g)]	x	
Rwanda	x		West Bank and Gaza	x	
Samoa	x		Yemen, Rep.[h)]	x	
San Marino	x		Zambia[i)]	x	
Sao Tome and Principe	x		Zimbabwe	x	
Saudi Arabia	x				

[a)] Includes former Dahomey.

[b)] Includes former Upper Volta.

[c)] Includes the former Khmer Rouge as well as the People's Republic of Kampuchea.

[d)] Includes the former Federal Republic of Cameroon and the United Republic of Cameroon.

[e)] For years prior to 1990: Germany=West Germany and unknown.

[f)] Includes former Portuguese Guinea.

[g)] Considered as one nation for all years.

[h)] Considered as one nation for all years.

[i)] Includes former Southern Rhodesia.

[*] Countries are not included in the balanced data set.

[**] Countries are not included as destination countries in the balanced data set.