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The Influence of International Students on the Quality of Dutch Universities

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Abstract

This paper examines the impact of international students on the quality of Dutch universities with regard to the Academic Ranking of World Universities. The paper applies Ordinary Least Squares and Fixed Effects regressions, along with an empirical study, based on information derived from 13 Dutch universities over the period 2008-2022. The findings suggest that a higher percentage of international students is associated with a lower ranking, indicating a negative impact on the quality of Dutch universities as measured by the ARWU-ranking. The analysis also distinguishes between EEA, European non-EEA, and non-European international students.

The study uses control variables such as expenditure per student, number of promovendus-students, number of students, and number of faculty members. All of these turn out to significantly affect the quality of Dutch universities, except the number of promovendus-students. These results indicate that policymakers and university administrators should consider these factors when managing the internationalization of higher education in the Netherlands to improve university performance and quality.

The thesis contains more detailed information concerning the analysis, with a huge amount of statistical data and methodologies that underline the robustness and hence the relevance of its findings for the current academic and political context.

Keywords: International students, Quality Dutch universities, Academic Ranking of World Universities

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1. Introduction

The presence of international students is becoming increasingly prominent in today's international university landscape. Countries strive to offer better quality universities where research output and social impact are central factors. The presence of international students has a significant impact on the dynamics of these institutions. They bring more diverse perspectives on various topics, including cultural differences, and contribute more financially to the universities. The question remains, what is: *“The Influence of International Students on the Quality of Dutch Universities”?*

The relationship with Dutch universities is very relevant. From 2008 to 2022, the absolute number of international students has risen (Figure 1.1). This upward trend demonstrates a growing influx of international students over time. The relationship compared to the total number of Dutch students has also continued to increase from 2008 to 2022 (Figure 1.2), indicating a rising proportion of international students within the overall student body. In the academy year 2022/23, international students have never taken such a constituted part of the total student population of Dutch universities, namely 24 percent (Universiteiten van Nederland, 2023a). These trends highlight the motivations for this research to examine their impact on the quality of Dutch universities. Moreover, Dutch universities are highly regarded in the ranking and have an international appearance. Many programs are offered in English, 28% of bachelor's and 77% of master's courses (Ilach, 2023). In addition, the Netherlands is known for the fact that a large part of the population has a good or very good command of the English language. These are two factors that contribute to the international appearance of Dutch universities.

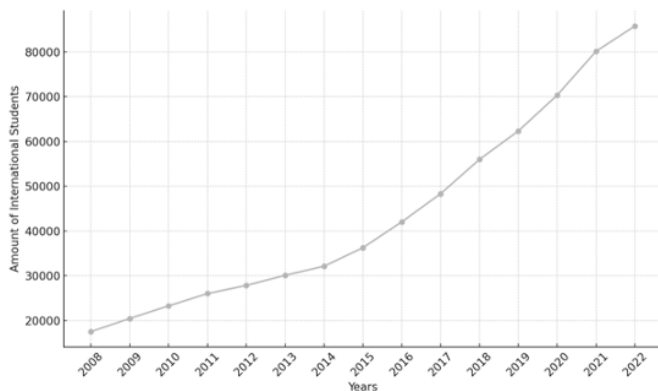


Figure 1.1: Total international students over the years at Dutch universities (2008-2023)

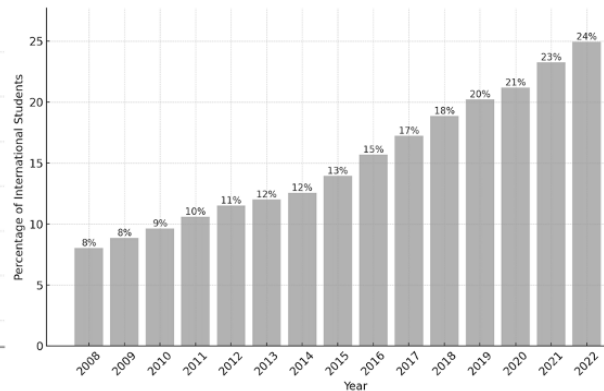


Figure 1.2: Percentage of international students relative to total students at dutch universities (2008-2023)

In the academic year 2022/23, 84,807 international students were enrolled in bachelor's or master's programs at Dutch universities on October 1. This was an increase of 6% compared to the previous academic year. A large proportion, 72%, come from countries within the European Economic Area (EEA). The largest group of students come from Germany and the United Kingdom (which is no longer part of the EEA-countries, since 2021). Many students from China and India also come to Dutch universities (Universities of the Netherlands, 2023b; Universities of the Netherlands, 2023c). International master students often choose technical and engineering courses, as well as behavioral and social sciences (Universities of the Netherlands, 2023b).

The quality of universities is often compared based on a ranking, such as the Academic Ranking of World Universities (ARWU). This ranking is drawn up based on factors such as research output, faculty performance, Nobel prizes and field prizes that show the level of education, reputation and prestige of a university (ShanghaiRanking Consultancy, 2023). It is not clear how the international students influence this ranking. Do international students contribute to improving quality based on the cultural diversity they offer, or do they strain existing resources, potentially leading to a negative academic experience?

For this research, a panel dataset was compiled of the 13 Dutch universities that were included in the AWRU-ranking between 2008-2022. The information in this dataset has been obtained from reliable sources: 'Universities of the Netherlands' and the 'AWRU-ranking, ShanghaiRanking'. Ordinary least squares regressions will be used to estimate the relationship between the dependent variable (Ranking Score) and a set of independent variables. The fixed effect regressions will also be used to control for unobserved heterogeneity (differences) between the different Dutch universities. This means that unique, unchangeable factors of each university are controlled so that they do not influence the effect of international students on the AWRU-ranking. In addition, the international students will also be divided into 3 different categories: EEA students, non-EEA European students, and non-European students. The focus will also be on the effects of the control variables: expenditure per student, number of promovendus-students, number of faculty members and total number of students on the AWRU-ranking for Dutch universities.

In recent times, the presence and impact of international students at Dutch universities have become hot topics in political and societal discussions. Following the recent elections, the coalition of PVV, VVD, NSC, and BBB has proposed stricter policies regarding international students. These include limiting the number of English-language programs and setting maximum quotas for foreign students (NOS, 2023). Such measures aim to alleviate pressure on infrastructure like housing and educational capacity but could also affect the quality of Dutch universities (Bureau Woordvoering Kabinetsformatie, 2024). This research

aims to explore these potential impacts, providing insights that are crucial for informed policymaking in this contentious area.

The aim is to investigate the relationship between international students and the quality of Dutch universities based on the ARWU-ranking. It will create an impression of whether the benefits will consider the disadvantages of international students in the field of quality of Dutch universities. As a result, a correct policy in connection with the number of international students can be implemented by the universities and governments to achieve the best quality of Dutch universities.

1.1 Structure of this research

The research question will first be discussed extensively and in the context of the relevant literature that exists on this subject. The data set will be analyzed on the basis of a descriptive analysis. The regression models will be carried out that investigates the impact of international students in the university ranking. Sufficient control variable is used here to give the most correct image possible. Finally, a conclusion will be drawn to what the effect is and the implications will be demonstrated to which potentially future research can answer.

1.2 Sub-questions

1. What is the evolution of the absolute and relative number of international students per Dutch university?

Panel data will be used, making it relevant to know whether the number of international students per Dutch university has increased or decreased absolutely and relatively over time.

2. Do international students have a direct influence on the quality/ ranking of Dutch universities?

The Academic Ranking of World Universities will be used as the dependent variable. The independent variables (control variables) will be used to gain insight into the quality of a university. This will help us gain insight into whether international students have a positive or negative effect on the quality of a university.

3. Does a specific international student category have more impact?

We will investigate whether the three different categories of international students (EEA, European (Non-EEA), Non-European) produce the same effect on university quality and ranking. If not, we will determine which category has the most influence.

1. Theoretical Framework

Theoretical ideas and concepts from previous academic research clarify which factors influence the quality and ranking of Dutch universities. In addition, the influence of international students on these factors and therefore also on the quality of the universities is examined. The Academic Ranking of World Universities (ARWU) will be the basis for measuring the quality of Dutch universities.

2.1 Academic Reputation and International Rankings

The international diversity of a university has a positive influence on its academic reputation. The QS World University Rankings assesses universities on various criteria such as academic reputation, citations per faculty, but also the international faculty ratio (QS World University Rankings, 2024). The last criterion suggests that internationalization of the faculty would have a positive effect because it indicates how attractive the university is to academic staff around the world, which can improve the quality of the university. Universities with many international students and diverse staff are considered more attractive and prestigious. This not only helps attract highly qualified staff but also provides additional funding (Altback and Knight, 2007).

2.2 Factors that Measure the Quality of the Universities according to the ARWU-ranking

The AWRU-ranking, Academic Ranking of World Universities, also known as Shanghai Ranking, reflects the quality of Dutch universities. This ranking has a detailed and objective methodology, making it one of the most valued and respected university rankings in the world (Liu & Cheng, 2005). The use of research output and the number of scientific prizes provide a good indication of the quality of the universities. In addition, the ranking is used by policy makers, university administrators and researchers to assess performance (Rauhvargers, 2011).

The AWRU-ranking is therefore highly suitable for this research. International students do not have a direct effect on the ranking score, but it could influence the six objective factors that primarily measure the academic and research performance of universities. International students can potentially contribute to improved research opportunities and international collaboration, which can have a direct impact on the indicators used by the ARWU-ranking. The following factors have been chosen with great caution by the AWRU-ranking to ensure a fair and objective comparison of universities' quality.

1. Alumni of an institution winning Nobel Prizes and Fields Medals: This factor accounts for 10% in determining the ranking. It measures how many alumni have won prestigious awards, which reflects the current and past academic excellence of the universities.
2. Staff of an institution winning Nobel Prizes and Fields Medals: This factor accounts for 20% in determining the ranking. It measures the current number of staff who have received a major academic award, indicating the current academic strength and its ability to recruit top talent.
3. Highly Cited Researchers: This factor accounts for 20% in determining the ranking. It indicates how many highly cited studies a university has, showcasing the influence and reach of its research.
4. Papers published in Nature and Science: This factor accounts for 20% in determining the ranking. It indicates how many articles have been published in scientific journals, which shows the impact and the quality of these studies.
5. Papers indexed in Science Citation Index-Expanded and Social Science Citation Index: This factor accounts for 20% in determining the ranking. It measures the number of articles published in international peer-reviewed journals indexed in SCIE and SSCI, providing a broad picture of a university's research performance.
6. Per Capita Academic Performance of an Institution: This factor accounts for 10% in determining the ranking. It adjusts the absolute figures relative to the number of scientific staff. One published article in relation to 1000 scientific professors is of course not the same as in relation to 10 scientific professors.

2.3 Factors Affecting Quality of Universities

This study uses proxies related to the factors of the AWRU-ranking. The expenditure per student, the number of promovendus-students, The number of faculty members, and the number of students are significant determinants for the ranking of universities (Marconi and Ritzen, 2015). It was decided to use these proxies instead of the direct factors as shown in section 2.2 for the following two reasons. First, the problem of the availability of the data: factors such as the number of Nobel Prize winners or the number of publications in leading magazines are often not available in detail for all universities and periods surveyed. Secondly, the proxies are more relevant for policy and management. Policy makers can influence the chosen proxies so that strategic choices can be made.

1. Expenditure per Student

Higher expenditure per student often leads to better facilities, more teaching and research resources, and better support for students. This often results in a higher score in the international ranking. Research into the top 200 universities according to Times Higher Education Supplement Ranking of 2007 concluded that expenditure per student and more investments in the universities have a positive and significant influence on the ranking score (Marconi & Ritzen, 2015). Recent studies confirm these results. Higher expenditure per student would have a positive effect on the efficiency of universities (Johnes et al., 2017). In this study, efficiency is measured by looking at the input (expenditure) and the output (student performance, research results, etc.) of the universities. It is concluded that higher expenditure per student often has a positive effect on study results, higher success rates and more publications of scientific research. Both small and large increases in expenditure per student lead to an improvement in academic performance (quality) of universities (Manzo, 2021).

2. Number of Phd/ Promovendus-students

Number of promovendus-students shows the academic capabilities of the universities and the extent to which universities are research-oriented. These students have a significant positive effect on university rankings (Marconi and Ritzen, 2015). Research indicates that these students and the general research environment positively impacts the number of research produced and citations an institution produces (Balavy et al., 2020). In Korea, this idea has been confirmed through correlational research, including the number of PhD-students, has a positive effect on the number of research produced and the number of citations an institution receives (Kwon et al., 2015). In addition, promovendus-students are often closely involved in high-quality research and provide input to other scientific articles, greatly strengthening the position in the international rankings (Larivière, 2011). (In the Netherlands, PhD-students are referred to as promovendus-students).

3. Total number of students

A large student population can suggest that a university is popular, often an indication of high-level quality. It was shown that a larger student population has a positive and significant effect on university rankings (Marconi and Ritzen, 2015). However, it can also lead to challenges with overcrowded lecture rooms, limited access to teachers and support staff, and reduced individual guidance for students. Larger classes may result in a lower performance of the students in compulsory subjects because the same sources as the number of teachers must be distributed over a larger number of students (Karas, 2019).

4. Number of Faculty Members

A higher number of faculty members means more academics are available to assist students which positively impacts the student learning experience and improves overall student satisfaction (Marconi & Ritzen, 2015). More faculty members often result in smaller class sizes, resulting in more personal attention and higher quality interactions between teachers and students (Ammigan and Jones, 2018). In addition, faculty members have a positive significant effect on students' learning experience and academic performance (Umbach and Wawrzynski, 2005). With more faculty members, students are more likely to find experts in specific subjects they are interested in.

2.4 Influence of Internationalization

1. Internationalization of the Curriculum

Internationalization of the curriculum leads to more English-language studies, it contributes to better preparation for the globalized world and improving the quality of universities. Dutch universities offer a sufficient number of English-language programs: 28% of the bachelor's and 77% of the master's programs (Llach, 2023). Offering these programs also increases the international reputation of Dutch universities and creates an inclusive learning environment (Knight, 2015). The curriculum, support services and teaching methods are adapted accordingly, developing students' global competencies (de Wit & Leask, 2015). Adding global issues and case studies from other countries improves students' understanding of cultural differences (Fragouli, 2021). These adjustments are not only aimed at attracting more international students but also promote the quality of the university (Ke, 2018). Online projects, such as Collaborative Online International Learning, are allowing students from different countries to work together on different projects, promoting intercultural collaboration and communication skills (Hackett, 2023).

2. Language Diversity and Language Policy

The rising diversity of languages offers both opportunities and challenges for the quality of a university. Effective language support, such as language courses in both Dutch and English, is essential for the academic performance and integration of international students (Curtin et al., 2013). This support improves the university's quality because international students perform better academically and integrate more effectively into their host country. In addition, multicultural support systems, such as language courses, mentor programs, and academic guidance, contribute to an inclusive campus where everyone feels at home (Andrade, 2006). This improves the problem-solving skills of the students.

However, more international students also create challenges such as language barriers and inequalities within a classroom that can negatively impact the learning experience. Furthermore, there is a concern that the prominence of international languages might come at the expense of the local language spoken in the host country (UNESCO, 2024; Wolfram, 2023).

3. Diversity and Cultural Differences

International students create more diversity and cultural differences on campus. This creates an inclusive and vibrant environment, improving the quality of the university. Universities should adapt the educational and socio-cultural environment of the campus to better deal with such a wide scale of cultural backgrounds. Implementing these adjustments will improve the overall academic experience for all students (Yen et al., 2021). Cultural exchange primarily happens through social activities outside the classroom. International students can be seen as cultural ambassadors of their countries. These global perspectives enrich the college experience by providing diverse viewpoints. (Howe et al., 2022). International students are also creating new teaching methods and promoting the use of global case studies. These can provide broader insights and should improve students' critical thinking (Halpern et al, 2022).

4. Stakeholder Perspectives

Many local students appreciate the diversity but seek little contact with internationals. The university boards are generally enthusiastic because of the financial contribution (see page 11, Financial Contribution of International Students), but professors often experience several challenges. They are concerned about an increased workload and the need to adapt their curriculum to another language and a diverse student population (Sawir et al., 2008). This can be solved by implementing further training of the professors. This is essential to manage the challenges of an international lecture hall and to ensure that the benefits of internationalization can be optimally exploited (Leask, 2009). Research shows that international students often desire to connect with local students, but this interaction has been very limited in New Zealand and Australia. Many international students feel socially isolated and unengaged with domestic students (Ward, 2001). This problem may be greater at Dutch universities due to language barriers faced by non-Dutch-speaking international students. The buddy program pairs international students with local students. This can partly solve the problem (Ward & Masgoret, 2004).

2.5 Academic and Financial Impacts of International Students

1. Academic Performance

Western international students often outperform Dutch students. A study across five business schools in the Netherlands compared the academic performance of international and local students. International students often perform worse initially due to language and adjustment problems, but as they become better integrated, performance improves. International students with a Western background are said to be more academically active and achieve better results than Dutch students. Students with a non-Western background generally experience a low degree of integration but score similarly to other international students (Rienties et al., 2012). Immigrant students also positively impact the academic performance of local students. A study of Florida high schools found that because of immigrant students, local students generally scored higher on reading and math tests, especially among students of lower socioeconomic status (Sapienza et al., 2022).

2. Financial Contribution of International Students

International students positively impact the economy by paying higher tuition fees and often working in the host country. These resources can be reinvested in facilities, research, and education, which enhance the quality of the university. For the academic year 2023/24, the tuition fees for EU/EEA students is 2,314 euros. For non-EU/EEA students, fees vary from 9,000 to 30,000 euros, depending on the study and university (Study in NL, 2023). At the University of Amsterdam, non-EU/EEA students pay between 9,570 euros and 27,390 euros per year (University of Amsterdam, 2023).

The international students also contribute significantly to the Dutch treasury. The average Dutch student generates 16,900 euros, while graduates from outside the EEA generate 96,300 euros (the economic effects of internationalization in higher education and MBO, price level, 2017). This is due to their higher average income after the study and lower education costs (since nothing was funded by the host country for primary and secondary school). This has generated a total of around 1.5 billion euros for the Dutch treasury (Nuffic, 2022).

About a third of international graduates from the 2018/19 academic year work and live in the Netherlands a year after graduation. In fields such as services, computer science, education and technology, industry and construction, between 40 and 50 percent remain in the Netherlands, (Central Bureau of Statistics, 2023). 57 Percent of all international students wish to stay in the Netherlands after graduation with students from outside the European Economic Area (EEA) even more inclined to stay (Ad Valvas, 2023). The main reasons for international students to stay include the high standard of living, the

quality of research and education, and good employment opportunities (Nuffic, 2023). International students from within the EEA often experience similar living standards and employment opportunities in their home country, making them more likely to return home than non-EEA students. However, many international students do not stay in the Netherlands due to high living costs, a tight housing market, and the necessity of Dutch language proficiency in many sectors (Nuffic, 2023).

3. Housing market in the Netherlands for (International) Students

International students often need to find student housing because they have fewer friends or family in the host country. An average room in the Netherlands costs between 450 and 700 euros per month (Study in NL, 2023). The increase in international students has put more pressure on housing in university cities, limiting the availability of affordable housing for both international and domestic students. Research indicates that the surge in international students at US universities between 2005 and 2015 led to significant pressure on local rental markets, resulting in higher rents and a shortage of available housing (SSRN, 2021). International students experience even more stress. A survey revealed that 35.3% of the international students had to pay more for accommodation compared to Dutch students at least once. It is therefore no surprise that 71.8% of respondents indicate that improvements should be made in the area of housing and more than half of respondents indicated that this is the responsibility of the universities.

Students who have difficulty finding suitable housing often experience stress and anxiety, negatively impacting their academic performance and overall well-being (BMC Public Health, 2021). This highlights the importance of ensuring that students can easily find accommodation so they can focus on their studies. Besides being affordable, housing must also provide a supportive environment where students can adapt and integrate.

2.6 The Relevance of the Research

This research will investigate the effect of international students on the quality of Dutch universities, a topic of great importance in connection with the current political and social climate in the Netherlands. Recent elections have resulted in a coalition between the PVV, VVD, NSC, and BBB, which aims to implement stricter policies regarding international students. The election manifestos of several parties stated that they wanted to limit the number of international students by offering fewer English-language studies, making the Netherlands less interesting to international students. Additionally, they are considering whether institutions can more easily set a maximum number of places for foreign students

(NOS, 2023). The new coalition's outline agreement includes plans to implement these policies. These measurements could relieve some pressure on Dutch infrastructure, such as housing and educational capacity in the short run (Bureau Woordvoering Kabinetsformatie, 2024). However, there may be negative long-term consequences. The economic contribution of international students will decrease, as would diversity. Limiting their numbers could lead to a loss of talent and a reduced attractiveness of Dutch universities on the world stage. However, the coalition's reasons for restricting international students are, according to many, correct. Solidarity between Dutch and international students is strained, as international students take up study places and make use of the already scarce housing options in student cities (EM, 2024). However, the question remains undiscussed as to what the effects will be on the quality of Dutch universities.

Policymakers can significantly shape the academic environment and strategies through various mechanisms. Germany and the United Kingdom, both with large numbers of international students, employ different policies. Germany focuses on the ability and potential of students, while the UK treats students as consumers and allows market forces to dictate admissions. Germany's approach includes government financing and numerous support networks, such as language courses and cultural integration programs. The UK, meanwhile, emphasizes individual supportservices tailored to the diverse needs of international students. This focus on internationalization has increased the number of international students in Germany (Bitschnau, 2023). Conversely, the UK has faced significant declines in international student applications post-Brexit, resulting in negative economic consequences for universities and the broader economy (Amuedo-Dorantes & Romiti, 2021). This example serves as a warning to Dutch policymakers.

An SEO-report investigated the costs and benefits of fewer international students in the study areas of economics and business administration. While fewer EEA students could have a positive effect, reducing non-EEA students would be detrimental due to their higher tuition fees. Overall, the research found more benefits than costs within this sector, suggesting it would be unwise to reduce the number of international students (Koopmans et al, 2024).

However, there has been no research into the consequences of these policies on the ranking and quality of Dutch universities. This study will help policymakers and universities determine whether international students significantly impact the quality and ranking of Dutch universities. This will enable a balanced decision on whether reducing the number of international students will positively or negatively affect university quality, or if the effect is negligible.

3. Data

3.1 Data and Sample Collection

A panel of 13 Dutch universities that existed between 2008 and 2022 is used: Erasmus University Rotterdam (EUR), Leiden University (LU), Radboud University Nijmegen (RU), University of Groningen (RUG), Tilburg University (TiU), Delft University of Technology (TU Delft), Eindhoven University of Technology (TU/e), University of Maastricht (UM), University of Twente (UT), Utrecht University (UU), University of Amsterdam (UvA), VU University Amsterdam (VU), University of Wageningen (WUR). These have all been included at least once in the Academic Ranking of World Universities (ARWU). The research period, 2008-2022, was chosen because there is existing data for these years and significant growth in international students at Dutch universities during this period (Appendix Figure A1). The data for this research was collected from various reliable sources. The main source is the 'Academic Ranking of World Universities (ARWU)', which provides detailed information on university rankings based on academic and research excellence. Additionally, data was obtained from 'Universiteiten van Nederland', which provides information on student populations, faculty members and financial data of Dutch universities.

3.2 ARWU-Ranking as Dependent Variable

All 13 Dutch universities always appear in the AWRU-ranking, except for Tilburg University (TiU) in some years. The AWRU accesses a total of 2,500 universities, and the best 1,000 are published. Some years, TiU was part of this top 1000, but other years it was not. However, this is not a problem for the research, as in years when TiU did not appear in the list, it would have been given the worst ranking score among Dutch universities.

The ARWU-ranking gives the best 100 an exact ranking score, for example rank 88. After rank 100, intervals such as rank 101-150, rank 151-200, and so on are used. To give Dutch universities a more logical and precise ranking score, an internal continuous ranking system was implemented. The best ranked Dutch university, according to the AWRU-ranking, receives rank 1, the second-best rank 2, and so on. If several Dutch universities achieve the same AWRU-ranking score, part of the same interval, they receive the same internal ranking number and the universities that follow receive the next ranking number. For example, two universities share rank 2, the next university that follows receives rank 3.

The way ranking numbers are shared among universities can vary from year to year leading to a challenge in interpreting these rankings. For instance, in 2008, the worst scoring university was assigned place 7 while this place is 10 in 2019. (Appendix Figure A4). To tackle this issue, universities, with ranking

numbers ranging from 8 to 10 were given a score of 7. This adjustment ensures that the relative positions of universities remain consistent making analysis easier and comparisons more straightforward while reducing biases. As a result it guarantees an interpretation of ranking scores across all years resulting in dependable and meaningful outcomes.

In general, the 13 Dutch universities score extremely well according to the AWRU-ranking. Utrecht University (UU), Erasmus University Rotterdam (EUR), Leiden University (LU), and University of Groningen (RUG) are almost always in the top 100. UU has consistently received the best score during the period 2008-2022. Radboud University Nijmegen (RU), Delft University of Technology (TU Delft), University of Amsterdam (UvA), VU University Amsterdam (VU), and University of Wageningen (WUR) have always had a ranking score of 101-200 over the years. Eindhoven University of Technology (TU/e), University of Maastricht (UM), and University of Twente (UT) achieved a score between rank 301-600. Tilburg University (TiU) scores lower and is not included in the ranking in some years. In recent years, the university has achieved a score between 501-700.

3.3 Control Variables: Factors that Determine the Quality of Dutch Universities

It was decided to use these proxies (control variables) instead of the direct factors that influence the AWRU-ranking (2.3 Factors Affecting Quality of Universities). These factors are used by universities in order to deliver the best possible quality. By analyzing these control variables, we can get a more complete picture of the factors that influence the ranking place of Dutch universities on the AWRU-ranking and also better understand the influence of international students.

1. Expenditure per Student: Dividing the total expenditure of the Dutch university of a certain year (Universities of the Netherlands, 2022a) by the number of students who studied that same year at the same university (Universities of the Netherlands, 2023a).
2. Number of Promovendus-students: (Nederlandse Universiteiten, 2022b).
3. Number of Students: (universities of the Netherlands, 2023a).
4. Number of Faculty Members: Faculty members are the professors, associate professors, assistant professors, lecturers, researchers and other academic staff (Universities of the Netherlands, 2022b).

3.4 International Student Ratio as Independent Variable

The question remains whether international students have a positive or negative effect on the quality and ranking of Dutch universities. There are plenty of arguments for both sides (Theoretical

Framework). This research will also investigate the impact of the three different categories of international students: EEA, European (Non-EEA), Non-European. To calculate these four variables, the number of international students or the number of one of these three categories: international students: EEA, European (Non-EEA), Non-European, for a specific year and university was divided by the total student population for that year and university. This method ensures the four different variables represent a percentage.

Table 3.1: Definition of international students, EEA-students, European (Non-EEA)-student, and Non-European-students

Category	Description
International students	International students are defined in this research as students with a non-Dutch nationality and non-Dutch prior education, which gives access to higher education.
EEA students	A student from the EEA originates from a country within the European Economic Area. The EEA consists of the EU countries plus Norway, Iceland, and Liechtenstein. These students pay the statutory tuition fees. Non-EEA countries Switzerland and Suriname are also included because the same rules for tuition fees apply to students from those countries. The visual takes the years that a country was an EU member into account. As a consequence, the United Kingdom is not included as an EEA member from 2021/'21.
European (Non-EEA) students	A non-EEA student originates from a country within Europe but outside the European Economic Area. These students pay the institutional tuition fees.
Non-European students	Students originating from outside Europe are non-European students. These students pay the institutional tuition fees.

Note. Definitions are based on the criteria set by Universiteiten van Nederland (2023a).

3.5 Descriptive Statistics

1. Panel A: Descriptive Statistics of the Variables

Panel A shows the descriptive statistics for all variables. The ranking of the universities has the minimum place 1 (the highest place) to a maximum of 7 (the lowest place). There are 13 Dutch universities, but sometimes Dutch universities share the same rank (see 3.2 ARWU-Ranking as Dependent Variable, page 14). The table reveals significant variation in the ratio of international students over the years and the universities. An average, 17% of the studentpopulation were international students, with a minimum of 3% and a maximum of 57%. This indicates that some universities had a much higher proportion of international students in certain years compared to the past or other universities. For example, at the University of Maastricht, the average percentage of international students in the years 2008-2022 was 49%, much higher than at other Dutch universities (Table 1.1, Appendix A). The expenditure per student

varies from 12,633 euros and 48,938 euros, indicating significant differences. Delft University of Technology, Eindhoven University of Technology, University of Twente and University of Wageningen, which have much higher expenditures per student, raising the overall average (Table 1.1, Appendix A). The number of faculty members also vary significantly, with the minimum of 724 and a maximum of 3112 at a Dutch university over the years.

Table 3.2: Descriptive Statistics: Means, Standard Deviations and Extreme Values

Panel A: Descriptive Statistics: Means, Standard Deviations and Extreme Values					
Variables	Obs.	Mean	Std.	Min.	Max.
Year	195	2015	4,33	2008	2022
Ranking Score	195	4,42	1,84	1	7
International Student Ratio	195	0,1674	0,1175	0,0320	0,5705
EEA Ratio	195	0,12056	0,1072	0,0123	0,5049
European, Non-EEA Ratio	195	0,0059	0,0049	0,0006	0,0243
Non-European Ratio	195	0,0397	0,0295	0,0032	0,1306
Expenditure Per Student	195	25.948	6.680	12.633	48.938
Number of Promovendus-Students	195	719	248	268	1.784
Number of Students	195	20.915	8.612	5.157	42.120
Number of Faculty Members	195	1.606	576	724	3.112

Note. Panel A shows the descriptive statistics of each variable used in this study, which covers the 13 Dutch universities from 2008 to 2022. All values are rounded to two decimal places. ***, ** and * present the statistical significance of the correlation coefficients on significant levels of 1, 5 and 10 percent respectively.

2. Panel B and C: Correlation Matrix between the Variables

Panel B presents the correlation matrix, the relationships between the different variables and the internal continuous ranking score (Ranking Score). Panel C does the same but focusses on the three categories of the international student ratio. The correlation matrices indicate that multiple variables have significant relationships with the dependent variable, the Ranking Score. The variable international students, as well as the three different categories of international students, has a positive correlation of 0.37 with the ranking score. This suggests that a higher percentage of international students is associated with a (higher) worse performance in the AWRU-ranking (where a ranking score of 1 is the best and 7 is

the worst). Additionally, the variables: Number of Promovendus-Students, Number of Students and Number of Faculty Members show a significant negative correlation with the ranking score. This indicates that universities with more promovendus-student, students, number of students, and faculty members are gaining a better place in the AWRU-ranking (where a ranking score of 1 is the best and 7 is the worst).

Table 3.2: Correlation matrices between the variables

Panel B: Correlation Matrix with International Student Ratio								
Variables		(1)	(2)	(3)	(4)	(5)	(6)	
Ranking Score	(1)	-						
International Student Ratio	(2)	0.37***	-					
Expenditure Per Student	(3)	0.09	0.14*	-				
Number of Promovendus-Students	(4)	-0.15**	0.14*	0.38***	-			
Number of Students	(5)	-0.62***	-0.16*	-0.53***	0.24***	-		
Number of Faculty Members	(6)	-0.5***	-0.0	-0.14*	0.67***	0.81***	-	

Panel C: Correlation Matrix with 3 Categorical International Student Ratio									
Variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ranking Score	(1)	-							
EEA Ratio	(2)	0.30***	-						
European (Non-EEA) Ratio	(3)	0.31***	0.41***	-					
Non-European Ratio	(4)	0.31***	0.12*	0.29***	-				
Expenditure Per Student	(5)	0.09	-0.01	-0.06	0.55***	-			
Promovendus-Students	(6)	-0.15**	0.08	0.06	0.28***	0.38***	-		
Number of Students	(7)	-0.62***	-0.06	0.16**	-0.34***	-0.53***	0.24***	-	
Number of Faculty Members	(8)	-0.50***	0.05	0.12*	-0.11	-0.14**	0.67***	0.81***	-

Note. Panel B and C shows the correlation matrix of all variables used for the research. ***, ** and * present the statistical significance of the correlation coefficients on significant levels of 1, 5 and 10 percent respectively.

To better understand the trends and relationships of the variables, graphs have been designed. Figure 1.3 shows what average percentage of international students is associated with the ranking score. The percentage of international students for each ranking place from 2008 to 2022 was averaged to create

this figure. This figure shows that a higher number of international students indicates a lower ranking score where a ranking score of 1 is the best and 10 is the worst). This graph would suggest that international students have a negative influence on the rankings of Dutch universities. Note that this graph did not merged the ranking number 8-10 to 7, but this graph can still give a general picture (3.2 ARWU-Ranking as Dependent Variable).

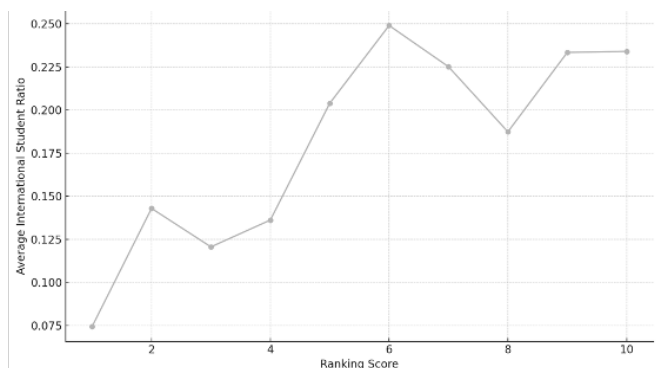


Figure 3.1: Average International Student Ratio for Dutch Universities by Ranking Position (2008-2022)

What is particularly striking is that Utrecht University (UU) has consistently scored the highest in the AWRU-ranking over the years (Appendix figure A4). Other Dutch universities fluctuate more over time. Tilburg University consistently scores the lowest. This is because Tilburg University was not included in the AWRU-ranking for several years, resulting in the lowest ranking position in the internal ranking of Dutch universities. In the years when it was included, TiU did not score highly.

Additionally, it is striking that Leiden University held the 2nd best place until 2014, but has since been overtaken by the University of Groningen and has alternated between 3rd and 4th place in recent years with Erasmus University Rotterdam. From 2011 onwards, the Radboud University and the University of Amsterdam have shared the same position in the internal ranking of Dutch universities.

The international student population has evolved in relation to the total student population over the years (Appendix Figure A1). This ratio has increased at almost every university except University of Wageningen, where it approximately remained the same (Figure 3.2). A notable observation is that there are many more international students at Maastricht University than at other Dutch universities. In 2008, international students made up 40 percent of its student population, and by 2022, this had nearly increased to 60 percent. The University of Amsterdam has also experienced a significant increase over the years. In 2008, only 7 percent were international students, but by 2022, this figure had risen to 33 percent. Utrecht University and Radboud University have the fewest international students from 2008 to 2022, with the ratio remaining between 9 and 14 percent.

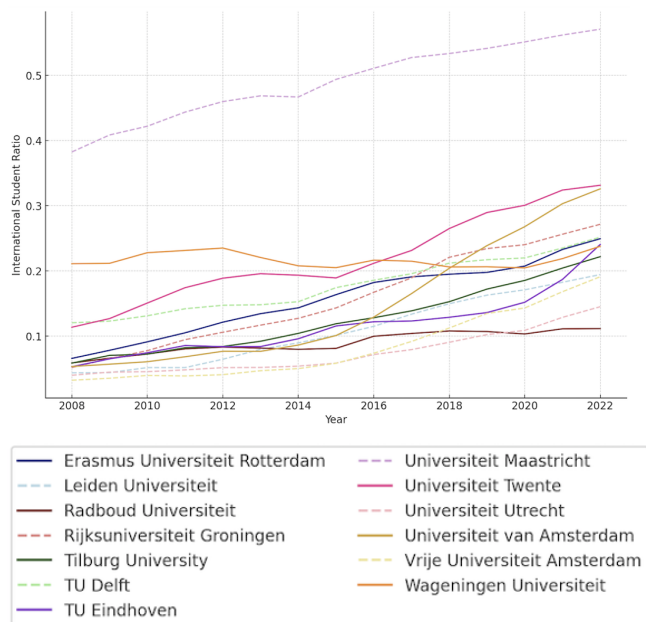


Figure 3.2: International Students Ratio over the Years for Each University (2008-2022)

The descriptive statistics and correlation analysis show that Dutch universities exhibit significant variations in their international student ratios, expenditure per student and number of faculty members. A higher percentage of international students appears to negatively impact the ranking score, while more promovendus-students, total number of students and faculty members actually have a positive impact. Despite these challenges, the number of international students has risen sharply. These trends suggest that while more international students can mean a lower ranking, universities pay little attention to this.

4. Methodology

To investigate the influence of international students on the quality of Dutch universities, both Ordinary Least Squares (OLS) and Fixed Effects (FE) models were utilized. These models were chosen to analyze the influence of the international student ratio, including the three different categories with the AWRU-ranking, taking into account the control variables. Additionally, to draw robust conclusions to check the unobserved heterogeneity between universities. In addition, it was decided to perform an empirical test.

4.1 Ordinary Least Squares (OLS) Regression

Ordinary Least Squares (OLS) is a widely used method because of its simplicity and efficiency in showing linear relationships between variables in an analysis. OLS-models estimate the relationship between the dependent variable (Ranking Score) and a set of independent variables by minimizing the sum of the squared deviations of the observed and estimated values. OLS-models are easy to interpret and communicate the impact of changes in the proportion of international students directly. In this study, four OLS regressions are performed.

4.2 Fixed Effect (FE) Regression

Fixed Effect (FE) regression leverages panel data, isolating the same units (the Dutch universities), and analyzes only the variance within these universities over time (the years 2008-2022). FE-models control for time-invariant variables that do not change over time, such as the location of a and the history of a university. As a result, only the variation within the variables over time, such as the percentage of international students, is analyzed. FE-models are advantageous because it ignores any bias due to potential observed heterogeneity between Dutch universities. All constant characteristics of a university that could influence the rankings but that are not explicitly included in the regression formulas are therefore controlled. In this study, four FE regressions are developed.

4.3 Differences OLS and FE Regression Models

Models 1 (OLS) and 5 (FE) examine the relationship between the proportion of international students and the ranking score without additional control variables. In models 2 (OLS) and 6 (FE), control variables such as expenditure per student, number of promovendus students, total number of students, and number of faculty members are added to consider other factors that influence the ranking score.

Models 3 (OLS) and 7 (FE) look at the same as models 1 (OLS) and 5 (FE) but instead of using the international student ratio, this ratio is divided into 3 different categories to represent international students: EEA- students, non-EEA European students and non-European students. These are also 3 ratios (percentages). Models 4 (OLS) and 8 (FE) are the most extensive regression formulas. The 3 different categories of international students are used with all control variables.

Table 4.1: Regression Models and Formulas for Analyzing the Impact of International Students on University Rankings

Model	Model description	Regression formula
1	OLS with International Student Ratio	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{International_Student_Ratio}_{it}) + \epsilon_{it}$
2	OLS with International Student Ratio and Control Variables	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{International Student Ratio}_{it}) + \beta_2(\text{Expenditure Per Student}_{it}) + \beta_3(\text{Number of Promovendus-students}_{it}) + \beta_4(\text{Number of Students}_{it}) + \beta_5(\text{Number of Faculty Members}_{it}) + \epsilon_{it}$
3	OLS with EEA, European (Non-EEA), Non-European Ratio's	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{EEA Ratio}_{it}) + \beta_2(\text{European, Non-EEA Ratio}_{it}) + \beta_3(\text{Non-European Ratio}_{it}) + \epsilon_{it}$
4	OLS with EEA, European (Non-EEA), Non-European Ratio's and Control Variables	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{EEA Ratio}_{it}) + \beta_2(\text{European, Non-EEA Ratio}_{it}) + \beta_3(\text{Non-European Ratio}_{it}) + \beta_4(\text{Expenditure Per Student}_{it}) + \beta_5(\text{Number of Promovendus-students}_{it}) + \beta_6(\text{Number of Students}_{it}) + \beta_7(\text{Number of Faculty Members}_{it}) + \epsilon_{it}$
5	FR with international student ratio	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{International Student Ratio}_{it}) + \mu_{it} + \epsilon_{it}$
6	FR with International Student Ratio and Control Variables	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{International Student Ratio}_{it}) + \beta_2(\text{Expenditure Per Student}_{it}) + \beta_3(\text{Number of Promovendus-students}_{it}) + \beta_4(\text{Number of Students}_{it}) + \beta_5(\text{Number of Faculty Members}_{it}) + \mu_{it} + \epsilon_{it}$
7	FR with EEA, European (Non-EEA), Non-European Ratio's	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{EEA Ratio}_{it}) + \beta_2(\text{European, Non-EEA Ratio}_{it}) + \beta_3(\text{Non-European Ratio}_{it}) + \mu_{it} + \epsilon_{it}$
8	FR with EEA, European (Non-EEA), Non-European ratio's and Control Variables	$\text{Ranking Score}_{it} = \beta_0 + \beta_1(\text{EEA Ratio}_{it}) + \beta_2(\text{European, Non-EEA Ratio}_{it}) + \beta_3(\text{Non-European}_{it}) + \beta_4(\text{Expenditure Per Student}_{it}) + \beta_5(\text{Number of Promovendus-students}_{it}) + \beta_6(\text{Number of Students}_{it}) + \beta_7(\text{Number of Faculty Members}_{it}) + \mu_{it} + \epsilon_{it}$

4.4 Empirical Test

For the 13 Dutch universities, the average values of all the variables for the period 2008-2022 have been calculated (Appendix Table A1). This table was then sorted based on the international student ratio from low to high. This empirical test will compare the six universities with the lowest international student ratio with the six universities with the highest international student ratio, , highlighting the

significant differences between these two groups. Erasmus University Rotterdam (EUR), which ranks 7th place, has not been included in either group, because this is exactly in the middle.

The six universities with the lowest international student ratio's: Utrecht University (UU), VU University Amsterdam (VU), Radboud University Nijmegen (RU), Leiden University (LU), Eindhoven University of Technology (TU/e), and University of Amsterdam (UvA).

The six universities with the highest international student ratio's: University of Maastricht (UM), University of Wageningen (WUR), University of Twente (UT), Delft University of Technology (TU Delft), Tilburg University (TiU), and University of Groningen (RUG).

5. Results

5.1 Ordinary Least Squares (OLS) regressions

Table 5.1: Ordinary Least Squares (OLS) regressions

Model	Dependent Variable:			
	Ranking Students			
	(1)	(2)	(3)	(4)
Constant	3,464687 *** (0,2141851)	10,01885 *** (0,650764)	3,058379 *** (0,240755)	10,56276 *** (0,5653266)
International Student Ratio	5,709756 *** (1,048015)	4,174833 *** (0,7833705)		
EEA Ratio			3,704455 *** (1,227855)	0,6168375 ** (0,8192802)
European (Non-EEA) Ratio			55,46396 * (28,07298)	147,2128 *** (19,28068)
Non-European Ratio			14,87802 *** (4,255625)	5,356797 (3,435818)
Expenditure Per Student		-0,0001324 *** (0,0000198)		-0,0001532 *** (0,0000181)
Number of Promovendus-students		0,0013684 * (0,0000768)		0,0009188 (0,0006159)
Number of Students		-0,0001912 *** (0,0000284)		-0,0002488 *** (0,0000253)
Number of Faculty Members		0,0000095 (0,00004886)		0,0007642 (0,0004281)
Observations	195	195	195	195
F-statistic	29,68*** df = (1,193)	48,47*** df = (5,189)	14,38*** df = (3,191)	57,80*** df = (7,187)

Note. Table 5.2 shows the four Fixed Effect (FE) regressions models, ***, ** and * present the statistical significance of the coefficients on significant levels of 1, 5 and 10 percent respectively.

When interpreting the results, it is important to note that a ranking score of 1 is the best and 7 is the worst. A positive coefficient of a variable has a negative effect on the ranking score, pushing it closer to 7 (the worst). Conversely, a negative coefficient positively affect the ranking score, bringing it closer to 1 (the best).

Model 1 shows that the International Student Ratio is significant and positive. An increase of 1 percentage point results in a deterioration of the ranking by 0.057 places, given the coefficient is 5.71. The average university has 17 percent international students between 2008 and 2022, implying a drop of approximately 1 place in the ranking. The minimum of this variable is 3% and the maximum is 57%, implying this variable can significantly impact the rankings.

Model 2 introduces the control variables. Notable, the variable Number of Faculty Members is not significant. Expenditure Per Student and Number of Students are significant with negative coefficients, which means they have a positive effect on the rankings score (closer to 1). The average of the variable Expenditure Per Student is 25,948 euros and the coefficient is 0.0001324, the average university improves by almost 3.5 ranking places. Similarly, the variable Number of Students will improve the ranking score by almost 4 ranking places. Number of promovendus-students has a positive coefficient which has a negative effect on the ranking score (closer to ranking score 7). The average university with 719 promovendus-students will drop nearly 1 place in the ranking score.

Model 3 introduces the three categories of the International Student Ratio: EEA Ratio, European (Non-EEA) Ratio and Non-European Ratio. All three have positive coefficients, consistent with the International Student Ratio. It seems like all three have a detrimental effect, their impact is less pronounced when considering the average values. The EEA Ratio, the average university with approximately 12% EEA students will decline by almost half a ranking score. For the European (Non-EEA) Ratio, with an average of 6%, the ranking score will deteriorate by one-third ranking-score, and for the Non-European Ratio, with an average of 4%, the ranking score will deteriorate by 0.6.

Model 4 includes the three categories and the control variables. Here, only the Non-European Ratio does not remain significant. The European (Non-EEA) Ratio is also assigned a much higher coefficient. This could be because the EEA Ratio has become less significant and also has a small coefficient and because Non-European Ratio is no longer significant. In addition, the variable Number of Promovendus-students is no longer significant in this model.

Reflecting on these OLS results, it is noteworthy that International Student Ratio consistently has a significant and negative effect on the ranking score across all four models. The three categories are consistent with this. It is striking that in model 4 only the European (Non-EEA) Ratio is significant, indicating that this category has a more pronounced effect on university rankings compared to other categories.

5.2 Fixed Effect (FE) Regressions

Table 5.2: Fixed Effect (FE) regressions

Model	Dependent Variable:			
	Ranking Students			
	(5)	(6)	(7)	(8)
International Student Ratio	3,65814 *** (0,90778)	3,781362 ** (1,59224)		
EEA Ratio			12,38093 *** (2,361677)	8,774263 ** (2,93773)
European (Non EEA) Ratio			79,46226 *** (20,11132)	47,54791 * (20,09756)
Non European Ratio			3,094358 (5,269722)	7,089395 (5,05364)
Expenditure Per Student		-0,0001252 *** (0,0000209)		-0,0001116 *** (0,0000219)
Number of Promovendus-students		-0,0009131 (0,0005833)		-0,0008279 (0,0005703)
Number of Students		-0,0001176 *** (0,0000389)		-0,0001134 *** (0,0000402)
Number of Faculty Members		0,0019912 *** (0,0004686)		0,0017702 *** (0,000463)
Observations	195	195	195	195
F-statistic	16,24*** df = (1,181)	13,00*** df = (5,177)	13,38*** df = (3,179)	31,75*** df = (12,175)

Note. Table 5.2 shows the four Fixed Effect (FE) regressions models, ***, ** and * present the statistical significance of the coefficients on significant levels of 1, 5 and 10 percent respectively.

Model 5 presents the first fixed effect regression. International Student Ratio has a significant positive effect on the ranking score. According to the fixed effect regressions, which control for unobserved heterogeneity and endogeneity, the effect of the International Student Ratio is smaller than in Model 1 of the OLS regression. An increase of 1 percentage point in the International Students Ratio leads to a deterioration in the ranking by approximately 0.0366 places. The maximum percentage of international students at a Dutch university between 2008-2022 was 57%. Based on this model, the ranking position of this university would deteriorate by approximately 2 places.

Model 6 adds the control variables. It is noticeable that the variable Number of Promovendus-students is no longer significant in the fixed effect regression. The Number of Faculty Members is significant and has a negative effect on the ranking score. The average university between 2008-2022 had 1606 faculty members, which would decrease this average university's ranking by more than 3 ranking places. The variables Expenditure Per Student and Number of Students both continue to have a positive effect on the ranking score, consistent with the OLS regressions.

Model 7 introduces the three categories of the International Student Ratio. All three have positive coefficients, consistent with the International Student Ratio. As in the 4th OLS model, Non-European Ratio is not significant. This could be, because on average only 4% of students in the Netherlands had this background between the period 2008 and 2022, potentially making it insignificant for the ranking score.

Model 8 is the most comprehensive regression and shows no major changes compared to model 7. The variables Expenditure Per Student and Number of Students both have a positive impact on the ranking score. The Number of Faculty Members has a negative effect on the ranking score and Number of Promovendus-students has no effect on the ranking score according to the fixed effect regression.

5.3 Empirical Test

Table 5.3: Summary statistics for the top six and bottom six universities based on their International Student Ratio.

Category	Ranking Score	International Student Ratio	Expenditure Per Student	Number of Promovendus-students	Number of Students	Number of Faculty Members
Lowest 6	3,75	0,10	25438	783	24317	1859
Highest 6	5,45	0,24	26828	718	16913	1434

The summary statistics for the top six and bottom six universities based on their International Student Ratio have been collected. The six universities with the lowest International Student Ratio

('Lowest 6') had an average of approximately 10% international students in the period 2008-2022. The ranking score averaged 3.75. This is significantly better compared to the six universities with the highest International Student Ratio ('Highest 6'), which had an average of 24% international students and a ranking score of 5.45. This suggests that Dutch universities with a lower International Student Ratio have achieved a higher ranking score on average in the period 2008-2022.

This difference could be due to the differences in the characteristics. The 'Lowest 6' spend an average of 1,390 euros less per student per year. Additionally, the 'Lowest 6' have, on average, 65 promovendus-students more. The most noticeable differences are in the average number of students and faculty members. The 'Lowest 6' have significantly more students (24,317) and faculty members (1,859) compared to the 'Highest 6', which have an average of 16,913 students and 1,434 faculty members.

These significant differences in the observable characteristics based on the proportion of international students are significant. The findings show that universities with a lower international student ratio have more students and faculty members and fewer promovendus-students. Most strikingly, the 'lowest 6' have scored an average of 1.7 places better in the ranking score.

5.4 Summary of the different results

The three different methods consistently show a negative relationship between the International Student Ratio and the rankings of Dutch universities. Universities with a lower proportion of international students generally perform better in the AWRU-rankings. Each category of the International Student Ratio (EEA Ratio, European (Non-EEA) Ratio, and Non-European Ratio) also have a negative effect on the ranking, aligning with the overall International Student Ratio findings. Non-European Ratio, however, is not significant in many of the OLS and FE models, likely due to its relatively small proportion (4%) among Dutch students. Additionally, universities with higher rankings have on average more students and faculty members, often indicating they are larger institutions. These findings highlight the importance of balancing internationalization with maintaining adequate resources to enhance the quality of Dutch universities and its AWRU-rankings.

6. Limitations

This research has several limitations that influence the results and validity of the research. Firstly, the sample size is small with only 13 Dutch universities included in the period of 2008-2022. During this period, Utrecht University has consistently remained the best Dutch university according to the AWRU-ranking (Appendix Figure A4) and the rankings of other universities have not changed frequently. As a result, each of the 13 universities has a disproportionately impact on the outcomes. For example, Utrecht University always had a low percentage of international students, which significantly influences the perceived impact of international students on the ranking.

A second limitation is the use of the Fixed Effect (FE) models. While these models are certainly effective in controlling time-invariant variables, the model cannot fully account for the time-variable factors such as student mobility and global trends. Although the AWRU-ranking is recognized as a globally appreciated ranking, it primarily relies on research output. This certainly provides a significant measure of the quality of the universities but does not capture everything. Factors such as student experience, teaching methods and social impact are not included.

Additionally, this research does not take external factors into account that international students have to deal with such as housing and integration. Issues with housing can influence the performance and well-being of international students, which can indirectly influence the quality of the university. By not accounting for these external factors, an important aspect of the student experience is overlooked. In addition, the control variables used are limited, which means the impact of international students could be either overestimated or underestimated results table.

A final limitation is that this study focuses solely on Dutch universities. Each country is different and the findings may not be generalized to other countries or time periods with various demographic, economic and academic conditions.

In conclusion, while this study provides valuable insights into the influence of international students on the quality of Dutch universities, there are many reasons why the results might not completely capture the complexities of this relationship. Future research could improve upon this by using a wider range of data, varying methods in the methods, and more comprehensive variables to provide a more complete picture of this complex issue.

7. Conclusion

This upward trend demonstrates a growing influx of international students over time. The relationship compared to the total number of Dutch students has also continued to increase from 2008 to 2022 (Figure 1.2), indicating a rising proportion of international students within the overall student body. In the academy year 2022/23, international students have never taken such a constituted part of the total student population of Dutch universities, namely 24 percent (Universiteiten van Nederland, 2023a).

This research provides valuable insights into the influence of international students on the quality of Dutch universities, measured based on their positions in the Academic Ranking of World Universities (ARWU). The research, conducted across 13 Dutch universities over the period 2008 to 2022, used Ordinary Least Squares (OLS) and Fixed Effects (FE) regression models along with an empirical study. A higher percentage of international students causes a deterioration in the ARWU-ranking, as shown by all three methods used. Tcorrelation table reveals that international students negatively impact the ranking score of the universities, suggesting that international students have a negative impact on the quality of Dutch universities.

The influence of international students varies depending on their origin. The analysis distinguishes three categories: EEA Ratio, European (Non-EEA) Ratio, and Non-European Ratio. All three categories negatively affect the ranking scores, but the impact of Non-European Ratio did not appear to be significant. On average only 4% of the students population in the Netherlands had this background between the period 2008 and 2022, potentially making it insignificant for the ranking score.

Control variables, acting as proxies for the factors in the ARWU-ranking, such as expenditure per student and total number of students, are significant and have a positively affect on the ranking score. Number of promovendus-students did not appear to have a significant effect in many tests. Number of faculty members appeared to have a negative effect on the ARWU-ranking according to the OLS and FE models. Despite the negative effect of the percentage of international students on the ARWU-ranking, it is crucial to also consider the benefits they bring, such as cultural diversity and financial contributions. The study suggests that policymakers should balance these benefits against the potential drawbacks.

This research has several limitations that influence the results and validity of the findings. Firstly, the sample size is small with only 13 Dutch universities included in the period of 2008-2022. As a result, each of the 13 universities has a disproportionately impact on the outcomes. Moreover, The control variables used are limited, meaning the impact of international students could be either overestimated

or underestimated. There is a lot of heterogeneity within universities in terms of the quality of education and the presence of international students, for example between faculties, research groups and study programs. Future research and policy should consider this heterogeneity to develop more targeted and effective measures.

In conclusion, this study shows that although the presence (The absolute and relative number of international students per Dutch university increased from 2008 to 2022) of international students can have a negative influence on the quality of Dutch universities, there are also other factors that influence the quality and performance of these institutions. The research highlights the need for future studies to use a more comprehensive approach. Recording a wider range of data, varying methodologies and additional control variables will offer a more complete understanding of this complex matter. Therefore, this study serves an indication but not a complete assessment. Future policy should focus on mitigating the disadvantages of internationalization to enhance the overall quality of Dutch universities while maximizing the benefits.

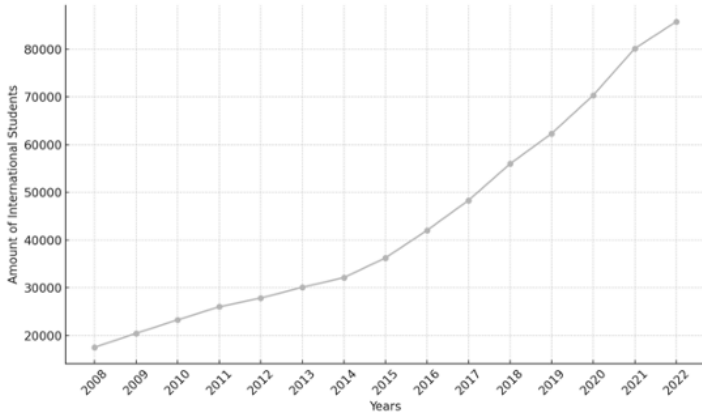
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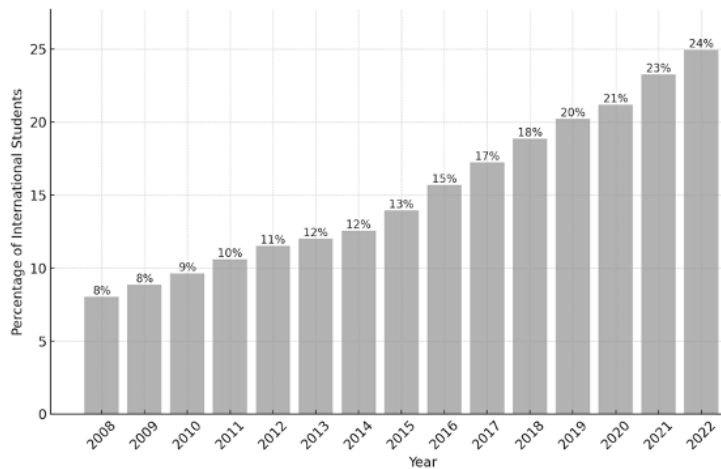
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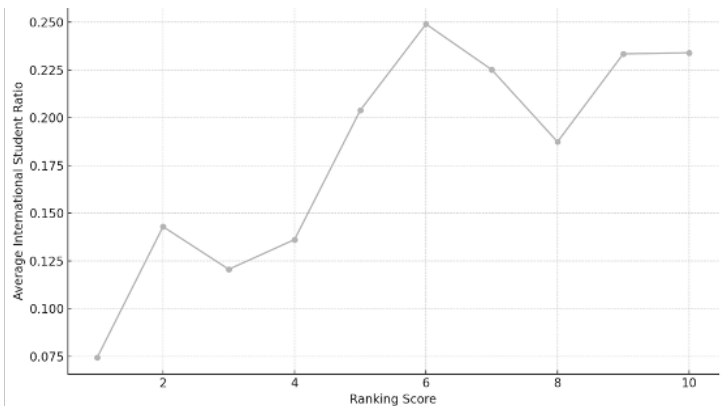
Appendix



Appendix Figure A1: Total International Students Over the Years at Dutch Universities (2008-2023)



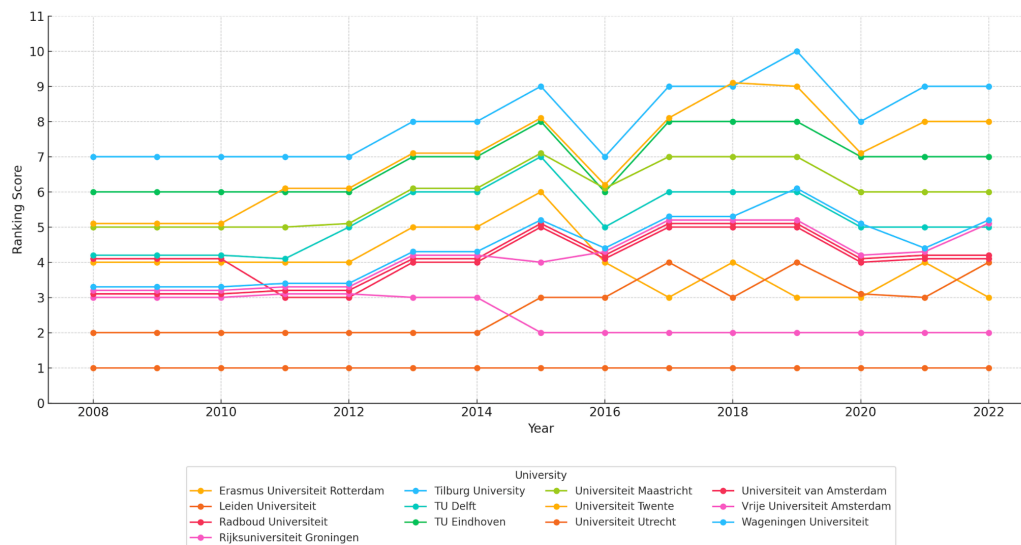
Appendix Figure A2: Percentage of International Students Relative to Total Students at Dutch Universities (2008-2023)



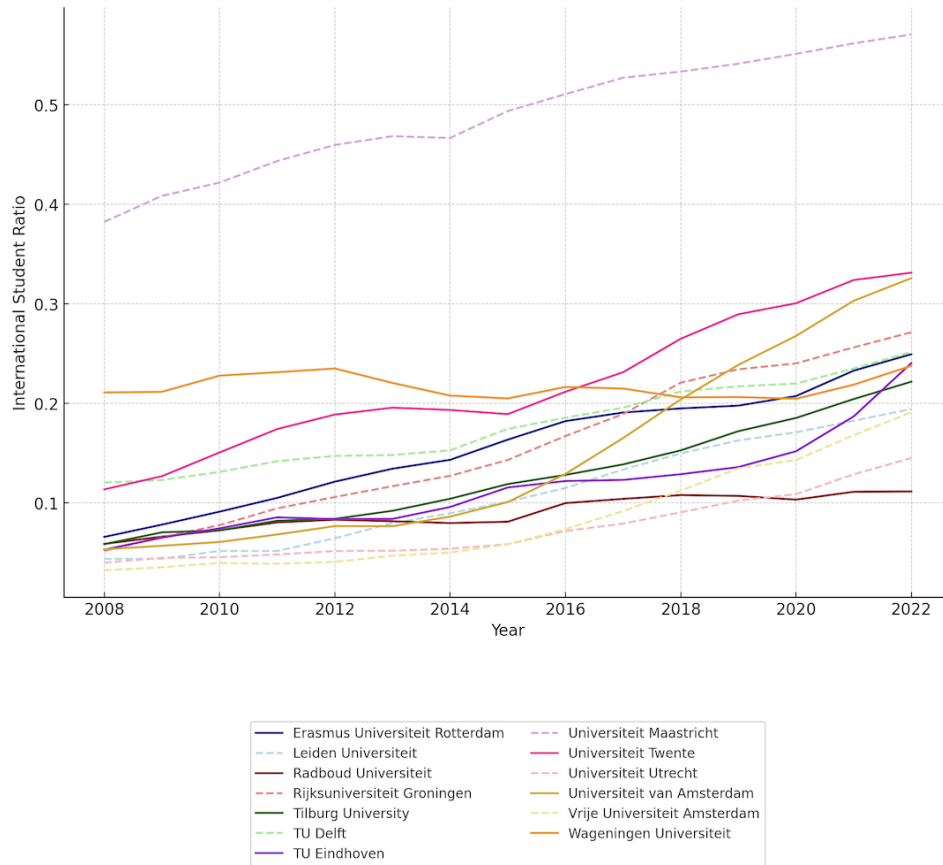
Appendix Figure A3: Average International Student Ratio for Dutch Universities by Ranking Position (2008-2022)

Appendix Table A1: Mean (2008-2022) of the Variables per University

University	Ranking Score	International Student Ratio	Expenditure Per Student	Number of Promovendus -students	Number of Students	Number of Faculty Members
UU	1	0,07	25.897	950	31747	2.631
VU	3,9	0,08	20.077	656	25068	1.703
RU Nijmegen	4,1	0,09	27.389	606	20186	1.475
LU	2,7	0,11	23.123	771	25421	1.737
TU/e	6,9	0,12	35.242	911	9962	1.176
UvA	3,9	0,15	20.901	803	33516	2.433
EUR	4	0,16	23.729	349	24512	1.120
RUG	2,5	0,16	21.892	715	29383	1.809
TiU	8,1	0,16	14.684	300	14746	863
TU Delft	5,2	0,18	30.156	1180	21328	2.145
UT	6,9	0,22	33.243	663	10021	1.150
WUR	4,1	0,22	36.395	694	9616	1.078
UM	5,9	0,49	24.599	754	16385	1.561



Appendix Figure A4: Ranking Score over the Years for Each University (2008-2022)



Appendix Figure A5: International Students Ratio over the Years for Each University (2008-2022)