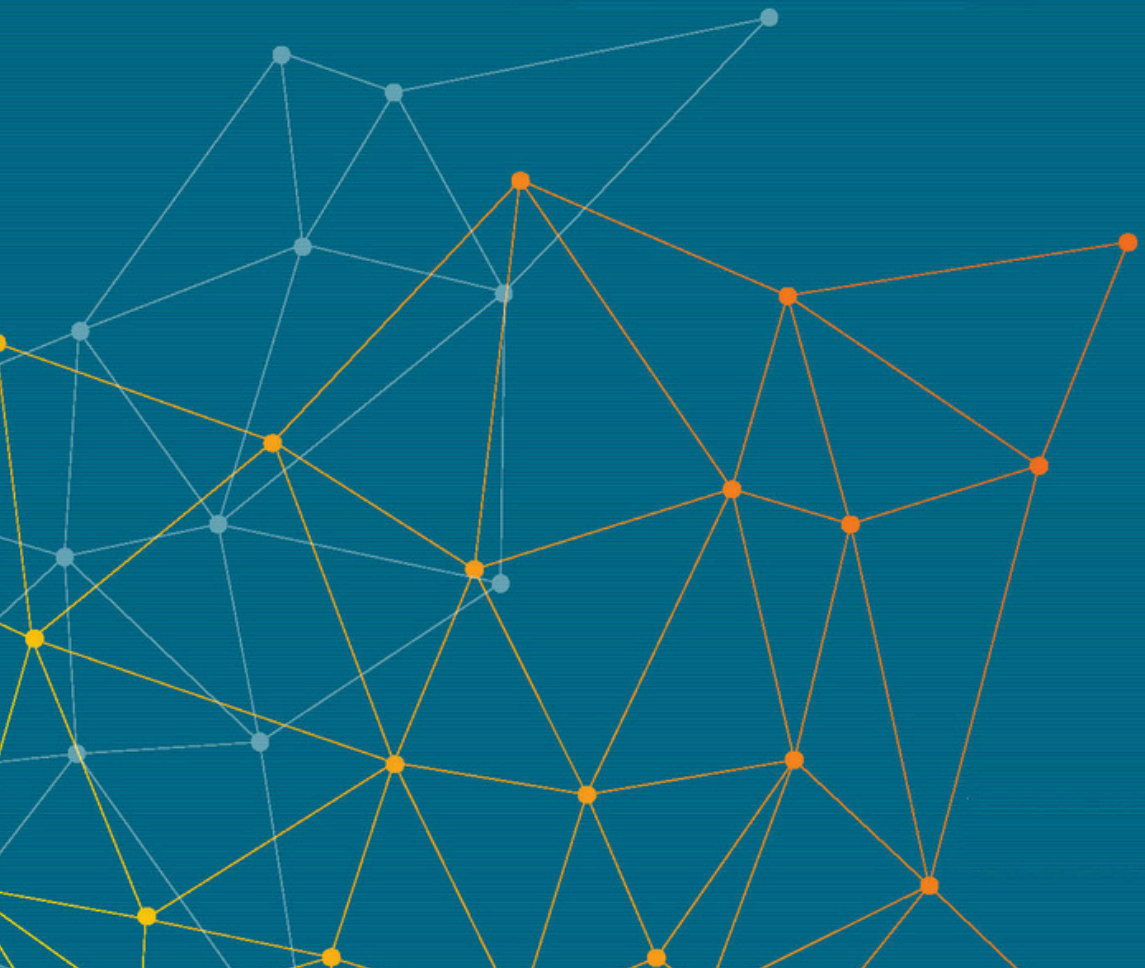
INFORMATICS EUROPE

BACHELOR-LEVEL INFORMATICS EDUCATION IN EUROPE

Key Data & Trends, 2018/19–2022/23



Bachelor-Level Informatics Education in Europe:

Key Data & Trends, 2018/19–2022/23

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September 2025

DOI: 10.5281/zenodo.17136493

Published by:

Informatics Europe

Binzmühlestrasse 14/54

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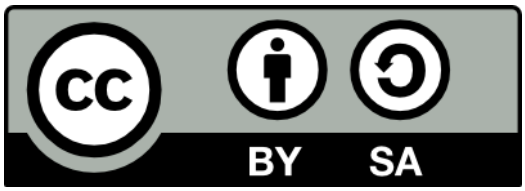

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Executive Summary

This report provides Key Data on Informatics Higher Education in Europe. It offers a comprehensive overview of trends in Bachelor's level Informatics education across 24 European countries, covering 5 academic years from 2018/19 to 2022/23. The analysis focuses on student enrolment — both first-year and total enrolment across all semesters — as well as degrees awarded, with a detailed look at gender distribution and the role of different types of higher education institutions.

The data comes mainly from official national statistics and has been validated by national experts. It is available in the Informatics Europe Higher Education (IEHE) Data Portal: https://www.informatics-europe.org/data-portal. This report includes only countries with verified, high-quality data. Being a valuable resource for educators, policymakers, and industry stakeholders seeking to understand the state and evolution of Informatics education in Europe, the report highlights positive trends in enrolment and graduation, while also drawing attention to persistent gender disparities and the varying roles of different higher education institution types.

Key Findings:

- ***Rising Enrolment Trends:*** Most countries experienced an increase in enrolments in Bachelor's Informatics programmes over the past five years, reflecting growing interest in the field.
- ***Role of Universities of Applied Sciences (UAS):*** Although UAS are not present in all countries, they play a significant role in Informatics education where they exist, especially at the Bachelor's level. In countries like Finland, Germany, Ireland, the Netherlands, and Switzerland, UAS often surpass traditional Research Universities (RUs) in first-year enrolments and make a substantial contribution to the total number of degrees awarded.
- ***Gender Imbalance Persists:*** Across all countries, women remain underrepresented in Informatics, with participation rarely exceeding 35%. Sweden shows the highest female student share, while Belgium (RUs) has the lowest. However, most countries are seeing an increasing trend in female enrolment, reflecting the positive impact of gender balance initiatives.
- ***Degrees Awarded and Gender Trends*****:** Most countries report an increase in Bachelor's degrees overall, but only half record a rising share awarded to women. In the others, the female share has stagnated or declined.

The findings highlight the ongoing need for data collection, gender equity efforts, and policy support to strengthen Informatics education across Europe. Building on this, Informatics Europe will continue its data collection initiatives, with plans to publish next year's report including the trends at the Master's and PhD levels. To support these efforts, the Informatics Europe Working Group on Data Analysis & Reporting (https://www.informatics-europe.org/education/higher-education-data.html) warmly welcomes new members who wish to contribute by adding or refining their country's data, assisting with report writing, or producing additional reports.

1. Introduction

The quality of higher education in Informatics[1] is critical to the future of Europe. Safeguarding and improving this quality is of paramount concern to the Informatics community; it is part of the mandate of Informatics Europe, as the representative of the European Informatics academic and research community, to help achieve this goal.

Any coherent attempt at improvement must begin with a clear understanding of the current situation, supported by credible qualitative and quantitative data[2]. Until the publication of the first Informatics Europe Key Data report in 2013, reliable sources of raw facts and figures about higher education in Informatics at a Europe-wide level were essentially unavailable. Some national repositories of data exist, but they do not readily give a general European perspective: they can be hard to find; they are at different levels of advancement, some detailed, others partial; they do not necessarily measure exactly the same things, sometimes with subtle differences; they are based on different methodologies; and, naturally enough in light of Europe's diversity, they use different languages.

Key Data on Informatics Higher Education in Europe report series published by Informatics Europe between 2013 and 2019 (with data from 2008 to 2018)[3] were aimed at filling this gap and brought forward solid, accurate facts and figures about Informatics research and education in Europe. As a further step, in 2019 Informatics Europe in collaboration with the Software Institute, Università della Swizzera Italiana (USI), launched the Informatics Europe Higher Education (IEHE) Data Portal (https://www.informatics-europe.org/data-portal) offering facilities for exploring the state of Informatics higher education in Europe with a wide range of indexing options (for example, by country, educational level, year) as well as making available data more accessible using data visualization tools.

The current report continues the ongoing effort to provide the European Informatics community with reliable insights into the state of higher education in the field. It complements the data available in the Data Portal, provides a concise analytical output focusing on a particular aspect of the data, and gives a brief demonstration of the types of visualisations and analyses that can be generated using the Data Portal, highlighting its relevance for academics, policymakers, industry professionals, and other stakeholders.

This 2025 edition focuses on the Bachelor's level of Informatics studies, presenting key trends and visualizations related to student enrolment (in first-year and all semesters) and degrees awarded — including gender distribution — across 24 countries, covering the 5-year window of academic years from 2018/19 to 2022/23 (the last year for which complete data is available at the time of writing this report).

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[1] In line with the ACM and IEEE-CS Computing Curricula 2020 (https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2020.pdf), the word "informatics" in this report refers to the overarching academic discipline encompassing computer science, software engineering, information systems, data science, cybersecurity, and to some degree also ICT and computer (hardware) engineering. The full list of the subject names that were used to identify Informatics programs in the countries included in this report can be found on the "Subjects" section of the Data Portal (https://www.informatics-europe.org/data-portal/?page=subjects/index.html).

[2] Here and in the rest of this report we follow the practice of using "data" as a singular noun.

[3] Full series of Key Data reports are available for Informatics Europe members on the IE Reports webpage: https://www.informatics-europe.org/services/publications/reports.html

Follow-up reports, scheduled for the upcoming years, will cover other levels of Informatics higher education in Europe, as well as additional aspects of the HE system. We also hope to continue expanding the country scope in the following years, with the rule that countries can only be included under the condition that precise, verified data is available. We welcome contributors willing to work on providing such data as well as subsequent analyses.

2. Methodology and Sources of Data

The source of the statistics for the countries included in this report can be found on the Data Portal section "Data Sources": https://www.informatics-europe.org/data-portal/?page=data-sources.html. The dataset, curated by Informatics Europe, is unique in providing detailed data on informatics higher education, including the dimensions of gender, stage (entry/enrolled/graduate) and level (Bachelor/Master/Doctoral) of study, and institution kind. At present, it covers informatics higher education data for 24 European countries (covering approximately. 80 % of the continent's population[4], omitting those for which reliable data have so far been unavailable) and 13 academic years from 2010/2011 to 2022/2023 (the last year for which complete data could be obtained for most countries).

While official sources such as national statistics offices, educational agencies or ministries, as well as the Eurostat, provide aggregate data similar to ours, detailed split by dimensions important for informatics HE education stakeholders is generally not available within these sources. Moreover, the methodologies for data collection, analysis and reporting (documented on the websites of the organisations) used by these sources vary. Finally, most often, the country-level data is provided in the national or regional languages(s).

The definition of the Informatics field also varies from country to country. Some national statistics offices use the International Standard Classification of Education (ISCED-F) to structure the fields of HE (i.e. Bulgaria, Finland, Ireland, Lithuania, Poland, Romania, Spain), in some countries a specific classification scheme is used (i.e. Belgium, Denmark, Germany, France, Sweden, UK), and in the third set of countries data is available per study programme, and no official nomenclature is used (i.e. Austria, Czech Republic, Estonia, Italy, Latvia, the Netherlands, Norway, Portugal, Switzerland, Turkey, etc.). In the last case, we relied on expert classification of the data before including them in the dataset. Even for the countries which do use ISCED-F, assignment of individual study programmes to the appropriate class may be done by different methodologies in different countries.

These aspects require us to carefully review the information available from each of these sources, to validate if, and to what degree, we can align the student and degree numbers between individual countries. Our process, therefore, includes the involvement of national experts to help with translations as well as to deal with the different definitions and particularities of the Informatics field in each country.

[4] Counting all European continental countries except Russia.

Building on our dataset, this report includes statistics not only on traditional "Research Universities" (abbreviated as RUs) but also from "Universities of Applied Sciences" (abbreviated as UAS). With respect to the latter:

1. These institutions are known by different names in different countries: *Fachhochschulen* (Austria, Germany and Switzerland), *Hautes Écoles* (Belgium and Swiss French community), *Hogescholen* (Belgium Flemish community and the Netherlands), *Högskolor* (Sweden), *Колежи* (Bulgaria), *Rakenduskõrgkoolid* (Estonia), *Ammattikorkeakoulujen* (Finland), *Professionshøjskolerne* (Denmark), *Institutes of Technology* (Ireland), *Kolegija* (Lithuania), *Høyskoler* (Norway), *Politécnico* (Portugal).
2. They have a common profile, in that they do offer profession- (or vocation-) oriented higher education studies. In a few countries, UAS offer degrees only at the Bachelor's level, but in most, studies at Bachelor's and Master's levels. In Estonia, most Universities of Applied Sciences are part of Research Universities and have common professors and teaching staff. It is important to note that in the UK, "polytechnics", formerly the equivalent of Universities of Applied Sciences, no longer exist as a separate category, having, as a result of the Further and Higher Education Act 1992, been either turned into universities or incorporated into existing ones.

This report has chosen precision and exactness over generality as much as the data makes this possible. We have limited ourselves to countries and parameters for which reliable official data was available, and have high confidence in the quality of the results presented here, yet are also aware of the inherent difficulties entailed in creating the dataset.

We therefore ask the reader to be careful when reading the reported observations, especially if some results do not immediately seem correct or believable. Please remember the following:

- Do not jump to conclusions after observing the graphs or reading the results without consulting the footnotes on the "Statistics" pages of the Data Portal.
- Student and degree numbers' comparisons must take into account the differing definitions of the field of informatics and of the types of universities, in particular the notion of "University of Applied Sciences" as it exists in the countries mentioned above.
- All numerical information comes from official governmental sources or from public data carefully vetted by senior members of the Informatics Europe academic community in the respective countries. In some cases, colleagues told us that they had doubts about some of the resulting figures. Our view has been that, whatever their possible limitations, we are better off trusting government statistical offices than relying on private sources.
- Europe's diversity and the richness of national education systems are part of Europe's strengths, but they also complicate the cross-country analysis. The Data Portal section "Higher Education Systems"[5] provides some background on the specifics of higher education among the countries presented in this report.

Genuine errors may, of course, have crept in, and we will be grateful to receive corrections.

[5] https://www.informatics-europe.org/data-portal/?page=higher-education-systems/index.html

3. Bachelor's Level Student Statistics

This section presents data on student enrolment in Informatics Bachelor's programmes: first-year enrolments (Section 3.1), total enrolments across all semesters (Section 3.2), and the number of Bachelor's degrees awarded (Section 3.3). It covers 24 European countries and a 5-year window of the academic years 2018/2019 — 2022/2023. To enable a fair comparison across countries with different population sizes, the numbers have been normalised by calculating the number of students/degrees awarded per 1,000,000 inhabitants for each year. In addition to the overall numbers, the data also includes gender distribution, highlighting trends in female participation and graduation. The key trends observed can be found in Section 4. Findings and Observations.

The definitions of Bachelor's programmes are explained in the footnotes on the "Statistics" pages of the Data Portal using the URL links with QR codes provided below.

Notes on the graphs:

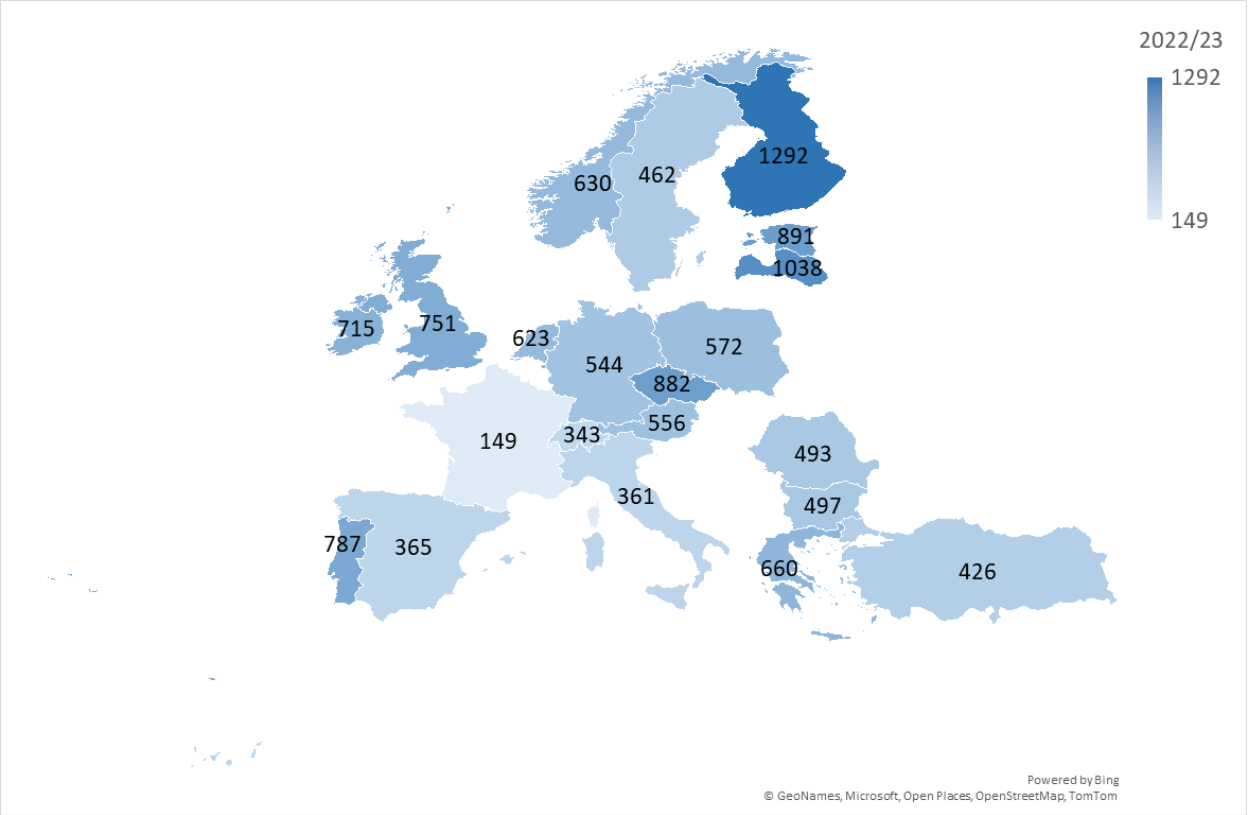
- where a data point is missing in the graph(s) for a country, it is due to the unavailability of data from official sources: e.g. most recent data points for Belgium (RU&UAS), France (RU), first-year enrolments for Lithuania (RU&UAS), and all data for Denmark (UAS);
- for Sweden and Poland, the figures include both RUs and UAS, as separate data for each type was not available from official sources.

3.1 First-year students

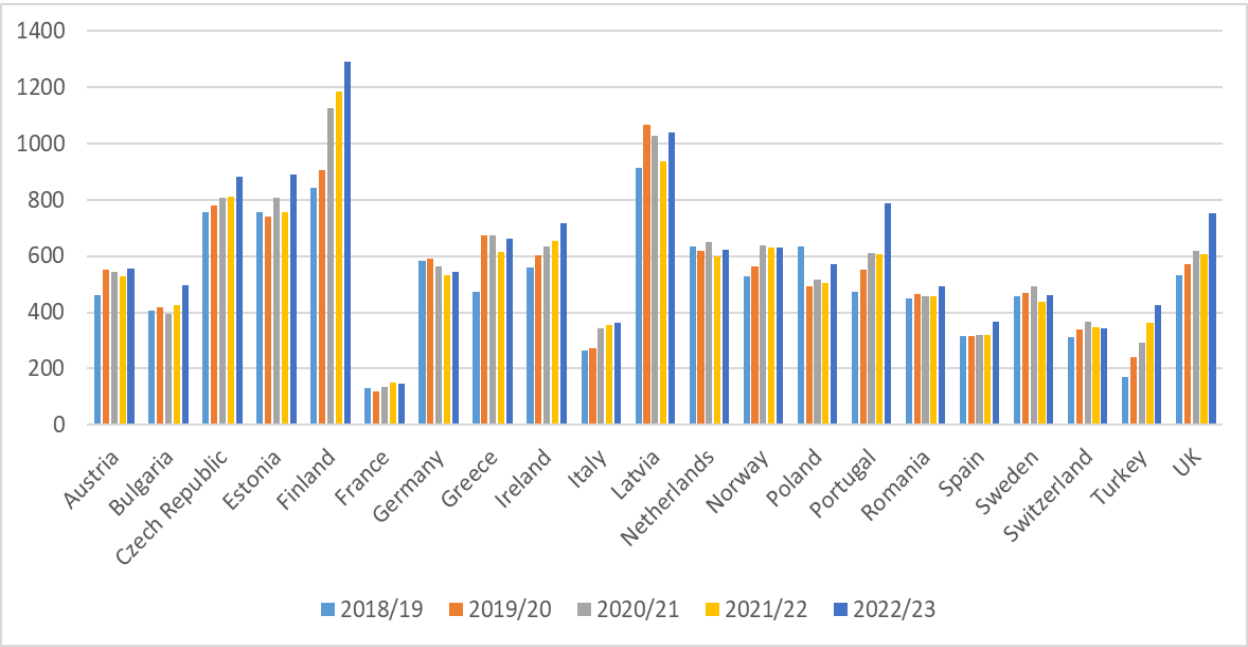
The general enrolment trends are illustrated in Graphs 1.1–1.6, followed by the female share of first-year Bachelor's students shown in Graphs 1.7–1.9.

The exact numbers of first-year Bachelor's students for all years starting from 2010/11, along with definitions used, enhanced data visualisations and explanations of changes in national trends, can be found on the Informatics Europe Higher Education Data Portal under the following links, or by scanning the QR codes below.		
Absolute number of students	***Ratio per 1,000,000 inhabitants***	***Female percentage***
https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_first_year_total.html	https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_first_year_ratio.html	https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_first_year_percentage.html

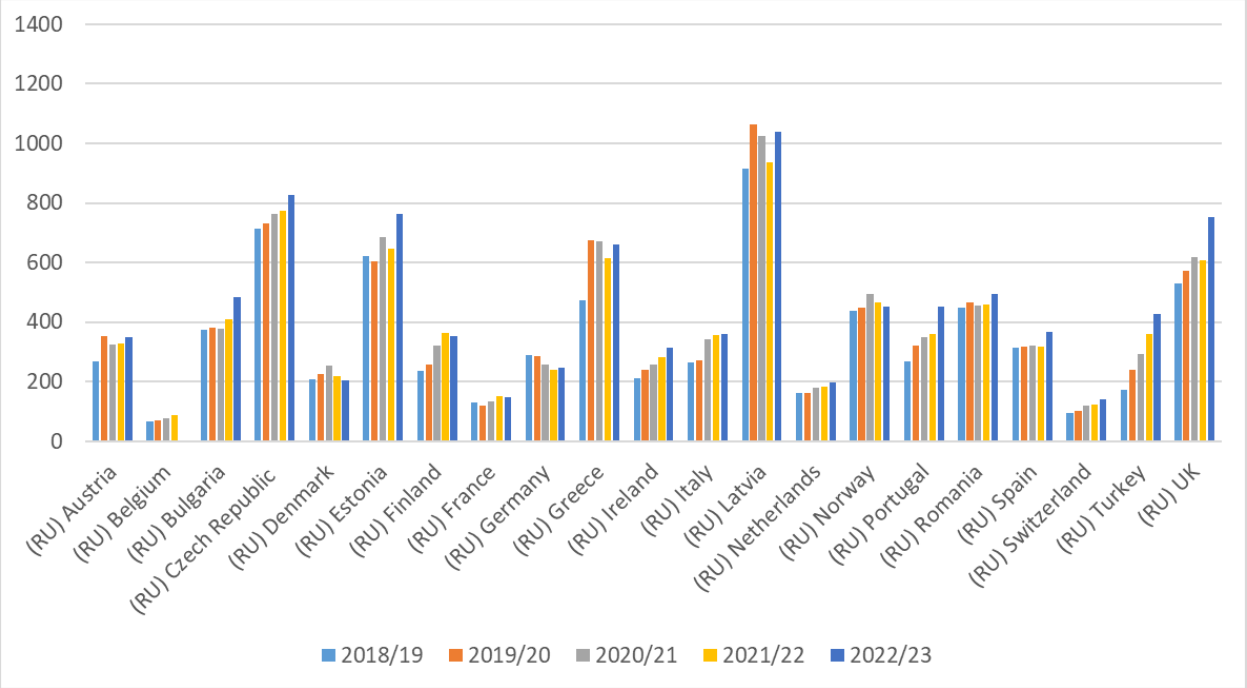
Graph 1.1 – Students in Informatics Bachelor's programmes (first-year) per 1,000,000 inhabitants at RU plus UAS in 2022/23



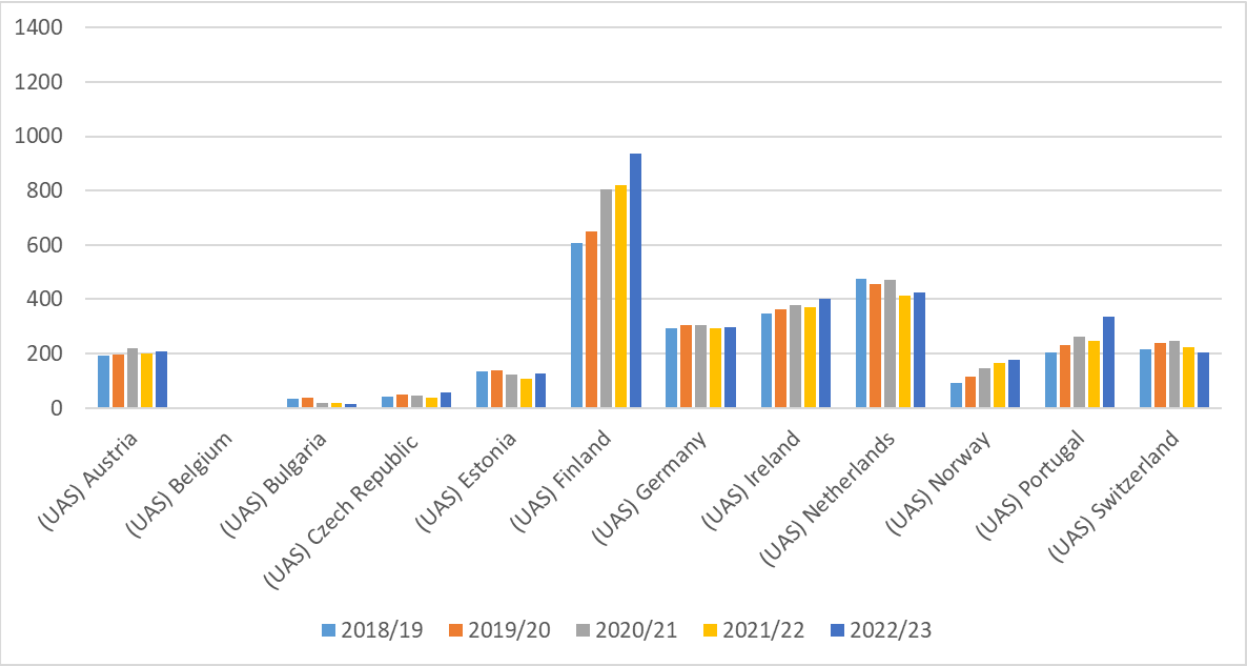
Graph 1.2 – Students in Informatics Bachelor's programmes (first-year) per 1,000,000 inhabitants at RU plus UAS – 5-year trend



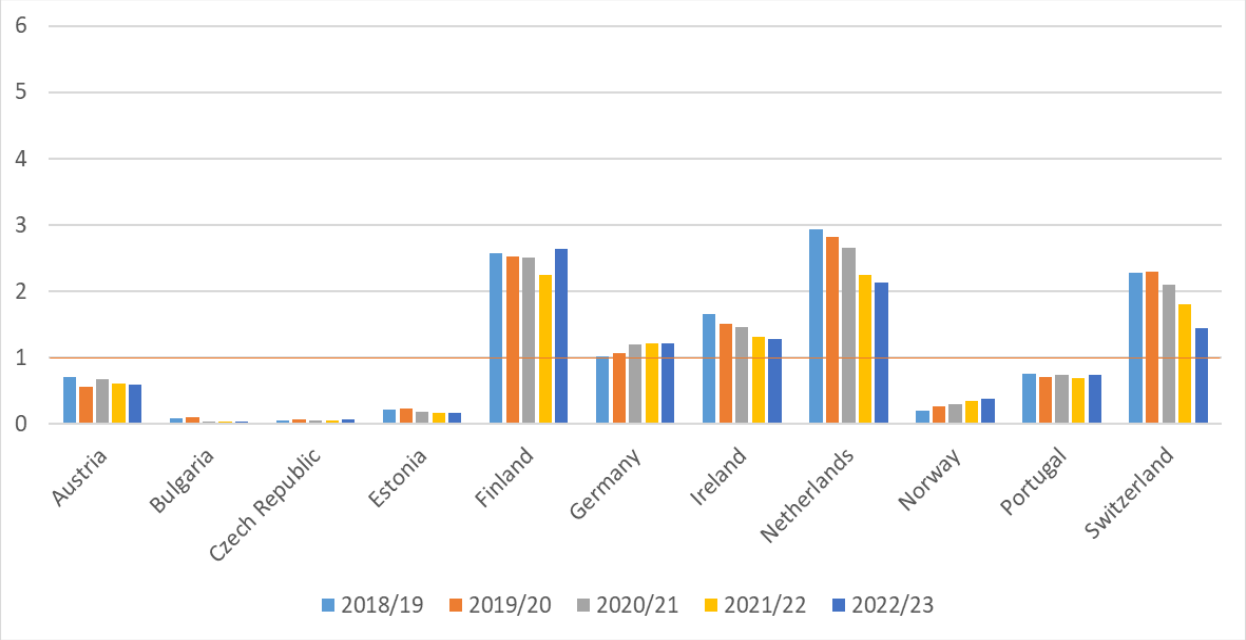
Graph 1.3 – Students in Informatics Bachelor's programmes (first-year) per 1,000,000 inhabitants at RU – 5-year trend



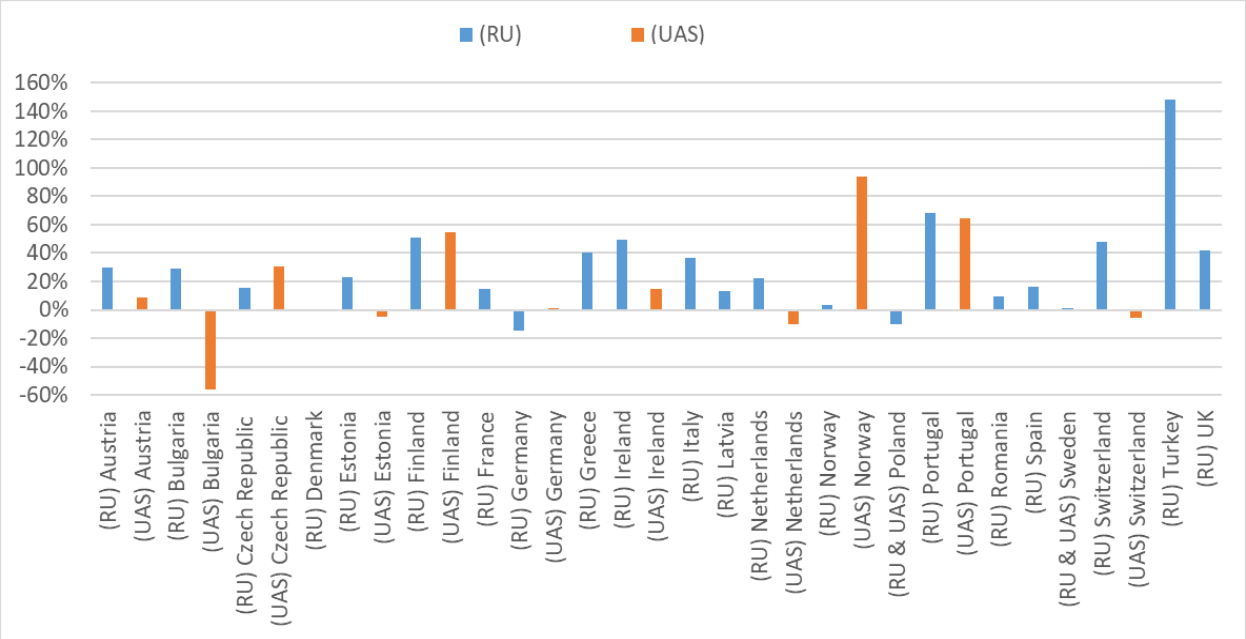
Graph 1.4 – Students in Informatics Bachelor's programmes (first-year) per 1,000,000 inhabitants at UAS – 5-year trend



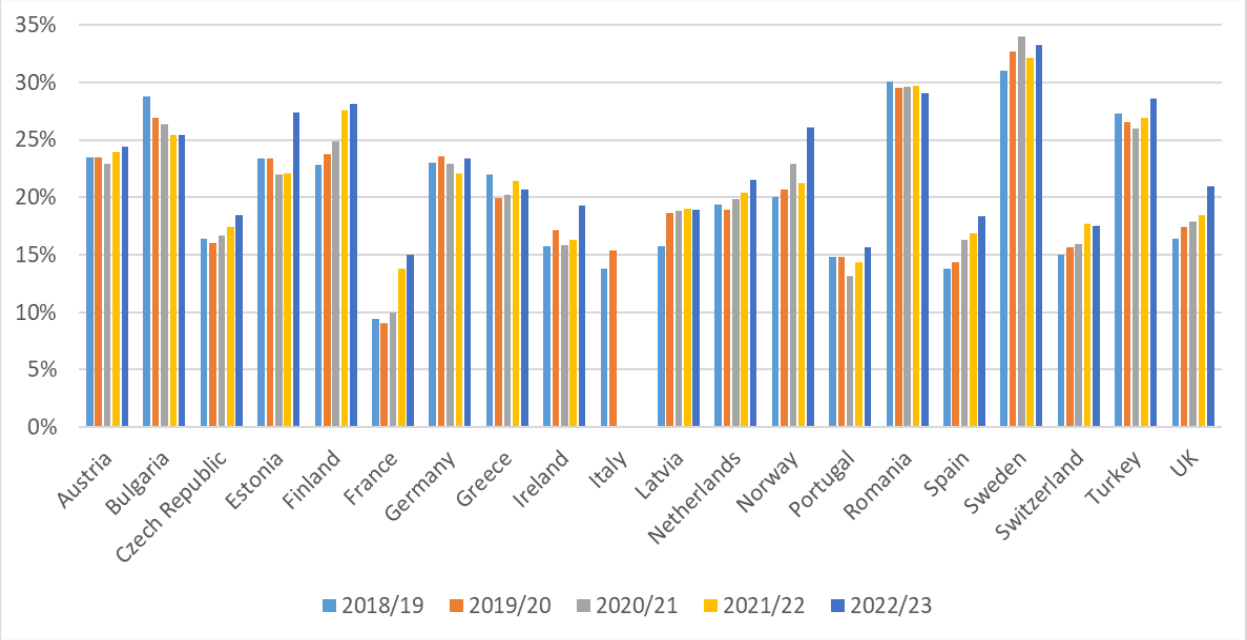
Graph 1.5 – Ratio between the number of students in Informatics Bachelor's Programmes (first-year) at UAS vs RU – 5-year trend



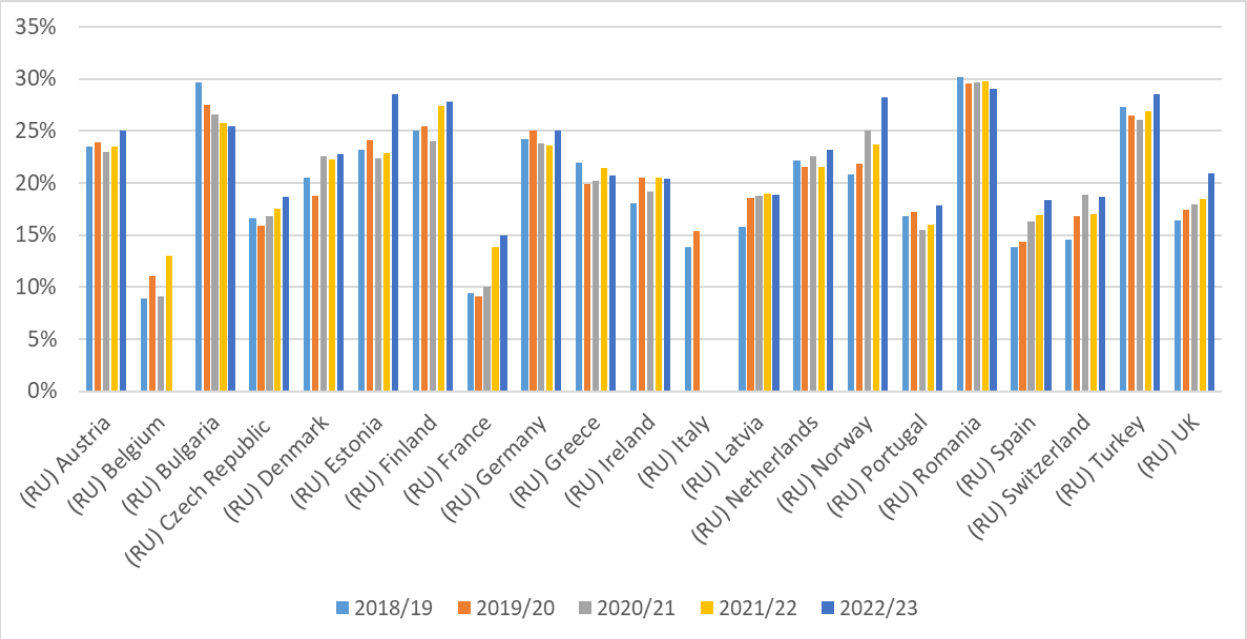
Graph 1.6 – Percentage change in the number of students in Informatics Bachelor's Programmes (first-year) from 2018/19 to 2022/23



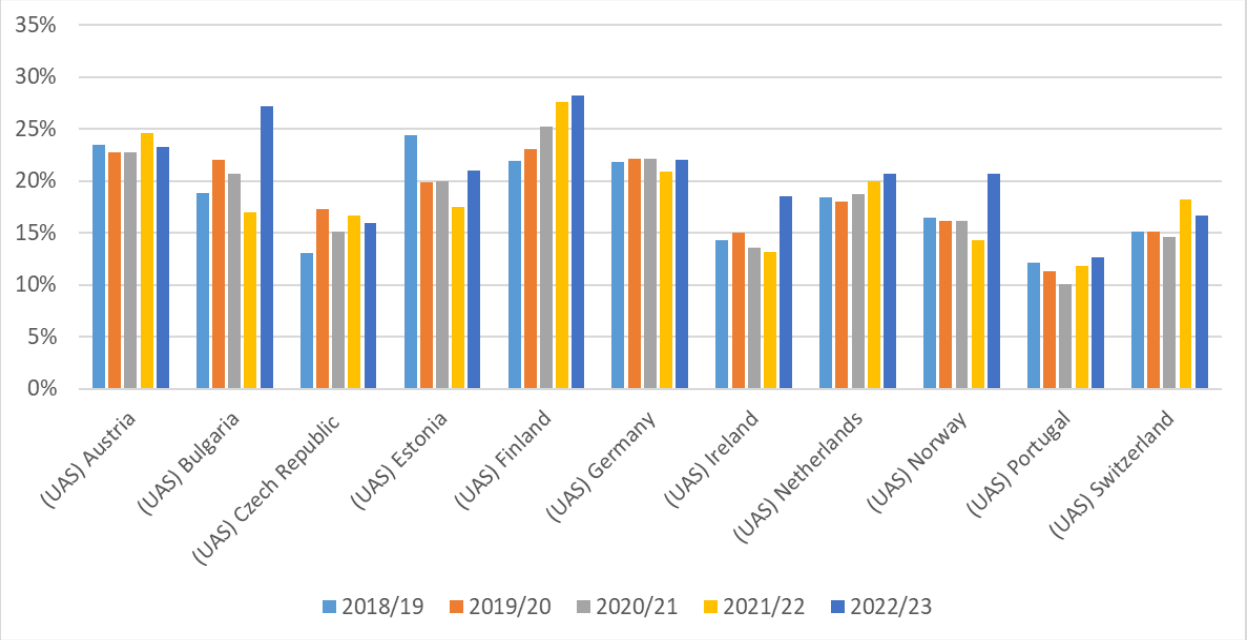
Graph 1.7 – Percentage of female students in Informatics Bachelor's programmes (first-year) at RU plus UAS – 5-year trend



Graph 1.8 – Percentage of female students in Informatics Bachelor's programmes (first-year) at RU – 5-year trend



Graph 1.9 – Percentage of female students in Informatics Bachelor's programmes (first-year) at UAS – 5-year trend



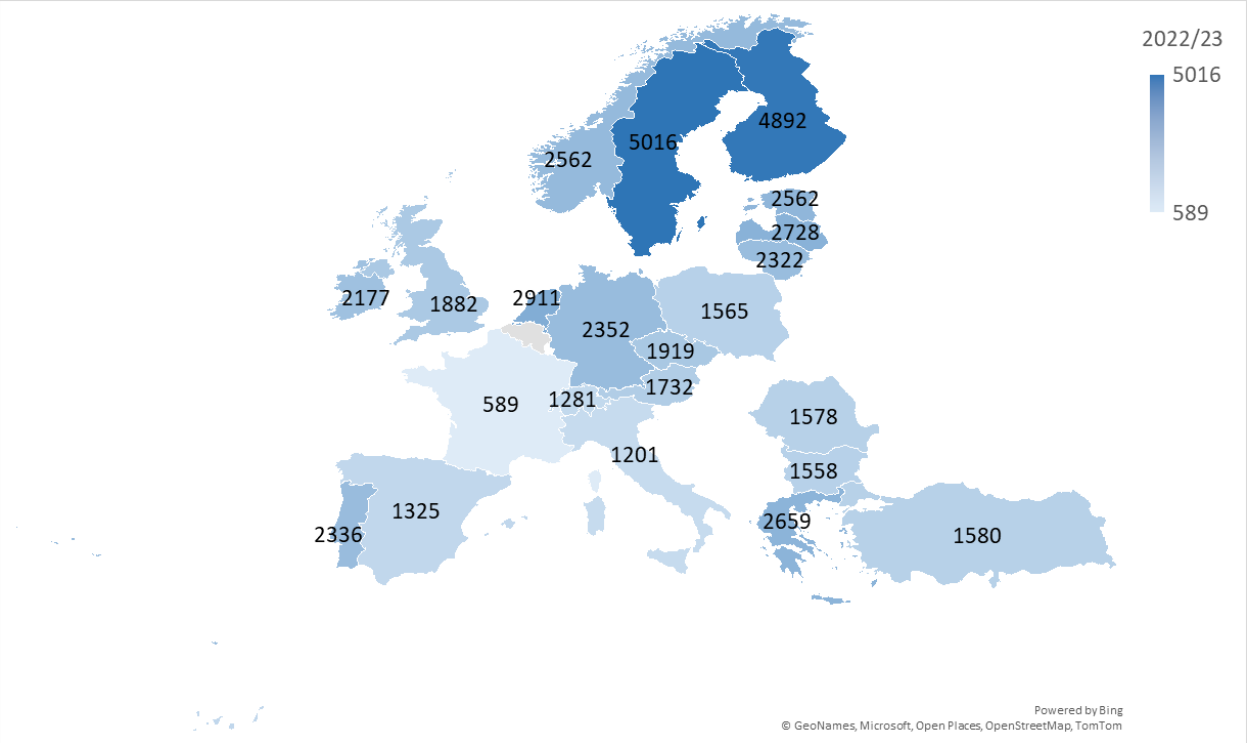
3.2 Students enrolled in all semesters

The general enrolment trends are illustrated in Graphs 2.1–2.6, followed by the female share of Bachelor's students enrolled in all semesters shown in Graphs 2.7–2.9. Note that these numbers are influenced by the length of Bachelor studies: while usually this is 3 years (nominally, i.e. the expected standard length), in some countries (e.g. Greece, the Netherlands–UAS, Spain, Turkey) and for some types of Bachelor's programmes (e.g. vocation or engineering-oriented ones), this may be 4 years. Another factor influencing these numbers, when relating them to those for first-year students in the preceding section, is the retention rate — this aspect is not analysed here.

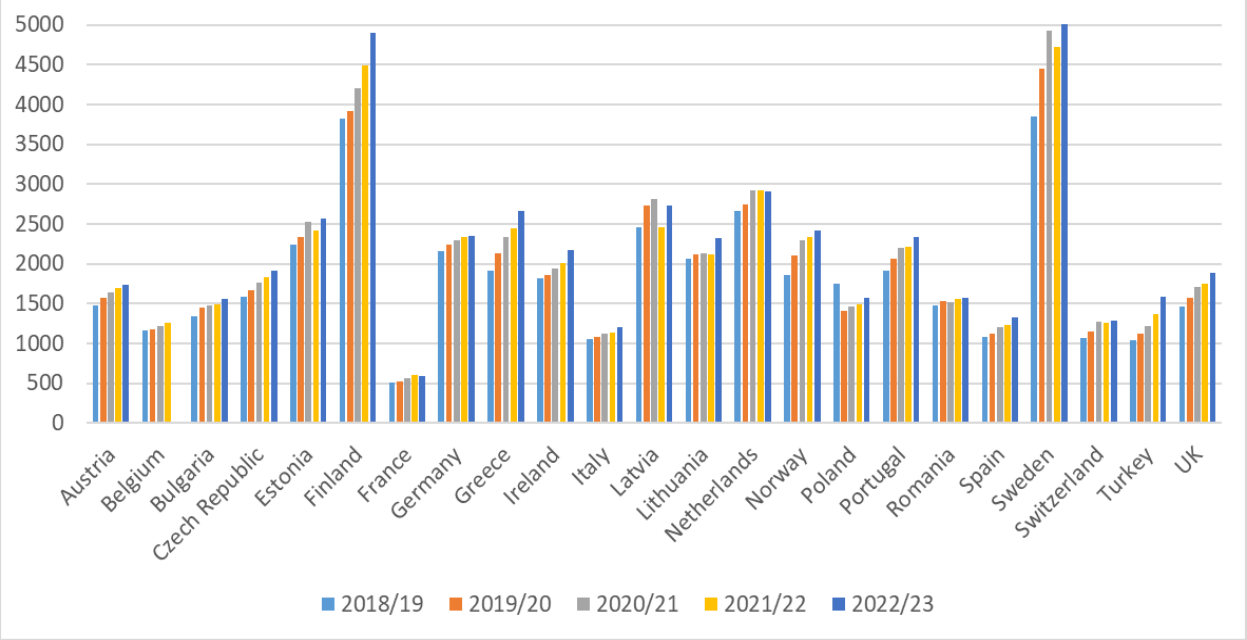
The exact numbers of Bachelor's students (enrolled in all semesters) for all years starting from 2010/11, along with definitions used, enhanced data visualizations and explanations of changes in national trends, can be found on the Informatics Europe Higher Education Data Portal under the following links, or by scanning the QR codes below.

Absolute number of students	***Ratio per 1,000,000 inhabitants***	***Female percentage***
https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_all_semesters_total.html	https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_all_semesters_ratio.html	https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_all_semesters_percentage.html

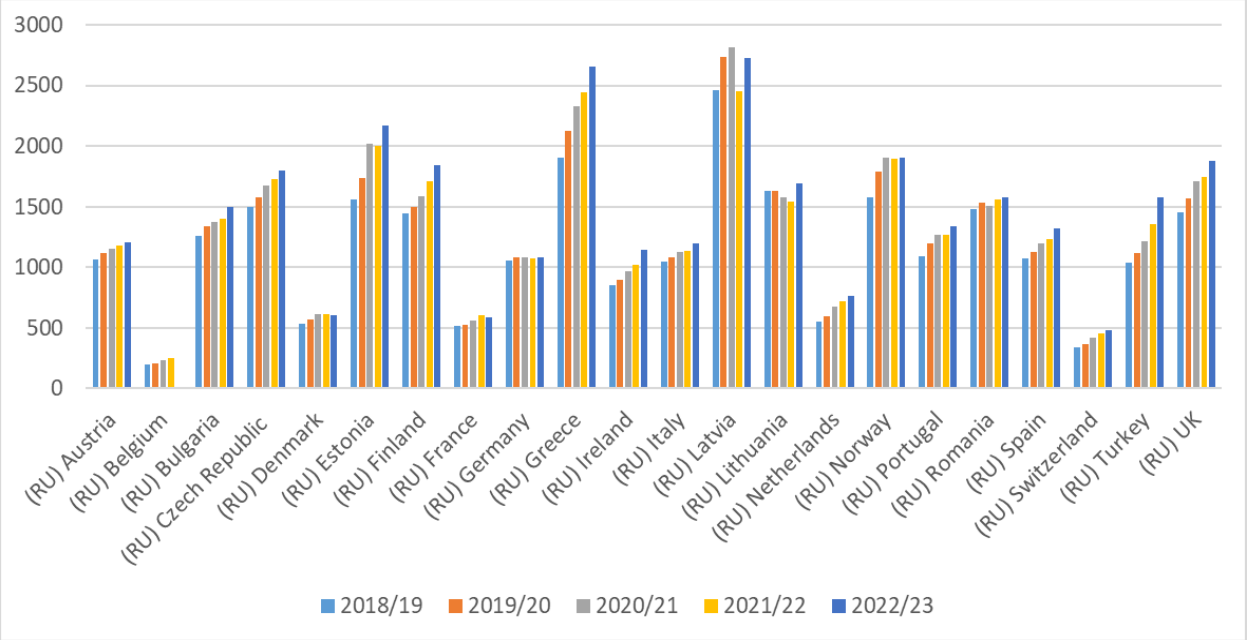
Graph 2.1 – Students in Informatics Bachelor's programmes (all semesters) per 1,000,000 inhabitants at RU plus UAS in 2022/23



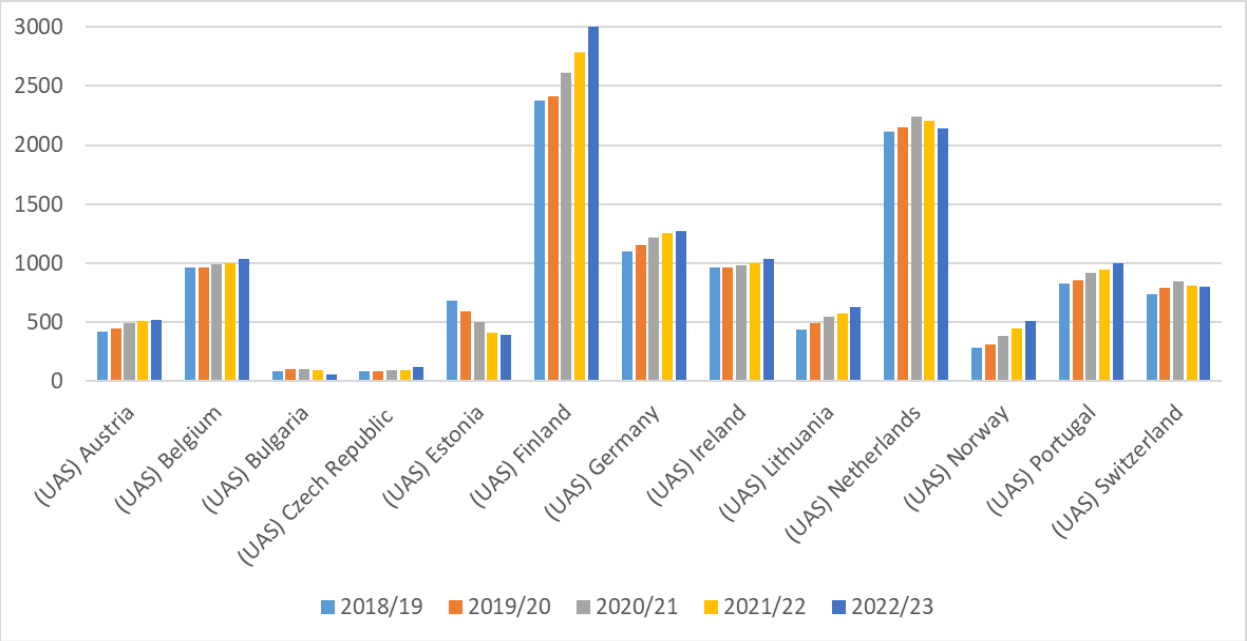
Graph 2.2 – Students in Informatics Bachelor's programmes (all semesters) per 1,000,000 inhabitants at RU plus UAS – 5-year trend



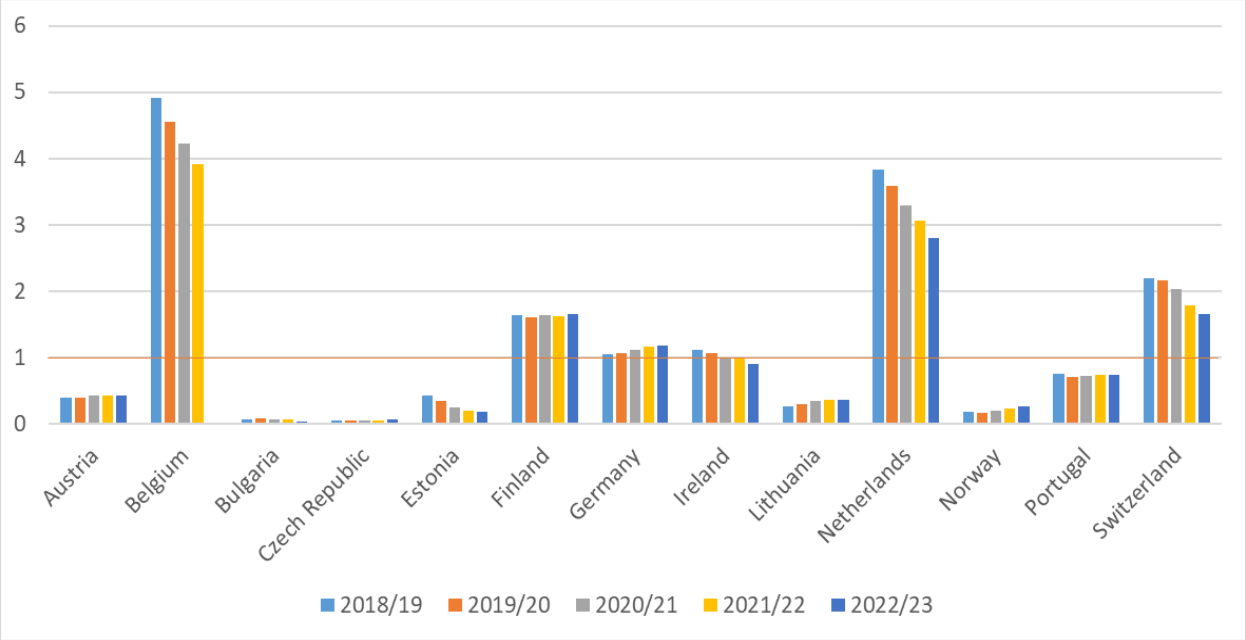
Graph 2.3 – Students in Informatics Bachelor's programmes (all semesters) per 1,000,000 inhabitants at RU – 5-year trend



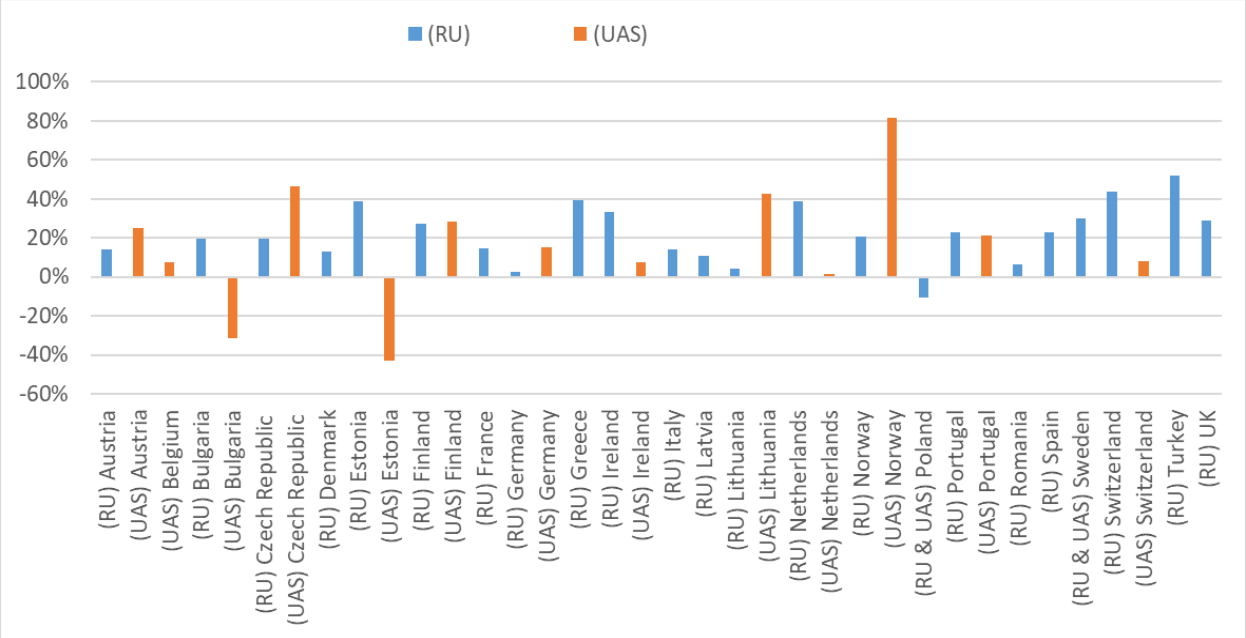
Graph 2.4 – Students in Informatics Bachelor's programmes (all semesters) per 1,000,000 inhabitants at UAS – 5-year trend



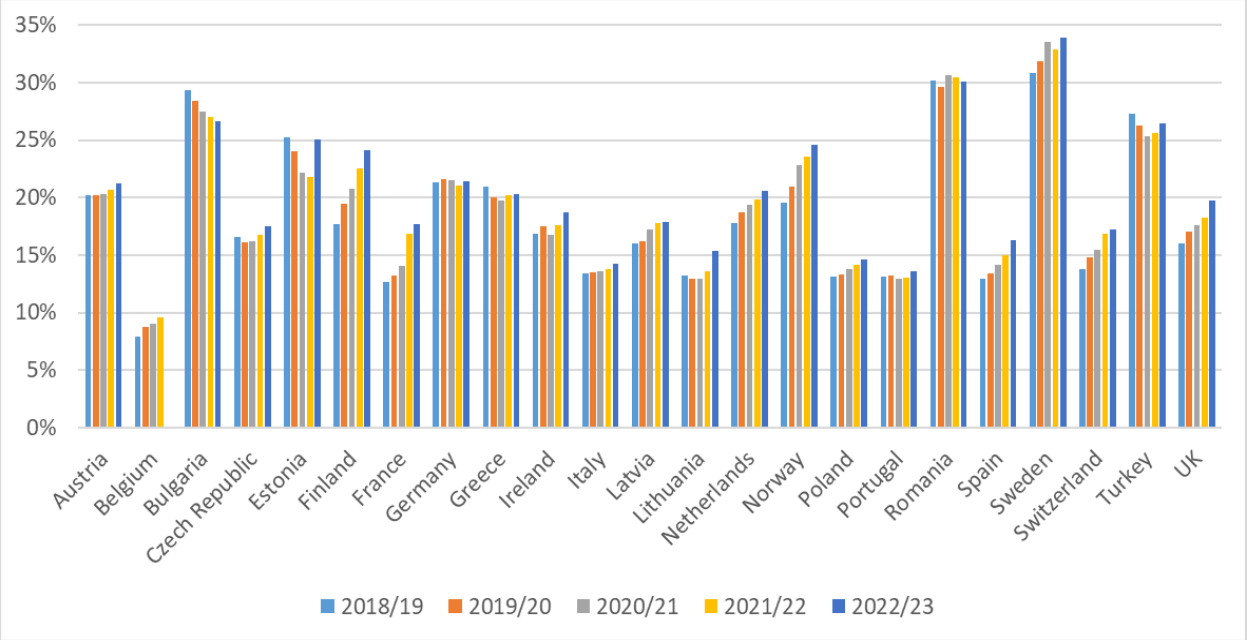
Graph 2.5 – Ratio between the number of students in Informatics Bachelor's Programmes (all semesters) at UAS vs RU – 5-year trend



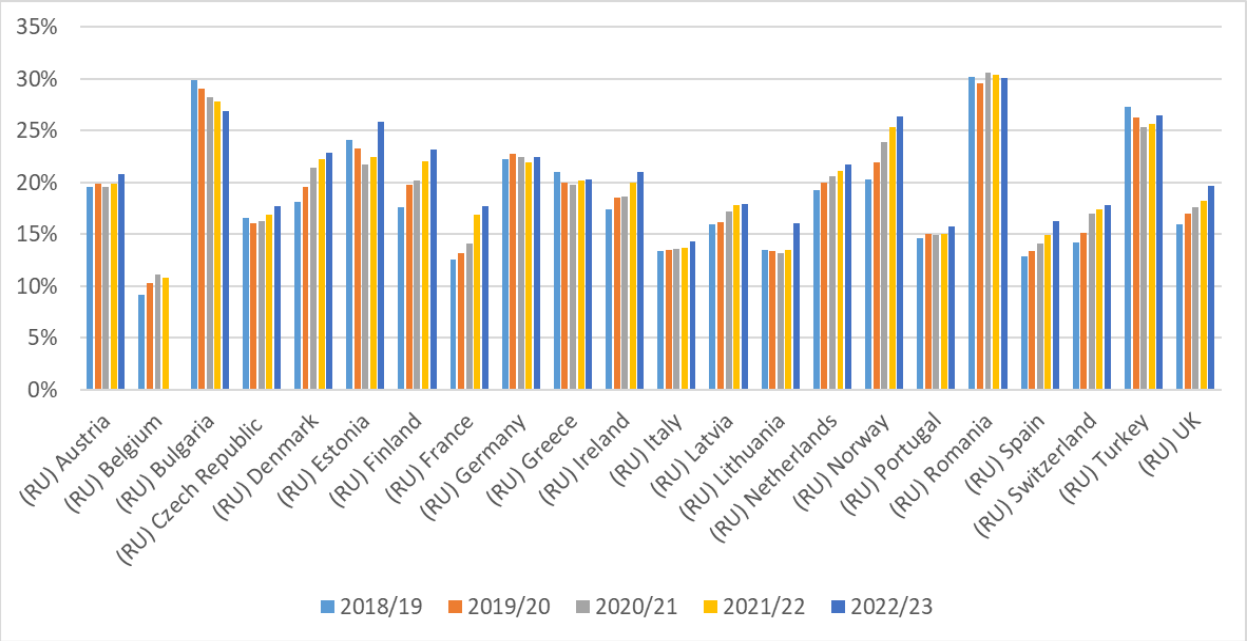
Graph 2.6 – Percentage change in the number of students in Informatics Bachelor's Programmes (all semesters) from 2018/19 to 2022/23



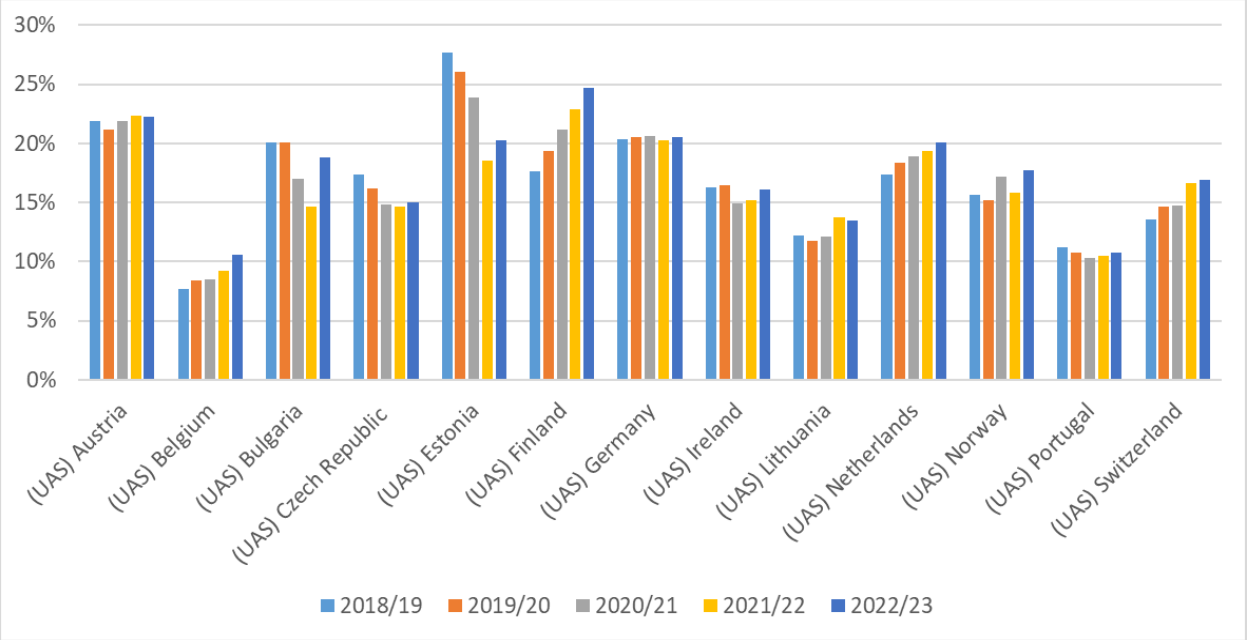
Graph 2.7 – Percentage of female students in Informatics Bachelor's programmes (all semesters) at RU plus UAS – 5-year trend



Graph 2.8 – Percentage of female students in Informatics Bachelor's programmes (all semesters) at RU – 5-year trend



Graph 2.9 – Percentage of female students in Informatics Bachelor's programmes (all semesters) at UAS – 5-year trend

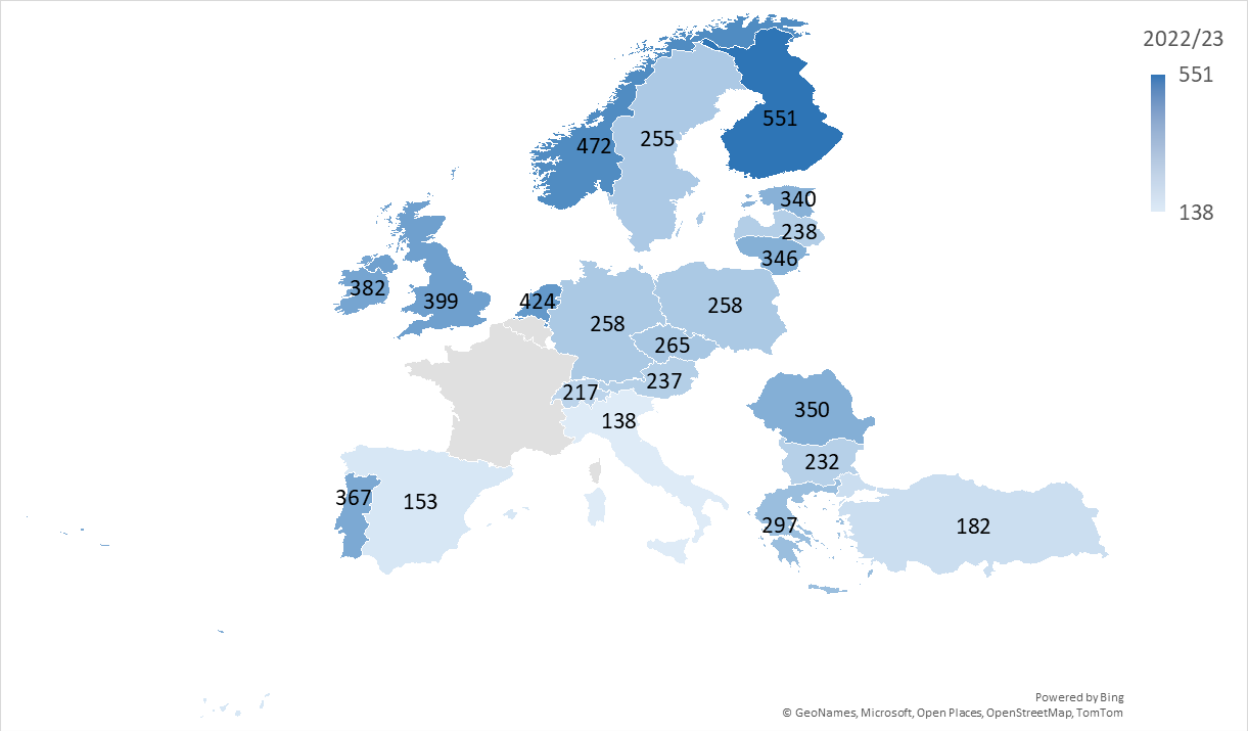


3.3 Degrees awarded

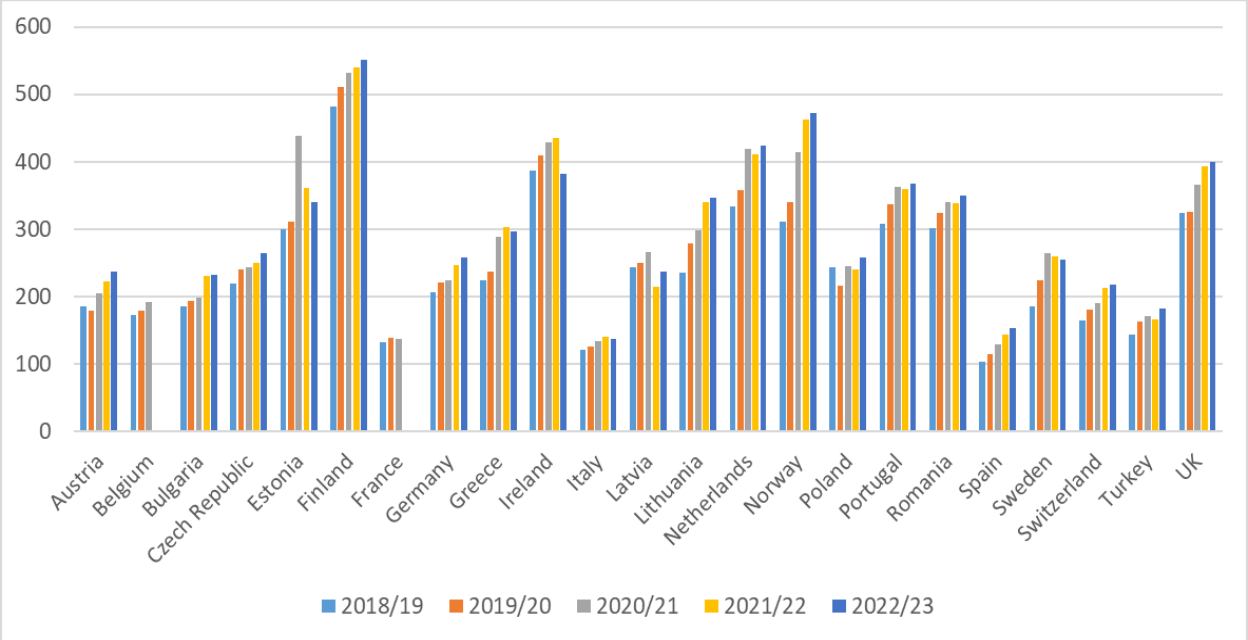
The general graduation trends are illustrated in Graphs 3.1–3.6, followed by the percentage of Bachelor's degrees awarded to female students shown in Graphs 3.7–3.8.

The exact numbers of Bachelor's degrees awarded for all years starting from 2010/11, along with definitions used, enhanced data visualizations and explanations of changes in national trends, can be found on the Informatics Europe Higher Education Data Portal under the following links, or by scanning the QR codes below.		
Absolute number of degrees awarded	**Ratio per 1,000,000 inhabitants**	**Female percentage**
https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_degrees_awarded_total.html	https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_degrees_awarded_ratio.html	https://www.informatics-europe.org/data-portal/?page=statistics/bachelor_degrees_awarded_percentage.html

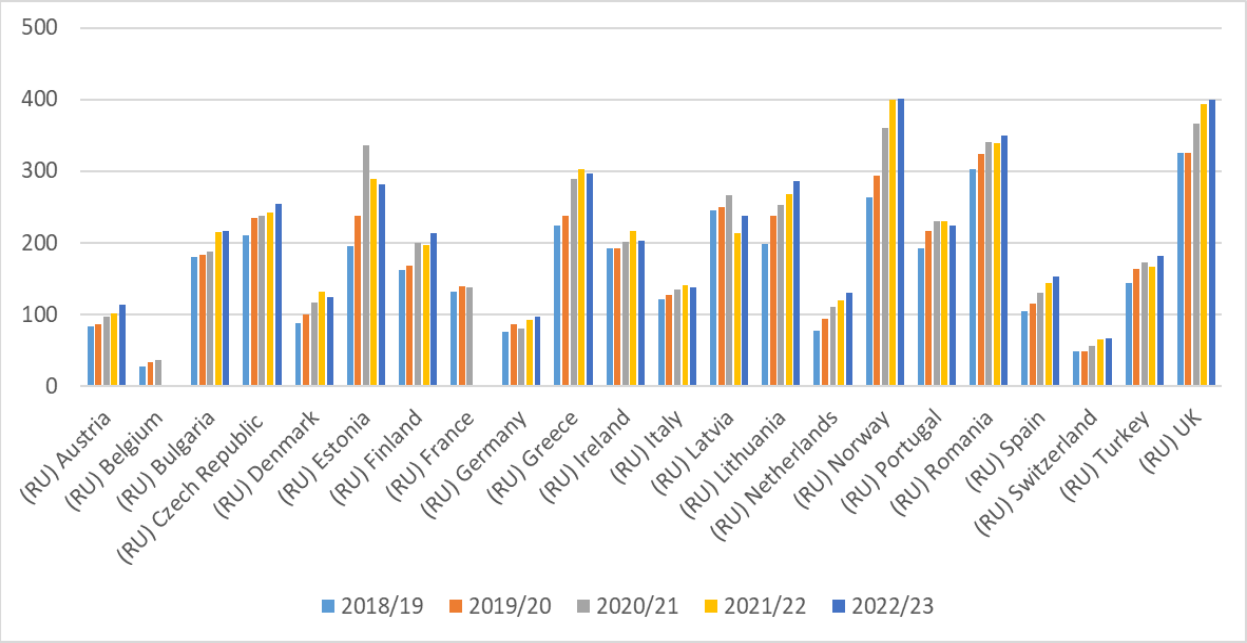
Graph 3.1. – Informatics Bachelor's degrees awarded per 1,000,000 inhabitants at RU plus UAS in 2022/23



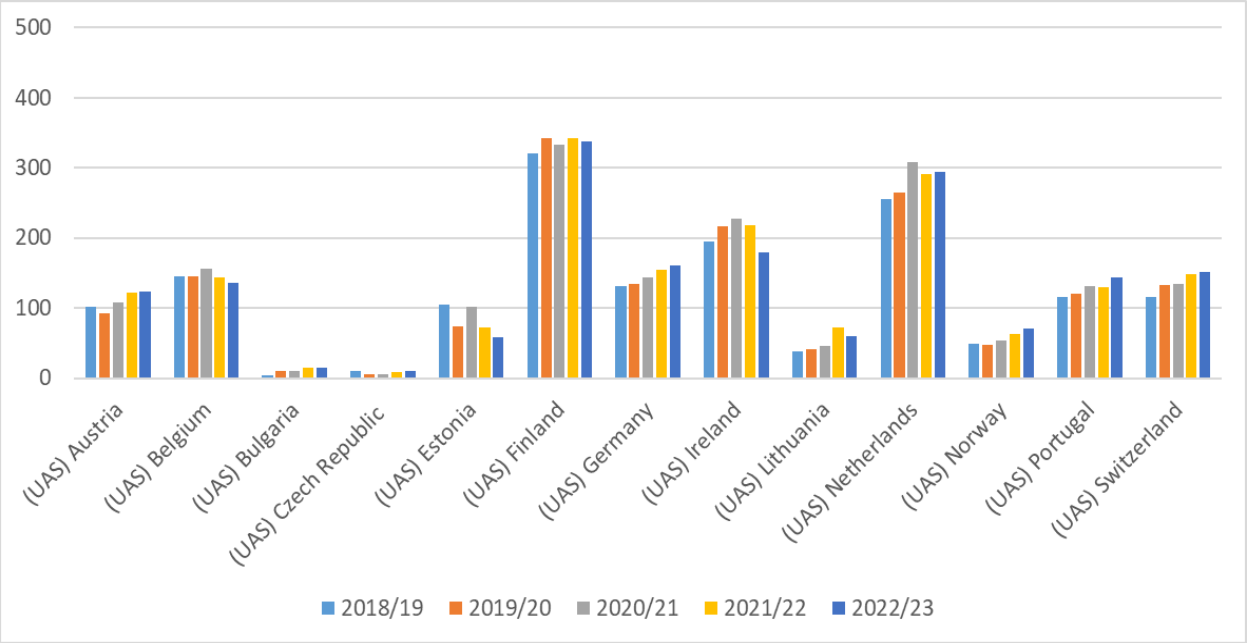
Graph 3.2 – Informatics Bachelor's degrees awarded per 1,000,000 inhabitants at RU plus UAS – 5-year trend



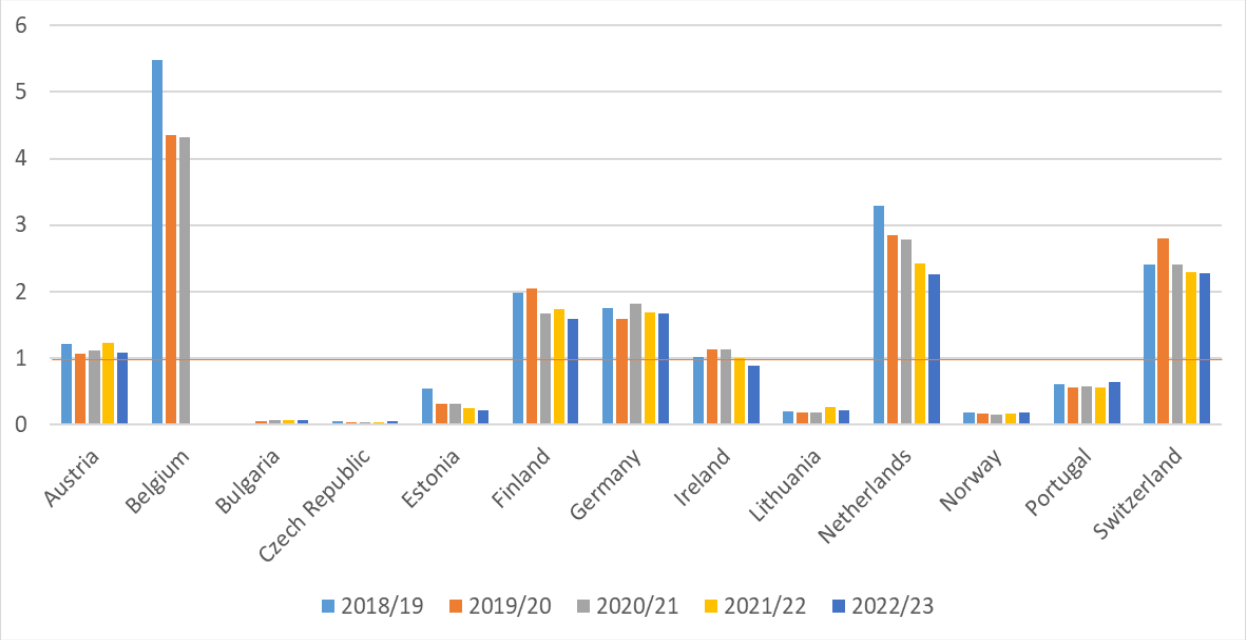
Graph 3.3 – Informatics Bachelor's degrees awarded per 1,000,000 inhabitants at RU – 5-year trend



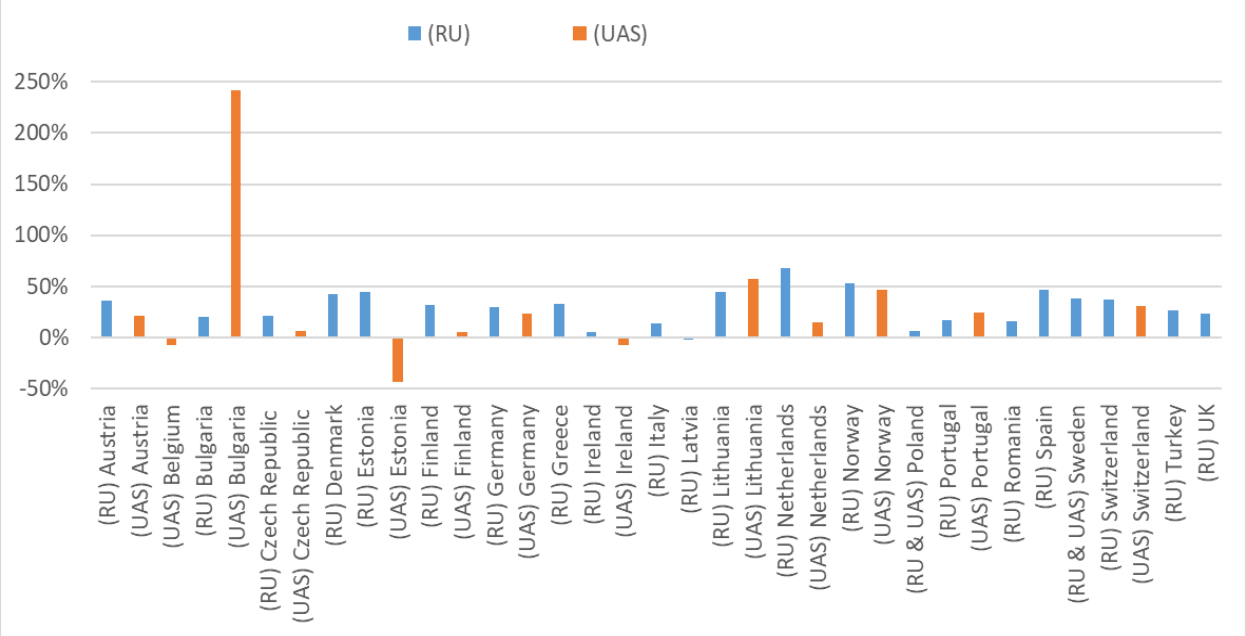
Graph 3.4 – Informatics Bachelor's degrees awarded per 1,000,000 inhabitants at UAS – 5-year trend



Graph 3.5 – Ratio between the number Informatics Bachelor's degrees awarded at UAS vs RU – 5-year trend

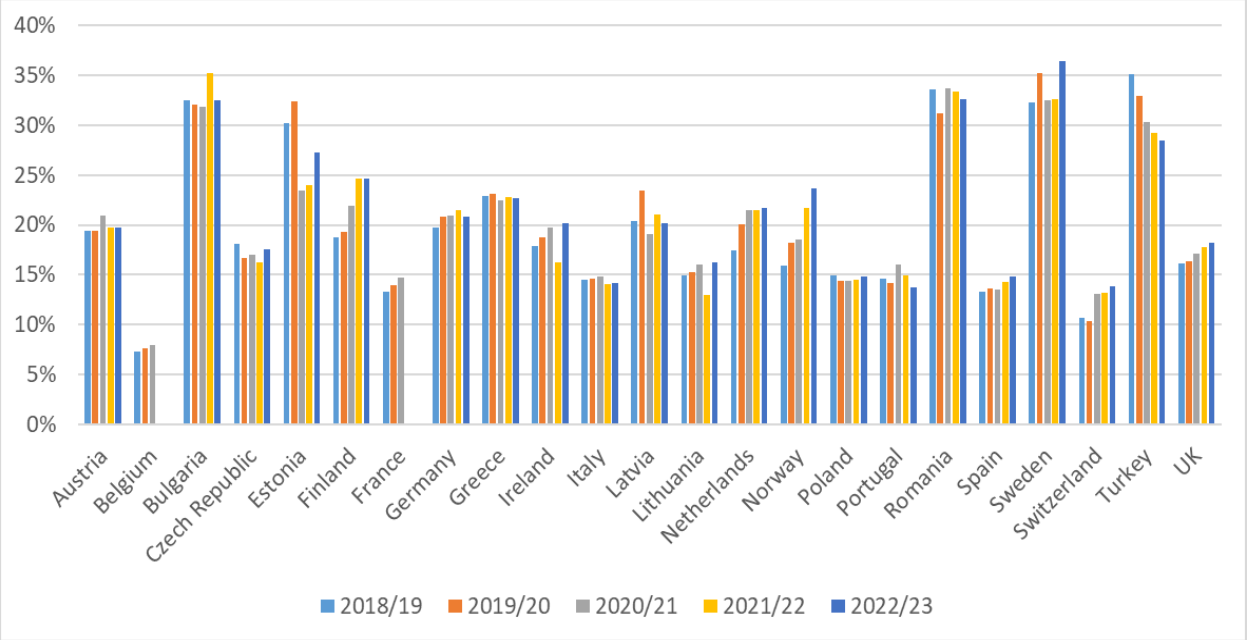


Graph 3.6 – Percentage change in the number of Informatics Bachelor's degrees awarded from 2018/19 to 2022/23

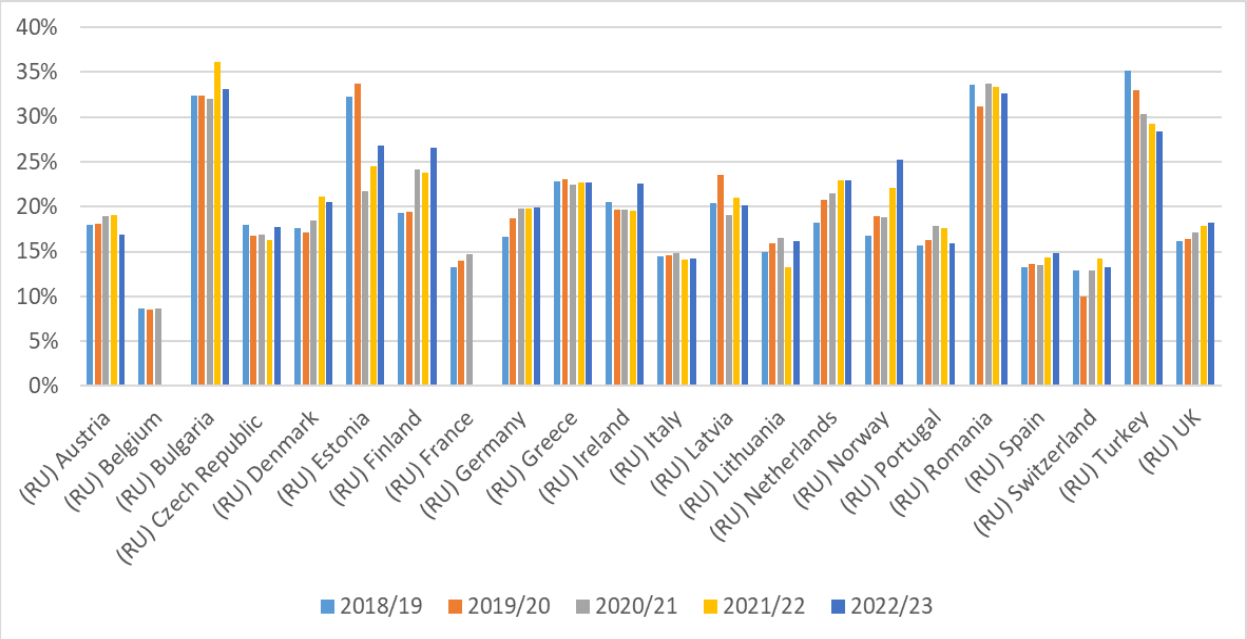


A significant change in Bachelor's degrees awarded at Bulgarian UAS can be better understood given the small number of Bachelor's degrees, where slight changes in absolute numbers cause large percentage shifts.

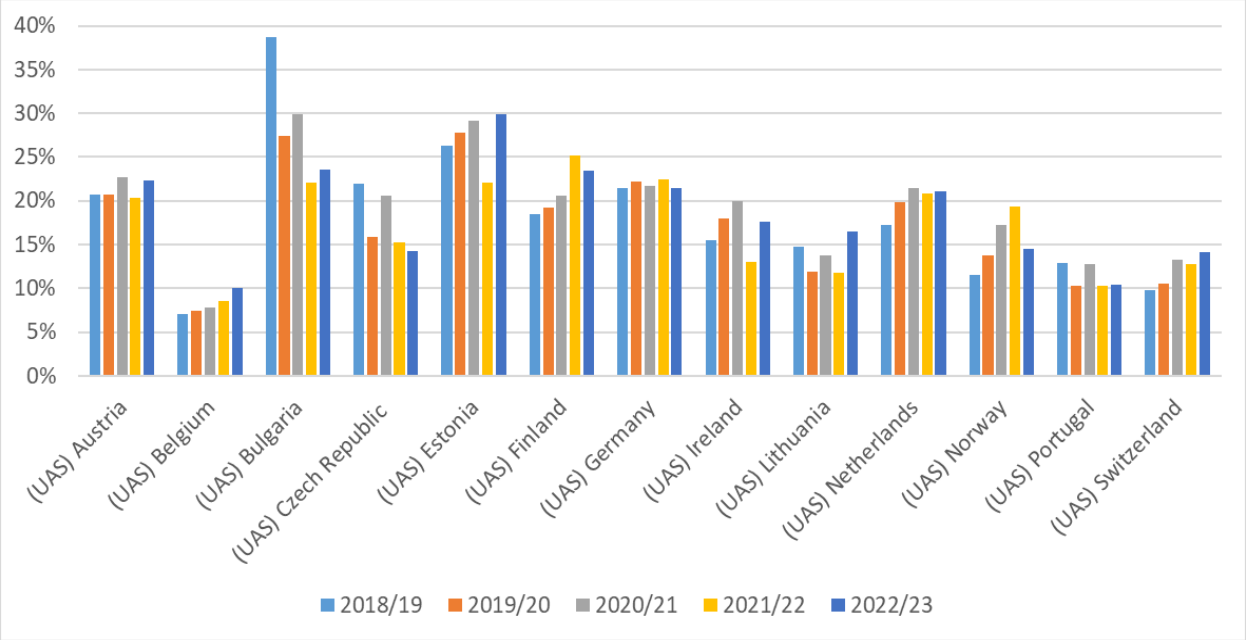
Graph 3.7 – Percentage of Informatics Bachelor's degrees awarded to female students at RU plus UAS – 5-year trend



Graph 3.8 – Percentage of Informatics Bachelor's degrees awarded to female students at RU – 5-year trend



Graph 3.9 – Percentage of Informatics Bachelor's degrees awarded to female students at UAS – 5-year trend



4. Findings and Observations

From the data and graphs presented above, we can draw the following observations.

Students (first-year and all semesters)

- In most countries, except Bulgaria (UAS), Estonia (UAS) and Poland (RU & UAS), the number of total Bachelor's students enrolled in Informatics programmes increased from 2018/19 to 2022/23 (see Graph 2.6). The same happened with the number of first-year Bachelor's students enrolled in those programmes with a few exceptions of Estonia, the Netherlands and Switzerland (UAS), Germany (RU), Poland (RU & UAS) (see Graph 1.6). This increasing trend reflects a positive development, indicating growing interest towards the Informatics programmes among Bachelor's students.
- Universities of Applied Sciences (UAS) play a key role in Bachelor's Informatics education by offering profession- or vocation-oriented studies. Over the past five years, they have attracted more first-year Bachelor's students than traditional research universities (RUs) in countries such as Finland, Germany, Ireland, the Netherlands, and Switzerland (see Graph 1.5). In Belgium, Finland, the Netherlands, and Switzerland the overall number of Bachelor's students enrolled in all semesters in UAS was significantly higher than in RUs (see Graph 2.5). In the Netherlands, this difference was partly due to UAS programmes lasting four years, compared to the typical three-year RUs' programmes. In Germany and Ireland, the number of Bachelor's students enrolled in all semesters was roughly equal between the two types of institutions. In contrast, in countries like Bulgaria, Czech Republic, Estonia, Lithuania, and Norway UAS institutions represented only a small minority of Bachelor's students.

Students per million inhabitants (first-year and all semesters)

- Finland and Latvia had the highest ratio of first-year Bachelor's students per million inhabitants (see Graph 1.2), while Sweden and Finland had the highest ratio of Bachelor's students enrolled in all semesters per million inhabitants (see Graph 2.2). France had the lowest ratio in both cases.
- Note that numbers for both Sweden and France should be interpreted considering the peculiarities of their higher education systems and data availability from official sources:
    - In France, the numbers of Bachelor's students (both first-year and total) are underestimated due to the structure of its higher education system and data availability from official sources. The statistics exclude students in two-year preparatory programs (*classes préparatoires*) and those pursuing advanced technical certificates (BTS), who may enter university in the third year. Additionally, students pursuing a *Diplôme universitaire de Technologie* (DUT) in non-Informatics fields and students from private higher education institutions and those overseen by ministries other than the Ministry of Higher Education, Research and Innovation (e.g., EPITA, École Polytechnique), representing about 10% of reputable Informatics institutions, were not included.
    - In Sweden, data includes both students registered for full study programmes aimed at first-cycle degrees as well as those taking individual courses within first-cycle degree programmes. This broader inclusion explains the comparatively higher number of Bachelor's students enrolled in all semesters.

Female students (first-year and all semesters)

- In all countries, the share of female students remained well below parity with their male counterparts, not exceeding 35%. The highest female participation was observed in Sweden (ranging from 31% to 34%), while the lowest was reported in Belgium RUs (ranging between 9–13% for first-year students and 8–11% for students enrolled across all semesters). Nevertheless, in most countries, except Bulgaria, Estonia, Germany, Portugal, Romania, and Turkey, the proportion of female Bachelor's students was increasing (see Graph 2.7), reflecting the positive influence of initiatives promoting gender balance in Informatics. Furthermore, the majority of surveyed countries, except Bulgaria, Germany, Greece, Portugal, and Romania, showed the growth in the share of female first-year Bachelor's students (see Graph 1.7), suggesting that efforts to attract female high school students to pursue Informatics are having a measurable impact.
- In most countries that distinguish between RUs and UAS, i.e. Bulgaria, Belgium, Germany, Ireland, Lithuania, the Netherlands, Norway, and Portugal, RUs have consistently shown a higher share of female Bachelor's students than UAS over the 5 years. In contrast, in Austria, Finland, the Czech Republic, Estonia, and Switzerland, the female share was either nearly equal between the two types of institutions or varied across years, with some years showing a higher share at RUs and others at UAS.

Degrees awarded

- In most countries, except Latvia, Belgium (UAS), Estonia (UAS), and Ireland (UAS), the number of Informatics Bachelor's degrees awarded increased from 2018/19 to 2022/23 (see Graph 3.6).
- Each year, Universities of Applied Sciences (UAS) graduated more and more Bachelor's students. In Belgium, Finland, Germany, the Netherlands, and Switzerland, the number of Informatics Bachelor's degrees awarded by UAS was significantly higher than by research universities (RUs), while in Austria and Ireland, the numbers were almost equal between the two types of institutions. In contrast, in Bulgaria, the Czech Republic, Estonia, Lithuania, and Norway, the number of Informatics degrees awarded by UAS was very low, and these institutions represent only a small minority of students (see Graph 3.5).

Degrees awarded per million inhabitants

- Finland had the highest ratio of Bachelor's degrees awarded per million inhabitants, while France, Italy and Spain had the lowest (see Graph 3.2). Note that numbers for France should be interpreted taking into consideration the data availability from official sources. French data do not cover private higher education institutions and those overseen by ministries other than the Ministry of Higher Education, Research and Innovation, representing about 10% of reputable Informatics institutions.

Degrees awarded to female students

- Compared to the positive trend in Bachelor's student enrolment, fewer countries showed a consistent increase in the share of female Bachelor's degrees awarded. In about half of the countries observed – Belgium, Finland, France, Germany, Ireland, the Netherlands, Norway, Spain, Sweden, Switzerland, and the UK – the share of female Bachelor's degrees awarded was increasing. In the other half, the trend was either relatively stable (Austria, Bulgaria, Czech Republic, Greece, Italy, Latvia, Lithuania, Poland, Portugal, Romania) or even declining (Estonia, Turkey). In all cases, the share of Bachelor's degrees awarded did not exceed 37% with the highest share observed in Sweden (varying between 32-37%), Turkey (30-35%), Bulgaria (32-36%), and Romania (31-34%), and the lowest share observed in Belgium (varying between 7-9%) (see Graph 3.7).
- In half of the countries that distinguish between RUs and UAS (i.e. Belgium, Finland, Ireland, Lithuania, the Netherlands, Norway, and Portugal), RUs awarded a higher share of female Bachelor's degrees than UAS. In Bulgaria, the Czech Republic, Estonia and Switzerland, the female share varied across years, with some years showing a higher share at RUs and others at UAS. In contrast, in Austria and Germany, UAS awarded a higher share of female Bachelor's degrees than RUs.

For enquiries and feedback about this publication, please contact administration@informatics-europe.org.

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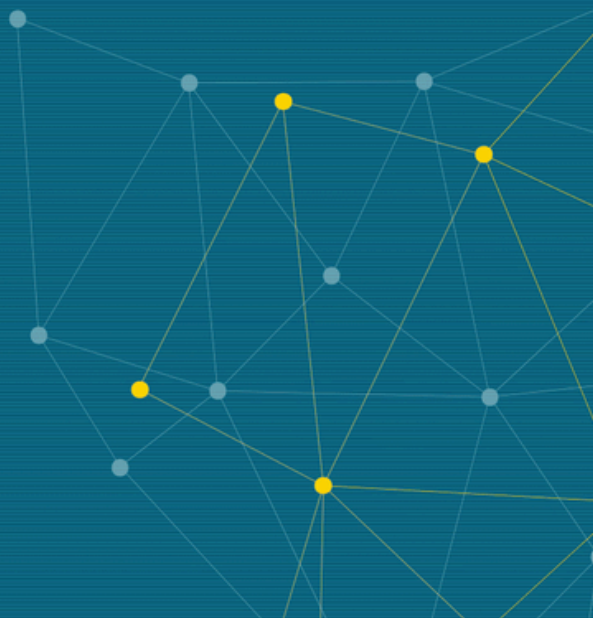
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