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The Evolution of the Number of Students Versus the Evolution of the Number of Teaching Stuff

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ABSTRACT

This study investigates the determinants of the number of graduating students in Romanian higher education using multiple linear regression on annual data from 2014 to 2022. The model demonstrates a high predictive capacity, identifying the previous year's number of graduates and the student graduation rate as significant predictors. A positive correlation exists between the previous and current number of graduates, suggesting temporal inertia. Conversely, the previous year's graduation rate shows a significant negative relationship with the current number of graduates, warranting further investigation into underlying mechanisms. Notably, the number of teaching staff was not a significant predictor in this model. The findings underscore the importance of prior graduation trends and graduation rates in forecasting graduate numbers, while the unexpected negative effect of the graduation rate and the non-significance of teaching staff highlight the complexity of factors influencing graduation outcomes and suggest avenues for future research, particularly concerning the role of human resources and the need for nuanced policy interventions in higher education.

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1. Introduction

Education forms an indispensable foundation for the progress of any society, and the interaction between the number of teaching staff represents a critical element in ensuring a high-performing and balanced educational system. The dynamics of these two variables are closely correlated with social, economic and political factors, and their detailed analysis offers a valuable perspective on the quality and accessibility of education. In recent decades, the evolution of the number of students has been characterized by a notable increase, fuelled by policies of educations democratization and the facilitation of access to higher education. This expansion has been largely supported by the processes of urbanization and globalization, which have transformed education into an essential priority for young people form various regions of the world. Furthermore, the awareness of the crucial role of education in improving career prospects has stimulated an increased demand for higher education, thus becoming a determining factor in the growth of the number of students. As the number of students has recorded a substantial increase, educational institutions have faced the need to adapt quickly to meet the additional demands. This expansion has exerted considerable pressure on available educational resources, including teaching staff, infrastructure and teaching materials. In many situations, this rapid growth has led to a significant imbalance between the number of students and the number of teaching staff, having a direct and negative impact on the quality of the educational process. In this context, the disproportion between the number of the students and the number of the teaching staff has created an environment in which the effectiveness of teaching and learning has been compromised by the inadequacy of appropriate resources. The evolution of the number of teaching staff, both in nigher education and in pre-university education, has been closely linked to the transformations within educational systems and the pressures generated by the increase in the number of students, the need of adapting to the pandemic crisis and the changes in labour market demands. Despite the significant expansion in the number of students, the growth of teaching staff has failed to keep pace with this trend and this gap has generated a series of major challenges for educational systems, affecting the quality of interaction between teachers and students, the capacity to offer individualized guidance and, ultimate, learning outcomes.

2. Literature review

In recent decades, the number of students has experienced a considerable increase, driven by policies to democratize education and expand access to higher education. An important dimension of this development

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has been student mobility, a phenomenon that has intensified in recent years, especially through European exchange programs such as Erasmus. A study on the participation of Romanian students in the Erasmus program highlights the fact that, although the number of Romanian participants is increasing, the participation rate continues to be below the European average (Marin, 2014). This reflects a trend of underutilization of the potential of the Erasmus program in Romania, compared to other European Union Member States. Moreover, Romania sends a higher number of students abroad than those who choose to study in Romania, which suggests a low attractiveness of the country's educational institutions for international students. This situation is determined by a number of factors, including financial and informational barriers, which limit Romanian students' access to the Erasmus program.

Another significant factor affecting mobility is the lack of an adequate funding system and the difficulties in accessing essential information about the opportunities offered by the programme. These barriers have been identified as major obstacles to increasing the number of participants and promoting educational mobility. Another study also suggests that in order to increase mobility and for Romania to fully exploit the potential of the Erasmus programme, it is necessary to invest more in financial support for students and in improving access to information (Franz, 2024). Furthermore, it is essential that the Romanian authorities develop national policies that support participation in Erasmus and attract more foreign students to Romania. In this regard, increasing the attractiveness of Romanian universities, by improving the visibility and quality of education, could significantly contribute to greater mobility and to strengthening the Romanian education system. In addition to student mobility, a German study on dropout and switching among teacher education students shows another important dimension of student numbers, namely school dropouts. In Germany, around 28% of students in teacher education programs do not complete their studies and choose to reorient themselves professionally, usually towards non-pedagogical fields or employment. This trend highlights the importance of matching the study program to students' personal goals (Sitar-Tăut, 2024). According to the study, a mismatch between students' expectations and academic reality led to a high dropout rate, while students who found clear and well-defined alternatives because of their careers had greater stability in choosing their professional path. The increase in student numbers has brought challenges for educational institutions, especially in terms of resources and student-teacher ratios. Mobility, including through Erasmus, has improved intercultural learning, but financial and informational barriers remain. Also, school dropout, especially in teacher education, highlights the need for adjustments to better support students' careers.

It should also be noted that the rapid growth in student numbers has often been insufficiently covered by inadequate recruitment of teaching staff. This gap was due to several factors, such as budgetary constraints, increasing demands for higher academic qualifications and recruitment difficulties in niche specialist areas such as technical fields or medical sciences. In some cases, educational authorities (Baskici, 2024) have tried to compensate by increasing the teaching workload of teachers, which has led to their overloading and, implicitly, to a decrease in the quality of the educational process. Measures such as the implementation of educational technology and online teaching have also been adopted, which, in theory, could have reduced the pressure on teachers, but have not provided a permanent solution to the acute need for teaching staff. Another significant factor in the evolution of the number of teachers was the impact of the COVID-19 pandemic, which brought fundamental changes to the way lessons are organized and how teachers are perceived in the educational setting. Loss of professional identity was a phenomenon encountered by many teachers, as they had difficulty adapting quickly to new online learning technologies and the loss of direct interaction with students (Lassri, 2023). This had a negative impact on the motivation and effectiveness of teachers in dealing with educational demands during the pandemic. Research has shown that, in order to meet these challenges, continuous teacher training and the development of digital skills were essential, and those who benefited from mentoring and professional support were able to adapt more effectively to the new requirements.

A study on staff turnover in early childhood education and other education sectors highlights a deeper problem: professional stress and teacher burnout. For example, research in the United States (Bryant, 2023) has shown that teachers in early childhood education schools, especially in the early years of their careers, are more likely to leave the education system due to stress, depression and poor working conditions. This turnover has been fueled by factors such as an unsafe working environment, lack of support and low salaries. In this context, authorities have been encouraged to implement measures to support teachers, such as creating a team-based environment and reducing stress, to help retain staff. In terms of the impact on higher education, teachers have been exposed to increased pressure due to the economic crisis, but also due to increasingly rigorous academic requirements. Studies (Zoltán, 2024) show that, in addition to financial and resource pressures, psychological stress caused by a lack of social support and the fact that they did not always have the necessary means to adopt effective educational technologies, led to an erosion of their professional identity. Teachers who were able to access continuous training and develop their digital skills had greater adaptability, but those who did not have access to such resources experienced a significant deterioration in relationships with students and a decrease in professional motivation.

3. Research methodology

This research was initiated by the pressing need to identify and understand the mechanisms through which various factors influence the number of students who successfully complete university degree programs. To this end, a rigorous methodological approach was adopted, based on the advanced statistical technique of multiple linear regression. This quantitative method allows for the investigation of complex relationships between a dependent variable – in this case, the number of graduating students – and a set of independent variables, offering the possibility to quantify both the direction (positive or negative) and the intensity of their impact. For the empirical analysis, secondary data, aggregated at the annual level, were utilized. The data collection process spanned a significant temporal interval of nine consecutive years, covering the period from the beginning of 2014 to the end of 2022 (INSSE). The selection of this period was motivated by the desire to capture potential medium-term trends and structural dynamics within the higher education system. The primary source of the data consisted of consulting official statistical databases, managed by governmental institutions and organizations specialized in the collection, validation, and dissemination of information relevant to the education sector. Reports published by these entities, which offer additional perspectives on trends in higher education, were also analysed. In the data selection process, particular attention was paid to the criteria of homogeneity and consistency, fundamental aspects for ensuring the internal and external validity of the estimated econometric model and, consequently, the reliability of the resulting inferences. The nine-year duration of the analysed period provides an adequate temporal horizon for identifying robust relationships and for mitigating the distorting effects of any idiosyncratic annual variations.

Table 1. Data base (INSSE)

Year	Number of enrolled students	Number of graduates	Student graduation rate	Number of teaching staff
2014	411229	85028	20.68%	27772
2015	410697	80815	19.68%	26949
2016	405638	80035	19.73%	26618
2017	408179	82848	20.30%	26266
2018	402696	83210	20.66%	26384
2019	407373	85779	21.06%	26429
2020	418346	85665	20.48%	25991
2021	415839	82454	19.83%	26555
2022	410181	85368	20.81%	26649

Source: Own representation based on data provided by the National Institute of Statistics

4. Results and Discussion

The estimated multiple linear regression model demonstrates a remarkable explanatory capacity for the investigated dependent variable, as indicated by the extremely high value of the coefficient of determination (R^2 = 0.9997). This suggests that almost the entire variance of the dependent variable is captured by the linear combination of the independent variables included in the analysis. The overall validity of the model is supported by the ANOVA test, which reveals a high statistical significance ($F(3, 5) = 5352.24$, $p < 0.001$), indicating that the independent variables, taken together, contribute significantly to explaining the variance of the dependent variable.

Table 2. ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	1.88E+08	62769706	5352.235	3.48E-09
Residual	5	58638.78	11727.76		
Total	8	1.88E+08			

Source: Author's own processing of aggregated data made available through the Microsoft Excel software platform

The analysis of individual coefficients highlights distinct effects of the predictors. A positive and statistically significant relationship was found between the number of graduating students and the dependent variable ($\beta = 4.91$, $p < 0.001$), suggesting that an increase in the number of graduates is associated with an increase in the dependent variable, holding the other variables constant. In contrast, the student graduation rate demonstrates an inverse and statistically significant relationship with the dependent variable ($\beta = -2011187.42$, $p < 0.001$). The negative magnitude of this coefficient indicates a substantial impact, although the direction of the effect requires a nuanced interpretation and possible further investigation to elucidate the complex mechanisms involved. Regarding the number of teaching staff, the estimated coefficient (-0.0158) is not statistically significant ($p = 0.843$), suggesting that this variable does not make a significant contribution to the prediction of the dependent variable within the context of the analysed model.

The 95% confidence intervals for the significant coefficients (number of graduating students and graduation rate) do not include zero, providing further confirmation of the statistical significance of these relationships. In conclusion, the multiple linear regression model demonstrates considerable predictive power, identifying the number of graduating students and the graduation rate as factors with a significant influence on the dependent variable. However, the negative effect observed for the graduation rate requires careful interpretative analysis, and the number of teaching staff did not prove to be a significant predictor in this specific model.

Given the significant influence of the number of graduating students and the graduation rate on the dependent variable, and considering Beer's (2014) assertion regarding the importance of the student/teacher ratio for educational quality, it is pertinent to further explore how changes in student enrolment and graduation, relative to the number of teaching staff, might mediate or confound the observed relationships. On the other hand, an increase in academic staff with diverse specializations can support the diversification of educational offers, allowing universities to better respond to labour market demands and create a curriculum more adapted to the needs of students. In the United Kingdom, the increase in the number of international students has led to a greater internationalization of higher education. This has had positive effects on the diversity and dynamism of the educational environment (Rinaldi, 2024). However, despite the rise in the number of international academic staff, studies suggest that there is still a gap in their access to leadership positions, which may limit diversity in higher education leadership. This phenomenon could affect the educational balance both culturally and administratively, indirectly influencing the quality of education.

The use of artificial intelligence (AI) in higher education, particularly for assessing academic tasks, has had a significant impact on reducing workload and saving time. Professors believe that AI supports learning activities at higher levels of abstraction, but at the same time, there are concerns about over-reliance on technology, plagiarism risks, and the loss of authenticity in academic work (Lee, 2024). These concerns are crucial for maintaining the quality of education as technology plays an increasingly important role. The use of AI should be regulated and accompanied by continuous training for academic staff to integrate technology in a constructive and ethical manner. In many countries, the number of students has increased significantly, but this growth has not always been accompanied by a corresponding expansion of academic staff. For example, in the United Kingdom, the rise in international students was followed by an increase in international academic staff, yet a significant portion of them has struggled to access leadership positions. This can limit the potential for diversity in higher education and, implicitly, negatively impact the quality of education, as academic leaders play a crucial role in adapting the curriculum and promoting innovative practices. In some technical universities or institutions offering niche specializations, recruiting qualified teaching staff remains a major challenge. This can impact the quality of teaching, especially in fields that require specialized expertise. On the other hand, time and resource savings achieved through the flexibility of online teaching and the use of educational technologies can support the adaptation and development of higher education in the face of ever-expanding educational demand.

The integration of educational technologies is crucial for supporting teaching staff and managing large numbers of students. Online platforms and digital educational solutions can significantly reduce the pressure on teachers, especially in large theoretical courses. In this regard, adopting hybrid learning, which combines online education with face-to-face interaction, can effectively address students' educational needs and support better management of human resources. Additionally, continuous training for teachers in the use of new technologies is essential to ensure quality teaching (Zeqiri, 2023). The quality of electronic services is a key determinant for student satisfaction and the success of digitized higher education. Educational platforms must be optimized to ensure a seamless learning experience, with clear, relevant, and up-to-date information. Furthermore, student data protection should be a priority to build trust in the use of online platforms. In this context, improving IT infrastructure and implementing robust data security systems could significantly enhance student satisfaction and performance (Hongqiao, 2022). Also, the transition of teaching staff from a traditional, content-based model to a learning-centred approach (LFAT) is crucial for achieving superior educational outcomes (Ilie, 2024). Educational programs must be tailored to support this transition, helping teachers adopt innovative and interactive teaching methods. Continuous professional development for educators and fostering an ongoing dialogue with students are essential for adapting to new educational demands and promoting active student engagement in the learning process.

5. Conclusions

The evolution of the number of students in relation to the number of teaching staff is a complex issue that requires a multidimensional approach. While access to education is a fundamental right, maintaining the quality of education must remain a priority. By implementing sustainable educational policies and promoting a balanced student-to-teacher ratio, we can ensure a high-performing educational system adapted to contemporary demands.

The present research investigated the determinants of the number of graduating students in the Romanian higher education system, employing a multiple linear regression model applied to secondary data with annual frequency for the time span 2014-2022. The results of the econometric model highlighted a

substantial predictive capacity, revealing the number of graduates in the preceding year and the graduation rate as significant predictors of the current volume of graduates. Specifically, a positive correlation was found between the number of graduates recorded in the previous year and the current number of graduates, suggesting a temporal inertia or a persistence of trends in graduation dynamics. In contrast, the student graduation rate of the previous year demonstrated a significant inverse relationship with the current number of graduates, a finding that necessitates an in-depth interpretative analysis to elucidate the underlying causal mechanisms, possibly mediated by omitted variables such as the initial cohort size or admission regulations.
A notable aspect of the results is the statistical insignificance of the number of teaching staff as a predictor of the number of graduating students within the specified model. This finding suggests a complexity in the interdependencies between human resources and graduation outcomes, potentially influenced by additional factors not included in the model, such as the specialization of academic staff, the quality of the instructional-educational process, or the integration of didactic technologies. Within the context of the academic debate regarding the student-teacher ratio and the quality of education (Bere, 2014), these findings indicate the need for further investigation into the ways in which human capital influences final academic performance, possibly by incorporating qualitative indicators or by adopting more advanced analytical methodologies.

In summary, the research underscores the relevance of the previous year's number of graduates and the graduation rate as key determinants in modelling the current number of graduates. Although the model possesses considerable predictive power, the negative effect observed in the case of the graduation rate requires rigorous contextual interpretation. The insignificant result for the number of teaching staff opens avenues for future research oriented towards a detailed analysis of the role of human resources in the graduation process, possibly by including additional control variables or by adopting more advanced analytical methodologies. The practical implications of this investigation can inform educational policy decisions regarding resource allocation and strategies for optimizing the number of graduates, taking into account the complex interactions between the analysed factors.

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