

ECONOMETRIC ANALYSIS OF THE INDUSTRIAL TECHNICAL HIGHER EDUCATION IN ROMANIA

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Keywords: technical higher education, regression, Fisher test, student test, ANOVA

Abstract: Technical education in Romania has suffered in the 1990-2008 period, significant changes in the time evolution and, on the other hand, in demand structure of the high school graduates for various specializations. The paper analyzes the time evolution of the technical industrial higher education in the period under review compared to higher evolution as a whole. Also are analyzed the structural changes in demand of high school graduates for technical specializations offered by higher education industry in Romania in the 1990-2008 period.

1. INTRODUCTION

After 1990 the relationship between demand and supply of places in educational institutions in Romania has made significant changes. If before 1989 the number of places in higher education was relatively limited, which is determined according to the country's development policy in the period until 1989, after 1990 the supply of places in higher education institutions gradually equal demand, and after the establishment private higher education, supply exceeds demand.

Basically, after the establishment of private higher education institutions, anyone who wants to attend college can do if not in the state universities at least in the private. The competition for places in the state higher education remains at least for the places financed from the budget

In these circumstances competition on the market of higher education services, moving from competition between candidates (existing before 1989 and in early '90) to competition between higher education institutions (higher education service providers). This competition, who is growing from year to year, is emphasizing once with declining demand, caused in turn by very low birth rate recorded in the early 90s.

From this competition will come out victorious those higher education institutions that will offer quality education, specializations and skills which will ensure compliance with labor market requirements.

2. EVOLUTION OF HIGHER EDUCATION IN ROMANIA DURING 1990-2008

During the analyzed period, the supply of places in higher education institutions in Romania recorded a steady growth. Thus, if the academic year 1990-1991 the total number of students (Table 1) was 192,810 students in academic year 2000-2001 it was 533,152 students ie 276.52% compared with the 1990-1991 academic year, and the 2007-2008 academic year it reaches 907,353 students i.e. 170.19% compared with the 2000-2001 i.e. 470.60% respectively compared with the 1990-1991 academic year.

If we deepen the analysis and monitor the changes in the number of students enrolled by groups of specialties, we will note that developments were different (Chart 1).

Analyzing the data presented in Chart 1 shows that the main source of growth in the total number of students enrolled in higher education is given by the development of economics and low science.

Tabelul 1 Evoluția numărului total de studenți înmatriculați în perioada 1990-2008.

	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
Students enrolled	192810	215226	235669	250087	255162	336141	354488	360590	407720	452621
	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008		
Students enrolled	533152	582221	596297	620785	650335	716464	785506	907353		

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Number of students enrolled in higher economics education increased from 20,003 in 1990-1991 academic year to 132,332 students 2000-2001 i.e. 276.52%, reaching 291,497 students in 2007-2008 i.e. 220, 28% compared with the 2000-2001 academic year, respectively, 1457.27% compared with the 1990-1991 academic year. If the total number of students enrolled in academic year 2007-2008 grew by 4.7 times compared with academic year 1990-1991 (Table 2), the number of students in higher economics education grew by 14.6 times.

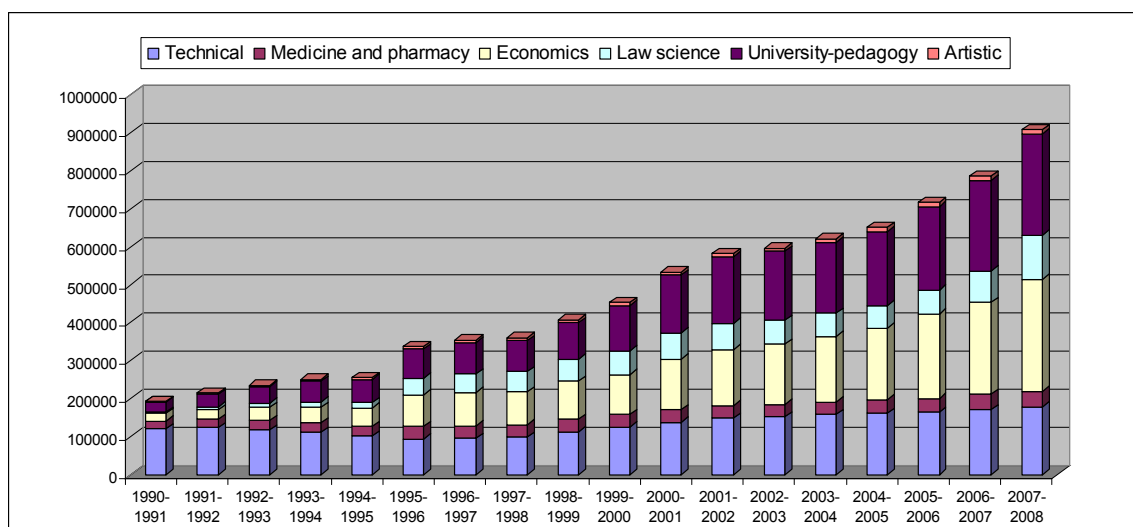


Chart 1 - Evolution of total and by groups of students enrolled in 1990-2008 period

Number of students enrolled in higher law science education increased from 3975 students in academic year 1990-1991, to 68,870 students in 2000-2001 i.e. 173.26% and to 116,538 students in academic year 2007-2008 i.e. 293.18% compared with the 1990-1991. Although relative growth of students enrolled in specialized law sciences is much higher than recorded in economics, the influence of increasing number of students enrolled in economics on the total number of students enrolled is predominant in absolute value.

Also, significant increases in the number of students enrolled in 2007-2008 academic year compared with those enrolled in 1990-1991 academic year were registered to other groups of specialties. Thus to the pedagogical university education the increase was 10.11 times higher and at artistically university education was 5.87 times higher. Lower than average

increases were recorded in higher education of medicine and pharmacy (2.06 times) and higher technical education (1.48 times).

Table 2 - Evolution of the number of students enrolled by groups of specialization

	1990-1991	2000-2001	2007-2008	I _{2000/1990}	I _{2007/1990}
Total	192810	533152	907353	2.76	4.71
Technical	120541	138324	178258	1.18	1.48
Medicine and pharmacy	20128	32999	41398	1.64	2.06
Economics	20003	132332	294417	6.62	14.72
Law science	3975	68870	116538	17.32	29.32
University-pedagogy	26270	152132	265624	5.79	10.11
Artistic	1893	8495	11118	4.49	5.87

This is because the severe organizational and technical conditions in these areas, and on the other hand due to economic and social policies implemented by successive governments in the period analyzed.

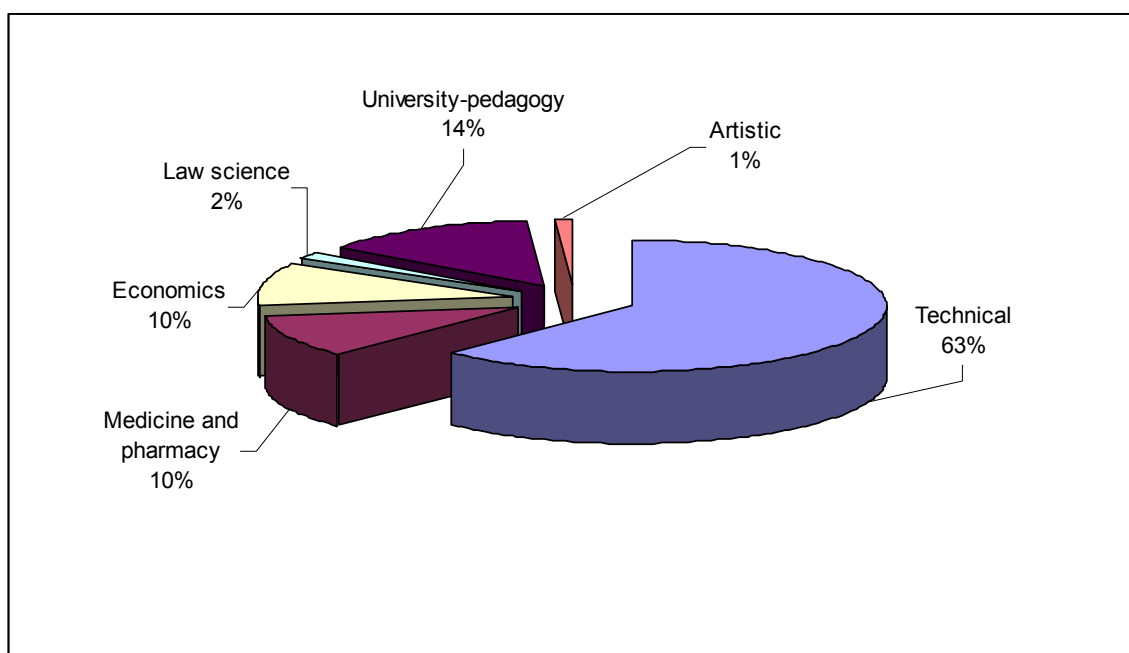


Chart 2 Structure of students enrolled in 1990-1991 academic year by groups of specializations

Different rates of growth recorded by the number of students enrolled at the main groups of specialization in the period under review led to significant structural changes. Thus, if in the academic year 1990-1991 the main share of 63% was for higher technical education (Chart 2) followed by pedagogical university education with 14% , in the 2007-2008 academic year the main share was for economic higher education with 32% (Chart 3)

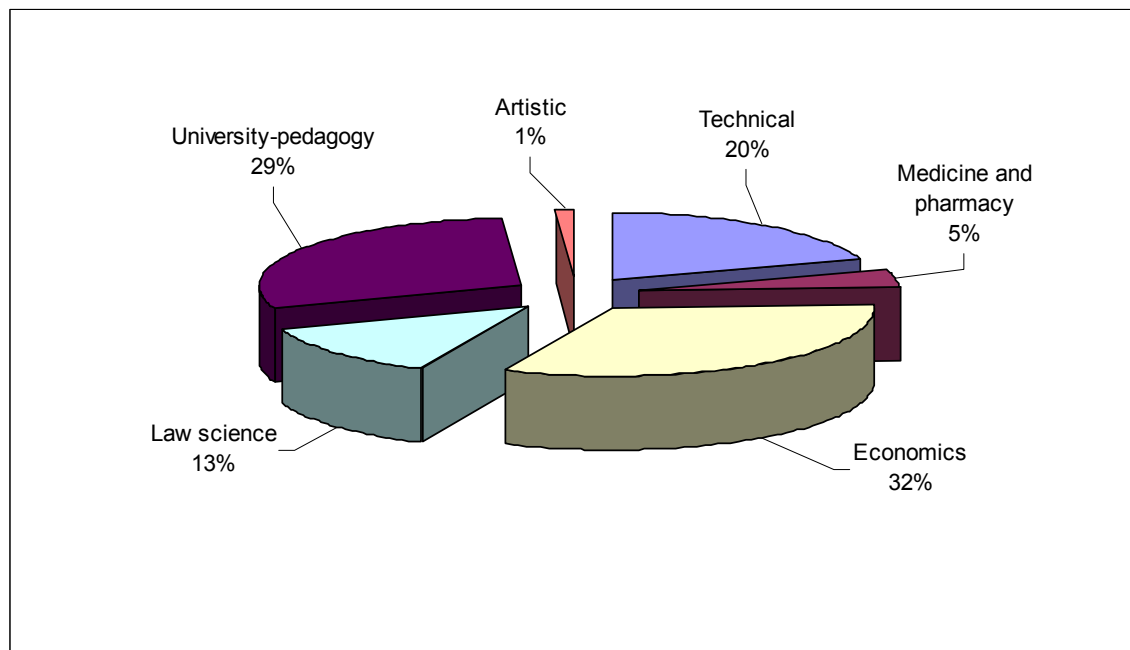


Chart 3 Structure of students enrolled in 2007-2008 academic year by groups of specializations

While pedagogical university education retains second place with 29%, higher technical education move in third place with a share of 20% from total students enrolled in academic year 2007-2008.

Mutations occurred in the other specializations share. So, in education, legal sciences go on from the last but one place in academic year 1990-1991 with a share of 2%, to the fourth place in the 2007-2008 academic year, with a share of 13%.

Finally, while the medicine and pharmacy specialization share is reduced from 10% to 5% in the period under review, the share of higher education artistic value is kept constant at 1%.

3. THE PLACE OF INDUSTRIAL HIGHER EDUCATION IN TECHNICAL EDUCATION IN ROMANIA

Analysis focusing on technical higher education within its specialized group of industrial education we find that the number of students enrolled suffered changes in number and structure from year to year,.

Unlike the evolution of the total number of students enrolled in higher education institutions in Romania which was a continuously upward trend, the number of students enrolled for higher technical education (Chart 4) ranged from a minimum of 94,289 students in academic year 1995 - 1996 to a maximum of 166,668 students in the academic year 2006-2007.

Analyzing data from chart 4 we see that higher education industry has the largest share from the higher technical education, and significantly determines the shape of the number of students enrolled.

Regarding the evolution of the number of students enrolled in technical specialties industry (Mining, Petroleum, Geology, Electric Power electrotehnics end, Metalurgy and Engineering, Chemical Technology, Wood and Building Materials Industry, Light Industry and Food Industry) illustrated in Chart 5, it evolves between a minimum of 63,968 students in 1996-1997 academic year to a maximum of 103,045 in the 2004-2005 academic year

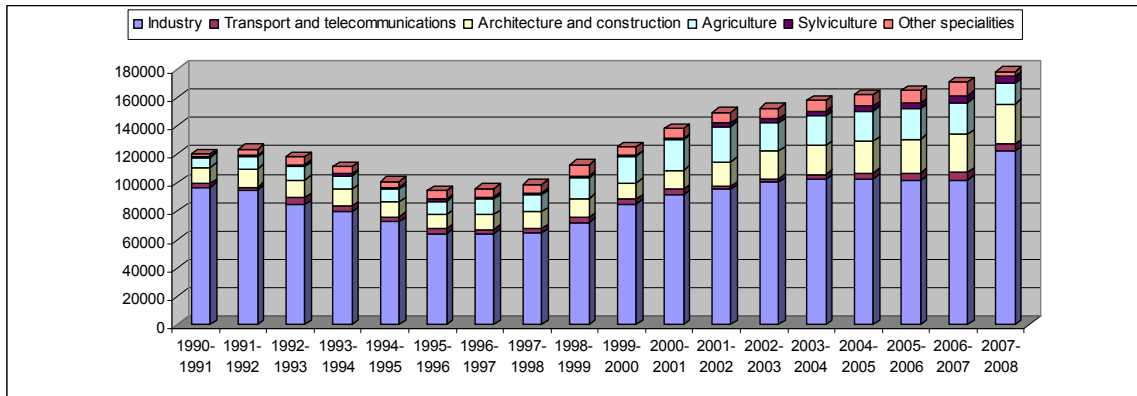


Chart 4 Evolution of specialization and structure of students enrolled in technical high schools

Overall, higher industrial education developments in the nearly 20 years of analysis can be analytically represented (Chart 6) by five degree polynomial function:

$$Y = 1.1238 \cdot t^5 - 60.665 \cdot t^4 + 1096.6 \cdot t^3 - 7324.7 \cdot t^2 + 11873 \cdot t + 91742 \quad (1)$$

Given that the indicator $R^2 = 0.9685$ has a value very close to 1, that equation (1) has a good approximation of the trend of the number of students enrolled in industrial specializations.

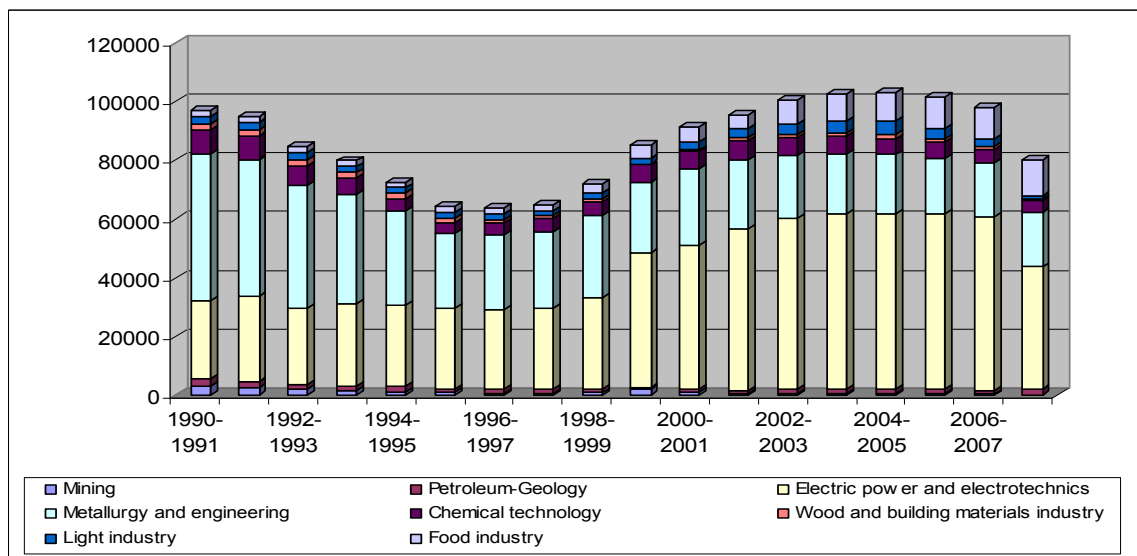


Chart 5 Evolution of number and specialization structure of students enrolled in higher education industry

From the Industrial specialties group shown in figure 5, the specialization Electric power end electrotehnics has developed somewhat separately. Share of students enrolled in this specialization has increased from 27% in the 1990-1991 academic year (Chart 7) to 58% in academic year 2007-2008 (Chart 8).

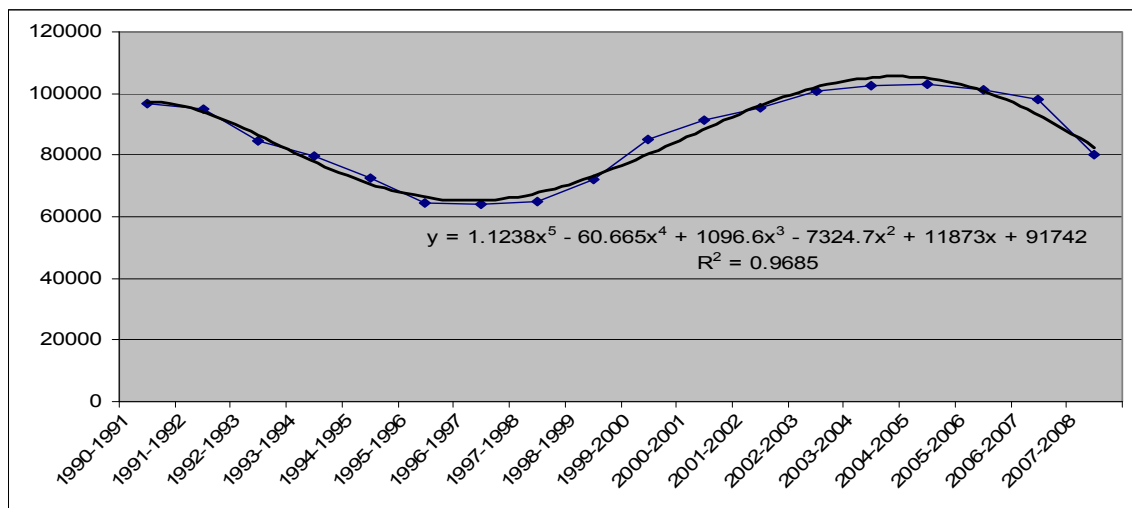


Chart 6 –The trend of total number of students enrolled in industrial specialization in the period under review

Also registered a significant increase in the share of students enrolled in specialty food industry, from 2% in academic year 1990-1991 to 15% in academic year 2007-2008.

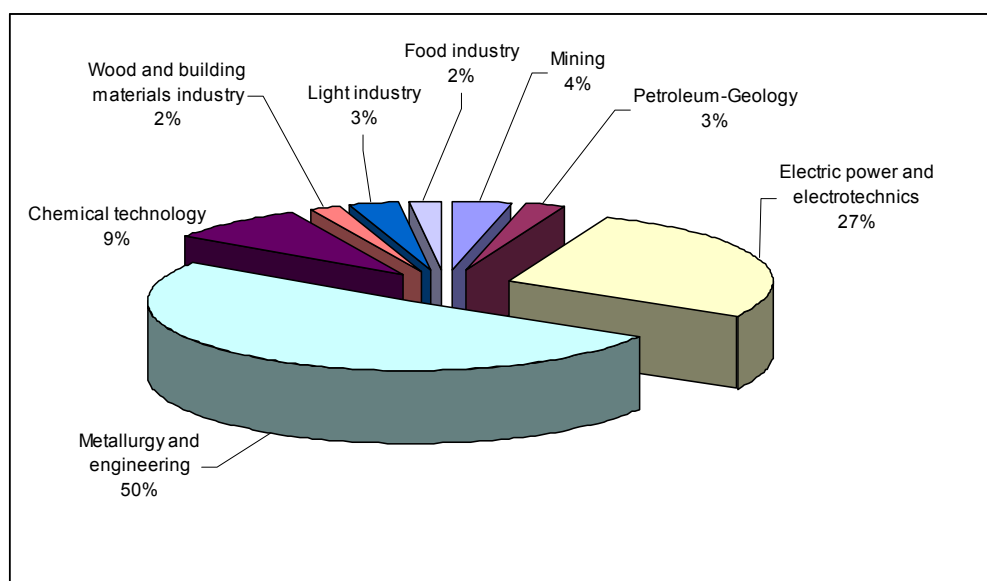


Chart 7 - Share of students enrolled in specialization Industry in the academic year 1990-1991

If, in the period analyzed, the share of students in specialized in Electric power end electrotehcnics increased, in specialization and Metalurgy and Engineering the share decreased significantly from 50% in academic year 1990-1991 to 23% in academic year 2007-2008.

Decreases in the share of students enrolled during the period under review, there have been registered in Chemical Technology specializations from 9% in the academic year 1990-1991 to 5% in academic year 2007-2008, Mining from 4% in academic year 1990 - 1991 to less than 1% for the academic year 2007-2008.

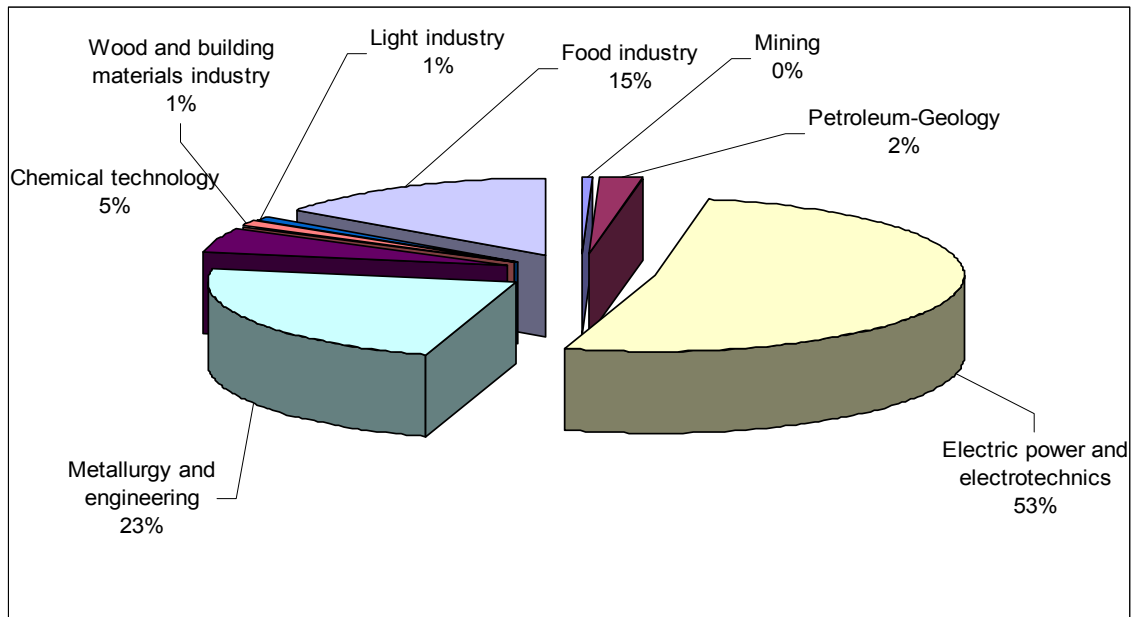


Chart 8 - Share of students enrolled in specialization Industry in the academic year 2007-2008

Finally, in the period analyzed, relatively constant shares were recorded for students enrolled in specialization Petroleum-Geology and Wood and building materials industry.

4. A BRIEF ANALYSIS OF THE CORRELATION BETWEEN THE NUMBER OF HIGH SCHOOL GRADUATES AND THE NUMBER OF STUDENTS ENROLLED IN HIGHER EDUCATION INDUSTRY

This chapter tested the existence of correlation between the number of students enrolled in higher industry education and the number of high school graduates in the last five promotions in respect of each school year, based on the following statistical assumptions:

H₀ (null hypothesis): Number of high school graduates in the last five promotions have a negligible influence on the number of students enrolled in higher industry education in each school year of the period analyzed.

H₁ (alternative hypothesis): Number of high school graduates in the last five promotions determined the number of students enrolled in higher industry education in each school year of the period analyzed.

It was initially tested null hypothesis (H₀) based on data for the period 1995-2007. The results are illustrated in Table 2.

Analyzing Table 2 we see that Multiple R has a value of 0.277 which corresponds to a very weak link between the two variables analyzed.

Furthermore, the calculated value of Fisher test $F = 0.83$ is lower than proper tabulated value $F_{0.05,k,n-k-1} = 4.96$, so in conclusion: null hypothesis is accepted.

During the period 1995-2007 the number of college graduates in the last five promotions has a negligible influence on the number of students enrolled in higher industry education.

That fact is emphasized by the value of Significance $F = 0.383198$, value that is greater than materiality used ($\alpha = 0.05$).

Table 2 Testing the hypothesis H0 for the period 1995-2007

<i>Regression Statistics</i>					
Multiple R	0.2771221				
R Square	0.0767967				
Adjusted R Square	-0.015524				
Standard Error	16237.714				
Observations	12				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.19E+08	2.19E+08	0.83185	0.383198
Residual	10	2.64E+09	2.64E+08		
Total	11	2.86E+09			

In a second stage null hypothesis was tested for dataset from the 2000-2007 period. The results for this period are shown in Table 3. The results differ significantly from those obtained in the first phase.

Table 3 Test of the hypothesis H0 for the period 2000-2007

<i>Regression Statistics</i>					
Multiple R	0.976786				
R Square	0.954111				
Adjusted R Square	0.944933				
Standard Error	991.9872				
Observations	7				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.02E+08	1.02E+08	103.9579	0.000156
Residual	5	4920193	984038.5		
Total	6	1.07E+08			

This time, the indicator Multiple R has a value of 0.976786 which corresponds to a strong link between the two variables analyzed. The indicator R Square is set to 0.954111. That means that 95% of the variation in number of students enrolled in higher education institutions is determined by the number of high school graduates in the last five years compared with each year analyzed.

The calculated value of Fisher test $F = 103.9579$ is higher than the corresponding tabulated value of $F_{0.05,k,n-k-1} = 6.61$ and we concluded that the null hypothesis is rejected and alternative hypothesis is accepted. The conclusion is: after 2000 the number of college graduates in the last five promotions has a significant influence on the number of students enrolled in higher education institutes. This fact is underlined by the value of Significance F = 0.000156, value lower than significance level used ($\alpha = 0.05$).

5. CONCLUSIONS

During 1990-2008 period, the number of students enrolled in institutions of higher education is steadily rising. Also, there have been significant structural mutations in student preferences on existing academic specializations. In academic year 2007-2008 the number of students enrolled in higher education increased from 4.7 times compared with

the academic year 1990-1991. Significant increases were recorded in the economics by 14.7 times, law sciences by 29.3 times, university-pedagogy by 10.1 times. On the other hand, in the higher technical education the increase was only 1.47 times.

Higher education industry had the time under consideration, a slight increase (2%). Note however that it went through a period of decline with a minimum in academic year 1996-1997 when the number of students enrolled was only 66% of those enrolled in academic year 1990-1991. After 1997 the number of enrolled students began to increase beyond the 1990/1991 baseline.

Regarding the correlation between the number of students enrolled in higher education institutes and high school graduates should be noted that after 2000 the number of school graduates in the last five promotions have a significant influence on number of students enrolled in higher education institutes which means that in the future their number will be influenced primarily by developments of the number of high school graduates and far more than other factors.

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