

WHAT FACTORS DETERMINE THE COMPETITIVENESS OF THE LEADING RUSSIAN UNIVERSITIES?

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Competitiveness of Russian universities

- Separation between education in universities and science in Russian Academy of science - inherited from Soviet times role of the centre for high education
- **Competitiveness of the universities** – an ability to accumulate the best applicants (future students)
- **Does the innovative activity of a university really influence its competitiveness in Russia?**

Factors of competitiveness

1. Traditional factors

- Quality of education (quality of teachers, students' characteristics, infrastructure)
- Reputation (cost of education, brand, demand for graduates)

2. Triple Helix factors

- Science and innovation
- Government support
- Interaction with enterprises

3. Proxies

- Universities' specialization
- Regional features

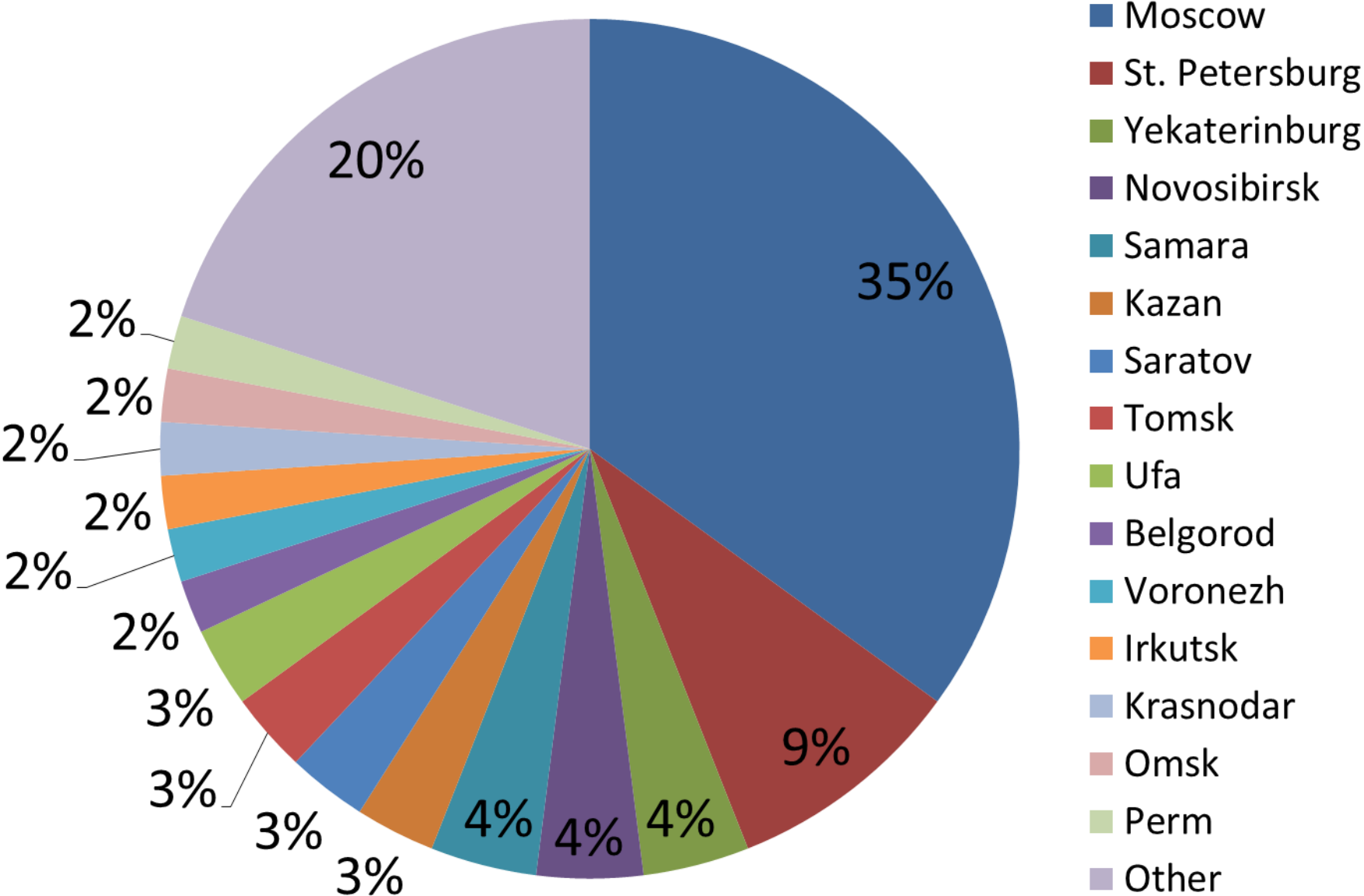
The main source of information - Monitoring of the Ministry of Education of the Russian Federation

THE LEADING RUSSIAN UNIVERSITIES

Data of the Russian rating agency “Expert RA” – 100 best Russian universities:

- Lomonosov Moscow State University
- Bauman Moscow State Technical University
- St. Petersburg State University
- Moscow Institute of Physics and Technology (National Research University)
- National Research University "Higher School of Economics"
- National Research University "Moscow Power Engineering Institute"
- National Research Nuclear University MEPhI "Moscow Engineering Physics Institute"
- National Research Tomsk Polytechnic University
- St. Petersburg State Polytechnic University (National Research University)
- National Research Novosibirsk State University

City distribution of the leading Russian universities



Dependent variables

| | |
|---------|---|
| Ave_UGE | The average score of the Unified State Examination |
| Min_UGE | The minimum score of the Unified State Examination |
| Olimp | The number of the winners of the All-Russia Olympiads per 1000 students |

| Quality of education | |
|---|---|
| <i>Students' characteristics</i> | |
| Students | The total number of students in high school, people. |
| Full_time_stud | The share of full-time students,% |
| Foreign_stud | The number of foreign students by 1000 graduates |
| CIS_stud | The number of foreign students from the CIS per 1000 graduates |
| Stud_abroad | The number of students who study abroad, per 1000 students |
| Stud_fr_abroad | The number of students from foreign universities per 1000 students |
| <i>Teachers' characteristics</i> | |
| Teach | The number of faculty members per 1000 students |
| Non_teach | The number of technical personnel per 1000 students |
| PHD_per_teach | The share of academic staff with a PhD degree |
| Young_scient | The proportion of the young scientists |
| Foreign_teach | The number of foreign academic staff per 1000 employees |
| <i>Process of education</i> | |
| Speciality | The number of specialities |
| <i>Incomes</i> | |
| Income_per_stud | The income from all sources per students |
| Income_per_teach | The income from all sources per teachers |
| Commer_income | The revenues from income-generating activities per teachers |
| Salary_to_reg | The ratio of the average earnings in the university to the average wage in the region's economy |
| <i>Infrastructure</i> | |
| Hostel | The share of students without dormitory |
| Lab_area | The total area of teaching and laboratory space per student |
| Computers | The personal computers per 100 students |
| Modern equip | The share of the modern equipment |
| Library_fund | The educational and methodological literature in the library fund per student |
| RnD_area | The area available for scientific research per 1000 students |

| | |
|--|---|
| Reputation | |
| <i>Cost of education</i> | |
| Educ_price | Price of the most expensive programm |
| <i>Brand of university's site</i> | |
| Webometrics | The rating of the web-site in Webometrics |
| Web_cited | The citation index of the web-site according to "Yandex" |
| Web_search | The number of searches according to "Yandex" per 100 students |
| <i>Alumnus' characteristics</i> | |
| Salary_stud | The average expected salary after 5 years following graduation |
| Unempl | The share of graduates, who have applied for assistance in finding suitable work |
| Unempl_true | The share of graduates, who have been recognized as unemployed |
| Unempl_year | The share of unemployed graduates during the year among applied for employment assistance |

| Science and Innovation | |
|-------------------------------|--|
| <i>Scientific work</i> | |
| Scopus_cited | The number of citations in the Web of Science / Scopus per 100 teachers |
| RINZ_cited | The number of citations in the Russian Science Citation Index per 100 teachers |
| Scopus_publ | The number of publications in the Web of Science / Scopus per 100 teachers |
| RINZ_publ | The number of publications in RSCI per 100 teachers |
| <i>Innovation</i> | |
| RnD_per_teach | The R & D spending per teachers |
| Income_fr_patents | The share of funds received from the intellectual property |
| Foreign_inc_per_stud | The revenues from the R & D and educational activities from foreign sources per 100 students |
| Foreign_inc_per_teach | The revenues from the R & D and educational activities from foreign sources per teachers |

Government and business interaction

Government's support

Federal_un

The status of a national research or federal university

Budget_per_commer

The ratio of budget and commercial expenses

Budget_income

The revenues from the university budget sources per teachers

Interaction with enterprises

Entr_agreem

The number of enterprises that have signed contracts for training, per 1000 students

Production_pract

The number of enterprises that are the bases of practice, per 1000 students

Proxies

Regional proxy

Moscow

Capital (Moscow)

Agglomeration

Region with agglomeration (1 mln)

Regions-innovators

Region-innovator

Universities' specialization

Tech_univ

Technical specialization

Econom_univ

Economic specialization

Methods

- Cross-correlation matrix
- Graphs
- Regression

Model 1: OLS, using observations 1-100 (n = 96). Dependent variable: Avr_UGE

Heteroskedasticity-robust standard errors, variant HC1

| | <i>Coefficient</i> | <i>Std. Error</i> | <i>t-ratio</i> | <i>p-value</i> | |
|----------------------|--------------------|-------------------|----------------|----------------|-----|
| const | 3.28395 | 0.277001 | 11.8554 | <0.00001 | *** |
| Agglomeration | 0.0613531 | 0.0229555 | 2.6727 | 0.00916 | *** |
| CIS_stud | 0.0110032 | 0.00731743 | 1.5037 | 0.13670 | |
| Econom_univ | 0.122365 | 0.0364955 | 3.3529 | 0.00124 | *** |
| Entr_agreem | -0.00382093 | 0.00288439 | -1.3247 | 0.18914 | |
| Income_fr_patents | -0.00201396 | 0.00271084 | -0.7429 | 0.45976 | |
| Income_per_stud | -0.0337159 | 0.0264934 | -1.2726 | 0.20693 | |
| RINZ_cited | 0.00774049 | 0.00478126 | 1.6189 | 0.10950 | |
| RnD_per_teach | 0.00081169 | 0.0139618 | 0.0581 | 0.95379 | |
| Salary_stud | 0.116288 | 0.0563539 | 2.0635 | 0.04239 | ** |
| Salary_to_reg | 0.0426086 | 0.034222 | 1.2451 | 0.21684 | |
| Speciality | -0.00881858 | 0.00829886 | -1.0626 | 0.29123 | |
| Stud_fr_abroad | 0.0032975 | 0.00259495 | 1.2707 | 0.20760 | |
| Teach | 0.0845683 | 0.0300367 | 2.8155 | 0.00616 | *** |
| Tech_univ | -0.0461441 | 0.0232777 | -1.9823 | 0.05096 | * |
| Unempl | -0.0159271 | 0.00918914 | -1.7333 | 0.08700 | * |
| Web_cited | 0.00354004 | 0.014375 | 0.2463 | 0.80612 | |
| Web_search | 0.0158785 | 0.0109521 | 1.4498 | 0.15112 | |

| | | | | |
|--------------------|-----------------|--|---------------------------|-----------------|
| Mean dependent var | 4.248193 | | S.D. dependent var | 0.120616 |
| Sum squared resid | 0.498545 | | S.E. of regression | 0.079948 |
| R-squared | 0.639279 | | Adjusted R-squared | 0.560661 |
| F(17, 78) | 13.82798 | | P-value(F) | 4.72e-17 |
| Log-likelihood | 116.2815 | | Akaike criterion | -196.5631 |
| Sum of squares | 150.4040 | | Unrestricted model | 177.0050 |

Model 2: OLS, using observations 1-100. Dependent variable: Min_UGE
Heteroskedasticity-robust standard errors, variant HC1

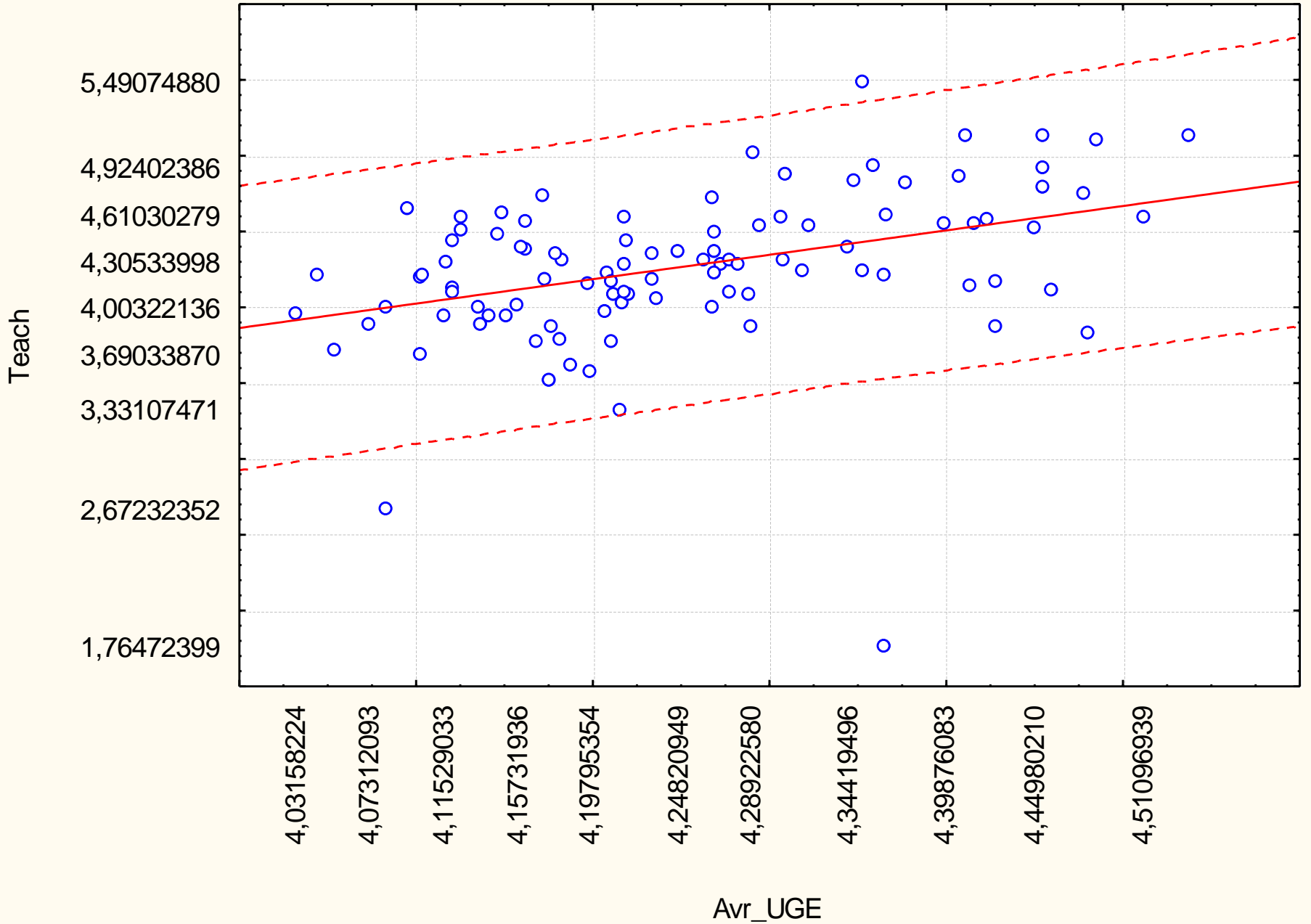
| | <i>Coefficient</i> | <i>Std. Error</i> | <i>t-ratio</i> | <i>p-value</i> | |
|--------------------------|--------------------|-------------------|----------------|----------------|-----|
| const | 2.25177 | 0.317585 | 7.0903 | <0.00001 | *** |
| CIS_stud | -0.000577331 | 0.00996144 | -0.0580 | 0.95392 | |
| Educ_price | 0.0160171 | 0.0389984 | 0.4107 | 0.68233 | |
| Entr_agreem | -0.000490394 | 0.00481515 | -0.1018 | 0.91912 | |
| Federal_un | 0.0414796 | 0.0326024 | 1.2723 | 0.20678 | |
| Foreign_inc_per_stud | 0.00246983 | 0.00220374 | 1.1207 | 0.26559 | |
| Income_fr_patents | -0.00703545 | 0.00311812 | -2.2563 | 0.02665 | ** |
| Income_per_stud | 0.0194327 | 0.0381396 | 0.5095 | 0.61173 | |
| Modern_equip | -0.00494422 | 0.00426429 | -1.1594 | 0.24956 | |
| Moscow | 0.0164284 | 0.0362174 | 0.4536 | 0.65128 | |
| RINZ_publ | 0.0430502 | 0.0264086 | 1.6302 | 0.10681 | |
| Salary_stud | 0.224504 | 0.073092 | 3.0715 | 0.00287 | *** |
| Speciality | -0.017535 | 0.00903536 | -1.9407 | 0.05565 | * |
| Teach | 0.0468778 | 0.0424101 | 1.1053 | 0.27217 | |
| Web_cited | -0.008667 | 0.0195246 | -0.4439 | 0.65826 | |
| Web_search | 0.0308344 | 0.0145253 | 2.1228 | 0.03671 | ** |

| | | | |
|--------------------|-----------------|---------------------------|-----------------|
| Mean dependent var | 3.848443 | S.D. dependent var | 0.137250 |
| Sum squared resid | 1.030667 | S.E. of regression | 0.110769 |
| R-squared | 0.447342 | Adjusted R-squared | 0.348653 |
| F(15, 84) | 4.049401 | P-value(F) | 0.000017 |
| Log-likelihood | 86.85434 | Akaike criterion | -141.7087 |
| Schwarz criterion | -100.0260 | Hannan-Quinn | -124.8389 |

Conclusion

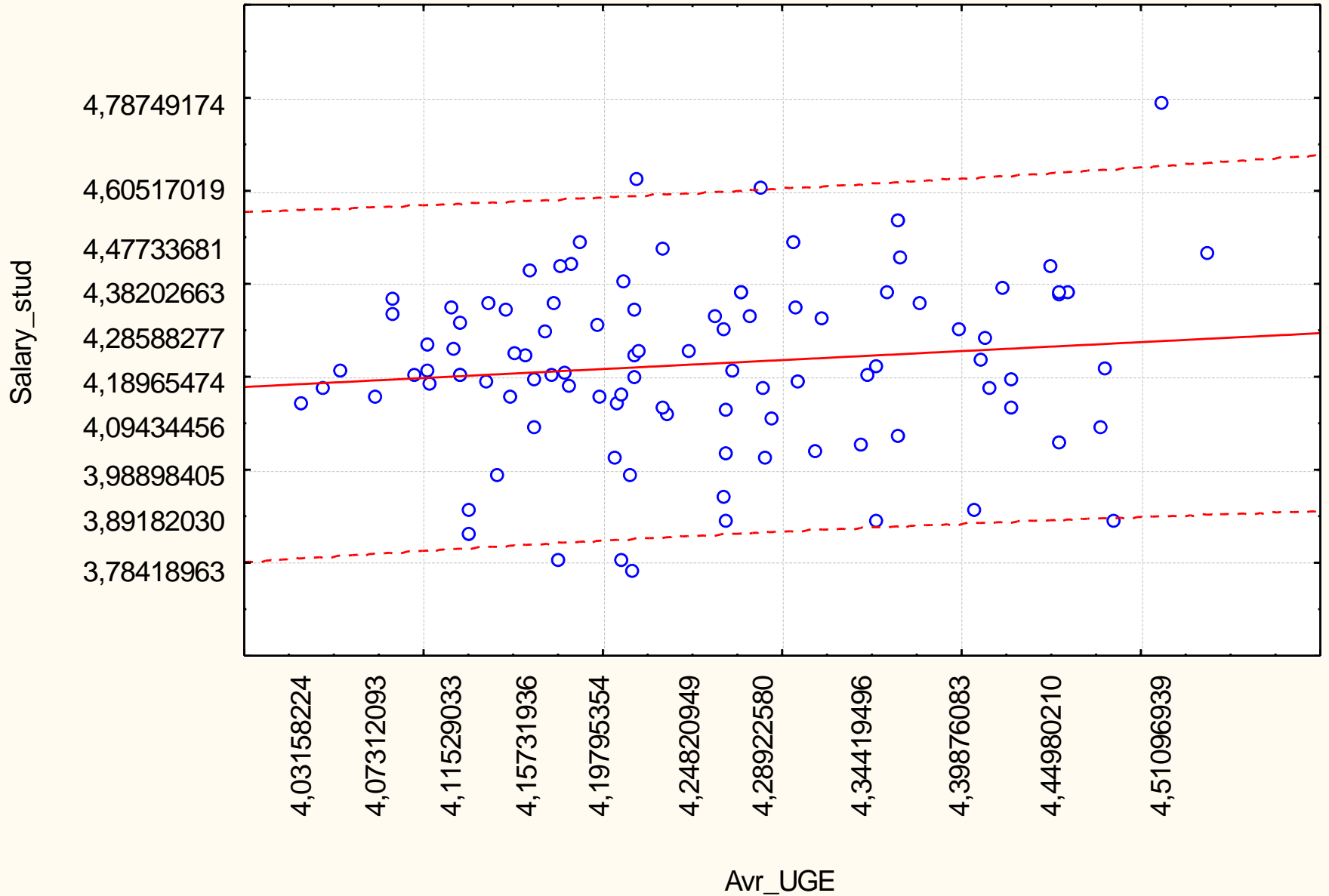
- The first model explains 56% (adjusted R^2) of the total variation. The main factors are: **the number of teachers per students, expected salary and employment of graduates**. The average USE score are **higher in economic universities and lower in technical**. Important role played an **agglomeration effects**. Unfortunately, the actions to reveal the "triple helix" effect are failed.
- In the second model (adjusted $R^2 = 0.35$), **expected salary and reputation (number of searches)** are the main factors. The **revenues from patent activity and the variety of specialties** have a low negative effect.
- The third probit model was the least explained (adjusted $R^2 = 0.05$). Only **potential wage**, web citation and agglomeration effect can be considered as positive significant.
- The study found that innovation activity and elements of the "triple helix" have practically no influence in the leading universities in Russia on students' demand.
- One of the most important conclusions is that the applicants are non-oriented to the production of innovative products and the implementation of research and development. The leading universities are focused on training of the highly specialized future employees (accountants, lawyers, etc.). For the former school competition participants, who more likely to choose a scientific profession, innovation activity can be also considered as an insignificant factor.
- As a result, innovation-active technical colleges are the least competitive.

Scatterplot (Spreadsheet1 18v*100c)



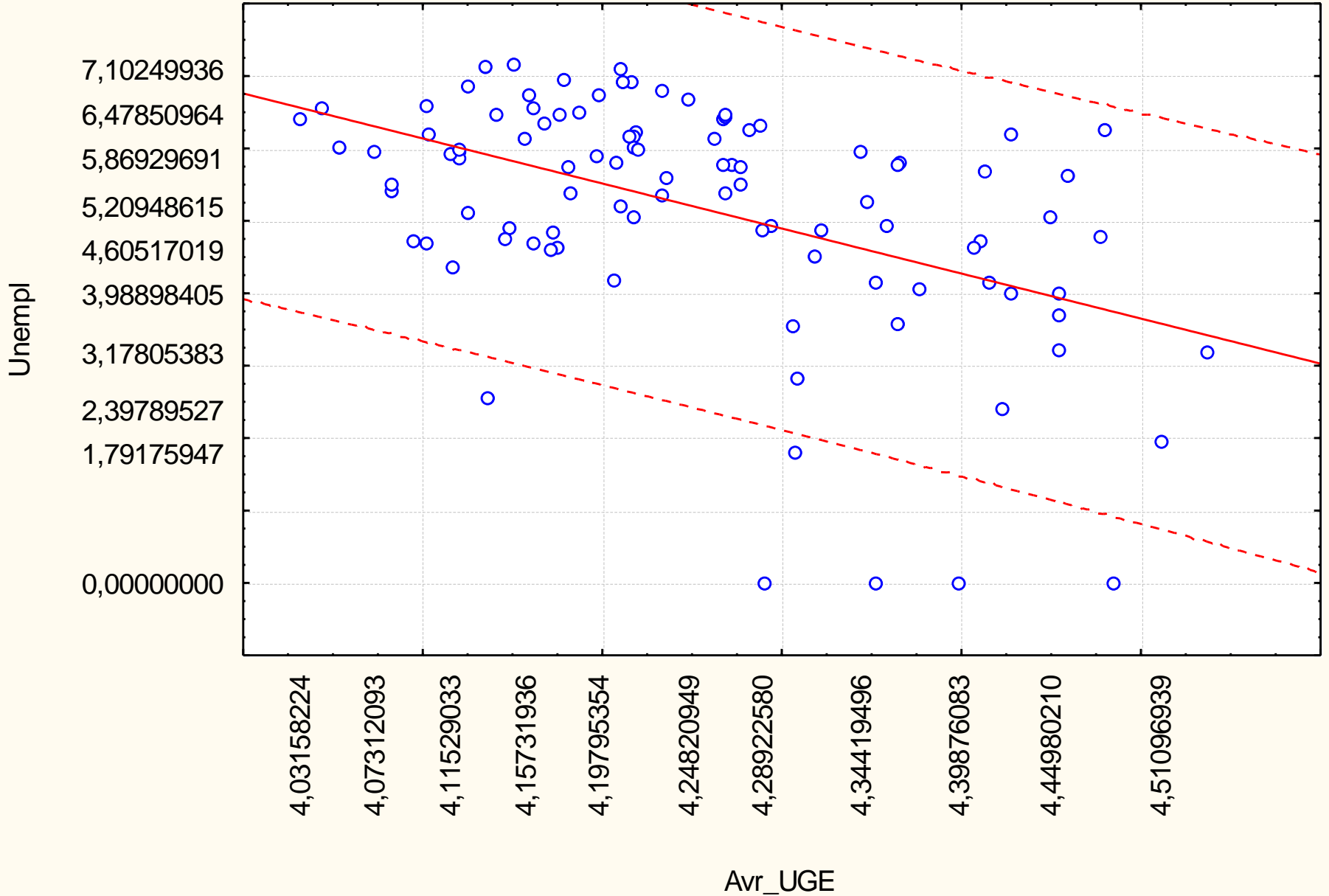
Scatterplot (Spreadsheet1 18v*100c)

$$\text{Salary_stud} = 3,4063 + 0,1929 \cdot x$$



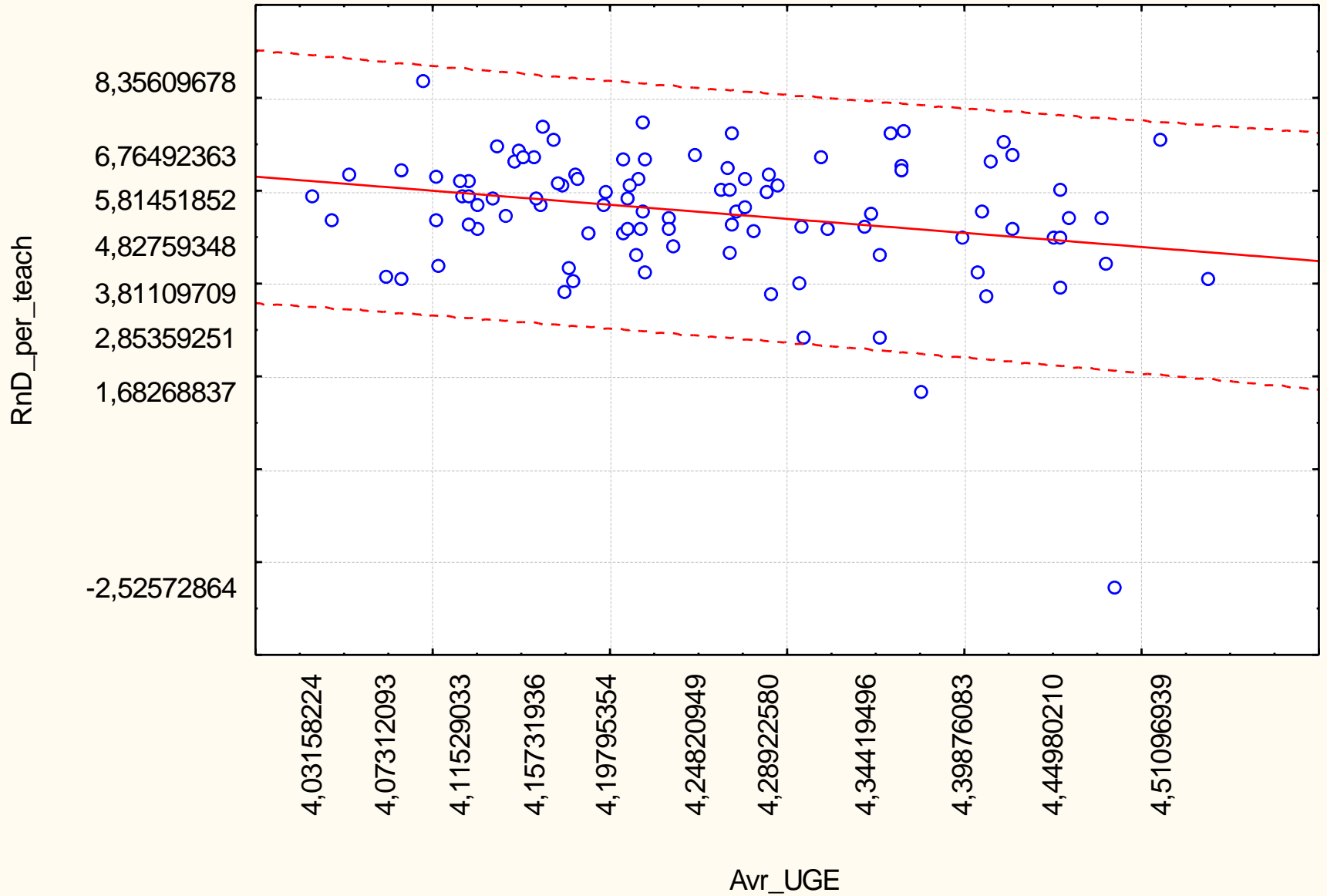
Scatterplot (Spreadsheet1 18v*100c)

$$\text{Unempl} = 31,6298 - 6,2177 * x$$

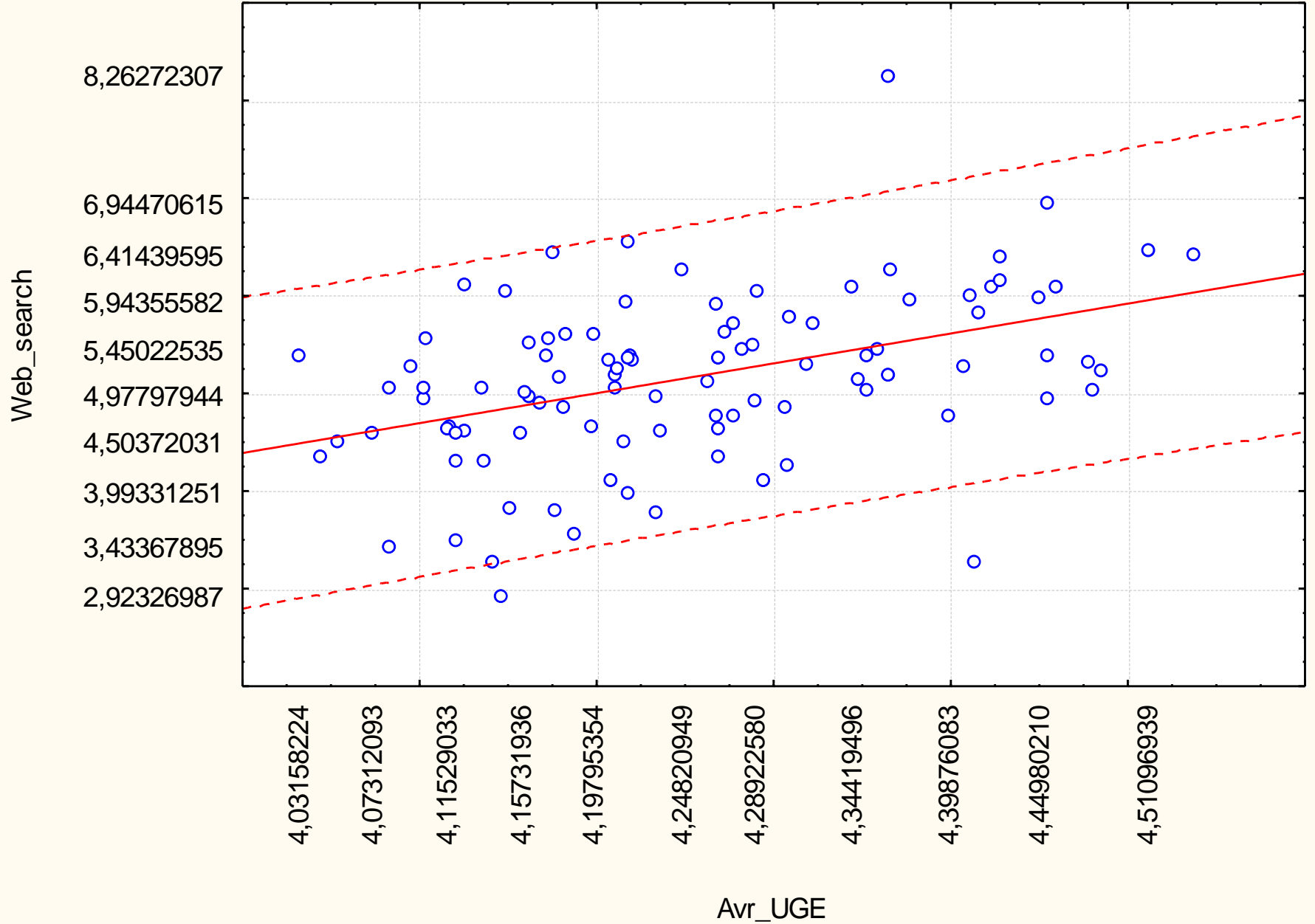


Scatterplot (Spreadsheet1 18v*100c)

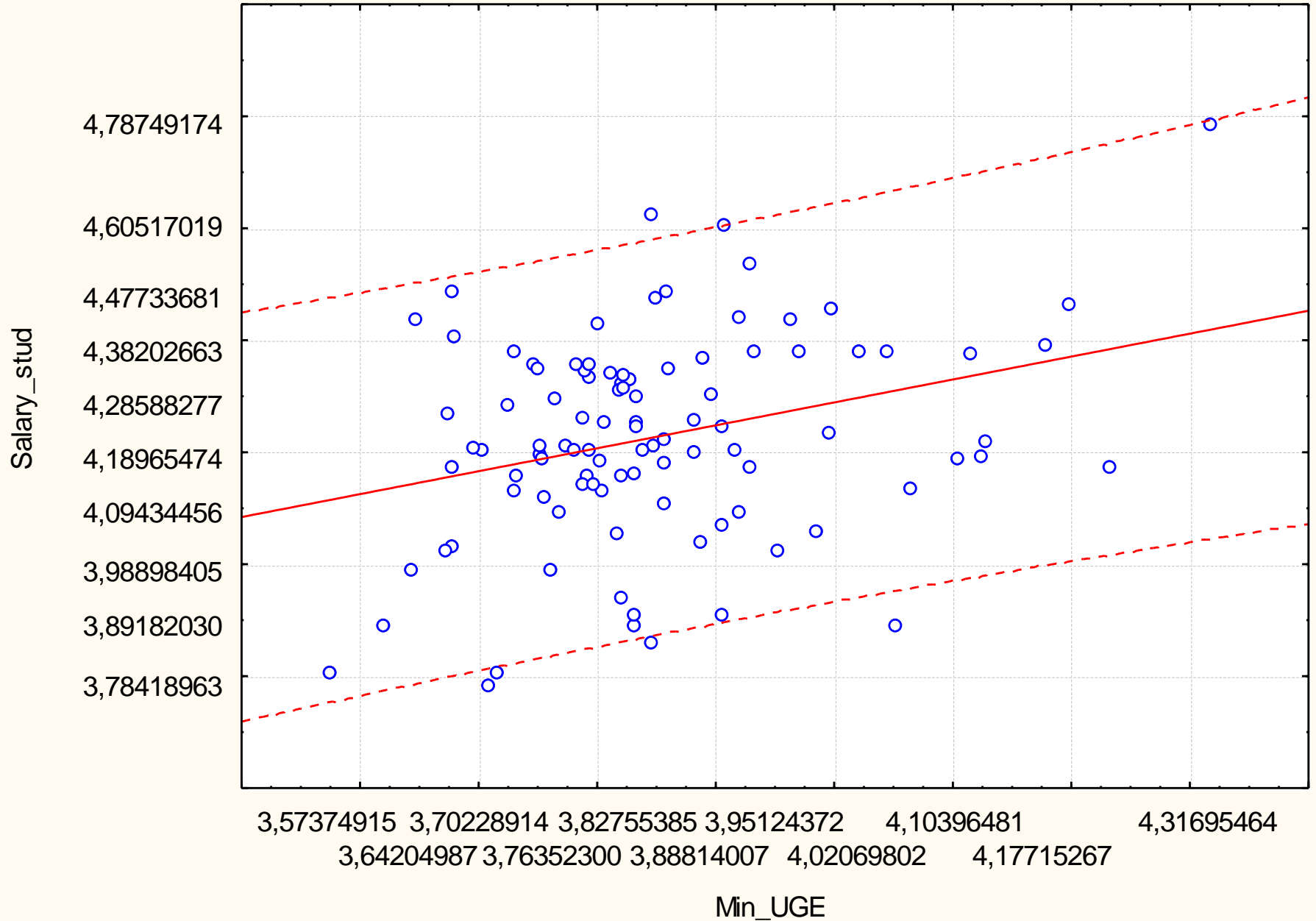
$$\text{RnD_per_teach} = 18,4204 - 3,0296 * x$$



Scatterplot (Spreadsheet1 18v*100c)

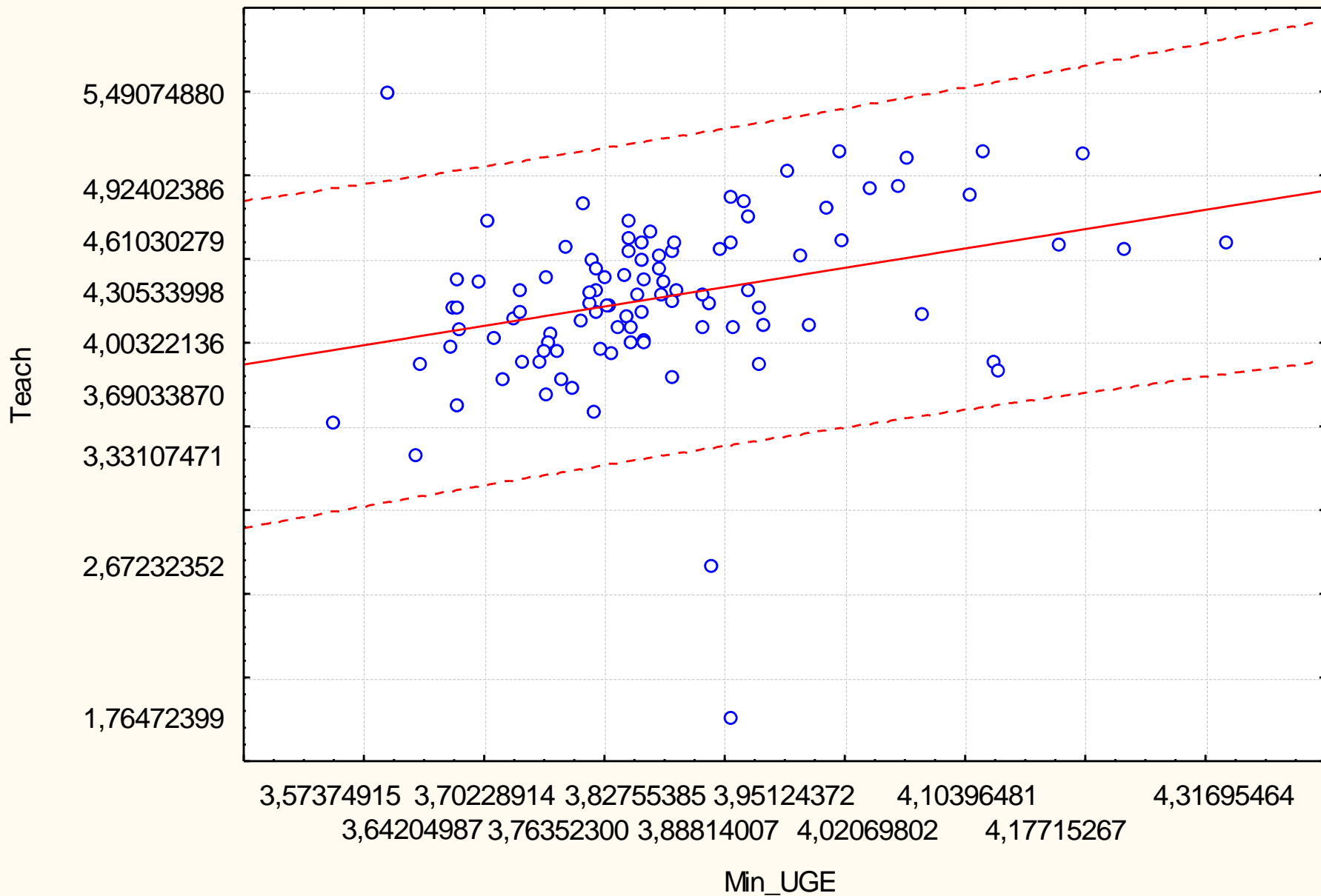


Scatterplot (Spreadsheet1 16v*100c)

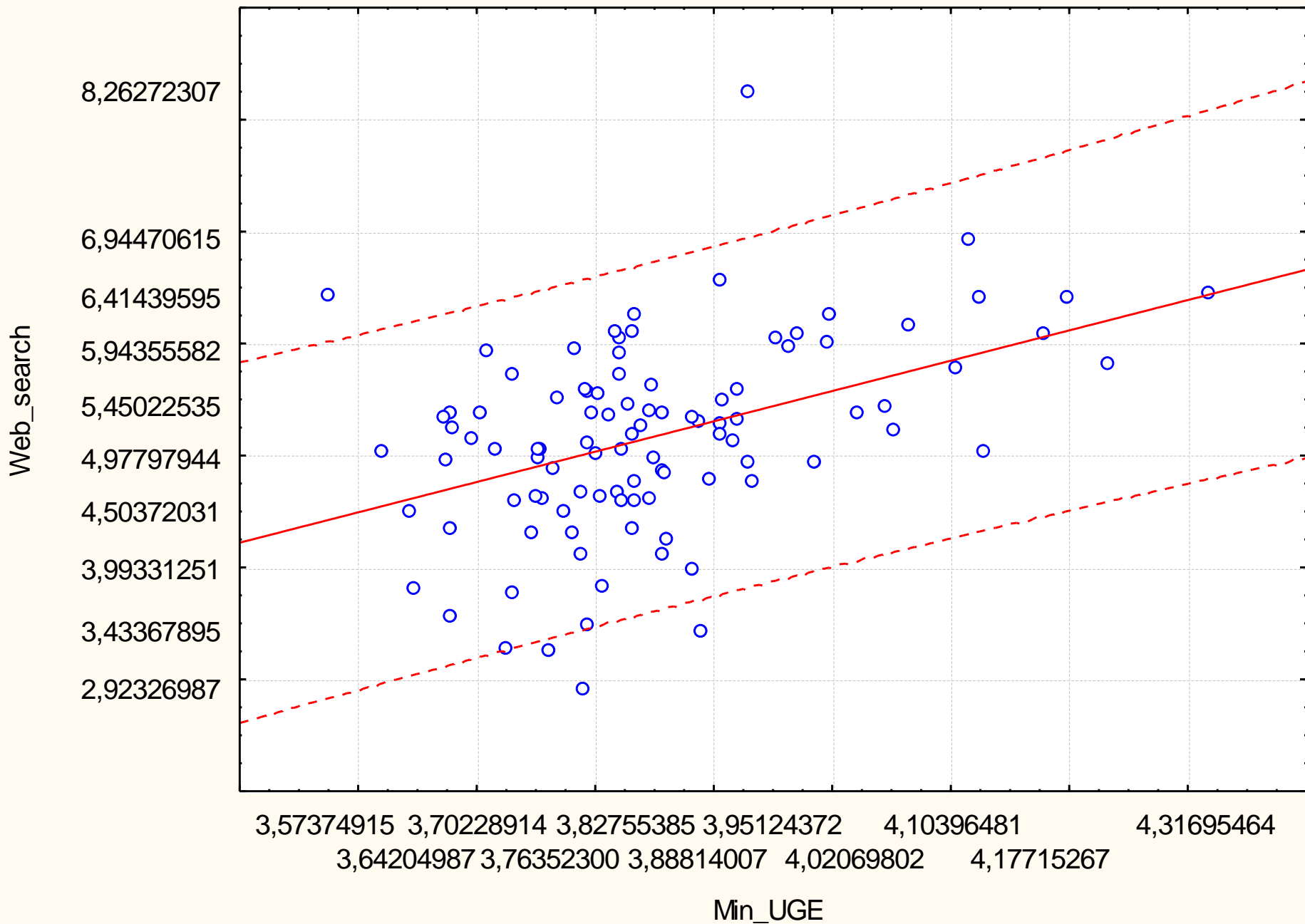


Scatterplot (Spreadsheet1 16v*100c)

$$\text{Teach} = -0,1729 + 1,155 * x$$



Scatterplot (Spreadsheet1 16v*100c)



Scatterplot (Spreadsheet1 16v*100c)

$$\text{Income_fr_patents} = 20,668 - 6,2074 * x$$

