

## **Factors and Models of Academic Success of Double Degree Programme in Economics**

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### **Abstract:**

*The problem to be discussed – finding the key groups of academic success factors, setting proper indicators for them, investigating quantitatively and qualitatively their influence on programme success and to manage them when possible.*

*The key factors considered – students' admission, grouping, teachers' appointments, students' assignments, workload and knowledge evaluation, motivation, individual students' characteristics. The indicators to reflect the academic outcome - average grades and standard deviations, progression rates, shares of pass or excellent grades, starting from admission to the graduation and placement. Modeling of the relationships between exogenous and endogenous factors and indicators allows to undertake proper managing policy measures.*

**Admission:** *since 2009 admission to Russian universities is done on the basis of scores of Unified State Exams (USE) in Mathematics, English and Russian languages. Every year econometric analysis of the USE scores as factor of further success is done at ICEF. It shows that the USE sum is reasonable indicator of success, and all three scores have individually significant, though gradually decreasing, influence on further success at the programme. The analysis allows to give recommendations on the admission criteria in further years.*

**Academic success during the studies.** *After the year 1 ICEF students are admitted to the UoL International programme on the basis of Advanced Placement tests (APTs). The following factors are considered in econometric models for APT results: grouping of the students, lecturers' and classteachers' appointments, external factors (worldwide grades dynamics), personal students' indicators, entrance qualifications and the progress during the year.*

*The progression of the years 2-4 students on double degree programme depends both on International (University of London) exams and local exams and other activities. Factor analysis of final success in each subject is regularly done using econometric methods. It allows to improve the programme, teaching and the students' motivation.*

**Grouping.** *The regression analysis showed that only stronger students staying in stronger groups win from the regrouping, while all the other students loss in terms of peer effect, and such a regrouping reduces the progression rate..*

**Teachers.** *There are few indicators used for the teachers' performance at the ICEF: the grades at the international exams, students' evaluations, and peer reviews. The average scores, standard deviations, pass rates and excellent grades' shares are analysed after receiving the exams grades. Dummy variables for particular classteachers are used in the*

*models of student achievement, and those who do significantly worse (though this happens rather seldom) get additional training. This analysis allowed to develop the teachers' appointments policies at ICEF.*

***Student evaluations.*** *Another set of indicators of teachers' performance comes from the students' evaluations of teacher's clarity, logic, feedback, control, availability. Again, econometric analysis shows that the "clarity" indicator is the most important for the students' overall teaching evaluation. Students' evaluations should be taken into account together with the course results and peer review reports. An intensive programme for new teachers' induction is implemented at ICEF, taking into account the factors from evaluations.*

*Modeling of the factors of academic success allows to develop the policy of admission, teachers' appointment and support, the students' grouping, motivation and workload distribution. This approach is planned to be extended in ICEF to the analysis of developments and evaluation of all kinds of knowledge and skills requested by the employers, to the wider range of subjects, indicators and activities.*

*Keywords: Academic Success, Education, Econometric Analysis, Factor, Model, Policy Measures*

**Achievement of high academic results is the key objective for a university. There are different factors of achieving this objective – on the sides of students, teachers and the institution. The problem to be discussed in the paper – investigation of how to formulate the key groups of academic success factors, to set proper indicators for them, investigate quantitatively and qualitatively their influence on programme success, and hence to manage these factors when possible.**

The key factors considered – students' admission, grouping, teachers' appointments, students' assignments, workload and knowledge evaluation, motivation stimulation, individual students' characteristics. The indicators to reflect the academic outcome - average grades and standard deviations, progression rates, shares of pass or excellent grades for different students' groups and subgroups, at different stages of studies, starting from admission to the graduation and placement. Modeling of the relationships between exogenous and endogenous factors and indicators allows to undertake proper managing policy measures. The double degree BSc programme at the International College of Economics and Finance (National Research University Higher School of Economics, Moscow, created and implemented in cooperation with the London School of Economics) is organized in such a way that provides sufficient data on students' academic success that allows serious statistical and econometric analysis of the factors of academic achievement. The students get BSc Degree in Economics of NRU HSE and the BSc degree of the University of London, and hence have regular and detailed knowledge control by both universities. ICEF also has MSc programme in Financial Economics also developed in cooperation with the LSE, and investigation of its academic success factors is also very important though being outside the scope of this paper.

**Admission:** since 2009 admission to Russian universities is done on the basis of scores of Unified State Exams (USE) in Mathematics, English and Russian languages. Every year careful econometric analysis of the USE scores as factor of further success is done at ICEF. It shows that the sum of three USE scores is reasonable indicator of success, and all three scores

have individually significant, though gradually decreasing, influence on further success at the programme. Those candidates who have the sum of three USEs scores 205 or more were admitted in 2011-2012, and various econometric models were estimated on the basis of admission criteria, further students' efforts and individual characteristics. The analysis allows to give particular recommendation of the admission criteria raise in further years. The fee discounts on the year 1 are given on the basis of weighted sum of USE scores, with the weights corresponding to the average contribution of each USE in final rating estimated using regression model (3 for Math, 2 for English, 1 for Russian). Modeling of the academic success also allows to give further recommendations for fee discounts policy.

**Academic success during the studies.** After the year 1 ICEF students are admitted to the UoL International programme on the basis of Advanced Placement tests (APT) in Calculus, Statistics, Microeconomics, Macroeconomics. To prepare the students to these exams, local exams in the same format are set three times during the year. Local grades serve as a good indicator for further APT success: normally the correlation of 0.7-0.8 is observed which is rather high. The average scores and the pass rates in each AP exam are analysed in dynamics, and the following factors are considered basing on econometric models: grouping of the students, lecturers' and classteachers' appointments, external factors (worldwide grades dynamics), personal students' indicators, entrance qualifications and the progress during the year. The results of analysis are used for programme developments. For example, in 2012 the Microeconomics was found being the bottleneck for further progression (together with Macroeconomics), and these courses were extended in time and in content.

The regression of the AP\_AVE (the average of 4 APT scores, out of 5) in 2012 on three USE scores (USE\_M, USE\_R and USE\_E for Mathematics, Russian and English languages), as well as gender dummy (MALE), being high school Olympiad winner (OLYMP), end being from non-Moscow region (REGIONS) is given below:

Dependent Variable: AP\_AVE

Method: Least Squares

Included observations: 176

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.471	0.967	-5.656	0.000
USE_M	0.050	0.008	6.471	0.000
USE_R	0.026	0.009	3.104	0.002
USE_E	0.032	0.010	3.110	0.002
MALE	0.309	0.149	2.076	0.040
OLYMP	0.436	0.212	2.060	0.041
REGIONS	-0.071	0.169	-0.421	0.674
R-squared	0.405	Mean dependent var		3.543
S.E. of regression	0.926	S.D. dependent var		1.180
Sum squared resid	144.8	F-statistic		19.19
Durbin-Watson stat	2.221	Prob(F-statistic)		0.000

It can be seen from the regression that all USE grades are significant indicators for further student's success, both as a group and individually, and even the contributions of the grades in the overall APT mean score are approximately proportional to their weights for the

indicator of fee discount. It is important that the High school olympiads' winners (who are likely the people most interested in the Economics subject area) perform significantly better than other students (with other factors fixed), male students doing slightly better than female (this should be confirmed by other models and years in order to judge, though in principle some motivations difference is possible due to different army service responsibilities in case of failure in studies), and popular opinion that the students from the regions other than Moscow can perform differently from the Moscovites is not correct.

At the same time, the overall explanatory power of the regressors is not too high (judging by the Determination coefficient 0.4), and the effectiveness of the personal student's effort throughout the year of study at ICEF (based on his/her abilities, motivation, and the quality of teaching) is very important. Adding to the regression above the average mid-term exams grades (4 ICEF exams in April, in the same subjects as APTs, out of 100) as an additional regressor allows to raise the  $R^2$  value from 0.4 to 0.75 immediately, and "absorbs" the explanatory power of Mathematics and Russian USE exams, as well as of OLYMP (but not MALE) variable.

While the average score shows the overall group's level and its factors, the progression rate (here the University of London admission rate) is also very important for investigation and analysis. The student is admitted to the University of London in terms of APT results (qualification in English is also needed) if he/she has passed (got 3 or more out of 5) 2 subjects out of 3 (Calculus, Statistics, Economics). To pass Economics means to pass both Micro- and Macroeconomics. In 2012, the UoL admission rate for ICEF students was about 76%, and the binary variable UL\_PASS indicates if the student was admitted. Here below the results of Logit model estimation are presented, and in terms of the variables significance they are similar to those of the model for the AP\_AVE variable factors. Even the order and ratios of the USE exams contributions are similar: the Mathematics exam has the highest coefficient, then English and Russian languages. Though MALE variable becomes insignificant here, as one could expect.

Dependent Variable: UL\_PASS

Method: ML - Binary Logit (Quadratic hill climbing)

Included observations: 174

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-20.206	3.615	-5.590	0.000
EGE_M	0.111	0.029	3.859	0.000
EGE_R	0.057	0.028	2.084	0.037
EGE_E	0.093	0.031	3.030	0.002
MALE	0.636	0.470	1.352	0.176
OLYMP	1.875	0.984	1.905	0.057
REGIONS	-0.010	0.530	-0.188	0.851
Mean dependent var	0.753	S.D. dependent var		0.433
S.E. of regression	0.358	McFadden R-squared		0.308
Sum squared resid	21.41	LR statistic (6 df)		59.92
Log likelihood	-67.33	Probability(LR stat)		0.000

The estimation shows that in order to provide higher than 50% progression rate to the year 1, the admission criteria should be set at about the level of 235 points, which means about 10 points more on average in each exam on average (out of 100) than now.

The progression of the years 2-4 students on double degree programme depends both on International (University of London) exams and local exams and other activities. Factor analysis of final success in each subject is regularly done using econometric methods. Current activities and motivation to study become more significant each further year of studies, and local performance is again very good indicator of the UoL exams grades: normally the  $R^2$  coefficient of regressions is 0.7-0.8. Lectures attendance or home assignments grades are usually significant for the forthcoming exams grades while if this grade is included as a factor for further success, it normally crowds out the influence of those indicators. Here is an example of regression of final exam in Econometrics (FINAL) on the rating (average grade) for the previous year (RATING), lectures attendance (LECT), home assignments average grade (HA\_AVE), and the mid-term exam result (MIDTERM); all variables out of 100 (the lecture attendance in %).

Dependent Variable: FINAL

Included observations: 85

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-19.67	6.319	-3.113	0.0026
MIDTERM	0.191	0.082	2.320	0.0229
LECT	0.057	0.024	2.172	0.0328
HA_AVE	0.273	0.089	3.058	0.0030
RATING	0.660	0.174	3.801	0.0003
R-squared	0.755	Mean dependent var	49.67	
S.E. of regression	9.478	S.D. dependent var	18.67	
Sum squared resid	7185.9	F-statistic	61.53	
Durbin-Watson stat	2.25	Prob(F-statistic)	0.0000	

All the variables are here significant, and the coefficients allow to estimate the average influence of each factor on the final exam grade. This type of analysis allows to adjust the teaching and knowledge control methods, also to improve the students' motivation in terms of informing them on the factors of success. Unlikely many other students, ICEF students usually study intensively throughout all academic year. By now, ICEF students presenting about 2.5% of the UoL EMFSS students, usually get 15-20% of awards for best academic achievement, 10-15 top scores out of 19 exams taken, and have average grade of about 60 (second upper class level) against 40-42 overall UoL average.

**Grouping.** Basing on the data on academic success after the students' regrouping on the basis of previous achievement, the regression analysis was done. It showed that only stronger students staying in stronger groups win from the regrouping, while all the other students loss in terms of peer effect, and such a regrouping definitely reduces the progression rate. In 2013 such a regrouping has not been done in accordance with recommendations, and an investigation of different approaches for initial grouping (from completely random to some "soft" streaming in accordance with their level/motivation are at further investigation. Some key results of regrouping analysis done are available below.

In August groups are formed on the basis of Unified State Exam (USE) in Mathematics. In 2011-2012 year ICEF had two types of groups: "stronger" and "weaker": top 40% of students were distributed among 4 groups quasi-randomly, other 60% of students were distributed among 6 groups also quasi-randomly.

In January 2012, after December exams, the groups were re-distributed on the basis of ICEF AP subjects exams rating (Calculus, Microeconomics, Statistics). Each group kept its “core”, but some student were “upgraded” to the “stronger” groups, some were “downgraded” to “weaker” (24 and 32 respectively), and some with the lowest results left the programme. Finally all who took the rating in top 40% after winter exams were in “stronger” groups, and next 60% in the weaker.

The analysis of regrouping efficiency was done on the basis of April ICEF exams. Here RAT\_APR shows the students’ April average scores in the 4 AP subjects, CALC\_APR, STAT\_APR, MIC\_APR and MAC\_APR are their scores (out of 100) at the April mid-term exams in Calculus, Statistics, Microeconomics and Macroeconomics respectively. The explanatory variables (ended by \_JAN, no Macroeconomics since it was taught in semester 2 only; HIST means History elective) are the scores at the final semester 1 exams after which the students were regrouped. Dummy variables WE\_WE, WE\_ST, ST\_WE and ST\_ST mean the initial and final group type for each student: for example, WE\_ST equals one for those moved from the weaker to stronger group, while WE\_WE equals one for those who stayed in their weaker group. Those who stayed in the stronger group are the reference category.

Dependent Variable: RAT\_APR

Included observations: 182

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.303	3.560	0.366	0.7148
STAT_JAN	0.187	0.070	2.674	0.0082
CALC_JAN	0.229	0.059	3.901	0.0001
MIC_JAN	0.353	0.065	5.458	0.0000
WE_WE	-3.088	1.858	-1.662	0.0983
WE_ST	-4.628	1.733	-2.671	0.0083
ST_WE	-3.793	1.915	-1.981	0.0492
HIST_JAN	0.082	0.030	2.758	0.0064
R-squared	0.809	Mean dependent var	38.89	
S.E. of regression	6.725	S.D. dependent var	15.04	
F-statistic	104.5	Durbin-Watson stat	2.087	

In the regression for overall rating all three categories of students got in April significantly (at least at 10% level) less than the reference category (if other factors are equal). This means that only those stronger students who stayed in their initial stronger groups won comparing to the others. As for the particular subjects, the most significant results in line with the overall ones were observed for Calculus (see below) which is based on Mathematics being the basis for initial grouping:

Dependent Variable: CALC\_APR

Included observations: 199

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.680	5.000	1.136	0.257
STAT_JAN	0.167	0.095	1.760	0.080
CALC_JAN	0.474	0.082	5.784	0.000

MIC_JAN	0.297	0.087	3.394	0.001
WE_WE	-9.008	2.606	-3.457	0.001
WE_ST	-7.430	2.472	-3.005	0.003
ST_WE	-6.344	2.738	-2.317	0.022
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R-squared	0.759	Mean dependent var	41.82	
S.E. of regression	9.811	S.D. dependent var	19.69	
F-statistic	100.9	Durbin-Watson stat	1.961	

According to statistical analysis, regrouping of the students according to rating positively influenced the performance of the students that stayed in the stronger groups. This category of students is taken as reference category, and its dummy is called ST\_ST. Regressions estimated with AP main courses grades as dependent variable gives us the same positive influence on strong students' performance.

Students who moved from stronger groups to weaker ones according to their academic performance, do not benefit from the movement. Their overall results decreased by 3.7 points, calculus results decreased even more, by 7 points. It can be assumed that strong students play the role of locomotive in weaker groups, so weaker students are more motivated to study and get additional peer support.

The students who moved from weaker groups to stronger ones have also demonstrated worse performance than the reference group. This result can be explained by the fact that in weaker groups such students were leaders that stimulated them to learn more, in particular in active interaction with the classteachers, as well as with their peers. In stronger groups these people are of the medium level and this fact discourages them.

The largest decrease in academic performance show the weaker students who stayed in weaker groups: the estimated decrease in calculus goes over 9%. The explanation of this fact is that after the movement stronger students are gone to stronger groups and in weaker ones only weaker students stay. Weaker environment makes weaker students even less motivated. They also do not get some peer support from the stronger students who left the group.

So, generally, the regrouping of students does not influence positively the academic performance, and it was not done in 2013 due to this.

**Teachers.** There are few indicators used for the teachers' performance at the ICEF double degree programme. First, these are the students' grades at the external (international) exams. Since the exams are external and properly set at the stable level, the grades' changes are not large and happen mostly due to the teachers' work and the students' motivation and effort. The average scores, standard deviations, pass rates and excellent grades' shares are analysed after receiving the external exams grades, also compared with the dynamics of the "other world" grades. The absolute changes corrected by the overall changes may be the "exam performance" indicators for teachers' and students' achievement. For example, if in 2011 the Elements of Econometrics ICEF students' average score went up by 7%, and the "other world" average went down by 6%, then hence the "corrected" increase was about 13%, - and this is the indicator to be regressed on other factors.

Dummy variables for particular classteachers are used in the models of student achievement, and those who do significantly worse (though this happens rather seldom) get additional support, or may be even replaced by more efficient colleagues. This analysis allowed to develop the teachers' appointments policies at ICEF.

**Student evaluations.** Another set of indicators of teachers' performance comes from the students' evaluations, - different features of teaching are evaluated in 1-5 scale: clarity, logic,

feedback, control, availability. Again, econometric analysis shows that the “clarity” indicator is the most important for the students’ overall teaching evaluation. Students’ evaluations are important but should be taken carefully: usually the students evaluate lower the teachers of more advanced courses, classes are evaluated higher than lectures, and electives higher than mandatory courses – irrespectively to the actual quality of teaching. But they should be taken into account together with the course results and peer review reports done by the experienced teachers and teaching methods specialists on a regular basis. Since 2011, the intensive programme for new teachers’ induction was implemented at ICEF, and the programme of teaching quality assurance (in co-operation with the LSE Teaching and Learning Center) was developed. Statistical analysis of the students’ evaluations showed that the new teachers in 2011-2012 got significantly higher evaluations than before, and even higher than most of more experienced teachers. Also, ICEF graduates coming further to teach have significantly higher evaluations (other factors equal) than the others. This is due to the availability of many talented students in ICEF, good preparation for further academic or professional activity, good further education (mostly at the Western Master programmes), and also understanding of the programme requirements and students expectations.

The result of regressing Clarity evaluation (out of 5) on a number of factors is shown below. The variables shown to be significant (at 5% level) are LECT=1 for lecturers, CLARITY\_SD – standard deviation of clarity – supposed to be higher for more advanced and complicated courses taught on the final year of the programme, GRAD=1 for ICEF graduates teaching at the programme, BEGIN – teaching for the first year at ICEF. The variables FTA =1 for full time academics with PhD degree, MSC=1 for master students teaching BSc class, UoL=1 for the University of London courses, YEAR2-4 dummies for the years of ICEF programme, NATIVE=1 for English native speakers, and ELECTIVE=1 for elective courses shown to be insignificant. Again, the students evaluate lower more advanced courses and activities, not just because of lower teaching quality, but essentially due to their own lack of understanding, and this should be taken into account when judging about the teachers’ performance.

Dependent Variable: CLARITY

Method: Least Squares

Included observations: 117

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.556	0.147	37.74	0.000
FTA	-0.207	0.139	-1.492	0.139
LECT	-0.166	0.077	-2.163	0.033
MSC	-0.045	0.120	-0.373	0.710
UOL	-0.192	0.098	-1.957	0.053
GRAD	0.228	0.096	2.380	0.019
CLARITY_SD	-1.462	0.140	-10.44	0.000
BEGIN	-0.347	0.110	-3.171	0.002
YEAR2	0.038	0.108	0.352	0.725
YEAR3	0.039	0.122	0.319	0.750
YEAR4	0.006	0.131	0.043	0.966
NATIVE	0.087	0.099	0.872	0.385
ELECTIVE	0.019	0.102	0.190	0.850
R-squared	0.670	Mean dependent var	4.064	



S.E. of regression	0.332	S.D. dependent var	0.547
Sum squared resid	11.436	F-statistic	17.62
Durbin-Watson stat	1.1629	Prob(F-statistic)	0.000

Modeling of the factors of academic success allows to develop the policy of admission, teachers' appointment and support, the students' grouping, motivation and workload distribution. This approach is planned to be extended in ICEF to the analysis of developments and evaluation of all kinds of knowledge and skills requested by the employers, to the wider range of subjects, indicators and activities (including the research type activities), and to the analysis of academic success factors at the MSc programme in Financial Economics where not just the grades but research quality is among the key academic results.

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