

Empirical Analysis of Employees with Tertiary Education Occupational Imbalances

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ABSTRACT

High percentage of graduates (among the highest in the world) with university degrees combined with unacceptably low level of utilization of acquired qualifications and generally low quality of education in the majority of Russian universities result in huge structural imbalances. The article presents quantitative estimates of disproportions between the educational levels of employees with higher education and their professional occupation for different branches of economy. A logit models based analysis is performed of how much the professional functions performed by employees match their professional qualifications, levels of education and the extent to which their previously acquired expertise and skills are put into use. The sample used represents working population of Russia with tertiary education. The results obtained allow to the conclusion that worst disproportions between education levels attained and job requirements are observed in trade and services sector, transport and communications, housing and utilities, consumer goods and food industries. The matters are compounded by inert and informationally inefficient labor market, incapable of sending proper signals to national system of tertiary education.

Keywords: Education, Higher Professional Education, Education Market Disparities, Logit Model

1. INTRODUCTION

Russia's accession to WTO puts before the national system of education a number of challenging problems, upon finding successful solutions to which economic progress as well as social stability in the country in general are contingent. Among those problems one can single out achievement of closest possible correlation between professional qualification of university-educated employees and professional functions they perform. This actualizes research into the determinants of demand for graduates with university degrees as well as the role of state in the process of shaping this demand. The latter is especially important since the trend of diminishing in real terms support on the part of public sector per one university entrant has already been indicated in the literature (Ehrenberg, 2006).

As for the empirical research of demand for higher education, there is a number of studies investigating the problem in developed markets. In particular, the studies

on human capital theory linked the decisions to invest in university education with expected future income. Empirical evidence in support of such conclusions can be found in Wilson *et al.* (2005) and Canton and De Jong (2005). The results of the studies indicate positive influence of expected returns on educational attainment. Some empirical confirmations have been received as of influence of such a factor as education level of parents (Flannery and O'Donoghue, 2009; Cunha and Heckman, 2007). However, other studies indicate weak effect of social environment on commitment to receive better education (Brannstrom, 2008). Chowdry *et al.* (2013) conclude that while a gap in university education attainment caused by differences in socioeconomic status actually exists, it comes down significantly if prior attainment is taken into account. At the same time studies conducted in the post-soviet Russia demonstrated social status to be one of the major determinants of educational attainment (Konstantinovskiy, 2012).

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The results of investigation into the role of financial constraints in attaining tertiary education are also ambiguous. Flannery and O'Donoghue (2013) indicate that low income level of families is positively related to lower participation of offspring tertiary education programs. At the same time, Cameron and Heckman (2001) indicate insignificant effect of credit restrictions on decisions to invest in attainment of tertiary education. Flannery and O'Donoghue (2009) also note the link between youth unemployment rates and higher education participation.

Inefficient and inert system of higher professional education might impose additional costs on national businesses, thus impeding the process of adaptation of national economy towards harsh conditions of global competition. About 25% of all university graduates in Russia are employed not according to their initially acquired qualifications, while students studying economics, management and law, who constitute about half of all university students lacked even basic professional competencies (Sinitsina, 2011). Taking into account the politically charged nature of national debate on educational issues, it seems appropriate to perform an unbiased empirical study of how much the professional functions performed by employees match their professional qualifications, levels of education and the extent to which their previously acquired expertise and skills are put into use.

2. MATERIALS AND METHODS

This research is based on the longitudinal study "The Russia Longitudinal Monitoring Survey" (RLMS), which is a series of nationally representative surveys designed to monitor the effects of Russian reforms on the health and economic welfare of households and individuals in the Russian Federation. In this study we present an analysis of data for 2010 covering respondents with university education (the authors can provide the data upon request).

The following binary variables were used as dependent ones.

The match between job role of a respondent and his or her subject specialism. The variable was formed according to respondents' answer to the following question: "How much is your current job role related towards the qualifications you have received in your learning institution?" (1 = I am employed exactly according to the qualifications acquired or according to closely related qualifications; 0 = I am employed according to entirely different qualifications).

The match between job role of a respondent and his or her education level. The variable was formed according to respondents' answer to the following question: "Please, assess, how much does your current job require the level of education you have received in your learning institution?" (1 = Your level of education is higher than needed; 0 = Your level of education exactly corresponds to what is needed or is lower).

Degree to which the respondents knowledge and experience are put into use. The variable was formed according to respondents' answer to the following question: "To what extent your knowledge and experience are used at your main job?" (1 = to a large extent; 0 = to a small extent).

Since the dependent variables are binary, use of linear regressions may lead to biased estimates. In the analysis of binary variables the appropriate technique is logit-modeling. Logit models estimation for individual number i was based on following general structure (dependent variables have been listed above):

$$y_i = \beta_0 + \beta_1 \text{oil_gas_ind}_i + \beta_2 \text{constr}_i + \beta_3 \text{transp_comm}_i + \beta_4 \text{govern_agencies}_i + \beta_5 \text{science_education}_i + \beta_6 \text{healthcare}_i + \beta_7 \text{trade_services}_i + \beta_8 \text{finance}_i + \beta_9 \text{energy}_i + \beta_{10} \text{army_security}_i + \beta_{11} \text{agricult}_i + \beta_{12} \text{utilities}_i + \beta_{13} \text{consumer_food_ind}_i + \beta_{14} \text{military_industr_complex}_i + \beta_{15} \text{sex}_i + \beta_{16} \text{age}_i + \beta_{17} \text{employment_length}_i + \beta_{18} \text{large_city}_i + \varepsilon_i.$$

A group of 15 economy-sector dummies were used as independent variables with machine-building serving as a criterion variable. To reduce the endogeneity problem control variables of respondents' sex, age, length of employment and type of settlement were introduced.

Estimates of logit models β coefficients were obtained using maximum likelihood estimation method, MLE. Formulae for calculation of β and percentage change in odds can be found in (StataCorp, 2009). All calculations as well as data management were performed using software package STATA12.0.

3. RESULTS

Table 1 documents the results of logit regressions for respondents with university education. Values of β coefficients are not presented here for the sake of brevity since their interpretation as changes in log-likelihoods is of no particular analytical value (except determination of direction the variable acts). It is percentage changes in odds that are analyzed (Long and Freese, 2005).

Table 1. Logit regressions estimates for respondents with university education (broken down by sectors of economy) (The table contains percentage changes in odds, with t-statistics adjusted for heteroscedasticity given in parentheses. Also presented is the number of observations (N. of obs.). McFadden's R² allows comparing likelihood coefficients of model incorporating only fixed term (β₀) as compared to a model including all regressors. Wald statistics is used to test the hypothesis on joint significance of independent variables.)

Variables	Match between job role and qualifications(1 = yes; 0 = no)		Match between job role and education level (1 = higher than required; 0 = corresponds or lower)		Degree of knowledge and experience use (1 = high; 0 = low)	
	% change in odds	t-stat. robust	% change in odds	t-stat. robust	% change in odds	t-stat. robust
Economy-sector dummies						
Oil and natural gas industry	17.10	(0.57)	14.50	(0.50)	-0.30	(0.01)
Construction	2.30	(0.11)	5.50	(0.25)	0.70	(0.02)
Transport and communications	-40.70	(2.56)**	81.50	(2.90)**	-56.50	(3.24)**
Government agencies	-5.40	(0.25)	-54.20	(2.95)**	113.30	(2.00)*
Science and education	99.60	(3.94)**	-13.60	(0.84)	118.20	(2.96)**
Healthcare	72.70	(2.48)*	-18.20	(0.92)	38.50	(1.05)
Trade and services	-70.10	(7.07)**	183.80	(6.06)**	-64.50	(4.74)**
Financial sector	104.90	(2.86)**	-40.60	(2.02)*	39.50	(0.97)
Energy sector	-23.70	(0.97)	4.00	(0.13)	0.70	(0.02)
Army and security agencies	-22.40	(1.19)	23.10	(0.96)	-31.00	(1.28)
Agriculture	59.80	(1.34)	-16.50	(0.54)	9.90	(0.20)
Utilities	-28.80	(1.24)	120.80	(2.82)**	-40.80	(1.48)
Consumer goods and food ind.	-25.20	(1.21)	66.00	(2.13)*	-34.10	(1.33)
Military-industrial complex	-6.30	(0.18)	-38.20	(1.20)	3.40	(0.06)
Control variables						
Sex (1=male; 0=female)	-9.00	(1.02)	11.40	(1.20)	6.50	(0.53)
Age	-2.40	(6.10)**	1.60	(4.01)**	-0.80	(1.45)
Length of employment	6.90	(10.01)**	-5.60	(8.23)**	9.40	(6.40)**
Large city (1=yes; 0=no)	-7.30	(0.88)	-3.30	(0.40)	-30.20	(3.11)**
N. of obs.	2981		2973		2973	
McFadden's R²	0.12		0.08		0.12	
Wald Chi²	370.57**		247.12**		221.13**	

** 1% significance level, * 5% significance level.

Wald statistics allows us to reject the zero hypothesis on joint insignificance of all models' factors with high level of reliability: p-values for all models are less than 0.000. Values of McFadden's R² indicate significant degree of statistical quality of models (it should be noted that the R² symbol can be somewhat misleading: despite formal similarity, the McFadden's R² has nothing in common with standard R² in linear regressions).

Formally interpreting the logit estimates it can be concluded that for a respondent with university education probability of being employed according to qualifications acquired is, ceteris paribus, 70% lower in trade and services sector and 41% lower in transport and communications comparing to machine building (both coefficients significant at 1% level). All indications are that these two sectors absorb the bulk of university graduates which is in excess of labor market demand. Housing and utilities sector, consumer goods and food industries, army and security agencies also employ significant numbers of graduates not according to their acquired qualifications: ceteris paribus,

probabilities of being employed according to initial subject specialism in those areas are respectively 29, 25 and 22% lower than in machine-building (however the estimates are less reliable and become significant only at 10% level using single-tail test).

On the other hand, respondents with university education in financial sector, science and education are approximately twice as much more likely to be employed according to their initially acquired qualifications compared to machine-building (1% significance level). In other sectors of economy there is generally similar to machine-building proportion employees with university education whose job role does not correspond to qualifications initially acquired (coefficients at dummy variables statistically differ from zero). As for control variables, age is negatively while length of employment is positively related to the likelihood of employment according to initially acquired qualifications.

Analysis of responses to the question concerning the match between job role of a respondent and his or her attained education level is also of some interest. Ceteris

paribus, the probabilities of respondent's educational attainment exceeding the required level in trade and services sector, housing and utilities sector, transport and communications, consumer goods and food industries are respectively 184, 121, 82 and 66% higher than in machine-building (estimates are significant at 1, 1, 1 and 5% level respectively) (Clarification remark: higher by 184% probability means that one positive answer in machine-building (criterion variable) was matched by 2.84 positive answers in trade and services sector). What this means is that in the listed above areas employees are not only most frequently employed not according to qualifications they had originally received but more often perform functions not requiring the level of education they have attained. At the same time in financial sector and administration respondents by 41 and 54% respectively less often than in machine-building indicate that their education level is higher than required (1% significance level). Differences between other sectors and machine-building are insignificant; estimates of coefficients at other sector dummies are unreliable. As for control variables, age is positively while length of employment is negatively related to the likelihood of employee's level of education exceeding the requirements.

Similar results are obtained with respect to the degree to which the respondents' with university education knowledge and skills are put into use. *Ceteris paribus*, the probabilities of respondent's knowledge and skills being extensively put into use in trade and services sector, transport and communications, housing and utilities sector, consumer goods and food industries, army and security agencies are respectively 65, 57, 41, 34 and 31% lower than in machine-building (first two coefficients are significant at 1% level, while others-at 10% level using single-tail test). This is hardly surprising: the listed above sectors are generally characterized by employing university graduates not according to their original qualifications but with higher level of education than it is actually needed. At the same time the highest degrees of job satisfaction with relation to application of acquired knowledge and skills were demonstrated by respondents involved in science and education as well as administration. Coefficients at other sectoral dummies are statistically unreliable. Meanwhile, the longer is the respondents' length of employment the more often he or she speaks about substantial use of acquired knowledge and skills. However, in large cities, *ceteris paribus*, employees less frequently indicate high degree of their knowledge and skills use.

On the other hand the highlighted disproportions could result not only from unbalanced supply and demand structure of the labor market but also from the poor quality of education as a whole: in many national universities students simply fail to acquire skills and competencies required by employers. Substantial percentage of training by correspondence contributes to the falling standards of education. As a result, national business is forced to contribute up to 40% of the total costs of building up the required level of university graduates qualifications compared to 15% in the Western countries. About 70% of graduates need additional training after getting a permanent job (Sinitsina, 2011), while according to the Education and Science Ministry estimates only about a third of university graduates meet the modern standards (Kostenko, 2010).

To ensure reliability of obtained results a number of diagnostic tests were performed. Variance Inflation Factors (VIF) were calculated to test hypothesis on the existence of multicollinearity effect. Values of VIF-factors for all models were lower than 3.0 which allows as to reject the multicollinearity hypothesis. The models were also tested for heteroscedasticity. The results of Breusch-Pagan test for heteroscedasticity confirm the existence of heteroscedasticity at 1% level for all models. However, for economic data one should not generally expect homoscedasticity of errors. To eliminate the heteroscedasticity problem t-statistics were adjusted for heteroscedasticity, while a number of control variables were included in the model to alleviate possible endogeneity problem.

4. DISCUSSION

In search of independent confirmation of the obtained estimates validity we turned to an authoritative OECD survey "Education at a Glance" (OECD, 2012). However, the latter source has a notable omission: estimates of net returns on investment in tertiary education in the form of Net Present Value (NPV) and Internal Rate of Return indicators do not include Russia. We tried to make up for this omission, using Discounted Cash Flows (DCF) methodology within the framework of OECD approach to estimate financial returns of investment in tertiary education for men and women in Russia. Even taking into account a number of limitations of OECD analysis, including using riskless rate to discount the relevant cash flows, our calculations have demonstrated a rather gloomy picture: NPV of acquiring of masters degree (6 years of study) for both men and women turned out to be negative: -\$44728 and -\$116306 respectively, while estimated NPV for bachelor degree produced positive results for men (\$59992) and

still negative for women (-\$20834) (Arriving at these figures has required somewhat cumbersome calculations which are not presented here. The authors can present upon request their detailed description including the assumptions made). These figures once again confirm the conclusion about gross imbalances existing between acquired (at least formally) qualifications and actual demand for graduates with university degrees.

It should be also noted that the existing disproportions might well worsen as a result of fall in demand due to demographic factors. According to recent estimates, by 2014 the overall number of students in Russia will go down to 4.5 million, while now they number 7.4 million. As a result about 100000 university teachers will lose their jobs (Kostenko, 2010). At the same time the supply is virtually unlimited while soviet-era memories of high social status associated with university degree act as an additional motive to acquire it notwithstanding possible payoff (Konstantinovskiy, 2012).

Further research into the problem can be carried out in the direction of quantitative analysis of "salary discounts" of employees working not according to their initially acquired qualifications. It can be also of some interest to study the revealed disproportions for the regions of Russia with inherited from Soviet era high concentration of manufacturing industries as well as learning institutions supplying those industries with skilled labor. An analysis of private universities' contribution towards growing disproportions in tertiary education also seems to be a promising, however controversial, direction of quantitative research, since the aforementioned learning institutions are generally characterized by lower standards of education (Geroimenko *et al.*, 2012).

Some specific limitations of the analysis performed have to be mentioned. In particular, it should be noted that some variables are built on the basis of the respondents' value judgments which could be quite subjective (for example, "high-low" degree of application of acquired knowledge and skills). Definition of economy sectors is also quite aggregative and brings together somewhat different types of activities. Besides, regressions identify the correlation itself, but not the causality.

5. CONCLUSION

The presented above results of econometric analysis of mismatch between employees with university education job roles and their professional qualifications, levels of education and acquired knowledge and skills in

different sectors of economy provide objective evidence of existence of substantial disproportions. The largest disproportions between levels of qualification of employees and what is actually required for positions they occupy are observed in trade and services sector, transport and communications, housing and utilities sector, consumer goods and food industries. While certain types of services as well as housing and utilities sector as a whole belong to the group of noncompetitive activities which would not suffer much as a result of Russia's membership in WTO, manufacturing and trade sectors with high percentage of employees with unreasonably high qualification (by their own estimates) as well as correspondingly high salary expectations might add additional financial burden on those sectors further lowering their competitiveness.

The results of empirical analysis are of particular importance for formation of state policy in the field of higher education. High percentage of graduates (among the highest in the world (OECD, 2012)) with university degrees combined with unacceptably low level of utilization of acquired qualifications and generally low quality of education in the majority of national universities result in huge structural imbalances. Inert and informationally inefficient labor market, incapable of sending proper signals to national system of tertiary education makes situation even worse. Compulsory military service adds further distortions to the process of shaping the demand for university graduates, since period of study provides draft deferment. The only feasible, however politically unpopular way to correct the revealed disproportions appears to be substantial reduction in availability of university education the effective demand for which is not proven. By effective demand we mean that the positions national economy can offer to the graduates are well enough paid to provide motivation for students to invest in their specific capital.

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