

Returns to Education in the Russian Federation: Variation across Regions

Ekaterina Melianova* | Suhas Parandekar* | Artëm Volgin*

* Education Global Practice, Europe and Central Asia

Correspondence

Email: sparandekar@worldbank.org

Data and Code

Thanks are due to the Higher School of Economics, Moscow for making the Russian Longitudinal Monitoring Study (RLMS) Household data readily available for reseachers around the world. The code used for this paper is made freely available for all researchers at <https://bitbucket.org/zagamog/edreru/src/master/>

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KEYWORDS

keyword 1, keyword 2, keyword 3, keyword 4, keyword 5, keyword 6, keyword 7

1 | REGIONAL RETURNS TO EDUCATION IN THE RUSSIAN FEDERATION: ROLE OF ACCESS TO VOCATIONAL AND HIGHER EDUCATION

1.1 | Data

To estimate returns to education in Russian regions, we use the most recent (2018) round of the Statistical Survey of Income and Participation in Social Programs, collected by Rosstat. The primary purpose of the Rosstat survey was to obtain statistical information, reflecting the role of wages, income from self-employment, property income, pensions, and social benefits in ensuring the material well-being of families. The survey contains data on trends in income and poverty variation among households with different socio-economic status. There are also variables on people's participation in social programs, their pension and health insurance, material and social security of low-income families, and the impact of social policy measures on people's well-being. The sample selected for the empirical modeling is identical to the one used for the RLMS analysis: individuals aged 25-64 who are out of school and have positive labor market experience and income.

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1.2 | Methods

The classical Mincerian equation (described in the previous sections) is the main focus in the regional investigation of returns to education in Russia: in this section we look at how these returns vary across regions. Additionally, we explore the determinants of the established variation through a random effects regression analysis. The equations of interest are as follows:

First level:

$$\text{LogWage}_{ij} = b_{0j} + b_{1j} \cdot \text{Educ} + b_{2j} \cdot \text{Exp} + b_{3j} \cdot \text{Exp}^2 + b_{4j} \cdot \text{Gender} + \epsilon_{ij} \quad (1)$$

Second Level:

$$b_{0j} = \gamma_{00} + \gamma_{0n} \cdot Z + u_{00}; \quad b_{1j} = \gamma_{10} + \gamma_{1n} \cdot Z + u_{10}; \quad b_{ij} = \gamma_{i0} \quad \text{for } i \neq 0 \quad (2)$$

where an individual i is nested within a region j , LogWage is a logarithm of monthly wage, Educ stands for highest attained level of education, Exp and Exp^2 reflect the years of working experience and its quadratic term respectively, Gender is a dummy variable for gender, Z is an $n \times i$ matrix of regional characteristics, ϵ and u_{00} , u_{10} are the first- and second-level errors respectively.

The random effects models were estimated using restricted maximum likelihood (REML). Individual Wald tests and likelihood ratio tests were exploited to evaluate the significance of fixed and random effects, respectively. Weights were used in the modeling to ensure the representativeness of the sample across Russian regions (the weighting variable was divided by 1000 to allow the convergence of the multilevel models).

1.2.1 | Left Hand Side (LHS) variable

Similar to the previous analyses, the outcome to be investigated is the logarithm of monthly monetary remuneration before income tax payment at the main place of work.

1.2.2 | Right Hand Side (RHS) variables

Education, experience, and gender are the first-level variables. Education is included in the random effects models as the focus of interest with a set of regional level variables - equation 2.

The random effects model seeks to estimate the magnitude of influence of regional level educational quantity and educational quality measures to explain the variation in returns to education across Russian regions. To measure educational quantity or access, we use the number of students enrolled in vocational education per 10,000 residents and the number of students enrolled in higher education per 10,000 residents. As a measure of educational quality, we use standard deviations from the national mean of the Russian school-leaving and university entrance examination, the EGE. We also add control variables regarding economic development and the labor market - these are respectively the gross regional product, the level of urbanization, the regional unemployment level and the the share of employment in jobs related to natural resource exploitation. Table 1.1 demonstrates the descriptive statistics by region.

TABLE 1.1 Descriptive Statistics for Regions in Russia, Rosstat 2018

Regions	N	Wage		Experience		Education, %			Gender, %	
		mean	sd	mean	sd	SE	VE	HE	Males	Females
Altayskiy Kray	4646	22127.6	11952.2	23.6	11.0	17.456	54.50	28.05	48.90	51.10
Amurskaya Oblast	2557	33441.2	17409.0	23.2	11.2	16.347	50.65	33.01	49.59	50.41
Arkhangelskaya Oblast	3183	33438.1	16884.2	22.6	10.6	12.692	54.95	32.36	44.17	55.83
Astrakhanskaya Oblast	2836	26474.1	13737.6	23.0	11.3	13.646	55.08	31.28	50.99	49.01
Belgorodskaya Oblast	3692	26281.0	10811.9	23.8	11.1	12.351	54.47	33.18	49.76	50.24
Bryanskaya Oblast	3087	22482.3	9634.1	23.5	10.9	19.631	50.66	29.71	48.66	51.34
Chechenskaya Respublika	2010	27718.4	11793.2	18.7	10.6	25.721	26.37	47.91	65.37	34.63
Chelyabinskaya Oblast	6717	27990.8	14280.9	23.9	11.2	12.104	54.53	33.36	47.39	52.61
Chukotskiy Aok	1535	65574.1	32370.8	23.6	10.6	13.941	46.06	40.00	43.97	56.03
Chuvashskaya Respublika	3248	21453.7	12602.2	24.3	11.0	19.119	50.80	30.08	50.18	49.82
Evreyskaya AO	1536	28532.1	17385.1	23.8	11.2	22.005	50.33	27.67	50.00	50.00
Irkutskaya Oblast	4686	29967.6	17443.1	22.3	11.2	17.520	47.06	35.42	47.57	52.43
Ivanovskaya Oblast	2876	24881.8	12496.8	23.3	10.9	20.341	49.90	29.76	47.77	52.23
Kabardino-Balkarskaya Res.	2006	23592.3	10766.2	21.7	11.6	21.137	40.53	38.33	52.04	47.96
Kaliningradskaya Oblast	2838	29749.2	15489.1	23.5	11.4	13.495	52.40	34.11	50.07	49.93
Kaluzhskaya Oblast	3155	29662.1	12879.5	24.1	11.2	13.312	52.11	34.58	47.92	52.08
Kamchatskaya Kray	2203	51160.5	29997.7	23.1	11.2	13.118	42.99	43.89	47.89	52.11
Karachayevo-Cherkessiya	1510	22900.6	12540.8	22.0	11.8	17.152	40.07	42.78	48.01	51.99
Kemerovskaya Oblast	5056	26287.0	13774.4	23.6	11.3	18.137	52.99	28.88	48.04	51.96
Khabarovskiy Kray	3731	42008.8	21837.8	22.3	11.2	11.900	44.33	43.77	46.15	53.85
Khanty-Mansiyskiy Aok	4335	50837.9	22261.7	22.8	10.5	13.564	46.78	39.65	49.60	50.40
Kirovskaya Oblast	3284	22941.0	13674.6	25.1	11.2	20.128	55.33	24.54	47.69	52.31
Kostromskaya Oblast	2518	23993.1	12090.9	23.6	11.1	12.669	61.28	26.05	47.82	52.18
Krasnodarskiy Kray	8730	32563.7	17499.8	23.0	10.9	15.888	48.57	35.54	50.02	49.98
Krasnoyarskiy Kray	5540	33954.6	21199.2	23.0	11.0	21.588	48.05	30.36	49.64	50.36
Kurganskaya Oblast	2468	20896.9	11539.5	24.4	10.7	21.394	52.47	26.13	48.38	51.62
Kurskaya Oblast	2956	23622.6	11475.0	23.9	11.0	14.783	52.17	33.05	50.30	49.70
Leningradskaya Oblast	4506	32124.3	17227.4	24.2	11.5	7.723	54.77	37.51	46.03	53.97
Lipetskaya Oblast	2869	25037.8	10813.5	24.1	11.0	13.106	53.82	33.08	49.60	50.40
Magadanskaya Oblast	1841	51000.8	23729.4	24.1	11.4	18.523	43.02	38.46	43.24	56.76
Moscow	29921	66263.5	26437.9	20.8	10.8	4.953	32.18	62.86	47.06	52.94
Moskovskaya Oblast	13431	46725.1	20563.7	22.6	11.4	10.975	39.13	49.89	47.51	52.49
Murmanskaya Oblast	3078	43992.5	28841.9	23.4	11.2	12.801	50.45	36.74	49.84	50.16
Nenetskiy Aok	1118	54467.3	23147.1	22.6	10.8	17.263	49.73	33.01	39.98	60.02
Nizhegorodskaya Oblast	6139	30912.9	13291.8	23.4	11.2	16.941	49.31	33.75	47.42	52.58
Novgorodskaya Oblast	2673	26856.0	12683.0	24.6	11.2	15.638	55.74	28.62	45.16	54.84
Novosibirskaya Oblast	5374	29229.9	14687.7	23.9	11.6	16.561	49.33	34.11	47.06	52.94
Omskaya Oblast	3978	25337.5	14613.1	23.6	10.9	22.197	51.31	26.50	51.11	48.89
Orenburgskaya Oblast	4190	24207.0	12519.9	23.3	11.0	15.131	53.68	31.19	51.29	48.71
Orlovskaya Oblast	2424	21901.2	10561.0	24.7	11.1	15.017	50.66	34.32	46.99	53.01
Penzenskaya Oblast	3103	23478.4	10982.9	24.2	11.0	20.722	51.40	27.88	51.02	48.98
Permskiy Krai	5290	29176.6	14449.4	23.4	11.0	13.894	58.32	27.79	48.17	51.83
Primorskiy Kray	4104	37839.9	18420.2	23.8	11.3	14.985	52.97	32.04	49.98	50.02
Pskovskaya Oblast	2382	23838.4	12015.3	25.0	11.0	17.632	55.33	27.04	48.11	51.89
Respublika Adygeya	2013	21350.3	10505.9	23.4	11.3	20.666	43.67	35.67	49.53	50.47
Respublika Altay	1381	20285.3	12029.5	23.0	10.6	23.027	45.26	31.72	43.08	56.92
Respublika Bashkortostan	7126	31100.8	15175.2	23.4	11.0	12.167	56.67	31.17	51.98	48.02
Respublika Buryatia	2469	29536.3	17237.4	22.1	10.6	17.173	45.61	37.22	48.12	51.88

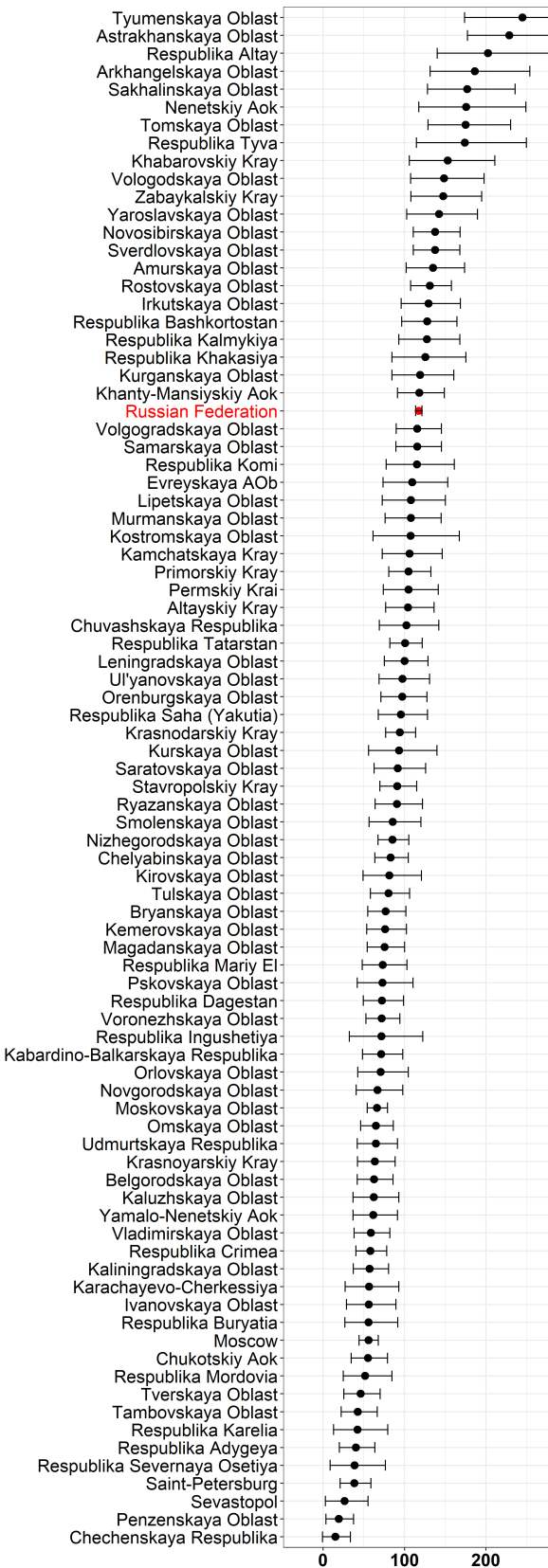
TABLE 1.1 Descriptive Statistics for Regions in Russia, Rosstat 2018

Regions	N	Wage		Experience		Education, %			Gender, %	
		mean	sd	mean	sd	SE	VE	HE	Males	Females
Respublika Crimea	2895	19916.2	9743.9	22.8	11.0	21.244	43.90	34.85	52.99	47.01
Respublika Dagestan	3388	26377.3	11971.9	23.0	10.7	30.519	30.79	38.70	55.99	44.01
Respublika Ingushetiya	1207	23740.2	10168.5	18.2	9.6	10.025	18.89	71.09	61.14	38.86
Respublika Kalmykiya	1751	18568.8	11749.1	23.6	11.4	15.762	40.89	43.35	46.43	53.57
Respublika Karelia	2164	28510.2	16639.5	23.7	10.8	17.144	55.45	27.40	47.00	53.00
Respublika Khakasiya	2064	27288.1	16613.3	23.3	11.1	22.045	51.11	26.84	50.97	49.03
Respublika Komi	2972	35891.6	21554.4	23.8	11.0	16.689	53.47	29.85	46.67	53.33
Respublika Mariy El	2486	21133.1	11941.6	24.1	11.2	18.785	52.98	28.24	47.87	52.13
Respublika Mordovia	2236	21221.0	10837.3	23.1	11.2	15.519	49.11	35.38	48.35	51.65
Respublika Saha (Yakutia)	3243	45763.1	25001.6	23.2	11.3	18.440	45.76	35.80	46.69	53.31
Respublika Severnaya Osetiya	2114	22993.1	12762.5	21.8	11.3	12.677	40.92	46.40	48.91	51.09
Respublika Tatarstan	7212	30327.9	12928.8	23.5	11.1	18.691	48.64	32.67	51.48	48.52
Respublika Tyva	1704	23421.9	16851.3	21.4	10.0	19.777	44.78	35.45	40.43	59.57
Rostovskaya Oblast	6985	28287.2	12779.9	23.1	11.0	15.476	48.03	36.49	50.68	49.32
Ryazanskaya Oblast	2609	25889.2	11760.9	24.7	11.1	12.457	59.37	28.17	49.18	50.82
Saint-Petersburg	11352	48520.8	23771.0	22.8	11.4	5.259	38.15	56.59	46.04	53.96
Sakhalinskaya Oblast	2258	50325.1	25563.0	23.6	11.2	17.493	48.23	34.28	46.94	53.06
Samarskaya Oblast	6275	32584.4	15015.6	23.8	11.1	11.331	47.87	40.80	47.71	52.29
Saratovskaya Oblast	4572	23698.6	12322.4	23.7	10.8	14.961	50.22	34.82	50.42	49.58
Sevastopol	1489	24811.3	13498.9	22.4	11.2	9.671	44.93	45.40	53.32	46.68
Smolenskaya Oblast	2726	25517.8	12104.9	24.6	11.3	14.380	52.31	33.31	46.04	53.96
Stavropolskiy Kray	4945	25263.6	12696.7	22.6	11.3	16.946	43.80	39.25	47.48	52.52
Sverdlovskaya Oblast	7712	35983.2	15242.7	23.6	11.3	16.779	54.94	28.28	48.59	51.41
Tambovskaya Oblast	2781	22698.6	10440.1	24.1	11.0	16.397	53.54	30.06	50.67	49.33
Tomskaya Oblast	3074	29580.6	16745.7	22.1	11.1	13.500	47.56	38.94	46.78	53.22
Tulskaya Oblast	3516	27687.4	11814.7	24.3	11.3	17.491	54.69	27.82	48.98	51.02
Tverskaya Oblast	3157	26310.0	15025.1	25.5	11.1	14.824	56.57	28.60	44.73	55.27
Tyumenskaya Oblast	3095	31441.2	17278.6	22.7	11.2	16.123	52.89	30.99	50.05	49.95
Udmurtskaya Respublika	4073	24044.6	11540.9	23.9	11.3	20.108	51.04	28.85	46.99	53.01
Ul'yanovskaya Oblast	3109	23215.3	10596.4	24.8	10.9	19.170	53.84	26.99	50.37	49.63
Vladimirska Oblast	3502	25001.4	12605.8	24.5	11.4	19.503	50.77	29.73	46.49	53.51
Volgogradskaya Oblast	4836	24459.0	12915.8	23.2	11.0	15.881	50.91	33.21	49.69	50.31
Vologodskaya Oblast	2965	28248.9	16693.8	23.9	11.2	17.302	57.47	25.23	49.61	50.39
Voronezhskaya Oblast	4348	26261.9	11813.9	23.6	11.5	22.700	43.38	33.92	48.37	51.63
Yamalo-Nenetskiy Aok	3164	69356.7	28075.6	21.0	10.4	10.683	40.27	49.05	48.74	51.26
Yaroslavskaya Oblast	3361	30261.4	14682.8	24.1	11.4	16.215	53.73	30.05	47.01	52.99
Zabaykalskiy Kray	3017	28336.6	16350.4	23.0	10.6	24.561	47.40	28.04	47.07	52.93

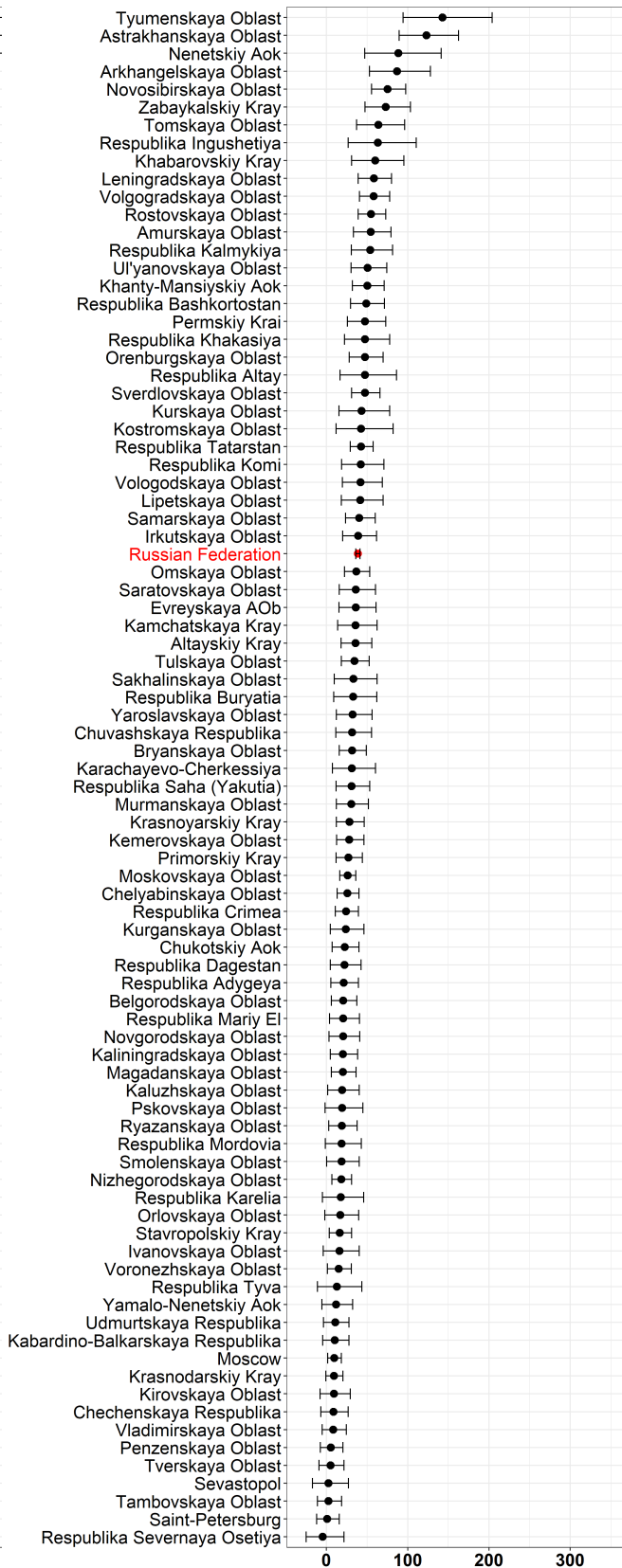
1.3 | Estimation Results of Regional Analysis

First, simple linear regression models were fitted to the observations in each region, and 95% confidence intervals for the education variable coefficients were returned to examine the overall pattern of regional diversity in education payoffs. A visual inspection of Figure 1.1 is illustrative of the fact that Russian regions are rather heterogeneous in terms of premiums to education. Following the basic Mincerian equation, we present the results of the multilevel regression.

A two-level model without covariates was initially specified and indicated that the Intra-class Correlation (ICC) was



(a) Higher Education



(b) Vocational Education

equal to 16%, i.e., 16% of the variation in wage outcome was between regions. This is a high enough level to justify the estimation of a random effects model with covariates. Nested models comparison showed that there is a statistically significant regional variation in the effect of education on people's earnings ($-2 \Delta LL1 = 413.54, p < .001$).

Next, we examined the possible causes of this variation by adding the second-level independent variables and their interactions with education. The investigation revealed that none of the second-level characteristics are capable of changing the association between education and the amount of money Russians earn, except for *the coverage by vocational education*. Substantively, it means that growth in the number of students covered by vocational programs leads to higher schooling premiums concerning both vocational and university education. As for the estimates obtained, sufficiently high vocational education coverage degree (when its standardized version is 1) corresponds to the average return rate of 30.6%; medium vocational education coverage degree (when its standardized version is 0) corresponds to the average return rate of 35.8%; low vocational education coverage degree (when its standardized version is -1) corresponds to the average return rate of 25.5%. The interpretation of such a finding can imply that this quantity-related dimension of vocational education has the potential to serve as an instrument of boosting financial payoffs from post-secondary education in Russian regions.

Appendix

TABLE A1 Results of Estimating Human Capital Depreciation for the Female sample, RLMS

	1994	1998	2003	2006	2012	2018
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	9.725*** (0.381)	3.786*** (0.322)	5.464*** (0.301)	6.946*** (0.247)	8.133*** (0.186)	8.767*** (0.242)
Educ, years (<i>S</i>)	0.122*** (0.025)	0.153*** (0.022)	0.158*** (0.020)	0.118*** (0.016)	0.087*** (0.012)	0.066*** (0.015)
Educ X Exper (<i>T</i> <i>S</i>)	−0.002* (0.001)	−0.002*** (0.001)	−0.002** (0.001)	−0.0002 (0.001)	−0.0001 (0.0005)	0.0004 (0.001)
Exper (<i>T</i>)	0.074*** (0.019)	0.080*** (0.016)	0.055*** (0.015)	0.013 (0.013)	0.020** (0.010)	0.020* (0.011)
Exper squared (<i>T</i> ²)	−0.001*** (0.0002)	−0.001*** (0.0002)	−0.001*** (0.0002)	−0.0003** (0.0001)	−0.0005*** (0.0001)	−0.001*** (0.0001)
Observations	1,645	1,667	2,093	2,630	4,057	3,312
R ²	0.051	0.089	0.110	0.139	0.104	0.092
Adjusted R ²	0.049	0.087	0.108	0.138	0.103	0.091
Residual Std. Error	0.853	0.728	0.731	0.664	0.641	0.597
F Statistic	22.179***	40.520***	64.342***	106.385***	117.366***	83.993***

Note:

*p<0.1; **p<0.05; ***p<0.01

TABLE A2 Results of Estimating Human Capital Depreciation for the Male sample, RLMS

	1994	1998	2003	2006	2012	2018
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	10.357*** (0.433)	5.029*** (0.360)	7.334*** (0.282)	8.067*** (0.243)	8.771*** (0.157)	9.094*** (0.185)
Educ, years (<i>S</i>)	0.136*** (0.028)	0.123*** (0.024)	0.080*** (0.019)	0.077*** (0.016)	0.077*** (0.010)	0.077*** (0.012)
Educ X Exper (<i>TS</i>)	−0.002* (0.001)	−0.001 (0.001)	0.0004 (0.001)	−0.0003 (0.001)	−0.0004 (0.0005)	−0.001 (0.001)
Exper (<i>T</i>)	0.054** (0.023)	0.032* (0.017)	0.002 (0.014)	0.007 (0.013)	0.035*** (0.009)	0.037*** (0.010)
Exper squared (<i>T</i> ²)	−0.001*** (0.0003)	−0.0004** (0.0002)	−0.0003* (0.0002)	−0.0003* (0.0001)	−0.001*** (0.0001)	−0.001*** (0.0001)
Observations	1,392	1,433	1,763	2,170	3,360	2,800
R ²	0.057	0.070	0.078	0.074	0.153	0.110
Adjusted R ²	0.054	0.067	0.076	0.072	0.152	0.108
Residual Std. Error	0.951	0.803	0.754	0.688	0.598	0.570
F Statistic	20.989***	26.879***	37.362***	43.281***	151.868***	86.125***

Note:

*p<0.1; **p<0.05; ***p<0.01

TABLE A3 Results of Multilevel Modeling with Coverage by Vocational Education, Rosstat 2018

	Null model	Mincerian	Random Slope	Cross-Level Interaction
	(1)	(2)	(3)	(4)
Constant	10.178*** (0.034)	10.032*** (0.034)	10.056*** (0.036)	10.065*** (0.036)
Vocational		0.283*** (0.009)	0.279*** (0.021)	0.267*** (0.021)
Higher		0.638*** (0.009)	0.641*** (0.025)	0.622*** (0.025)
Coverage VE X Vocational				0.050** (0.025)
Coverage VE X Higher				0.083*** (0.030)
Experience		−0.026*** (0.002)	−0.027*** (0.002)	−0.027*** (0.002)
Experience squared		−0.065*** (0.002)	−0.065*** (0.002)	−0.065*** (0.002)
Females		−0.403*** (0.005)	−0.404*** (0.005)	−0.404*** (0.005)
Coverage VE			−0.101*** (0.039)	−0.142*** (0.043)
Variance of Intecept	0.09	0.08	0.09	0.09
Variance of Vocational			0.02	0.02
Variance of Higher			0.04	0.04
Residual Deviance	0.45	0.35	0.34	0.34
Observations	49,187	49,187	49,187	49,187
Log Likelihood	−59,755.060	−53,289.500	−53,094.620	−53,096.640
Akaike Inf. Crit.	119,516.100	106,595.000	106,217.200	106,225.300
Bayesian Inf. Crit.	119,542.500	106,665.400	106,340.500	106,366.100

Note:

*p<0.1; **p<0.05; ***p<0.01