

Melianova, Ekaterina; Parandekar, Suhas; Patrinos, Harry A.; Volgin, Artëm

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Returns to Education in the Russian Federation: Some New Estimates

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Ekaterina Melianova
Higher School of Economics

Suhas Parandekar
World Bank

Harry Anthony Patrinos
World Bank and IZA

Artëm Volgin
Higher School of Economics

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Returns to Education in the Russian Federation: Some New Estimates¹

This paper presents new estimates of the returns to education in the Russian Federation using data from 1994 to 2018. Although the returns to schooling increased for a time, they are now much lower than the global average. Private returns to education are three times greater for higher education compared with vocational education, and the returns to education for females are higher than for males. Returns for females show an inverse U-shaped curve over the past two decades. Female education is a policy priority and there is a need to investigate the labor market relevance of vocational education. Higher education may have reached an expansion limit, and it may be necessary to investigate options for increasing the productivity of schooling.

JEL Classification: I26, I28, J16

Keywords: returns to education, Russian Federation

Corresponding author:

Harry Anthony Patrinos

The World Bank

Avenue Marnix 17

1000 Bruxelles

Belgium

E-mail: hpatrinos@worldbank.org

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1. Introduction

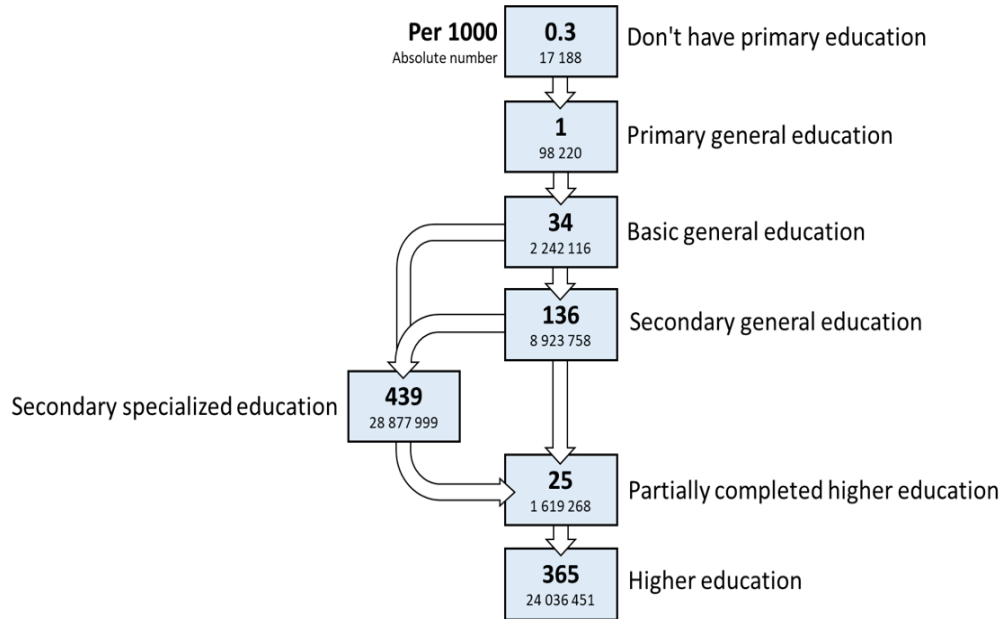
“How Wealthy Is Russia?” is a recently published World Bank report that analyzed the human, natural, and produced capital of the Russian Federation (Naikal et al. 2019). Human capital only accounts for 46 percent of total wealth in Russia, as compared to the OECD average of 70 percent. The report showed that even as growth *rates* of per capita wealth were 10 times higher in Russia as compared to the OECD, the gap in *levels* compared with the OECD is still very wide. The per capita human capital wealth level on average for the OECD in 2014 was about \$500,000 – five times that of Russia’s \$95,000 (measured in 2014 dollars). In order to catch up with the OECD, the returns to education in Russia will need to be increased.

Human capital, or the stock of skills that is possessed by the labor force, is pivotal in enabling countries and individuals to flourish in a multifaceted, increasingly comprehensive, interrelated, and rapidly changing society (Becker 2009; Broecke 2015; Heckman, Lochner, and Todd 2003; Mincer 1974; Schultz 1972). The returns to investment in education have been a popular subject of empirical analysis in research to study the relationship between schooling and earnings. Private returns can also explain the private demand for education. The literature suggests that each additional year of schooling produces a private (that is, individual) rate of return to schooling of about 8 to 9 percent a year (Montenegro and Patrinos 2014; Psacharopoulos and Patrinos 2018). Globally, the returns are highest at the tertiary education level, followed by primary and then secondary schooling. This represents a significant reversal from the results of prior studies. Policy makers can learn much from Mincerian results; for instance, further expansion of university education still appears to be worthwhile for the individual even as access to university education has increased dramatically in the past two decades.

Figure 1 indicates the educational attainment of the population aged 25 to 54 years. Less than 14 percent of the labor force has a secondary general education (academic high school); the main choice is between vocational education (45 percent) and university education (40 percent). It is well-known that Russian secondary school students perform at par with OECD students in terms of cognitive achievement (PISA scores around 500, the OECD average). What happens after secondary education and in the labor market are crucial issues for convergence with OECD on human capital wealth levels.

Figure 1: Labor Force Distribution by Educational Level

Number of People in Russia Aged 25-54 by Achieved Level of Education
(per 1000 and an absolute number)



Source: Rosstat

In this paper we report on over-time private rates of return to investment in education in the Russian Federation. We examine the trends in returns to education in the Russian Federation using a common methodology used for more than 100 countries (Montenegro and Patrinos 2014; Psacharopoulos and Patrinos 2018). Using standard regression techniques, we find that the returns to education in Russia increased between 1996 and 2003 and then declined thereafter. They reach a high of 9.1 percent in 2001. By 2018, they fall to 5.4 percent. The average returns for the entire period are 7.3 percent, but only 6.3 percent in the last 10 years, among the lowest worldwide and comparable to those estimated using Russian data from the early 1990s.

We find that private returns to education are three times greater for higher education compared to vocational education. The returns to higher education peak at 18 percent. By 2018 they settle at 8 percent, which is just below the European Union average of 10 percent and well below the global average of 15 percent (Psacharopoulos and Patrinos 2018). The returns show a declining trend in recent years, in line with the expansion in access that took place up to 2009. Higher education may have reached an expansion limit and it may be necessary to investigate options for increasing the productivity of schooling.

The returns to education are higher for females than for males. Returns for females show an inverse U-shaped curve over the past two decades. Women receive much higher returns, averaging above 10 percent during the first few years of the new century. They decline after that, and are approaching convergence with men's returns, but are still significantly higher. We acknowledge

the possible endogeneity of the schooling measure and instrument it appropriately. This gives a higher return to female education, but almost no change for men. On average, in Russia, an additional year of education provides a relatively small – and declining – increase in wages.

In the next section we provide a brief overview of the literature with a focus on Russia. Section 3 describes and analyzes the RLMS data used in this study. Section 4 presents the empirical results and Section 5 offers some conclusions.

2. Literature Review

In a worldwide perspective, the latest findings on returns to education can be condensed to the following (Psacharopoulos and Patrinos 2018): (1) overall, an increased share of workers with tertiary education in the labor market has not reduced the magnitude of returns on the investment due to “skill-biasedness” of technological progress boosting the demand for higher skills; (2) low- and middle-income regions are characterized by the largest returns (except for the Middle East and North Africa, with the lowest returns); (3) the private returns to education for women outstrip those for men by roughly two percentage points; (4) private sector employees receive greater returns than those working in the public sector; (5) social returns to education are negatively associated with a country’s level of economic development and education level; and (6) on average, there is a growing trend in returns to higher education.

A small corpus of the research on returns to education has focused on the Russian/USSR case. In the USSR, during the period before education reforms, the private rate of return to schooling was strikingly low: 2-3 percent for secondary and 5 percent for higher education levels (Graeser 1988). Low returns to human capital were in line with a planned economy offering free education, centralized allocation of labor, and the ideology of the dictatorship of the proletariat; a similar picture was observed in other contemporaneous socialist countries (see, for example, Münich, Svejnar, and Terrell 2005).

However, an even earlier attempt to establish the contribution of education to productivity took place during early Soviet times. Strumilin (1924) showed that those who were more educated contributed more in terms of productivity. He even calculated earnings benefits, and though his calculations did not discount earnings, the estimates of educational returns were high, at about 17 percent in 1919 (Strumilin 1924).

Within the first two decades of the collapse of the Soviet Union, a group of scholars reported that during the transition period from a planned to market economy in Russia rates of returns to schooling rose sharply (Brainerd 1998; Clark 2003; Vernon 2002; Akhmedjonov 2014). The upsurge in wage premiums to education (especially university education) was asserted to be a pivotal factor that exacerbated wage dispersion: salaries of highly skilled and trained workers had increased in absolute terms and compared to less-educated workers (Fleisher, Sabirianova, and Wang 2005). However, returns to schooling declined for those people who took advantage of higher education expansion in a post-communist Russia (1990-2005) in comparison to youths who obtained university degrees in the preceding periods (Kyui 2016). One researcher exploited data about the average education level at the end of a Soviet period as an instrument and inferred that the growth in the proportion of city dwellers with university degrees was associated with a rise in

the wages of city residents (Muravyev 2008). Despite increases in premiums to professional and higher education in the Russian Federation at the beginning of the 2000s, the labor market was shown to be different from that of developed countries. Comparing Russia with France, a researcher demonstrated the existence of a vertical education-occupation mismatch in Russia (Kyui 2010). A recent paper claims that a horizontal education-job mismatch negatively impacts the earnings of university graduates in all fields except for the lowest-paid ones (Rudakov et al. 2019).

Another stream of research ascertained that during the market transition period, private returns to education in Russia were not rising and remained among the lowest in the world – the so-called educated Russian’s curse (Cheidvasser and Benítez-Silva 2007). The contradiction of this finding with previous research was explained by the omitted variable bias: past researchers did not account for regional covariates and rural residence, thus overstating the returns. It was highlighted that the excess of well-educated workers seemed to be the main underpinning factor of wage differentials in Russia after the dissolution of the Soviet Union. Subsequently, Calvo et al. (2015) provide evidence of a reduction in skill premiums in Russia during the 2002 - 2012 period that was claimed to be one of the most relevant underlying forces explaining a deceleration in trends of widening wage inequality (Calvo et al. 2015). Belskaya, Peter and Posso (2020) evaluated a large-scale college expansion in Russia after the breakdown of the Soviet Union. Among the key conclusions is that as the number of university campuses grew, individuals with low returns to schooling grew as well. But for a marginal person, who switched into a treatment group as a result of new campuses opening, the total gains from attending a college are considerable and positive. Furthermore, the scholars found that students with higher returns are attracted more intensively by new campuses opened in constrained municipalities (small non-capital cities or those lacking higher education institutions before college expansion) in comparison to the unconstrained ones.

In line with global patterns, studies in Russia have shown that in the post-Soviet decade, workers hired in firms controlled/owned by private organizations/individuals, retained a marked premium to education in contrast to workers employed in state companies. This is rooted in a greater flexibility of private firms, enabling them to overcome restrictions caused by the rigidity of state wages, hence leading to higher returns to schooling (Clark 2003). Borisov (2007) was among the first who employed cohort analysis, using a Mincerian wage equation with Russian data, and found evidence favoring the existence of a powerful vintage effect (especially for men) in the Russian labor market during the transition period: consecutive cohorts were paid more than the previous ones, keeping educational achievements constant; this phenomenon was entrenched in the specificity of the Soviet system, encouraging the pursuit of communist interests through extensive propaganda. A source of heterogeneity in rates of returns to education in Russia hails from gender differences, just like the patterns observed globally: women received higher returns to higher education than men (see, for example, Cheidvasser and Benítez-Silva 2007; Luk’yanova 2010). By the end of the first decade of the 21st century, some scholars detected positive changes concerning tertiary education in Russia (and other BRIC countries): payoff rates to university completion have generally magnified relative to the rates in lower levels of education and were higher than returns to secondary schooling (Carnoy et al. 2012). Private rates of return in Russia, even accounting for privately incurred tuition cost, are especially high in business/economics as a field of study (Carnoy et al. 2012). Additionally, rates of returns to vocational education were found to be lower than payoffs to tertiary education (Borisov 2007). In a recent paper, Gimpelson

(2019) argues that the labor market in Russia might be at risk of over-education, which leads to a reduction in educational premiums.

3. Data and Methodology

In this paper we use the Russian Longitudinal Monitoring Survey (RLMS) – the only representative Russian household survey with a sizable panel component allowing for dynamic analysis (Kozyreva, Kosolapov and Popkin 2016). The data are notable for their reliability, diversity, and applicability to a variety of research questions. The RLMS collects information on people’s income and expenditures, educational and occupational behavior, and a range of other variables. RLMS sampling procedures have been thoroughly and extensively described elsewhere (Kozyreva et al. 2016). The present research uses all 23 waves (1994 - 2018) that were available as of June 1, 2020. Two years (1997 and 1999) are missing in the data because data were not collected in those years due to funding problems. The sub-sample selected for empirical investigation in this paper consists of working individuals aged 25-64 who are out of school and have positive labor market experience and income.

Table 1 shows descriptive statistics for the key variables under focus and sample sizes by years. The mean of years of potential experience is relatively stable over time and the mean of years of education is observed to increase over time. The increase in mean years of education is matched by the increasing proportion of those graduating from higher education, shown in the last column. Average years of schooling increased from 12.4 to 13.3 years between 1994 and 2018, but the proportion of the labor force with higher education increased 26 to 41 percent, or by 59 percent.

Table 1: Descriptive Statistics

Year	N	Wage (rubles current)		Experience (years)		Education (years)		Level of Education (%)		
		Mean	SD	Mean	SD	Mean	SD	Secondary	Vocational	Higher
								Percent	Percent	Percent
1994	3204	266012	339748	22.5	10.6	12.4	2.7	21.3	47.8	25.9
1995	2792	546812	613490	22.5	10.4	12.5	2.5	21.5	46.1	28.8
1996	2355	803429	993793	22.3	10.3	12.6	2.5	19.2	47.1	30.7
1998	3186	895	943	22.9	10.2	12.5	2.4	19.3	50.7	27.6
2000	3282	1808	2550	22.7	10.3	12.6	2.3	19.9	50.3	27.9
2001	3659	2664	2839	22.3	10.1	12.7	2.3	19.5	48.6	30.6
2002	3853	3596	4299	22.3	10.2	12.7	2.2	19.1	49.3	30.5
2003	3900	4355	4003	22.3	10.2	12.8	2.2	18.9	49.0	31.3
2004	3994	5361	4913	22.1	10.3	12.8	2.2	18.3	50.1	31.0
2005	3937	6624	5715	22.2	10.5	12.8	2.2	18.3	49.4	31.9
2006	4837	8081	6577	22.3	10.5	12.8	2.3	17.9	50.7	30.9
2007	4766	9655	7129	22.5	10.6	12.8	2.3	18.4	49.9	31.3
2008	4844	12788	10767	22.6	10.8	12.9	2.3	17.8	47.7	34.2
2009	4818	13344	10409	22.5	11.0	12.9	2.3	16.6	47.7	35.5
2010	7360	14743	12579	22.6	11.1	13.0	2.3	16.9	48.0	34.9
2011	7197	16190	12853	22.5	11.1	13.0	2.3	17.9	46.8	35.1
2012	7461	18844	15104	22.5	11.2	12.9	2.4	18.2	45.8	35.8
2013	7346	20567	16404	22.5	11.2	13.0	2.3	17.0	46.7	36.1
2014	6161	22734	17280	22.3	11.1	13.1	2.3	16.5	45.7	37.6
2015	6236	23532	16966	22.2	11.2	13.2	2.3	15.2	44.4	40.3
2016	6313	24899	18634	22.3	11.1	13.3	2.3	14.6	43.6	41.7
2017	6375	26226	19542	22.4	11.0	13.2	2.3	14.0	45.0	40.9
2018	6129	28081	19728	22.5	10.8	13.3	2.3	13.8	45.0	41.1

Source: RLMS

The Mincer equation, arguably the most widely used in empirical work, can be used to explain a host of economic phenomena. One such application involves explaining (and estimating) wage earnings as a function of schooling and labor market experience. The Mincer equation provides an estimate of the average monetary returns of one additional year of education. This information is important for policy makers who must decide on education spending, prioritization of schooling levels, and education financing programs such as student loans (Patrinos 2016).

The empirical analysis in this paper presents results for the general working population of the Russian Federation aged 25-64. We use a basic Mincerian specification shown in equation (1):

$$\text{Log}(\text{Wage}) = b_0 + b_1 \cdot \text{Educ} + b_2 \cdot \text{Exp} + b_3 \cdot \text{Exp}^2 + \epsilon \quad (1)$$

where $\text{Log}(\text{Wage})$ is a logarithm of monthly wage, Educ stands for the years of education or highest attained level of education, Exp and Exp^2 reflect the years of working experience and its

quadratic term respectively, b_0 is an intercept, $b_1 \dots b_n$ are the respective slope estimates, ϵ refers to a normally distributed error term.

Dependent variable

For the dependent variable, we use the logarithm of the average monthly wage within the past year from a person's primary job (variable $J13.2$ in the RLMS data set). If a person had an additional job, the maximum wage value among the two (variables $J13.2$ and $J40$) was selected for the analysis. In the waves from 1994 to 1996, the question mentioned above was absent; for those waves, we exploited a variable about the average amount of money earned by a respondent within the past 30 days (variable $J10$) as a reasonable approximation.

Independent variables

The present research uses both metric (measured in years) and categorical education variables. The metric version was created by assigning the average expected number of years corresponding to each attained education level. For the categorical version (EDUC), we distinguished three categories: (1) *secondary*, (2) *vocational* and (3) *higher*. Incomplete levels were incorporated into the respective upper categories (e.g., incomplete higher into higher). Vocational education here includes the International Standard Classification of Education (ISCED) levels for vocational education: 35, 45 and 55.² We are interested in exploring returns to education in general, and vocational and higher education. Estimations of premiums to primary and secondary schooling levels are technically not possible since there is a minuscule proportion of people with only primary education or lower. The experience variable was calculated as a potential experience, subtracting from the current age the years of education minus 6 (the typical school starting age). Regression (1) was estimated separately for each year for the entire sample and separately for males and females. The Appendix (Tables A1 to A23) presents the results for each year.

We are particularly interested in the returns to specific levels of education, estimated through a series of dummy variables. Using Secondary Education completed as the base or omitted dummy for purposes of interpretation, we use dummy variables for vocational and higher education. The specification is presented in equation (2):

$$\text{Log}(\text{Wage}) = a_0 + a_1 \cdot D_{Voc} + a_2 \cdot D_{Higher} + a_3 \cdot \text{Exp} + a_4 \cdot \text{Exp}^2 + \epsilon \quad (2)$$

4. Results

Results of equation (1) for the whole sample are shown in Figure 2 with an adjoining graph showing the increase in the mean years of education over the period 1994 to 2018. Returns by each year in the Russian Federation need to be considered carefully because of the high educational attainment of the population. There are hardly any individuals in the sample who have less than a high school education (precisely 35 of 1,000 as shown in Figure 1), and only a handful of

² The ISCED classification as it is applied to the Russian Federation is graphically explained in the OECD online publication accessible at <https://gpseducation.oecd.org/CountryProfile?primaryCountry=RUS>.

individuals who finished their education at the high school level. Consequently, the mean education is more than 13 years.

Figure 2: Labor Force Distribution by Educational Level

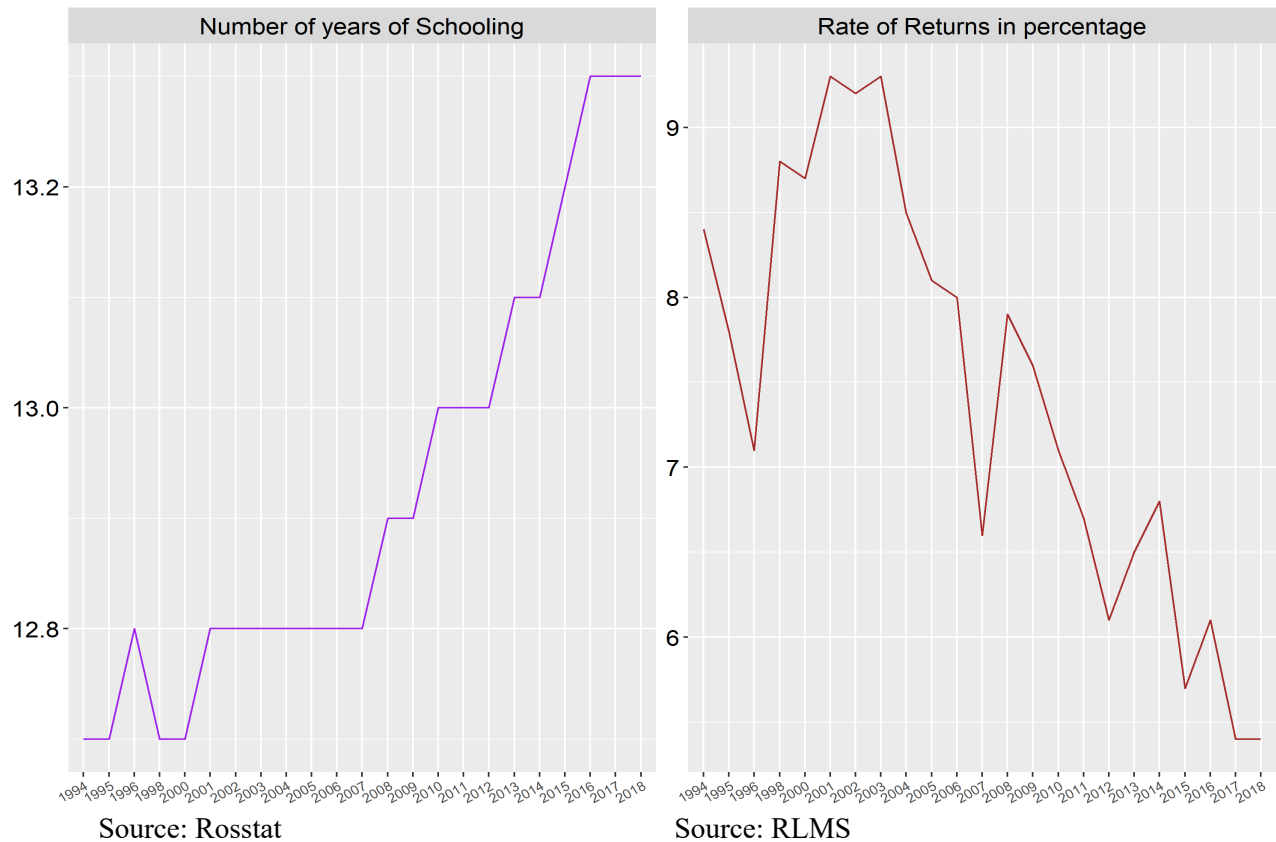
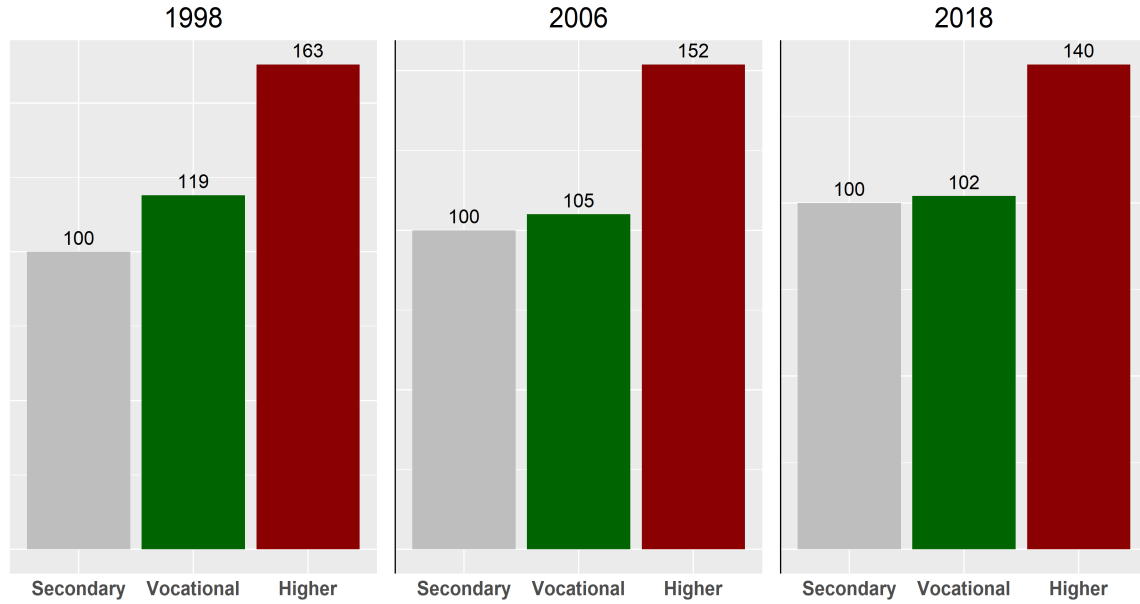


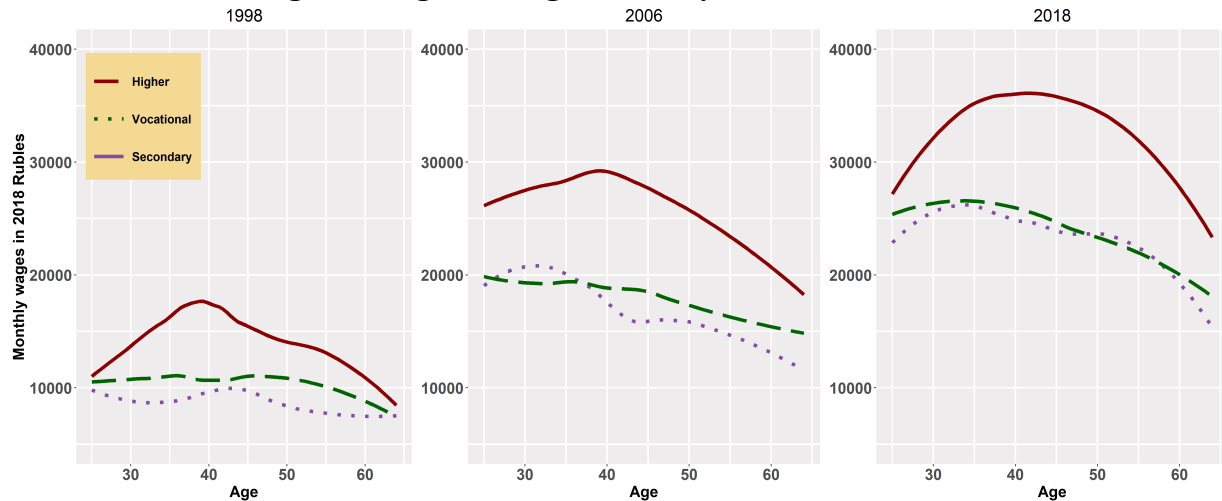
Figure 3 demonstrates the earnings ratio by educational level (secondary education is equal to 100 percent) for 1998, 2006, and 2018. Each panel in the graph depicts a pronounced gap in the wages of people with secondary or vocational education compared to those with university level especially in earlier years in Russia.

Figures 3: Earnings Ratio by Educational Level (Secondary Education = 100%)



Source: RLMS

Figure 4: Age-earning Profiles by Level of Education



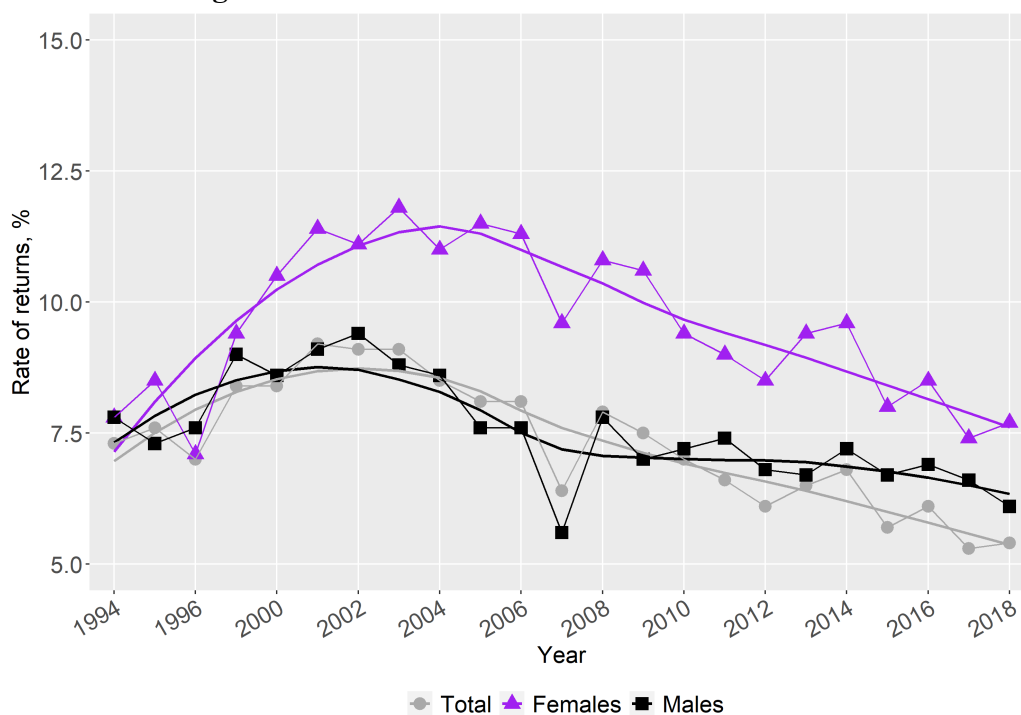
Source: RLMS

Figure 4 displays age-earning profiles in Russia by education level. There is a concave pattern for individuals with higher education, whereas for secondary and vocational levels, the association between wages and age is almost flat or descending. Figure 5 depicts the estimates of equation (1) for the whole sample compared with sub-samples by gender for the period 1994-2018: the percentage increment in a person's earnings due to one additional year of schooling. Overall, one can notice a moderate curved growth in returns to education in Russia, achieving its peak in the early 2000s (returns of 9.8 percent), which is followed by a downward pattern (returns of 5.6 percent by 2018). The values of returns to schooling in recent years in Russia seem to lag far behind the global average of 9.5 percent (Psacharopoulos and Patrinos 2018). Education payoffs

for women are higher than those of men, but the difference appears to have narrowed slightly in recent years.

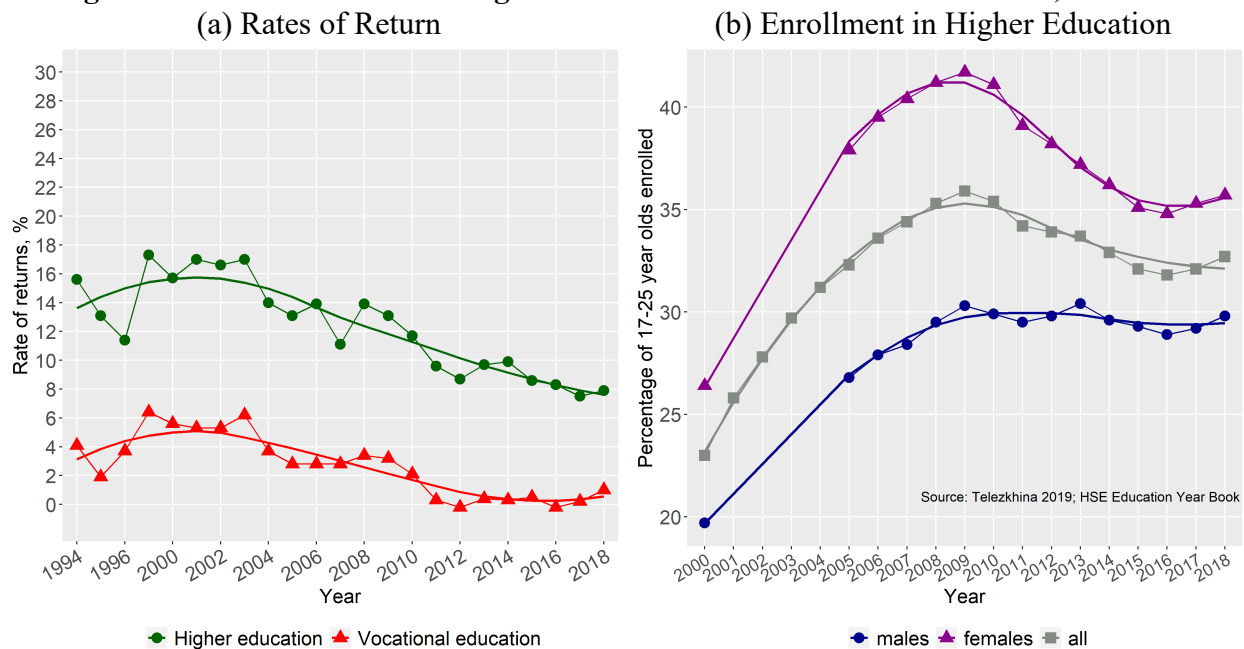
Figure 6 panel (a) displays the results of estimating equation (2) – the rates of returns to higher and vocational education (as compared to secondary education) in Russia for the period 1994-2018. The figure shows wage premiums to university education in Russia that are 3-5 times greater than vocational education. The observed trend for premiums to both vocational and higher education levels shows a peak of 18 percent per year for higher education and 6 percent a year for vocational education compared to the average earnings of workers with a secondary education. The interesting pattern to note from Figure 6a is the apparent co-movement of vocational education and higher education - the higher education smoothing curve turns a bit more sharply than the one for vocational education, but their movement is matching, even at second-order levels of smoothness. Even though the higher education premium remains above the premium for vocational education, there is a perceptible narrowing of the difference in recent years. Panel 6.4b, which is drawn from Telezhkina (2019), shows the interesting pattern of higher education enrollment rates for the population ages 17-25 years. Figure 6b shows the downturn in returns reflected in enrollments, with the peak in enrollments coming about 10 years later. The latest estimate of the returns to higher education in the Russian Federation is about 8 percent, which is just below the EU average of about 10 percent and the global average of 15 percent (Psacharopoulos and Patrinos 2018). The returns show a declining trend in recent years, in line with the expansion in access that took place up to 2009.

Figure 5: Rates of Returns to Education in Russia



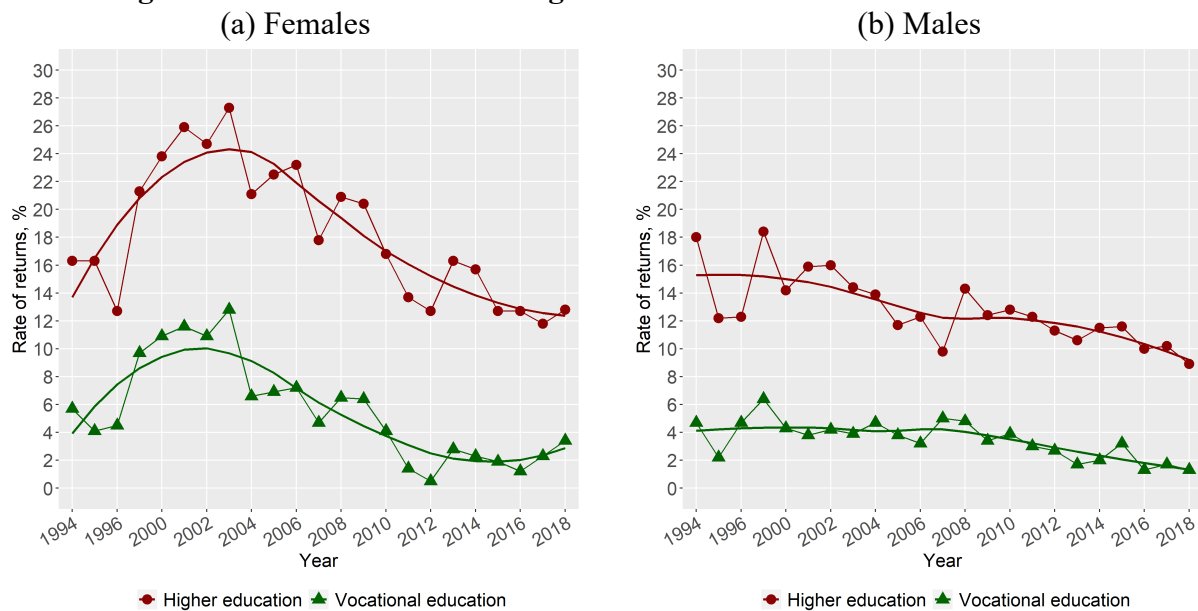
Source: RLMS 1994-2018

Figure 6: Rates of Returns to Higher and Vocational Education in Russia, 1994-2018



Source: RLMS 1994-2018

Figure 7: Rates of Returns to Higher and Vocational Education in Russia



Source: RLMS 1994-2018

Estimation separately by sub-samples of gender shows a variation in the trends. Annual returns to higher education for males declined from 15 to 9 percent, whereas women's returns are described

by an inversely U-shaped pattern, reaching their maximum of 28 percent in 2003. Within roughly the last 5 years, wage premiums to higher education for women have stabilized at around 12 percent, a couple of percentage points ahead of men. Gender-wise enrollment rates in higher education (not shown) 10 years later appear to match the differences in rates of return, strengthening the hypothesis that market rates of return to education in Russia do indeed influence individual continuing school decisions.

A similar comparative picture is observed with respect to vocational education, albeit with a different kind of variation by gender (see Figure 7): returns for males are almost flat within the time period while returns for females shows a concave pattern. The overall outcome concerning payoffs to schooling isolated by gender has been confirmed in a similar fashion by past studies (see, for example, Cheidvasser and Benítez-Silva 2007).

Instrumental Variable Specification

A sizeable proportion of the earnings literature holds that returns estimated from Ordinary Least Squares (OLS) may be biased due to the possible presence of an omitted variable bias and resulting heterogeneity in the net benefits of additional schooling across individuals. Instrumental variable (IV) regression is a method used to deal with these issues (Card 1999; Patrinos and Sakellariou 2005).

As instrumental variables, we use indicators of the Parental Socio-Economic Status (SES) of individuals when the individuals were 15 years old. Even though some authors express the opinion that family background related variables may suffer the same problem as an endogenous education variable, variables such as father's education have been used as instruments in earnings functions (see, for example, Dearden 1998; Harmon and Walker 2000; Hoogerheide, Block, and Thurik 2012; Ichino and Winter-Ebmer 1999; Pons and Gonzalo 2001). Parental education can be said to be related to the schooling level of an individual through genetic or environmental effects when an individual is a dependent child in a parent's household. However, the direct influence of parental education on adult earnings, independent of the influence on schooling, would be mild. In such a case it has been shown that the findings would not substantially deviate from the benchmark case of a strictly exogenous instrument.

The current paper exploited retrospective RLMS questions, asked in 2006 and 2011, about mother's and father's occupation (J216AC08, J216BC08), and their highest achieved education level (J217A, J217B) at a respondent's age of 15. Occupational categories were converted to indices with the help of The Standard Occupational Prestige Scale (SIOPS) (Ganzeboom and Treiman 2019). The final family background measures represented maximum values for the two SES dimensions between two parents. Besides, following the lead of several past studies (Angrist and Krueger 1991; Card 1999; Kim et al. 2019) we make use of dummies for the Russian regions, in which individuals reside at the time of the interview (STATUS), as instruments. The analysis was performed, using 2018 RLMS data to capture the most recent labor market situation.

The general TSLS specification of interest can be written by the following equations.

First stage:

$$x_{1i} = z_i' \pi_1 + x_{2i}' \pi_2 + v_i \quad (3)$$

Second stage:

$$y_i = x_{1i}\beta_1 + x'_{2i}\beta_2 + \varepsilon_i \quad (4)$$

where y is a logarithm of wages for $i = 1, 2, \dots, N$; x_{1i} reflects years of education (an endogenous regressor); x_{2i} is a vector of exogenous variables: labor market experience, its squared term, and a binary characteristic for living in urban area; z_i is a vector of instrumental variables; β_1 is the causal effect of x_1 on y ; ε_i and v_i are normally distributed error terms.

Table 2 presents the estimated schooling equation for males and females. The results demonstrate that after controlling for the labor market experience, its quadratic term, and type of settlement individuals, whose parents had higher occupational prestige and more completed years of education during his or her adolescence, study longer. Statistically insignificant regional dummies were removed from the models, therefore, only a fraction of regions was specified as instruments. The findings imply that the monotonicity identifying assumption (the absence of defiers) may be satisfied, although, in general, it is considered untestable. Defiers in this case would be children of highly educated parents who get the same education as children of low educated parents and vice-versa.

Table 2: Schooling Equations: Russia, 2018

	Females	Males
Family occupational prestige	0.0204 (-6.65)	0.0237 (-6.57)
Family education, years	0.111 (-7.64)	0.0823 (-5.01)
Permskiy Krai	-0.66 (-2.78)	-0.891 (-3.72)
Tverskaya Oblast	-0.56 (-2.31)	
Krasnoyarskiy Kray	-1.287 (-4.32)	
Rostovskaya Oblast	-0.825 (-2.74)	
Experience	-0.12 (-8.13)	-0.153 (-7.71)
Experience squared	0.00129 (-4.34)	0.00198 (-5.05)
Urban	0.52 (-5.43)	0.795 (-7.49)
Tambovskaya Oblast		-0.923 (-3.92)
Kabardino-Balkarskaya Resp		1.382 (-2.4)
Constant	13.18 (-55.35)	12.74 (-41.77)
<i>N</i>	2222	1694
<i>adj R</i> ²	0.2266	0.2359
F-value	73.32	66.35

Note: t statistics in parentheses

Source: RLMS

The IV estimation results, using the parental SES and regional dummies, are shown in the upper panel of Table 3. The instrumental variable approach yields the rate of returns to education in Russia of around 14.3 percent for females and 8 percent for males. Females' IV parameters appeared to be tangibly larger compared to the respective OLS estimate of 7.6 percent, while for males the IV and OLS (6 percent) estimates are much closer in magnitude. The female estimates are in line with what other researchers using instruments find in Russia (see, for example, Arabsheibani and Staneva 2012).

Table 3: Returns to Education from Instrumental Variables: Russia, 2018

	Females	Males
Education, years	0.1430 (-8.19)	0.0798 (-3.43)
Experience	0.0313 (-5.65)	0.0303 (-4.3)
Experience squared	-0.0006 (-5.99)	-0.0007 (-5.61)
Urban	0.161 (-5.51)	0.18 (-5.69)
Constant	7.501 (-27.00)	8.833 (-26.65)
<i>N</i>	2222	1694
Centered R^2	0.083	0.131
(i) Partial R^2 for excluded instruments in the first stage	0.105	0.093
F-test	43.63	34.43
<i>p-value</i>	0.000	0.000
(ii) Pagan–Hall for heteroskedasticity	5.78	9.973
<i>p-value</i>	0.762	0.267
(iii) Kleibergen-Paap rk LM statistic (underidentification test)	200.607	132.985
<i>p-value</i>	0.000	0.000
(iv) Sargan-Hansen J statistic (overidentification test)	10.395	20.158
<i>p-value</i>	0.065	0.0005
(v) Hausman endogeneity test	17.243	1.099
<i>p-value</i>	0.000	0.295
(vi) Cragg-Donald Wald F statistic	43.279	34.399
<i>Stock-Yogo critical values: 5% maximal IV relative bias</i>	19.28	18.37
<i>Stock-Yogo critical values: 10% maximal IV size</i>	29.18	26.87

Note: z statistics in parentheses

Source: RLMS

To ascertain the statistical validity of the implemented instruments, we conducted an array of diagnostic tests using the Stata command *ivreg2*. The lower panel of Table 3 shows the results from these tests. The F-test for possibility of weak instruments indicates that the instruments under focus are not weak; they are strongly correlated with the endogenous regressor. The Pagan-Hall tests indicate that errors are homoscedastic. The Kleibergen-Paap under-identification test further supports the null hypothesis, meaning that the instruments are relevant. The orthogonality of the set of instruments to the error process in the structural equation was checked by the Sargan-Hansen test of overidentifying restrictions; this is statistically significant for males, but for females the *p*-value is 0.065. The Hausman endogeneity test shows that the education variable may not be endogenous for males ($p = 0.295$); therefore, there is no advantage to be gained from IV estimation for males, a finding already hinted at from the low difference between OLS and IV estimates for males. Finally, a Stock and Yogo's test points out that even if we are willing to tolerate a 5 percent IV relative bias or 10 percent IV rejection rate at maximum, we can conclude that our instruments are not weak because the Cragg-Donald Wald F for both male and female sub-samples

exceeds the corresponding critical values. To summarize, the diagnostics contend that the OLS estimates of returns to schooling for males in the given specification are more preferable over the IV estimates, whereas for females the IV parameters are appropriate.

5. Conclusions

Russia is a highly educated country, and the level schooling continues to increase. More than one-third of the labor force possesses a post-secondary qualification. Our analysis confirms previous studies showing a growth in the overall returns to schooling during the post-transition period (Brainerd 1998; Clark 2003; Vernon 2002). There was an increase in the returns to an additional year of schooling in the 1990s. The returns peaked in the early 2000s (at almost 10 percent) followed by a downward pattern (returns of 5.6 percent by 2018). Note that the global average is about 8-9 percent (Psacharopoulos and Patrinos 2018). The extent to which the declines are due to potential “over-education” is worth investigating (Gimpelson 2019).

Education payoffs for women are higher than those of men, but the difference appears to have narrowed in recent years. The higher returns to education for females is consistent with global findings (Psacharopoulos and Patrinos 2018) and previous studies of the Russian labor market (Cheidvasser and Benítez-Silva 2007; Luk’yanova 2010). When estimated separately by gender, we find trend variation. The results from estimation of earnings functions show that annual returns to higher education for males varied from 9 to 15 percent, whereas women’s returns are described by an inverse U-shaped pattern, reaching their maximum of 28 percent in 2003. Within roughly the last five years, wage premiums to higher education for women have stabilized at around 12 percent, a couple of percentage points ahead of men. Gender-wise enrollment rates in higher education 10 years later appear to match the differences in rates of return, strengthening the hypothesis that market rates of return to education in Russia do indeed influence positively the demand for schooling. Just in the past two years, the enrollment decline appears to be slowly reversing, but this phenomenon needs to be watched more closely to determine if it is merely a fluctuation or a new trend.

We show that private returns to education are three times greater for higher education compared to vocational education. On average, wage premiums to university education in Russia are roughly 3-5 times greater than to vocational schooling. This is consistent with findings from global studies and from previous research on the Russian labor market (Borisov 2007; Carnoy et al. 2012). Higher education enrollment rates increased substantially after the break-up of the Soviet Union (Belskaya, Peter and Posso 2020). Enrollments peaked in 2009. Subsequent returns to higher education started to fall relative to secondary education. The latest estimate of the returns to higher education in the Russian Federation is about 8 percent, which is just below the EU average of about 10 percent and the global average of 15 percent (Psacharopoulos and Patrinos 2018). But the wage profiles for those with secondary and vocational education are almost flat or descending, while the gaps between higher education and vocational education are increasing, in favor of higher education.

Going forward, several policy options and research priorities are worth mentioning. Female education remains a policy priority as it promotes earnings growth and helps reduce gender gaps in the labor market. Maintaining the high level of participation is warranted, while investigating

the declining trends in returns is a research theme for future work. There is a need to investigate the labor market relevance of vocational education given the low and declining returns. Higher education may have reached an expansion limit and it may be necessary to investigate options for increasing the productivity of schooling. Estimates of the social returns to vocational education should be part of the further research agenda. Alternatively, a cost-effectiveness comparing with secondary may give useful information as well. Future research could also look at the variations in returns across regions. Also, it would be useful to estimate social returns to education in order to derive more robust policy recommendations. Finally, further causal estimates of the returns to schooling should be estimated, perhaps using the recent pandemic as an instrument.

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APPENDIX

Table A22: Results of Mincer Analysis, 1994

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	10.905*** (10.679, 11.131)	11.265*** (10.938, 11.591)	10.449*** (10.158, 10.740)	11.570*** (11.387, 11.754)	11.946*** (11.672, 12.221)	11.134*** (10.904, 11.364)
Education, years	0.073*** (0.060, 0.087)	0.078*** (0.058, 0.097)	0.078*** (0.061, 0.095)			
Vocational education				0.115*** (0.030, 0.200)	0.132** (0.008, 0.257)	0.158*** (0.049, 0.268)
Higher education				0.486*** (0.389, 0.583)	0.543*** (0.400, 0.685)	0.502*** (0.378, 0.625)
Experience	0.023*** (0.010, 0.036)	0.013 (-0.007, 0.033)	0.035*** (0.019, 0.051)	0.032*** (0.016, 0.047)	0.024** (0.001, 0.048)	0.045*** (0.026, 0.064)
Experience squared	-0.0004*** (-0.001, -0.0002)	-0.0003 (-0.001, 0.0001)	-0.001*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0003)	-0.001** (-0.001, -0.0001)	-0.001*** (-0.001, -0.0005)
Observations	3,204	1,487	1,717	3,041	1,395	1,646
R ²	0.049	0.061	0.061	0.040	0.051	0.049
Adjusted R ²	0.048	0.059	0.060	0.039	0.048	0.047
Residual Std. Error	0.930	0.948	0.849	0.935	0.955	0.853
F Statistic	54.847***	32.176***	37.217***	31.859***	18.578***	21.336***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A23: Results of Mincer Analysis, 1995

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	11.612*** (11.367, 11.856)	12.105*** (11.759, 12.450)	11.053*** (10.726, 11.379)	12.362*** (12.173, 12.552)	12.845*** (12.567, 13.122)	11.832*** (11.585, 12.078)
Education, years	0.076*** (0.061, 0.090)	0.073*** (0.052, 0.093)	0.085*** (0.065, 0.104)			
Vocational education				0.055 (-0.034, 0.145)	0.064 (-0.065, 0.193)	0.115* (-0.004, 0.234)
Higher education				0.421*** (0.322, 0.521)	0.397*** (0.255, 0.538)	0.503*** (0.370, 0.635)
Experience	0.024*** (0.010, 0.038)	0.007 (-0.013, 0.028)	0.043*** (0.026, 0.061)	0.032*** (0.016, 0.047)	0.012 (-0.011, 0.035)	0.055*** (0.034, 0.075)
Experience squared	-0.0005*** (-0.001, -0.0002)	-0.0002 (-0.001, 0.0002)	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.0004)	-0.0004 (-0.001, 0.0001)	-0.001*** (-0.002, -0.001)
Observations	2,792	1,293	1,499	2,693	1,237	1,456
R ²	0.050	0.054	0.068	0.039	0.036	0.059
Adjusted R ²	0.049	0.052	0.066	0.038	0.033	0.056
Residual Std. Error	0.914	0.916	0.860	0.918	0.920	0.864
F Statistic	49.270***	24.594***	36.509***	27.447***	11.576***	22.579***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A24: Results of Mincer Analysis, 1996

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	12.283*** (12.006, 12.560)	12.553*** (12.143, 12.963)	11.895*** (11.541, 12.249)	12.989*** (12.774, 13.205)	13.307*** (12.988, 13.626)	12.565*** (12.290, 12.841)
Education, years	0.070*** (0.053, 0.086)	0.076*** (0.051, 0.100)	0.071*** (0.050, 0.092)			
Vocational education				0.105* (-0.001, 0.210)	0.132* (-0.024, 0.287)	0.126* (-0.009, 0.262)
Higher education				0.377*** (0.262, 0.492)	0.400*** (0.229, 0.571)	0.411*** (0.264, 0.558)
Experience	0.002 (-0.013, 0.017)	-0.003 (-0.026, 0.020)	0.013 (-0.005, 0.032)	0.005 (-0.013, 0.022)	0.001 (-0.026, 0.027)	0.019* (-0.003, 0.042)
Experience squared	-0.0001 (-0.0004, 0.0002)	-0.0001 (-0.001, 0.0004)	-0.0003 (-0.001, 0.0001)	-0.0002 (-0.001, 0.0002)	-0.0002 (-0.001, 0.0004)	-0.0004* (-0.001, 0.0001)
Observations	2,355	1,067	1,288	2,283	1,034	1,249
R ²	0.039	0.050	0.042	0.026	0.032	0.031
Adjusted R ²	0.038	0.048	0.040	0.024	0.028	0.027
Residual Std. Error	0.951	0.969	0.879	0.959	0.977	0.887
F Statistic	31.838***	18.765***	18.779***	14.947***	8.405***	9.812***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A 25: Results of Mincer Analysis, 1998

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.221*** (5.013, 5.429)	5.526*** (5.229, 5.823)	4.710*** (4.443, 4.978)	5.960*** (5.803, 6.118)	6.329*** (6.097, 6.561)	5.502*** (5.304, 5.701)
Education, years	0.084*** (0.071, 0.096)	0.090*** (0.072, 0.108)	0.094*** (0.078, 0.110)			
Vocational education				0.177*** (0.102, 0.252)	0.175*** (0.070, 0.280)	0.256*** (0.157, 0.355)
Higher education				0.527*** (0.443, 0.611)	0.552*** (0.431, 0.673)	0.616*** (0.506, 0.725)
Experience	0.019*** (0.007, 0.030)	0.008 (-0.009, 0.025)	0.032*** (0.018, 0.046)	0.028*** (0.015, 0.041)	0.019* (-0.0001, 0.038)	0.043*** (0.027, 0.059)
Experience squared	-0.0004*** (-0.001, -0.0002)	-0.0002 (-0.001, 0.0001)	-0.001*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0003)	-0.0005** (-0.001, -0.0001)	-0.001*** (-0.001, -0.001)
Observations	3,186	1,483	1,703	3,108	1,438	1,670
R ²	0.065	0.080	0.094	0.058	0.066	0.085
Adjusted R ²	0.065	0.078	0.092	0.057	0.063	0.083
Residual Std. Error	0.797	0.799	0.727	0.800	0.804	0.729
F Statistic	74.330***	42.686***	58.475***	47.544***	25.234***	38.908***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A 26: Results of Mincer Analysis, 2000

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.911*** (5.688, 6.134)	6.325*** (6.016, 6.635)	5.131*** (4.835, 5.427)	6.698*** (6.541, 6.855)	7.177*** (6.956, 7.399)	6.072*** (5.869, 6.276)
Education, years	0.084*** (0.070, 0.097)	0.086*** (0.067, 0.106)	0.105*** (0.088, 0.122)			
Vocational education				0.155*** (0.075, 0.234)	0.120** (0.010, 0.230)	0.283*** (0.178, 0.388)
Higher education				0.488*** (0.399, 0.577)	0.450*** (0.323, 0.577)	0.668*** (0.553, 0.784)
Experience	0.015** (0.003, 0.026)	0.003 (-0.014, 0.020)	0.036*** (0.020, 0.051)	0.021*** (0.008, 0.034)	0.010 (-0.009, 0.028)	0.042*** (0.025, 0.058)
Experience squared	-0.0003** (-0.001, -0.0001)	-0.0002 (-0.001, 0.0002)	-0.001*** (-0.001, -0.0003)	-0.0005*** (-0.001, -0.0002)	-0.0003* (-0.001, 0.00005)	-0.001*** (-0.001, -0.0005)
Observations	3,282	1,527	1,755	3,222	1,483	1,739
R ²	0.051	0.069	0.084	0.044	0.046	0.082
Adjusted R ²	0.050	0.067	0.082	0.043	0.044	0.080
Residual Std. Error	0.866	0.853	0.796	0.868	0.858	0.796
F Statistic	58.937***	37.376***	53.532***	36.905***	17.967***	38.861***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A 27: Results of Mincer Analysis, 2001

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	6.373*** (6.165, 6.581)	6.680*** (6.388, 6.971)	5.677*** (5.398, 5.955)	7.280*** (7.136, 7.424)	7.577*** (7.373, 7.780)	6.768*** (6.578, 6.957)
Education, years	0.092*** (0.079, 0.104)	0.091*** (0.073, 0.109)	0.114*** (0.098, 0.130)			
Vocational education				0.147*** (0.072, 0.221)	0.107** (0.004, 0.210)	0.299*** (0.199, 0.399)
Higher education				0.518*** (0.437, 0.599)	0.492*** (0.376, 0.608)	0.711*** (0.603, 0.819)
Experience	-0.001 (-0.012, 0.010)	-0.003 (-0.018, 0.013)	0.012 (-0.003, 0.027)	0.003 (-0.009, 0.015)	0.005 (-0.013, 0.022)	0.012 (-0.004, 0.028)
Experience squared	-0.00001 (-0.0002, 0.0002)	-0.00004 (-0.0004, 0.0003)	-0.0002 (-0.0005, 0.0001)	-0.0001 (-0.0004, 0.0001)	-0.0002 (-0.001, 0.0001)	-0.0002 (-0.001, 0.0002)
Observations	3,659	1,708	1,951	3,611	1,675	1,936
R ²	0.060	0.067	0.092	0.055	0.056	0.091
Adjusted R ²	0.059	0.065	0.091	0.054	0.054	0.089
Residual Std. Error	0.846	0.853	0.777	0.846	0.853	0.777
F Statistic	77.748***	40.535***	66.139***	52.342***	24.825***	48.381***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A28: Results of Mincer Analysis, 2002

	Total (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)
Constant	6.574*** (6.386, 6.762)	6.853*** (6.590, 7.116)	5.944*** (5.693, 6.194)	7.477*** (7.348, 7.606)	7.797*** (7.617, 7.978)	6.974*** (6.802, 7.145)
Education, years	0.091*** (0.080, 0.103)	0.094*** (0.078, 0.111)	0.111*** (0.096, 0.125)			
Vocational education				0.147*** (0.080, 0.214)	0.120** (0.028, 0.211)	0.283*** (0.191, 0.374)
Higher education				0.510*** (0.437, 0.584)	0.496*** (0.392, 0.600)	0.687*** (0.588, 0.785)
Experience	0.014*** (0.004, 0.024)	0.010 (-0.004, 0.025)	0.025*** (0.011, 0.038)	0.018*** (0.007, 0.029)	0.016** (0.001, 0.032)	0.027*** (0.013, 0.042)
Experience squared	-0.0003*** (-0.001, -0.0001)	-0.0003** (-0.001, -0.00003)	-0.0004*** (-0.001, -0.0001)	-0.0004*** (-0.001, -0.0002)	-0.0005*** (-0.001, -0.0001)	-0.0005*** (-0.001, -0.0002)
Observations	3,853	1,780	2,073	3,809	1,750	2,059
R ²	0.069	0.087	0.100	0.060	0.068	0.098
Adjusted R ²	0.068	0.086	0.099	0.059	0.066	0.097
Residual Std. Error	0.778	0.771	0.724	0.778	0.771	0.723
F Statistic	95.214***	56.700***	76.506***	61.036***	31.819***	56.047***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A 29: Results of Mincer Analysis, 2003

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	6.810*** (6.617, 7.004)	7.243*** (6.973, 7.513)	6.069*** (5.817, 6.321)	7.703*** (7.574, 7.832)	8.133*** (7.951, 8.315)	7.175*** (7.009, 7.341)
Education, years	0.091*** (0.080, 0.103)	0.088*** (0.072, 0.105)	0.118*** (0.104, 0.133)			
Vocational education				0.170*** (0.103, 0.237)	0.111** (0.020, 0.201)	0.325*** (0.234, 0.417)
Higher education				0.519*** (0.445, 0.593)	0.454*** (0.352, 0.556)	0.738*** (0.640, 0.836)
Experience	0.014*** (0.003, 0.024)	0.006 (−0.009, 0.021)	0.023*** (0.010, 0.036)	0.017*** (0.006, 0.028)	0.010 (−0.005, 0.026)	0.024*** (0.010, 0.038)
Experience squared	−0.0004*** (−0.001, −0.0001)	−0.0003* (−0.001, 0.00003)	−0.0004*** (−0.001, −0.0002)	−0.0004*** (−0.001, −0.0002)	−0.0004** (−0.001, −0.0001)	−0.0004*** (−0.001, −0.0001)
Observations	3,900	1,789	2,111	3,871	1,770	2,101
R ²	0.071	0.084	0.112	0.064	0.069	0.109
Adjusted R ²	0.071	0.082	0.111	0.063	0.067	0.107
Residual Std. Error	0.783	0.755	0.732	0.784	0.758	0.731
F Statistic	99.596***	54.327***	88.575***	66.214***	32.543***	64.108***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A 30: Results of Mincer Analysis, 2004

	Total (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)
Constant	7.183*** (6.998, 7.367)	7.530*** (7.276, 7.785)	6.457*** (6.216, 6.697)	8.054*** (7.933, 8.176)	8.406*** (8.235, 8.577)	7.555*** (7.399, 7.712)
Education, years	0.085*** (0.074, 0.096)	0.086*** (0.070, 0.101)	0.110*** (0.096, 0.124)			
Vocational education				0.105*** (0.041, 0.169)	0.133*** (0.048, 0.219)	0.181*** (0.094, 0.269)
Higher education				0.446*** (0.375, 0.517)	0.443*** (0.345, 0.541)	0.612*** (0.518, 0.706)
Experience	0.010* (-0.0001, 0.020)	0.006 (-0.008, 0.020)	0.020*** (0.008, 0.033)	0.013** (0.002, 0.023)	0.007 (-0.008, 0.022)	0.024*** (0.011, 0.037)
Experience squared	-0.0003*** (-0.001, -0.0001)	-0.0003** (-0.001, -0.00003)	-0.0004*** (-0.001, -0.0001)	-0.0004*** (-0.001, -0.0002)	-0.0003** (-0.001, -0.00004)	-0.0005*** (-0.001, -0.0002)
Observations	3,994	1,841	2,153	3,970	1,824	2,146
R ²	0.072	0.096	0.108	0.062	0.074	0.100
Adjusted R ²	0.072	0.094	0.107	0.061	0.072	0.099
Residual Std. Error	0.748	0.723	0.690	0.750	0.725	0.693
F Statistic	103.687***	64.859***	86.667***	65.934***	36.585***	59.620***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A31: Results of Mincer Analysis, 2005

	Total (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)
Constant	7.514*** (7.328, 7.699)	7.908*** (7.651, 8.166)	6.703*** (6.462, 6.943)	8.377*** (8.258, 8.496)	8.728*** (8.561, 8.895)	7.867*** (7.713, 8.020)
Education, years	0.081*** (0.071, 0.092)	0.076*** (0.061, 0.092)	0.115*** (0.101, 0.129)			
Vocational education				0.082** (0.018, 0.146)	0.109** (0.024, 0.193)	0.188*** (0.100, 0.276)
Higher education				0.421*** (0.351, 0.492)	0.385*** (0.289, 0.482)	0.642*** (0.548, 0.736)
Experience	0.004 (−0.006, 0.013)	0.001 (−0.013, 0.014)	0.012** (0.0003, 0.025)	0.004 (−0.006, 0.014)	−0.002 (−0.016, 0.012)	0.013** (0.0005, 0.026)
Experience squared	−0.0002* (−0.0004, 0.00001)	−0.0002 (−0.0005, 0.0001)	−0.0003** (−0.001, −0.00002)	−0.0002* (−0.0004, 0.00002)	−0.0001 (−0.0004, 0.0002)	−0.0003** (−0.001, −0.00001)
Observations	3,937	1,818	2,119	3,919	1,804	2,115
R ²	0.070	0.079	0.120	0.062	0.061	0.114
Adjusted R ²	0.069	0.077	0.119	0.061	0.059	0.112
Residual Std. Error	0.745	0.720	0.685	0.745	0.719	0.686
F Statistic	97.983***	51.838***	96.196***	64.571***	29.231***	67.731***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A32: Results of Mincer Analysis, 2006

	Total (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)
Constant	7.750*** (7.590, 7.911)	8.083*** (7.855, 8.311)	7.026*** (6.820, 7.231)	8.590*** (8.486, 8.695)	8.875*** (8.726, 9.024)	8.164*** (8.030, 8.298)
Education, years	0.081*** (0.072, 0.090)	0.076*** (0.063, 0.090)	0.113*** (0.101, 0.125)			
Vocational education				0.081*** (0.025, 0.136)	0.091** (0.017, 0.165)	0.197*** (0.119, 0.274)
Higher education				0.442*** (0.380, 0.504)	0.400*** (0.315, 0.486)	0.656*** (0.573, 0.739)
Experience	0.004 (-0.005, 0.012)	0.003 (-0.009, 0.016)	0.010* (-0.001, 0.020)	0.006 (-0.003, 0.015)	0.005 (-0.008, 0.018)	0.011* (-0.0001, 0.022)
Experience squared	-0.0002** (-0.0004, -0.00004)	-0.0002* (-0.001, 0.00001)	-0.0003** (-0.001, -0.00005)	-0.0003*** (-0.0005, -0.0001)	-0.0003** (-0.001, -0.00002)	-0.0003*** (-0.001, -0.0001)
Observations	4,837	2,193	2,644	4,817	2,178	2,639
R ²	0.080	0.082	0.139	0.078	0.072	0.132
Adjusted R ²	0.080	0.081	0.138	0.077	0.070	0.131
Residual Std. Error	0.719	0.698	0.666	0.716	0.691	0.668
F Statistic	140.652***	65.352***	141.538***	101.228***	42.144***	100.160***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A33: Results of Mincer Analysis, 2007

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.178*** (8.025, 8.331)	8.526*** (8.312, 8.739)	7.480*** (7.281, 7.680)	8.830*** (8.731, 8.928)	9.075*** (8.938, 9.213)	8.461*** (8.333, 8.588)
Education, years	0.064*** (0.055, 0.073)	0.056*** (0.044, 0.068)	0.096*** (0.084, 0.107)			
Vocational education				0.082*** (0.029, 0.134)	0.139*** (0.071, 0.208)	0.132*** (0.059, 0.205)
Higher education				0.366*** (0.308, 0.424)	0.332*** (0.253, 0.410)	0.537*** (0.459, 0.616)
Experience	0.005 (-0.003, 0.013)	0.005 (-0.007, 0.017)	0.011** (0.0003, 0.021)	0.006 (-0.002, 0.015)	0.004 (-0.008, 0.016)	0.013** (0.002, 0.023)
Experience squared	-0.0003*** (-0.0004, -0.0001)	-0.0003** (-0.001, -0.0001)	-0.0003*** (-0.001, -0.0001)	-0.0003*** (-0.0005, -0.0001)	-0.0003** (-0.001, -0.00003)	-0.0004*** (-0.001, -0.0002)
Observations	4,766	2,174	2,592	4,747	2,161	2,586
R ²	0.069	0.069	0.120	0.068	0.064	0.117
Adjusted R ²	0.068	0.068	0.119	0.067	0.062	0.116
Residual Std. Error	0.674	0.639	0.636	0.673	0.638	0.637
F Statistic	117.382***	53.847***	117.362***	86.858***	36.710***	85.757***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A34: Results of Mincer Analysis, 2008

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.133*** (7.970, 8.296)	8.386*** (8.156, 8.616)	7.477*** (7.265, 7.689)	8.915*** (8.811, 9.019)	9.145*** (8.999, 9.291)	8.545*** (8.410, 8.680)
Education, years	0.079*** (0.069, 0.088)	0.078*** (0.065, 0.091)	0.108*** (0.096, 0.120)			
Vocational education				0.097*** (0.040, 0.153)	0.134*** (0.061, 0.206)	0.177*** (0.098, 0.256)
Higher education				0.442*** (0.381, 0.504)	0.453*** (0.370, 0.536)	0.608*** (0.524, 0.692)
Experience	0.016*** (0.007, 0.024)	0.019*** (0.007, 0.031)	0.018*** (0.007, 0.028)	0.018*** (0.010, 0.027)	0.020*** (0.008, 0.033)	0.020*** (0.010, 0.031)
Experience squared	-0.0005*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0003)	-0.0005*** (-0.001, -0.0002)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0004)	-0.0005*** (-0.001, -0.0003)
Observations	4,844	2,182	2,662	4,832	2,172	2,660
R ²	0.084	0.100	0.126	0.082	0.096	0.118
Adjusted R ²	0.084	0.099	0.125	0.082	0.094	0.117
Residual Std. Error	0.715	0.674	0.679	0.715	0.674	0.682
F Statistic	148.108***	81.005***	127.729***	108.415***	57.530***	88.839***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A35: Results of Mincer Analysis, 2009

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.183*** (8.027, 8.339)	8.527*** (8.310, 8.744)	7.461*** (7.257, 7.666)	8.930*** (8.831, 9.030)	9.214*** (9.076, 9.351)	8.511*** (8.380, 8.642)
Education, years	0.075*** (0.067, 0.084)	0.070*** (0.058, 0.083)	0.106*** (0.095, 0.118)			
Vocational education				0.093*** (0.038, 0.148)	0.098*** (0.027, 0.169)	0.177*** (0.099, 0.254)
Higher education				0.422*** (0.363, 0.482)	0.404*** (0.323, 0.484)	0.597*** (0.516, 0.679)
Experience	0.019*** (0.011, 0.027)	0.018*** (0.006, 0.029)	0.026*** (0.016, 0.036)	0.022*** (0.014, 0.030)	0.020*** (0.009, 0.031)	0.029*** (0.019, 0.039)
Experience squared	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0004)
Observations	4,818	2,155	2,663	4,808	2,150	2,658
R ²	0.080	0.092	0.128	0.078	0.089	0.118
Adjusted R ²	0.080	0.090	0.127	0.077	0.088	0.117
Residual Std. Error	0.681	0.636	0.651	0.681	0.636	0.655
F Statistic	139.709***	72.368***	129.693***	101.856***	52.583***	88.717***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A36: Results Of Mincer Analysis, 2010

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.416*** (8.292, 8.540)	8.596*** (8.420, 8.771)	7.826*** (7.664, 7.988)	9.146*** (9.068, 9.224)	9.321*** (9.210, 9.432)	8.809*** (8.708, 8.910)
Education, years	0.070*** (0.063, 0.077)	0.072*** (0.062, 0.082)	0.094*** (0.085, 0.104)			
Vocational education				0.061*** (0.017, 0.104)	0.111*** (0.054, 0.169)	0.115*** (0.054, 0.176)
Higher education				0.383*** (0.336, 0.430)	0.414*** (0.349, 0.479)	0.514*** (0.450, 0.579)
Experience	0.012*** (0.006, 0.018)	0.017*** (0.008, 0.026)	0.015*** (0.007, 0.023)	0.014*** (0.007, 0.020)	0.018*** (0.009, 0.028)	0.016*** (0.008, 0.024)
Experience squared	-0.0004*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0004)	-0.0004*** (-0.001, -0.0002)	-0.0004*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0004)	-0.0004*** (-0.001, -0.0002)
Observations	7,360	3,339	4,021	7,341	3,325	4,016
R ²	0.077	0.099	0.110	0.076	0.094	0.106
Adjusted R ²	0.076	0.098	0.110	0.076	0.093	0.105
Residual Std. Error	0.674	0.651	0.632	0.673	0.652	0.634
F Statistic	204.097***	122.160***	165.996***	151.744***	85.825***	119.134***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A37: Results of Mincer Analysis, 2011

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.579*** (8.457, 8.702)	8.692*** (8.527, 8.857)	7.971*** (7.807, 8.135)	9.303*** (9.227, 9.379)	9.460*** (9.358, 9.562)	8.954*** (8.853, 9.056)
Education, years	0.066*** (0.059, 0.073)	0.074*** (0.064, 0.083)	0.090*** (0.080, 0.099)			
Vocational education				0.009 (-0.033, 0.051)	0.086*** (0.033, 0.139)	0.042 (-0.018, 0.102)
Higher education				0.326*** (0.280, 0.371)	0.399*** (0.339, 0.459)	0.438*** (0.374, 0.501)
Experience	0.014*** (0.008, 0.020)	0.020*** (0.011, 0.028)	0.017*** (0.010, 0.025)	0.016*** (0.009, 0.022)	0.021*** (0.012, 0.029)	0.019*** (0.011, 0.027)
Experience squared	-0.0005*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0004)	-0.0004*** (-0.001, -0.0003)	-0.0005*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0005)	-0.0005*** (-0.001, -0.0003)
Observations	7,197	3,287	3,910	7,181	3,274	3,907
R ²	0.086	0.125	0.112	0.085	0.117	0.106
Adjusted R ²	0.085	0.124	0.112	0.084	0.116	0.105
Residual Std. Error	0.652	0.599	0.623	0.653	0.600	0.625
F Statistic	225.034***	155.765***	164.526***	165.664***	108.723***	115.528***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A38: Results of Mincer Analysis, 2012

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.788*** (8.667, 8.909)	8.914*** (8.753, 9.076)	8.159*** (7.999, 8.320)	9.456*** (9.380, 9.531)	9.616*** (9.515, 9.717)	9.104*** (9.004, 9.205)
Education, years	0.061*** (0.054, 0.067)	0.068*** (0.058, 0.077)	0.085*** (0.077, 0.094)			
Vocational education				-0.007 (-0.049, 0.035)	0.079*** (0.027, 0.131)	0.015 (-0.045, 0.076)
Higher education				0.298*** (0.252, 0.343)	0.373*** (0.315, 0.432)	0.412*** (0.349, 0.475)
Experience	0.017*** (0.011, 0.023)	0.026*** (0.018, 0.035)	0.019*** (0.011, 0.026)	0.018*** (0.012, 0.025)	0.026*** (0.018, 0.035)	0.020*** (0.012, 0.028)
Experience squared	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.001)	-0.0005*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.001)	-0.0005*** (-0.001, -0.0003)
Observations	7,461	3,385	4,076	7,442	3,371	4,071
R ²	0.087	0.150	0.104	0.087	0.145	0.099
Adjusted R ²	0.086	0.149	0.103	0.086	0.144	0.098
Residual Std. Error	0.668	0.602	0.643	0.668	0.603	0.644
F Statistic	236.314***	198.539***	157.757***	176.856***	143.027***	111.637***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A39: Results of Mincer Analysis, 2013

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.793*** (8.671, 8.916)	9.014*** (8.847, 9.182)	8.095*** (7.932, 8.259)	9.497*** (9.420, 9.574)	9.713*** (9.609, 9.817)	9.094*** (8.991, 9.196)
Education, years	0.065*** (0.058, 0.072)	0.067*** (0.057, 0.076)	0.094*** (0.085, 0.103)			
Vocational education				0.011 (-0.032, 0.054)	0.050* (-0.003, 0.103)	0.082** (0.020, 0.144)
Higher education				0.329*** (0.283, 0.375)	0.353*** (0.292, 0.414)	0.501*** (0.437, 0.566)
Experience	0.019*** (0.013, 0.025)	0.022*** (0.014, 0.031)	0.023*** (0.015, 0.031)	0.020*** (0.014, 0.027)	0.024*** (0.015, 0.033)	0.024*** (0.016, 0.032)
Experience squared	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.001)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.001)	-0.001*** (-0.001, -0.0004)
Observations	7,346	3,368	3,978	7,332	3,358	3,974
R ²	0.092	0.136	0.122	0.093	0.133	0.121
Adjusted R ²	0.092	0.135	0.121	0.092	0.131	0.120
Residual Std. Error	0.657	0.608	0.629	0.657	0.609	0.630
F Statistic	247.588***	176.036***	184.225***	187.572***	128.051***	136.169***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A40: Results of Mincer Analysis, 2014

	Total (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)
Constant	8.816*** (8.684, 8.947)	8.969*** (8.783, 9.156)	8.170*** (7.999, 8.342)	9.571*** (9.488, 9.653)	9.729*** (9.613, 9.845)	9.225*** (9.117, 9.333)
Education, years	0.068*** (0.061, 0.076)	0.072*** (0.061, 0.082)	0.096*** (0.087, 0.106)			
Vocational education				0.008 (-0.038, 0.054)	0.058* (-0.002, 0.117)	0.068** (0.002, 0.134)
Higher education				0.335*** (0.286, 0.384)	0.378*** (0.311, 0.446)	0.487*** (0.419, 0.556)
Experience	0.021*** (0.015, 0.028)	0.026*** (0.017, 0.035)	0.024*** (0.016, 0.033)	0.022*** (0.016, 0.029)	0.027*** (0.018, 0.037)	0.024*** (0.016, 0.033)
Experience squared	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.001)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.001)	-0.001*** (-0.001, -0.0004)
Observations	6,161	2,803	3,358	6,150	2,793	3,357
R ²	0.094	0.124	0.134	0.094	0.120	0.128
Adjusted R ²	0.094	0.123	0.133	0.093	0.118	0.127
Residual Std. Error	0.641	0.615	0.600	0.641	0.616	0.602
F Statistic	212.827***	132.356***	172.860***	158.634***	94.659***	123.316***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A41: Results of Mincer Analysis, 2015

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	9.052*** (8.923, 9.181)	9.101*** (8.927, 9.276)	8.484*** (8.310, 8.657)	9.656*** (9.576, 9.737)	9.764*** (9.656, 9.873)	9.348*** (9.238, 9.457)
Education, years	0.057*** (0.050, 0.064)	0.067*** (0.057, 0.077)	0.080*** (0.070, 0.089)			
Vocational education				0.015 (-0.031, 0.062)	0.091*** (0.034, 0.147)	0.054 (-0.015, 0.124)
Higher education				0.294*** (0.245, 0.343)	0.381*** (0.318, 0.445)	0.411*** (0.340, 0.482)
Experience	0.018*** (0.011, 0.024)	0.024*** (0.016, 0.033)	0.019*** (0.011, 0.027)	0.019*** (0.013, 0.025)	0.026*** (0.018, 0.035)	0.019*** (0.011, 0.027)
Experience squared	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.001)	-0.0005*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.001)	-0.0005*** (-0.001, -0.0003)
Observations	6,236	2,845	3,391	6,227	2,839	3,388
R ²	0.084	0.134	0.102	0.086	0.133	0.101
Adjusted R ²	0.083	0.133	0.102	0.085	0.132	0.100
Residual Std. Error	0.627	0.574	0.604	0.626	0.574	0.604
F Statistic	189.378***	146.920***	128.754***	146.430***	108.622***	95.258***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A42: Results of Mincer Analysis, 2016

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	8.964*** (8.831, 9.097)	9.116*** (8.940, 9.291)	8.343*** (8.159, 8.526)	9.651*** (9.567, 9.735)	9.856*** (9.746, 9.966)	9.283*** (9.166, 9.400)
Education, years	0.061*** (0.054, 0.069)	0.069*** (0.059, 0.078)	0.085*** (0.075, 0.095)			
Vocational education				-0.007 (-0.055, 0.041)	0.038 (-0.020, 0.096)	0.036 (-0.037, 0.109)
Higher education				0.285*** (0.235, 0.336)	0.337*** (0.272, 0.401)	0.411*** (0.336, 0.486)
Experience	0.022*** (0.016, 0.029)	0.023*** (0.014, 0.031)	0.028*** (0.019, 0.036)	0.023*** (0.017, 0.030)	0.023*** (0.015, 0.032)	0.028*** (0.019, 0.037)
Experience squared	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.0005)	-0.001*** (-0.001, -0.0004)
Observations	6,313	2,912	3,401	6,302	2,904	3,398
R ²	0.074	0.120	0.093	0.073	0.112	0.089
Adjusted R ²	0.074	0.119	0.092	0.073	0.110	0.088
Residual Std. Error	0.646	0.581	0.639	0.647	0.583	0.641
F Statistic	168.277***	132.178***	116.214***	124.160***	91.100***	82.554***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A43: Results of Mincer Analysis, 2017

	Total	Males	Females	Total	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	9.181*** (9.046, 9.316)	9.232*** (9.060, 9.404)	8.618*** (8.429, 8.808)	9.761*** (9.675, 9.848)	9.927*** (9.818, 10.037)	9.411*** (9.288, 9.534)
Education, years	0.053*** (0.046, 0.060)	0.066*** (0.056, 0.075)	0.074*** (0.064, 0.084)			
Vocational education				0.006 (-0.043, 0.056)	0.049* (-0.009, 0.106)	0.066* (-0.011, 0.143)
Higher education				0.263*** (0.210, 0.315)	0.344*** (0.280, 0.407)	0.386*** (0.308, 0.465)
Experience	0.018*** (0.011, 0.025)	0.021*** (0.012, 0.030)	0.021*** (0.012, 0.030)	0.019*** (0.012, 0.026)	0.022*** (0.013, 0.031)	0.021*** (0.012, 0.030)
Experience squared	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0004)	-0.0005*** (-0.001, -0.0003)	-0.001*** (-0.001, -0.0004)	-0.001*** (-0.001, -0.0004)	-0.0005*** (-0.001, -0.0003)
Observations	6,375	2,952	3,423	6,367	2,946	3,421
R ²	0.064	0.117	0.074	0.065	0.113	0.073
Adjusted R ²	0.064	0.116	0.073	0.065	0.111	0.071
Residual Std. Error	0.660	0.569	0.665	0.660	0.570	0.666
F Statistic	145.834***	129.593***	91.376***	111.451***	93.267***	66.832***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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

Table A44: Results of Mincer Analysis, 2018

	Total (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)
Constant	9.185*** (9.053, 9.316)	9.347*** (9.167, 9.527)	8.609*** (8.434, 8.784)	9.777*** (9.692, 9.863)	9.997*** (9.881, 10.114)	9.425*** (9.310, 9.539)
Education, years	0.054*** (0.047, 0.062)	0.061*** (0.051, 0.070)	0.077*** (0.067, 0.086)			
Vocational education				0.029 (−0.019, 0.077)	0.040 (−0.020, 0.099)	0.097*** (0.027, 0.167)
Higher education				0.275*** (0.225, 0.325)	0.305*** (0.239, 0.371)	0.413*** (0.341, 0.484)
Experience	0.024*** (0.017, 0.030)	0.024*** (0.014, 0.033)	0.027*** (0.019, 0.036)	0.024*** (0.017, 0.030)	0.024*** (0.015, 0.033)	0.027*** (0.018, 0.035)
Experience squared	−0.001*** (−0.001, −0.0005)	−0.001*** (−0.001, −0.0005)	−0.001*** (−0.001, −0.0004)	−0.001*** (−0.001, −0.0005)	−0.001*** (−0.001, −0.0005)	−0.001*** (−0.001, −0.0004)
Observations	6,129	2,810	3,319	6,120	2,802	3,318
R ²	0.072	0.110	0.093	0.070	0.105	0.087
Adjusted R ²	0.071	0.109	0.092	0.070	0.104	0.086
Residual Std. Error	0.618	0.570	0.598	0.619	0.572	0.599
F Statistic	157.295***	115.600***	112.737***	115.383***	82.238***	78.824***

Note:

Figures in parentheses are the limits of the 95% confidence interval for the coefficient

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