The Educated Russian's Curse: Returns to Education in the Russian Federation[†]

Sofia Sheidvasser[‡]
Yale University

and

Hugo Benítez-Silva
Yale University

First version: October 9, 1999
This version: January 12, 2000

Abstract

This paper uses the only representative sample of the Russian Federation, the Russian Longitudinal Monitoring Survey, to estimate the returns to education in this ex-communist country. This is one of the first studies to tackle this classic issue in labor economics with the realistic expectation of obtaining results for Russia comparable in quality and reliability to those available in developed countries and other economies in transition. Using standard regression techniques we find that the returns to education in Russia are quite low compared with those reported in the literature on countries throughout the world, in almost no specification reaching higher than 5%. Moreover, there is virtually no improvement in returns to education in the 1992-99 period, a result somewhat at odds with the suggestion of several studies using Russian data from the early 1990s. When we instrument our main regressor using policy experiments from the 1960s, we find comparable results. We also perform a selectivity correction and discover even lower returns to education for men, although they become slightly higher for women. Additionally, we find extremely low returns to tenure, which can even become negative in certain specifications. These results present a bleak perspective for educated Russians, with negative implications for investments in education at all levels, auguring the imminent erosion of one of Russia's few assets not yet completely devalued, the human capital of its citizens.

Keywords: Returns to Education, Russia, Economic Transition, Instrumental Variables, Selectivity Correction.
JEL classification: I2, J31, O52, P2

[†] Benítez-Silva is grateful for the financial support of the Cowles Foundation for Research in Economics through a Carl Arvid Anderson Dissertation Fellowship. Sheidvasser is grateful for the support from a Sassakawa Fellowship. We thank Peter Lanjouw for getting us started on this project. We have benefited from comments from Patrick Bayer, Elizabeth Brainerd, Ester Duflo, Mark Foley, Ann Huff-Stevens, Jenny Hunt, Paul Mishkin, Gustav Ranis, John Rust, T. Paul Schultz, T.N. Srinivasan, Chris Udry, participants of the Summer Workshop in Development Economics, and the Workshop in Trade and Development at Yale University. We thank Jenny Klugman, Jeanine Braithwaite, and Laura Henderson for helping us in finding the RLMS data and for answering numerous questions. All remaining errors are our own.

[‡] Corresponding author: Sofia Sheidvasser, Department of Economics, Yale University, 37 Hillhouse Avenue, New Haven CT 06520-8264, phone: (203) 432-3564, fax: (203) 432-6323, e-mail: sofia.sheidvasser@yale.edu

1 Introduction

"... to learn, to learn, and to learn..."
Vladimir Lenin. October 2, 1920.[1]

The estimation of the profitability of investment in human capital has been a central topic for numerous papers since the question was first posed in the early 1960s.[2] These estimates have also been used to investigate other economic issues, such as wage determination (Willis 1986) and optimality of the resource allocation between education and other sectors (Dougherty and Psacharopoulos 1977). Returns to education affect the overall educational level of the population, which in turn has been suggested as one of the key determinants of a country's economic growth (Barro 1991). The question of profitability of investment in education is now of central importance for Russia, after the abandoning of its centrally planned path and its shift toward a market economy with liberalized prices and wages determined by supply and demand.

The Russian educational system is quite advanced, both in attainment and quality, even in comparison to that of developed countries. However, Russia's low and still declining output per capita as well as its disrupted social networks and eroded production structure provide for economic and social conditions far worse than those of any developed country. Russia is also struggling in comparison with other Central and Eastern European countries undergoing the transition from a socialist to market economy. While most Central European transition economies were experiencing recovery of output and substantial decline in inflation by the second or third year of transition, Russia is still undergoing a kind of "prolonged transition."[3] Despite a decade of reforms (mild at first, then more active starting in 1992), Russians have seen their economy shrink nearly every year and are suffering a mounting erosion of their purchasing power as well as a rocketing of corruption and organized crime in all levels of society. No major reform achievements were implemented beyond the price and trade liberalization and the marginally successful privatization. The government has reduced subsidies to its numerous research institutions, especially in the defense industry, and struggling enterprises have little money to support R&D. With this combination of poor economic conditions and a high supply of educated labor force, we conjectured that Russian returns to education would likely be quite low. We further did not expect to find an increase

[1] Quote from "The Tasks of the Youth Leagues," a speech delivered at the Third All-Russia Congress of the Russian Young Communists League. Nearly every school in the USSR had this slogan posted for all students to see. The promotion of (politically correct) education was one of the cornerstones of the Russian revolution. More than a means for obtaining higher wages, education was seen as a good in itself.

[2] See Mincer (1958), Schultz (1961), and Becker (1964).

[3] Data for transition economies are from Åslund et al.(1996).

in these returns during recent years, given that there has been no improvement in the economic conditions.

This is one of the first studies to tackle this classic issue in labor economics with the realistic expectation of obtaining results comparable in quality and reliability to those available in developed countries and other economies in transition. It is also the first study that we are aware of that using Russian data acknowledges the possible endogeneity of the schooling measure and instrument it appropriately, and performs a selectivity correction given that only current workers are used in our estimations. This has become possible due to the Russian Longitudinal Monitoring Survey (RLMS), an excellent source of current data and the only representative sample of the Russian Federation. The RLMS is a household-based survey of more than 6,000 households (as of the first round of data), each interviewed eight times between October of 1992 and January of 1999. Given various constraints and data problems (explained in Section 4), we have had to consider almost exclusively the last three rounds of data. Our results, however, remain unchanged when using the entire data set.

We restrict our attention to workers earning positive wages in the month before the interview. Using standard regression techniques we find that the returns to education in Russia are mostly in the range of 3% to 5%, among the lowest worldwide and comparable to those estimated using Russian data from the early 1990s.[4] More importantly, we find virtually no improvement in the returns to education in the 1992-99 period, rarely exceeding 5%. This contrasts with the picture suggested by Brainerd (1998), and considering several drawbacks of the data set used in that study to analyze returns to education in the post-reform period, we believe our conclusions better characterize the reality that Russians with varying levels of education face in the labor market.[5] We have further been able to evaluate the relative importance of two factors that have contributed to the small wage differentials with respect to education in Soviet and post-Soviet Russia. Our findings suggest that market-type wage adjustment to equilibrate the high supply of human capital with its relatively low demand, rather than the egalitarian wage policy of the Soviet government, is the most likely explanation for the low returns to education.

We acknowledge the possible endogeneity of the schooling level in our OLS regressions and the

[4] Brainerd (1998) and Newell and Reilly (1996).

[5] Brainerd's study had different objectives, but one of its results shows an important increase in the returns to education in the 1991-94 period and conjectures that the returns should increase further in the future. However, the author acknowledges the lack of representativeness of the data used, and the study is likely to have measurement error problems affecting the relevant variables.

bias it can cause. Using a policy experiment from the 1950s–1960s we are able to instrument our main regressor, years of schooling, and confirm the validity of our OLS results. We also correct for selectivity stemming from our exclusive consideration of workers in our estimates. The returns to education for males after the correction are lower than those of the OLS regression, and the returns for females are higher. However, for the full sample the corrected returns are almost identical to the OLS estimates. Although the RLMS was conceived as repeated cross-sections, it is possible to construct two panels using the two phases of the survey. We use this capability to provide further confirmation of our results.

We also estimate returns to education for various subsamples of individuals: men and women, rural and urban workers, and people working for private enterprises vs. government employees. Women and rural workers consistently receive higher returns; contrary to the findings of some authors, for individuals employed by the government the returns are slightly higher, although this difference is not statistically significant.[6]

We additionally observe extremely low returns to tenure, which can even become negative depending on the specification used. This is the first study of which we are aware to produce this result, and the conclusion confirms the intuition that past experience pays off less in a radically changing economy. Workers who stay in government-owned companies see mostly the stagnation of their wages once we control for other observable characteristics, and those who switch to new private/foreign-owned companies or begin in privatized enterprises also see no increase in wages due to tenure, and at times even suffer a decline in salary.

As our title suggests, and in accordance with the belief that fostered this project, we conclude that for most Russian citizens, an additional year of education is of little use in increasing wages. And although only supported by anecdotal evidence (given the unavailability of detailed data), the low returns seem to induce Russians to emigrate in search of a better life and a higher reward for their abilities. Often they leave never to come back, ultimately contributing to the advance of companies and countries that for decades were seen as rivals. Additional evidence, dating back to the Soviet period, suggests that Russians who emigrated to Israel had above-average level of education (Ofer and Vinokur 1992), and similar evidence can be gathered from the Soviet Interview Project, which uses data on Russian emigrants to the United States.

The picture we present is less encouraging than that of previous studies on Russia, but we also believe it to be more realistic. We find a bleak perspective for educated Russians, with negative

[6] Psacharopoulos (1985, 1994), Maurer-Fazio (1999).

implications for investments in education at all levels, auguring the imminent erosion of one of Russia's few assets not yet completely devalued, the human capital of its citizens.

In the next section we provide a brief background on Russia and on the Russian educational system, highlighting the characteristics most important to our estimation strategy. Section 3 reviews the literature on returns to education, devoting special attention to studies of other transition economies and previous studies using Russian data. Section 4 describes and analyzes the RLMS data used in this study. Section 5 presents the empirical results and Section 6 offers some conclusions.

2 Background on the Russian Educational System.

In 1917, when the Bolshevik Revolution transformed tsarist Russia into a Communist republic, some of the first reforms were aimed at the education sector. Before then, 66% of the Russian population had been illiterate, with only half of the children ages 8 to 12 attending primary schools. With little choice other than to start working at a very young age in order to support their families, children of workers and peasants were often unable to attend institutions of secondary and higher education. Access to many schools was even limited by socio-economic status. In 1919, Russian education was made free, and compulsory schools and universities opened to the general public (even declaring a preference for admitting children of low class families). The number of secondary schools quickly grew, and alternative educational institutions were established for adults who had never received primary or secondary education. A universal curriculum including required courses for all Russian schools was introduced. By the early 1930s, the illiteracy rate fell to 38%, which was still considered to be too high. Compulsory education was extended from only primary school to seven years of mandated schooling.

In 1956, the Twentieth Communist Party Congress denounced the Russian school curriculum as largely irrelevant to real life and made several modifications to the program. Certain courses related to the real work process were added, the seven-year compulsory programs and the ten-year curricula were extended by one year, although this last change was reversed eight years later. After that, the educational structure remained virtually unchanged until 1984, when a new regulation introduced an optional reduction of the school admission age from seven to six, with a consequent increase in the duration of primary school from three to four years. However, this has not yet become compulsory. The policy experiments described above allow us to instrument the years of

schooling variable in our empirical analysis.

Education in Russia has the structure presented in Figure A.1 in the Appendix. School covers three levels: primary, incomplete secondary and complete secondary, the first two of which are compulsory. Students who stop after the incomplete secondary level can pursue a vocational degree (requiring two to three additional years) or a specialized secondary or technical degree (requiring four more years). Complete secondary school graduates wishing to continue their education can study for approximately five more years at an "institute" or university (an analog of combined U.S. bachelor and master programs). They can also enter specialized secondary or technical schools and receive a degree after a period of two to three years. To enter these two types of educational institutions, applicants are required to pass a set of entrance examinations, often very rigorous.

Those with a specialized secondary degree can in turn enter universities in pursuit of higher education. Institute or university graduates can enter a "kandidat nauk" program (roughly an analog of Ph.D. programs in the U.S.), usually lasting three years. At every stage of the education process after the incomplete secondary school level, Russians can postpone or end their schooling in order to join the labor force.[7]

Russian levels of education fit the International Standard Classification of Education (ISCED), allowing us to compare Russian educational attainment in the period covered by our data to that of some OECD countries presented in studies conducted by the Centre of Educational Research and Innovation (CERI). The 1997 study reports figures for 1995, and our sample covers the 1992-1999 period. According to a subsample of individuals ages 25 to 64 from our study (the brackets were chosen to match those of the CERI), as shown in Table 2.1, the fraction of people holding only incomplete secondary or primary degree is 16%, lower than in any country except for the U.S. with 14%. Forty two percent of Russians have higher university or non-university degrees, the highest percentage of all the countries except Canada, where the figure is 47%. This fraction is far above the average of the OECD countries, 22%. The share of people with university degrees is 20%, with only the United States ahead (25%). According to education indicators, Russia is far ahead of the two most successful Central European transitioners, the Czech Republic and Poland, where the fractions of people with a university degree are 11% and 10%, respectively.

The Russian population not only acquires on average more education than people in other countries but the quality of that education seems to be quite high. Russian students performed well

[7] More detailed information on the structure and history of the Russian educational system can be found in Popovych and Levin-Stankevich (1992).

in the last International Comparative Tests in Math and Sciences. These tests are standardized and are used to compare more than 40 countries. Russian secondary school students obtained uniformly higher scores than American students, and their scores in advanced tests were among the highest for the countries sampled.[8]

Table 2.1: Percentage of population 25 to 64 years of age by the highest completed level of education.

Country	Primary and incomplete (lower) secondary	Complete and specialized secondary	Non-university tertiary	University tertiary
Russia	16	42	22	20
United states	14	53	8	25
Canada	25	28	30	17
Germany	16	61	10	13
Sweden[a]	25	46	14	14
United Kingdom[a]	24	54	9	12
Czech Republic[a]	17	73	—[b]	11
Poland	26	61	3	10
OECD mean[a]	40	40	9	13

[a] The numbers do not add up to 100 due to rounding error.
[b] This category is included in the Complete and specialized secondary education level category.

There are several reasons why Russians have traditionally acquired so much education. The idea of the necessity and prestige of education was one of the key points of the new Communist regime, obviously very important in illiterate post-tsarist Russia. This idea remained well-promoted throughout the ruling period of the Communist Party and became essential to many Soviet citizens. People assigned high value to education not usually because of its future wage rewards (which were quite low) or fringe benefits, but primarily because of the prestige and self-esteem associated with education itself and with a qualified white-collar job. Teenagers, as surveys show, assigned very high prestige to professions requiring higher education, such as doctors and teachers, although these were relatively low-paying occupations.[9] The highest ratio of applicants to admissions was found in universities offering preparation for these jobs. Free tuition and stipend, as well as inexpensive or free dormitories, made the option of pursuing higher education not only desirable but also affordable. These features of the Russian education system and the Soviet mentality have led to the widely recognized fact that Russia has one of the most highly educated populations in the world.

[8] See the summary report of the Third International Mathematics and Science Study, TIMSS (1999).
[9] Katz (1999).

3 Literature

As was mentioned in the introduction, since the 1960s hundreds of studies have estimated returns to education in numerous countries, measured as years of schooling or as education levels attained. Two of the most comprehensive surveys are presented by Psacharopoulos (1985, 1994). They cover the results of estimations of the returns to human capital studies for over sixty countries, presenting a summary analysis. The surveys include a wide set of developing countries, a set of developed countries, and several intermediate performers.[10] According to the surveys' results, developing countries have the highest return to an additional year of schooling, from 11% in Asia to 14% in Latin America. They are followed by advanced countries, were the return is 9%, and by the intermediate group of countries with a return of 8%.[11] The results are mainly explained by the relative scarcity of human-to-physical capital.

Other important features of the estimates are also reported. The returns to education in the government sector tend to be lower than those in the private (competitive) sector by almost 25%, and the explanation suggested is wage-equalization policy often present at state enterprises. This general finding is likely to be applicable to post-Soviet Russia and can be tested on Russian data in two dimensions: comparing rates of return in the government sector to those in privately-owned firms, and observing the trend in the rate of returns as Russia moves away from central planning and the role of governmental regulations diminishes. Additionally, returns to human capital for women are more than 25% higher than those for men, and returns to investment in general academic education are greater than the returns to investment in a comparable curriculum with emphasis on vocational or technical training. And finally, marginal returns to education decline as the level of education increases.

Another comprehensive survey is presented by Card (1999). He covers not only results using different data sets, but also different techniques used in the estimation of the returns to education. The study emphasizes the importance of a possible endogeneity bias in OLS estimates—the technique used in the majority of papers devoted to the wage equation estimation—and presents the results of various U.S. studies as well as some European and Australian studies, in order to contrast OLS estimates with those obtained by instrumental variables estimation or differencing.

[10] The author acknowledges difficulties related to comparison of the estimates across samples and countries, where the sampling methodology and estimation techniques are often very different. However, the author claims that his summary statistics and general conclusions are robust.

[11] When classified by returns to levels of education, intermediate countries have slightly higher returns than those of the advanced group.

Supporting Psacharopoulos' findings, simple OLS estimates of return to an extra year of education for various samples of U.S. workers varies mostly from 5% to 8%, with similar results for Australia and the U.K., slightly higher for Finland and slightly lower for Sweden. However, when the endogeneity ("ability bias") is corrected by using instruments based on features of the school system, or on family background, the estimate is consistently higher by about 3 percentage points. Yet when controlling ability bias using within-family differenced estimates, the results are somewhat lower than those of OLS. Several explanations of these facts are presented, and the main conclusion based on the "best available" evidence is that simple OLS estimates have a slight upward bias. Instrumental variables estimates are likely to be biased upward because of the difference between the treatment and the control group, since the group whose schooling decision is most affected by an institutional change or other factors presented as an instrument is the group with higher returns to education.

Very few papers study the Russian (Soviet) labor market prior to 1992, when the transition process began. The main reason for this is the lack of available micro-level data. The data collected by Soviet statistical authorities were reported only in the form of highly aggregated numbers or simple cross-tabulations. Moreover, local authorities even prohibited this type of study out of fear that the central planners would notice possible problems in the different regions. Even if the data had been available, they could not be considered very reliable, since collection was performed only by government agencies and respondents were not given any guarantee of confidentiality. Everyone was well aware of the use of private information in the communist regime for purposes other than research.

The papers that did perform micro-analysis of the Soviet labor market were based on surveys whose sampling methods and selectivity problems affected the reliability of the analysis. Ofer and Vinokur (1992) use a sample of immigrants who traveled from the Soviet Union to Israel in the early 1970. An emigrants' survey based on the Soviet Interview Project (SIP) presents a sample of former Soviet citizens who emigrated to the United States in the 1979-1982 period (Gregory and Kohlhase 1988). These data can be considered accurate, as individuals in the studies did not have an incentive to misreport to their interviewers; but the sample selection issue could have biased the results of the analyses, given that individual characteristics of successful emigrants are likely to differ from those of the overall population.[12]

[12] Although both samples were carefully stratified, some problems were likely to remain. For example, the sample of 2,793 SIP individuals was stratified from over 33,000 cases according to educational, geographical, and nationality

Katz (1999) uses a survey conducted in 1989 of a single city, Taganrog, whose economy depends almost entirely on a heavy industry. As the author admits, the labor force in that city differs from that of the referent population in educational attainment and employment sector distribution. This difference does not allow us to generalize the results of the estimation of the wage equation, and especially returns to education estimates, to the whole Russian population.

In spite of the difference in sampling methods and years of information collection, the authors report qualitatively similar findings with respect to returns to education. Katz reports 23%-35% return to higher education (compared to having incomplete secondary education) for men and 14%-32% for women. The results of Ofer and Vinokur are comparable, 29% for men and 32% for women. Results of Gregory and Kohlhase are even lower, 13% to 22% for the whole sample. Returns for having complete secondary, vocational, or specialized education are in many cases insignificant or low. All the authors found non-decreasing rates of return for successively higher levels of schooling.[13] These rates of return are considered to be among the lowest in the world.[14]

The combination of two factors can help explain this phenomenon. First, as was the case for all other markets in the Soviet Union, the labor market was heavily controlled by the government, and wages were centrally determined according to a set of scales and grades. Wage differentials were kept artificially low, in accordance with the Communist policy of "equal distribution." However, firms did have some flexibility in changing wages, and the government itself realized the necessity of using wages as an incentive mechanism to draw workers to occupations with excess demand for labor. This presented the second reason for low education premia. As was mentioned above, the Soviet people regarded higher education and qualified white-collar positions prestigious, which effectively lowered the wage they would agree to accept for these jobs. These jobs also often presented more opportunities for side income, more flexible and sometimes shorter working hours, and more fringe benefits.[15] On the other hand, with a relatively low degree of automation and a large demand for low-quality manual work, government and enterprises had to set wage incentives for people to apply for these jobs. Both forces reduced the wage rewards of highly educated

characteristics of the referent population, but it still over-represented the population of medium and large cities, populations with higher education, and workers concentrated in service occupations, as the authors acknowledge. Ofer and Vinokur's study also demonstrates differences between the sample and the Soviet population.

[13] These papers use levels of education, or years of education at a given level, rather than total number of schooling years.

[14] For example, a simple calculation using Mincer's (1974) results on returns to human capital delivers a return to higher education of more than 80%. Brainerd (1998) reports a return to higher education of about 70% in the late 1980s.

[15] See Katz (1999) and the discussion of Table 4.2 in the next section.

individuals relative to those with less education. As Russia moves from a centrally planned to a market economy, the first reason loses significance, but as long as the large pool of highly educated workers faces a low demand for their skills, we can expect the returns to education to remain low.

Newell and Reilly (1996) estimate a wage function in Russia at the very beginning of the active reform process. They use the first round of the RLMS, collected in the third quarter of 1992, and find fairly low returns to human capital, 3% to 4.5% for different subsets of control variables. They attribute the low coefficient to the legacy of socialist wage equalization. However, their results are based on computed years of education (the survey has only levels of education available), and this is likely to amplify measurement error, biasing the coefficient of interest downward. In their further research (Newell and Reilly 1997) the authors report returns to levels of education up to 1996. Their findings for Russia show an initial increase in the human capital premium in the post-reform period, and a subsequent decline.

Brainerd (1998) uses several monthly surveys conducted by the All-Russian Center for Public Opinion Research in the 1991-94 period, and finds an increase in returns to education over this period by about 4 percentage points. This result, if sustained for later years, might suggest that egalitarian Soviet government policies dominated equilibrium wage setting in the labor market, keeping returns to education low, and that their removal has permitted returns to adjust to the equilibrium level. However, as mentioned in the introduction, the lack of representativeness and the problems of measurement with the relevant variables can bias some of her results on returns to human capital.

All the papers on Russia mentioned above use OLS to estimate the wage equation and obtain the estimates of the returns to human capital. It remains to be shown that the results would not change substantially when corrected for possible endogeneity, measurement error, or sample selection bias.

When we turn to Central European countries experiencing transitions from the Socialist planned economies to market democracies, we consistently find a picture similar to that portrayed in Brainerd (1998). Chase (1998) reports low returns to a marginal year of education of 2.5%-4% in the Czech Republic and Slovakia in 1984, prior to the beginning of the reform, and then an increase to 5-6% by 1993. Returns also increase for all the levels of education (except for post-graduate level), with a relatively higher increase for the higher education levels. Filer et al. (1999) report further increases in returns to education in the two Republics to around 8-9% by 1997. Orazem and Vodopivec (1995), and Stanovnik (1996) find similar changes during the

transition in Slovenia, and Jones and Ilayperuma (1994) report an increase in returns to education during the early transition in Bulgaria.[16] Similarly, Maurer-Fazio (1999) observes an increase in returns to human capital in reforming China in the late 1980s and early 1990s. These findings are consistent with the often mentioned observation that the government sector usually suppresses wage rewards for higher levels of human capital, and as the government role diminishes, the returns to education are likely to rise. Another explanation, suggested in Schultz (1975), is that higher education allows a person to adjust to a disequilibrium more efficiently, for example, by enhancing entrepreneurial ability. If we consider a transition process as a disequilibrium, we can expect that highly educated individuals would be able to find higher returns to their education and that a more general academic education would bring higher rewards than one that is specialized, technical or vocational.

4 Data and Summary Statistics

4.1 Measurement and Data Issues

The RLMS is a survey of more than 6,000 households that began in 1992. It was designed to measure the effects of economic and political reforms on the economic well-being of the Russian population. The survey has had two phases, with four rounds of data collected in each phase as of January 1999. The most important characteristic of the RLMS is that it is the first nationally representative longitudinal survey of Russia. Due to its representativeness, the broad range of issues covered (including information on employment, use of time, consumption expenditures, health, nutrition, etc.), and high quality of the data collection process, this study gives a detailed and realistic view of the current labor and economic situation of the Russian population. This survey has been widely used for poverty, health, and nutrition studies, but its application to labor market issues has thus far been limited.[17] Foley (1997) uses the first seven rounds of this data set to analyze labor market dynamics, unemployment duration, and multiple job holding in Russia, and Newell and Reilly (1996,1997) conduct a wage equation analysis, including an estimation of the gender wage gap and returns to education.

[16] Declining returns to education were found by Krueger and Pischke (1995) in East Germany. However, this is a special case of "transition" considering West Germany's extensive assistance in rebuilding the East German economy.

[17] A set of references to these papers on health and nutrition issues can be found on the URL www.cpc.unc.edu/projects/rlms/papers.htm.

The agencies in charge of developing the RLMS and taking it to the field had to overcome a range of problems, from training of interviewers and important budget constraints to decisions regarding language in a highly heterogeneous country.[18] The result of these constraints is that the survey agencies decided to use a stratified sample of dwellings—excluding military, penal, and other institutionalized populations—and decided not to follow families that changed addresses from survey to survey. This raises issues of selectivity and representativeness. But given the evidence that the surveying agencies offer, this strategy seems to have been effective with a cross-section perspective in mind, meaning that each of the eight cross-sections represents the population fairly accurately, based on the last available census survey.[19] The head of each household answered questions pertaining to the entire family, but as many adults as possible completed the individual questionnaires that are the basis for our empirical work.

Given the very wide information coverage of the questionnaires and taking into account various constraints, some data, especially part of the most relevant data for our purposes, had some potentially serious problems. Often questions were imprecisely stated or omitted entirely. For example, in the first rounds of data the respondents were asked only to indicate their highest attained education level or whether they had attended or graduated from a particular kind of educational institution. It was difficult to obtain a total number of schooling years, and the use of this measure can lead to an aggravated measurement error problem, and obscure the comparability across rounds. This has led us to focus our attention on phase two, and especially on the last three rounds of data—rounds 6 to 8—which greatly improved upon the quality of the data collection process in previous rounds. In these rounds, for example, respondents are asked precisely how many years they had studied in a particular type of school, and whether or not they had graduated. We will present some results using the earlier rounds and show that the conclusions of our main empirical work are not influenced by concentrating on the last rounds of data.

The construction of other explanatory variables was less of a problem, especially in the last rounds of data. The dependent variable, monthly wages, was also relatively easy to extract, but we had to correct it for the high inflation and currency reform in the period of study.[20] We use

[18] Several agencies have provided funding for this survey. The World Bank, the Agency for International Development (USAID), the National Science Foundation, the National Institute of Health, the Carolina Population Center at the University of North Carolina at Chapel Hill, the Russian State Statistical Bureau, and the All-Russia Center of Preventive Medicine.

[19] See the RLMS Web page for more details on the representativeness of each cross-section.

[20] The inflation data were obtained from the following URLs: www.worldbank.org/html/extdr/offrep/eca/ru.htm and www2.hawaii.edu/shaps/russia/1997inflation.html.

monthly wages, instead of an hourly wage indicator, because this is the figure respondents were explicitly asked to supply. Calculation of hourly wages would require us to use another variable, hours worked in the referent month, which is in turn subject to measurement error. We also have to consider that in Russia employer/employee agreements are traditionally based on monthly wages, and the variation in paid days off, vacation days, and sick leaves could introduce additional noise to our calculations.[21]

4.2 Data Analysis

We begin with Table 4.1 which presents means and standard deviations of the pooled sample of respondents of rounds 6 to 8 (interviews performed in the 1995-1999 period) and subsamples divided by sex and labor force status. The average age of the respondents is slightly below 39, more than 55% are female, roughly 2/3 are married, and approximately 2/3 were in the labor force in the months before the interview. The average of total years of schooling is slightly above 11. In the first three columns of the table we see a lower percentage of individuals with a university degree, because this sample includes people below 25 and above 64, members of the population who either have not yet had time to complete their university degree, or who attended school before the educational system was well-developed. The average tenure among workers is around 7.7 years. Three-fourths of workers still reported that their companies are at least partly owned by the government, and only 4% of respondents' enterprises are owned by foreign capital. More than 22% of workers have supervisory responsibilities in their jobs, and they perform tasks that require some heavy physical effort for almost half of their working time on average.

Comparing males and females, we see that the average age of females is approximately five years higher, and they are married in a lower proportion. This might be partly explained by the plummeted life expectancy of men in the beginning of the transition: by 1994, life expectancy of men was around 58 years and that of women was still above 71 years.[22] Men and women work in a fairly similar proportion: 70.2% for men and 67.6% for women. Figure 4.1 plots the labor force participation rate for males and females by age using our sample of respondents. We can observe that the participation rates are similar, with higher participation for males at the beginning and

[21] The choice of monthly wages is criticized by Katz (1999) because it can fail to consider the decision to work fewer hours for a relatively higher hourly wage, something that could potentially lead to an underestimation of the returns to education, especially for women needing to set aside time for housework. Our findings indicate that this is not a problem in our study.

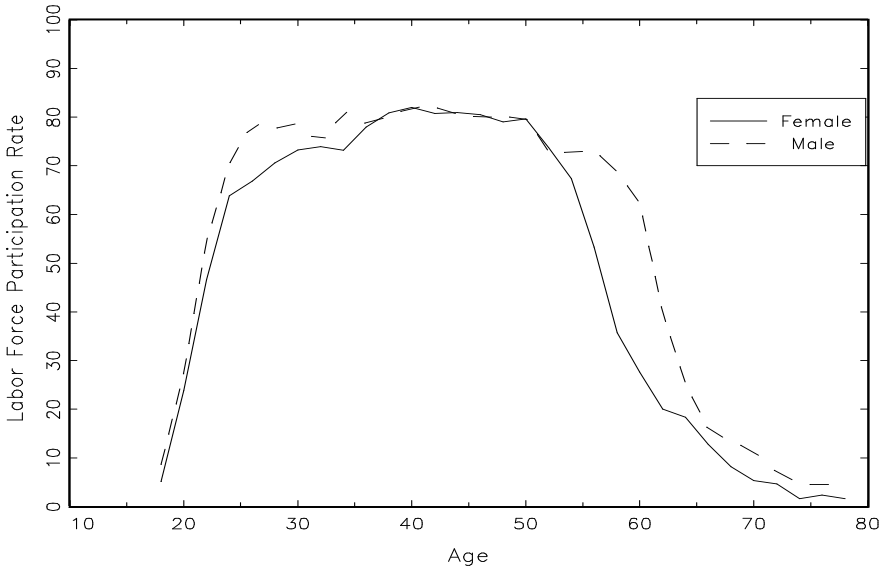
[22] Sheidvasser (1996).

end of the life cycle. This can be explained by the tendency of young Russian women to postpone working until their children have reached the age of three, and also by the lower retirement age for women, 55, as opposed to 60 for men. For both men and women the participation falls sharply after those ages are reached.

Table 4.1: Characteristics of Respondents by Sex and Work Status

Variable	Full Sample	Males	Females	Workers	Non-Workers Working Age
N	29,814	13,267	16,547	12,522	5,493
Age	38.79	35.99	41.04	39.99	31.66
	(21.32)	(20.11)	(21.98)	(11.73)	(12.99)
Wage	209,244	261,029	163,704	210,021	-
	(265,458)	(323,363)	(189,871)	(256,588)	
Female	55.50	0.00	100.00	49.55	52.89
Married	67.95	74.92	62.62	81.92	57.33
% Working	68.90	70.25	67.59	100.00	0.00
Rural	26.68	27.01	26.41	21.57	28.69
Total Schooling	11.02	11.30	10.81	12.41	11.50
	(3.70)	(3.37)	(3.92)	(2.89)	(2.61)
Secondary Sch.	8.73	8.92	8.60	9.44	9.51
	(2.18)	(1.84)	(2.39)	(1.28)	(1.45)
Vocational	16.95	21.69	13.14	25.41	20.77
Technical	17.98	12.93	22.03	27.49	14.89
University	12.72	12.33	13.02	21.59	7.83
Graduate	0.57	0.73	0.45	1.14	0.09
Tenure	7.75	7.15	8.30	7.77	-
	(8.92)	(8.93)	(8.88)	(8.99)	
Gov. Firm	75.04	71.88	77.96	74.81	-
Foreign Firm	3.92	4.41	3.46	3.88	-
Russian Firm	30.86	34.79	27.24	30.81	-
Part-time	6.98	5.68	8.02	16.26	-
Second Job	4.35	4.51	4.20	4.35	-
Supervisor	22.46	24.12	20.87	22.77	-
Heavy workload	0.44	0.56	0.32	0.44	-
	(0.47)	(0.48)	(0.44)	(0.47)	

Figure 4.1: Labor Force Participation. Males and Females



Women have on average only half a year less of total schooling, but they have a higher share of technical/specialized and university degrees. Tenure for women is higher than that of men by more than a year on average. Wages for women, however, are on average only 63% of those of men, and women are less likely to hold positions that require supervisory responsibilities, suggesting the existence of gender segregation and/or wage discrimination. On average, more than a half of men's working time, and less than a third of women's, involves heavy physical effort, consistent with the higher proportion of men receiving vocational training.

Comparing workers and non-workers of working age—i.e., individuals between 16 and retirement age—the latter population tends to be younger (suggesting higher educational enrollment of young people and possibly higher unemployment rates among the young) and is single and female in a higher proportion. Non-workers more often live in rural areas, have slightly fewer years of total schooling, and have a lower attainment rate for any particular level of schooling.

Table 4.2 classifies respondents of age 25 to retirement age by their educational level. Individuals with the lowest levels of education (below complete secondary) tend to be much older than those with secondary or higher levels of schooling. They tend to be male in a higher proportion and almost half of them live in rural areas. They have a much lower labor force participation rate,

receive substantially lower wages mainly from government owned companies, and perform blue-collar jobs. The comparison of individuals who have completed secondary education to those with vocational or technical training shows that the latter categories, requiring additional schooling, do not seem to report higher wages. This is consistent with Psacharopoulos' (1985, 1994) observation that returns to specialized vocational or technical education are lower than the returns to the similar but less specialized academic one. The group with vocational training education is dominated by males, with few supervisory responsibilities and mainly blue-collar work. Women comprise almost 70% of the group with technical or specialized education. These educational institutions cover such traditionally "female" occupations as elementary school and pre-school teachers, primary care physicians, nurses, technicians, and numerous qualified blue-collar jobs in some female-dominated industries. More than 80% of the individuals in this group are currently working, 29% have supervisory responsibilities, and only 36% of their working time is devoted to physically heavy workload, versus approximately 60% for individuals with less education. They earn on average more than those with vocational training but less than those who have only completed secondary schooling.

The university-educated (those with university degrees or post-graduate education) do obtain higher wages than the previous groups, suggesting possible degree effects that will be tested in the multivariate analysis. Females are a majority among those with university degrees, but men represent 61% of those with a post-graduate education. More than 86% of individuals in these education groups were working at the time of the interviews. Almost half of them took jobs involving supervisory responsibilities, and more than 80% of their work time is spent doing less physically demanding work. Workers with graduate education mainly work in government companies and obtain lower wages than do university graduates.

Common trends across education levels include a strict increase in labor force participation, from 61% for people with only primary education to 96% for people with a post-graduate degree, an increase in share of jobs with supervisory responsibilities from 3% to almost 70%, and a fall in the physically heavy workload from above 70% to 12% of working time.[23] Also, as we already mentioned in Section 3, people with higher levels of education can often obtain jobs with more flexible working hours and have more opportunities for side income, reflected in an increased proportion of part-time positions and second job holdings as the education level increases.[24] It is also

[23] Foley (1997) shows that Russians with more education are less likely to make a transition from employment to unemployment or out of the labor force and are more likely to become employed after being unemployed or out of the labor force, than are individuals with lower levels of education.

[24] See Foley (1997) for detailed analysis of second job holdings in Russia.

noteworthy that people tend to choose a spouse with a similar education level, as is demonstrated by the similarity of variables reflecting total schooling of respondents and their spouses.

Table 4.2: Characteristics of respondents by highest Education Level completed

Variable	Primary	Incomplete secondary	Complete secondary	Vocational	Technical/ Specialized	University	Post-graduate
Number obs.	161	1,255	2,675	3,217	2,991	2,584	118
Age	52.84	45.83	38.71	38.86	39.76	40.60	44.75
	(7.59)	(9.30)	(7.86)	(8.79)	(8.34)	(8.78)	(9.26)
Wage	112,793	169,438	210,627	194,218	208,601	279,883	273,942
	(96,195)	(247,459)	(250,361)	(251,613)	(262,972)	(331,959)	(231,034)
Schooling	5.33	8.76	11.08	11.57	12.97	15.94	18.79
	(2.07)	(1.44)	(1.42)	(1.55)	(1.51)	(1.64)	(1.67)
Spouse's Sch.	7.76	10.88	11.96	12.03	12.87	14.34	16.26
	(2.95)	(5.29)	(4.77)	(5.24)	(5.93)	(3.30)	(2.59)
Female	22.36	41.59	45.27	41.09	67.34	55.50	38.98
Married	85.00	86.67	88.52	87.44	86.92	88.12	91.53
% Working	60.87	72.35	73.42	77.62	82.38	86.73	95.76
Rural	49.07	39.52	29.98	27.14	18.32	11.46	8.47
Gov. Firm	79.27	74.63	73.37	74.33	76.34	75.60	88.07
Foreign Firm	1.12	3.33	3.31	4.05	3.72	4.29	10.09
Russian Firm	23.81	27.42	31.78	33.33	30.31	30.97	20.00
Part-time	12.42	9.96	9.79	10.35	11.67	15.02	22.88
Second Job	0.00	2.09	3.82	3.78	3.82	7.43	22.32
Supervisor	3.09	9.92	14.69	11.19	29.58	46.93	69.64
Heavy workload	0.72	0.66	0.55	0.61	0.36	0.19	0.12
	(0.44)	(0.47)	(0.47)	(0.47)	(0.46)	(0.35)	(0.27)

Finally, Table A.1 in the Appendix classifies respondents by the region in which they live. For the purposes of the RLMS this vast country is divided to 8 regions, where Moscow and St. Petersburg are considered as a single metropolitan area. One of the most clear conclusions from the analysis of this table is that the regions are fairly homogeneous across the socio-economic variables presented, except for wages (probably due to differences in production structure and inflation adjustments). The metropolitan area differs from the other regions in a number of variables. For example, the average years of schooling are 15% higher, and the size of the government sector is smaller than in the rest of the country.

5 Empirical Methods and Results.

5.1 Returns to Education using OLS

We start with the Ordinary Least Squares (OLS) estimation of the simplest and most often used model of wage determination, the Mincerian-type semi-log wage equation (Mincer 1974).[25] We regress the logarithm of the monthly wage on years of schooling and sets of individual and geographical characteristics, as presented in the following equation:[26]

$$\ln Y_i = \alpha_1' X_{1i} + S_i\beta + u_i, \tag{1}$$

where the set of individual characteristics X_{1i} consists of potential experience, its square, and a female dummy.[27] It also includes regional dummies and a dummy for rural areas, in order to proxy for potential differences in education level, production structure, and other social and economic indicators. These variables are unlikely to be endogenous, given Russia's low labor force mobility. We additionally include a set of time dummies indicating to which round each observation belongs, allowing us to capture the effect of partial wage indexation in an inflationary environment. We also check specifications allowing education to vary in level rather than years of schooling, and estimate the equation separately for different subsamples.

Table 5.1 presents the results of the log wage equation estimated on the pooled sample of rounds 6 to 8, using total years of schooling or dummies identifying different schooling levels.[28] Since each individual could contribute up to three observations to our sample (obtained from three different survey rounds), we corrected standard errors of the regression coefficients for clustering.[29]

[25] As mentioned in the introduction we are only considering individuals with positive wages in the referent month. This means that we exclude those respondents that were either not working in that month or did not receive any wages due to wage arrears. We control for this selectivity below. At this point we are assuming that wage arrears are uncorrelated with the variables of interest, and therefore do not bias our results. We also run our estimations excluding all individuals who reported that their employer owe them part of their wages, or they had been paid at least partially in kind. These exclusions did not significantly affect our results.

[26] We also run the regression using hourly wages, calculated as the monthly wage divided by the hours worked in a referent month. Results obtained were not significantly different from those with monthly wages. We report estimation results for the monthly wage as the dependent variable, as we believe that it is a less noisy measure of wages (see Section 4).

[27] Potential experience is calculated as Age − 7 − Years of Schooling

[28] Given that during 1998 Russia underwent an economic crisis that could have affected the labor market enough to consider not to pool rounds 6 and 7 with round 8, we estimate the log wage equations without the data from the last round. The results from this exercise are not significantly different from those reported below. Another possible modification of our benchmark pooled sample is to exclude workers of retirement age based on the conjecture that they might face a different labor market. Performings this exclusion leads to results that are again not significantly different from those presented in this section. These estimations are available from the authors upon request.

[29] In performing this correction we employed the techniques suggested by Deaton (1997).

With both specifications we obtain an $\overline{R}^2$ of 0.24, a fairly good fit. The most striking result is that the returns to an additional year of education are 4%, a premium lower than that of almost any country. The only comparable results in the literature are those of Brainerd (1998) for pre-reform period in Russia, and those of Newell and Reilly (1996) based on the first round of the RLMS. But as we have emphasized in the previous sections, we are using more reliable data (which reduces measurement error) and are concentrating on the post-reform period, making these results even more remarkable. If we use levels of schooling we observe a marginal university premium of 28% and a technical school premium of only 11%. Vocational and graduate studies have negative marginal returns, although they are not statistically significant. These educational premia are quantitatively comparable to those found by Katz (1999), Gregory and Kohlhase (1988), and Ofer and Vinokur (1992). These studies, however, used Soviet period data, again suggesting that almost a decade of transitions has not increased the higher education premium in Russia, contrary to the conjectures of several authors, including Schultz (1999) and Brainerd (1998).

Table 5.1: OLS Estimates of the Wage Equation

		Using Years of Education		Using Levels of Education	
No.	Variable	Estimate	Standard Error	Estimate	Standard Error
1	Schooling	0.0401	0.0043	-	-
2	Sec. school	-	-	0.0567	0.0253
3	Vocational	-	-	-0.0136	0.0287
4	Technical	-	-	0.1085	0.0277
5	University	-	-	0.2842	0.0293
6	Graduate	-	-	-0.1088	0.0999
7	Constant	11.8928	0.0739	12.2972	0.0535
8	Experience	0.0215	0.0030	0.0225	0.0030
9	Exper. Sq.	-0.0520	0.0062	-0.0575	0.0061
10	Female	-0.4179	0.0235	-0.4413	0.0239
11	Rural	-0.6127	0.0374	-0.6113	0.0372
12	Region 2	-0.0177	0.0547	-0.0210	0.0543
13	Region 3	-0.3634	0.0413	-0.3757	0.0409
14	Region 4	-0.6226	0.0420	-0.6420	0.0418
15	Region 5	-0.3652	0.0485	-0.3815	0.0480
16	Region 6	-0.3115	0.0405	-0.3177	0.0401
17	Region 7	0.0653	0.0603	0.0515	0.0601
18	Region 8	-0.1246	0.0527	-0.1407	0.0528
19	Round 7	-0.0821	0.0210	-0.0808	0.0209
20	Round 8	-0.4811	0.0218	-0.4762	0.0217
	# Obs.	7,343		7,324	
	$\overline{R}^2$	0.2354		0.2404	

These results are consistent with our hypothesis of low returns to human capital in the Russian labor market. Although university graduates do receive higher wages, when considering all forms of higher education, an additional year of schooling has a very low monetary reward, even after the general reforms that the Russian economy has undergone in the last decade.

In Table 5.1 we also show that the wage differential between men and women is fairly high, above 40% in both specifications. Working in a rural area negatively affects average earnings, reducing them by more than 60%, even when we control for an array of regions. Belonging to certain regions can have an additional negative effect of up to 62%, compared with living in a metropolitan area. Finally, being interviewed in rounds 7 and 8 of the survey significantly depresses real wages, proxying for the erosion of purchasing power to which we have already referred.

Table 5.2 presents estimates of the coefficient on the total years of schooling using the specification described above for different subsamples of individuals. The first column replicates the schooling coefficient from Table 5.1. The following two columns divide the sample between females and males. We find that returns to education are higher for females than for males, 4.9% compared with 3.3%, a result qualitatively consistent with, although quantitatively more striking than that presented by Psacharopoulos (1985), who finds that women have a return 25% higher on average. In order to explore in greater depth the differences between urban and rural Russia we divide our sample between individuals that live in an urban environment and those that live in rural areas. Our results show that in rural areas returns to schooling are significantly higher. In the last two columns of Table 5.2 we divide our sample depending on the type of company the individual works for. Those working in privately owned companies *do not* have higher returns to education, a result somewhat surprising and contrary to the conclusions of Psacharopoulos (1985, 1994) and Maurer-Fazio (1999). This result also contradicts the conclusion of Newell and Reilly (1996) regarding the source of low returns to education in the pre-reform and early reform era in Russia. They argue that low returns are the consequence of wage equalization policies present in the Soviet period and inherited by government firms. We find that the alternative explanation of excess supply of highly qualified individuals is more plausible in post-reform Russia.[30]

[30] Another possible explanation for the low returns to human capital is related to the quality of the education of most of those currently in the labor market. Those individuals educated during the pre-reform period are likely to have skills less valued in the current economic situation, and therefore are more likely to receive lower rewards for those skills. One way of testing this hypothesis is to estimate returns to education only for young individuals who obtained most of their education under the new system, which we believe has improved with the introduction of new curricula, and the opening of new schools in law, economics, and management. We find no support for this hypothesis as returns to education for a subsample of individuals of age below 30 significantly declined during the post-reform period.

Table 5.2: Returns to education for Different Subsamples.

	All	Females	Males	Urban	Rural	State	Private
Schooling	0.0401	0.0491	0.0327	0.0367	0.0629	0.0425	0.0419
	(0.0043)	(0.0060)	(0.0061)	(0.0046)	(0.0115)	(0.0048)	(0.0081)
# Obs.	7,343	3,876	3,467	6,143	1,200	5,107	2,236
$\overline{R}^2$	0.2354	0.1995	0.2093	0.2057	0.1367	0.2548	0.1652

In order to expand our analysis of the effect of education and other variables on the wage determination we incorporate an additional set of variables W_{1i} into equation (1). This is an array of choice variables, such as a dummy for being married, and certain job characteristics. We control for sector of employment by adding dummies for working in an enterprise owned at least partly by foreign or Russian private capital. In an attempt to control for part-time work, we introduce a dummy that equals 1 if an individual worked less than 120 hours in the referent month. Another control that proxies for a job that has flexible or short hours is a dummy for having a second job. We also include a variable that reflects the fraction of working time devoted to physically heavy or medium workload and a dummy for having supervisory responsibilities. These choice variables are likely to be endogenous and thus the estimation results require more careful interpretation. We include them in order to divide the effect of education into two parts: an effect of education on wages *conditional* on the type of job chosen, and an effect through a particular job choice. Also, including these variables facilitates comparability with other papers working with the wage determination equation in Russia that include similar variables in their specifications (Brainerd 1998, Newell and Reilly 1996). Estimation results of this specification are presented in Table A.2 in the Appendix.

Returns to education conditional on the job type are substantially lower, 2.8% for the full sample. This implies that part of the total wage reward for higher education, as estimated using the Mincerian specification, comes not directly through higher wages, but rather through the choice of a better job. For example, better educated individuals are more likely to hold jobs involving supervisory responsibilities, which tend to carry higher rewards.

Another interesting and fairly new result obtained is that tenure effects are essentially non-existent in Russia: the coefficients are very small and only marginally significant. We are the first to demonstrate this, although it is not a surprising conclusion if we conjecture that in post-communist Russia long tenure is likely to be correlated with belonging to government-run companies.[31] We

[31] See Topel (1991) for a discussion of returns to tenure and Schultz (1999) for arguments regarding returns to

will explore these issues further, but at this point it is worth recalling that we are controlling for the kind of company an individual works for, and thus tenure effects are not biased by the correlation mentioned above.

We also find that working for a privately-owned company, either foreign or Russian, has a sizable premium that is slightly larger for foreign companies. People are willing to accept lower monthly wages for jobs offering short or flexible hours: the coefficients on the set of job characteristics indicate that part-time workers tend to have lower wages, and those holding second jobs have significantly lower wages as well. The other job characteristics also have the expected sign: supervisory responsibilities increase the wage by approximately 27%, and wages are more than 10% lower for physically demanding jobs.

Table 5.3 is similar to Table 5.2, presenting estimates of the returns to education and tenure under the expanded specification. The coefficient on years of schooling in all cases is below that of the basic Mincerian specification, but all the patterns of the previous table remain the same. The coefficient for males now becomes very small and statistically indistinguishable from zero. Tenure effects are again very low (in almost all the cases below 1%), but this time more precisely estimated, and they even become negative for those working in private firms, a result indicating that in poor economic environments tenure effects do not play a substantial role in wage determination.

Table 5.3: Returns to education for Different Subsamples. Extended Specification

	All	Females	Males	Urban	Rural	State	Private
Schooling	0.0232	0.0370	0.0098	0.0206	0.0381	0.0227	0.0213
	(0.0049)	(0.0066)	(0.0074)	(0.0053)	(0.0138)	(0.0054)	(0.0090)
Tenure	0.0015	0.0026	-0.0004	-0.0007	0.0153	0.0054	-0.0096
	(0.0015)	(0.0020)	(0.0023)	(0.0016)	(0.0041)	(0.0017)	(0.0028)
# Obs.	5,878	3,233	2,645	4,925	953	4,384	2,003
$\overline{R}^2$	0.2648	0.2536	0.2264	0.2388	0.1682	0.2665	0.1941

In Tables 5.4 and 5.5 we present returns to education by region and by round of data, using the same specification as in Table 5.1. From Table 5.4 we see that education premia are low everywhere, but with considerable variation. They are lowest (below 1%) in the metropolitan area, and highest (above 7%) in Eastern Siberia. Given that the Metropolitan area has the highest supply of human capital (see Table A.1), this finding supports the supply/demand hypothesis for the determination of returns to education, although we do not find a strong relationship between the (rather uniform) supply of human capital across regions and its varying returns.

experience during economic transitions.

Table 5.4: Returns to Education by Region. OLS Estimates.

No.	Region	Estimate	Standard Error
1	Moscow and St. Petersburg	0.0042	0.0093
2	Northern and North Western	0.0415	0.0152
3	Central and Central Black-Earth	0.0358	0.0095
4	Volga-Vyatski and Volga Basin	0.0589	0.0108
5	North Caucasian	0.0448	0.0127
6	Ural	0.0511	0.0101
7	Western Siberian	0.0596	0.0208
8	Eastern Siberian and Far Eastern	0.0785	0.0154

Table 5.5: Returns to Education by Rounds. OLS Estimates.

	Not Controlling for Job Characteristics		Controlling for Occupation	
Round	Estimate	Standard Error	Estimate	Standard Error
1	0.0336	0.0034	0.0213	0.0036
2	0.0567	0.0043	0.0469	0.0045
3	0.0632	0.0037	0.0516	0.0038
4	0.0328	0.0044	-	-
5	0.0572	0.0057	0.0400	0.0078
6	0.0370	0.0058	0.0152	0.0070
7	0.0347	0.0067	0.0213	0.0077
8	0.0498	0.0070	0.0299	0.0076

Table 5.5 shows that for every cross-section of data, returns to education using OLS estimates are very low. We have, however, emphasized the noisiness of the education measures in the first five rounds of interviews. The left-hand side shows the estimates of the returns to education from the specification used in the Table 5.1. The first three rounds suggest a trend similar to the one presented by Brainerd (1998). But our estimates using all the rounds of data available come as a contrast to Brainerd's conjecture on the future evolution of the returns to human capital in Russia. These returns have not changed significantly during the transition, and some of the lowest levels are observed in the last few years. This evidence also supports the supply/demand explanation for the low returns to education in Soviet times. The right-hand side of the table shows the cross-section OLS estimates when we add the job characteristics variables W_{1i}, which can be potentially endogenous to the wage process. For the first round of data we find returns similar to those reported by Brainerd (1998) and Newell and Reilly (1996). We observe that the returns to education decrease in all cases compared with the results of the Mincerian-type specification.

5.2 IV Estimation and Selection Correction

It is widely recognized that the OLS estimator of the schooling coefficient in the log wage equation is subject to possible "ability bias."[32] A more general structural model has (1) as an equation of wage determination, and a second equation to determine endogenously years of schooling:

$$S_i = \alpha_2' X_{2i} + \epsilon_i. \tag{2}$$

If u_i in (1) and ϵ_i are correlated (e.g. in the case where both include unmeasured "ability,"), then the OLS estimate of the schooling coefficient in equation (1) will be biased. To correct this bias, we use the instrumental variables (IV) approach.

Our instruments for S_i are based on the institutional changes in the Russian educational system.[33] Two of the policy experiments in the Russian educational system, described in Section 2, help us form instruments for the years of schooling variable. First, the minimum compulsory curriculum was extended from seven years to eight years of secondary school in 1959. Second, total number of grades in the secondary school increased from ten to eleven in the same year, and then eight years later returned to ten. We introduce a dummy for each of the experiments that equals one if a respondent graduated from an incomplete or complete secondary school program when the experiment was in effect. In our sample of workers, 83% had 8 years of compulsory schooling (instrument dummy *lgsc8* equal to 1), and 9% had one additional school year, whether they left school to join the labor force or whether they continued their education (instrument dummy *lgsc11* equal to 1). We use these dummies as identifying instruments of S_i, since they affect schooling years of an individual, but do not affect his or her wage.

In Table A.3 in the Appendix we report the IV results using both instruments. For completeness we also report the results of the first stage of the estimation procedure, the reduced form schooling equation. We find that the IV estimate of the returns to schooling is lower than the OLS estimate. It is not, however, very precisely estimated and we cannot reject that it is significantly different from zero. Given that we have two instruments we test the overidentifying restrictions and conclude that both are good instruments of the schooling variable. Finally, using the Hausman-Wu test statistic we conclude that the data do not allow us to reject exogeneity of the schooling variable, thus justifying our use of the OLS results when computing returns to education with our sample

[32] See Griliches (1977) and Card (1995, 1999).

[33] For a similar approach see Harmon and Walker (1995).

of respondents.

Another type of bias in OLS models is associated with nonrandom sample selection. Results of our analysis are obtained using the sample of workers. If the selection rule of people into the labor force is nonrandom we are likely to get a biased coefficient on the returns to education. Consistent estimates in this case can be obtained using Heckman's (1979) procedure for selectivity correction.[34]

We add a participation equation:

$$l_i = \alpha_3' X_{3i} + \gamma_3' H_{3i} + \nu_i, \tag{3}$$

where X_{3i} is the set of an individual's characteristics similar to that of equation (1), with education variables included. Additionally, we include a self-reported dummy of being in poor or very poor health. This dummy can be a proxy for both poor health and a distaste for work, as individuals sometimes rationalize their unwillingness to work by reporting a poor health condition.[35] H_{3i} is the set of household variables that could affect an individual's decision to join the labor force but that do not affect his or her wages. Following the labor supply literature we include spouse's earnings and labor force status. As a proxy for competing demand for a respondent's time, we also include dummies for having children under 12 years old and having a parent above 50 years old who needs help in performing some activities of daily living, such as eating or dressing. Mindful of the traditional difference in effect of this type of variables on male and female behavior, we also include interactions of these variables with the female dummy.[36]

Table 5.6 presents the selectivity corrected OLS estimates of the log wage equations for the full sample. Again we present the results using years of schooling and dummies for different education levels. Given the statistical significance of the estimate of the λ parameter, selection bias seems to be present in the sample; therefore the correction we perform is necessary to distinguish appropriately the effects on wages of our variables of interest and the effect of nonrandom selection of our sample.

[34] The selectivity rule in this case excludes not only those individuals that reported not working in the referent month, but also those that reported working but not receiving positive wages. This means that our selectivity corrected results should be interpreted with caution given the special nature of the sample selection rule.

[35] See Benítez-Silva et al. (1999) for an updated discussion.

[36] We checked a number of different specifications for this stage, using different subsets of identifying variables, and found little change in our results.

Table 5.6: Selection corrected OLS Estimates of the Wage Equation

		Using Years of Education		Using Levels of Education	
No.	Variable	Estimate	Standard Error	Estimate	Standard Error
1	Schooling	0.0402	0.0018	-	-
2	Sec. school	-	-	0.0674	0.0093
3	Vocational	-	-	-0.0596	0.0175
4	Technical	-	-	0.0499	0.0136
5	University	-	-	0.2496	0.0197
6	Graduate	-	-	-0.1431	0.0551
7	Constant	12.1219	0.0630	12.5550	0.0504
8	Experience	0.0127	0.0028	0.0132	0.0030
9	Exper. Sq.	-0.0317	0.0075	-0.0364	0.0081
10	Female	-0.4451	0.0125	-0.4616	0.0131
11	Rural	-0.6201	0.0183	-0.6238	0.0176
12	Region 2	-0.0979	0.0224	-0.1003	0.0333
13	Region 3	-0.4319	0.0228	-0.4439	0.0230
14	Region 4	-0.6769	0.0224	-0.7007	0.0210
15	Region 5	-0.3724	0.0279	-0.3877	0.0271
16	Region 6	-0.3920	0.0276	-0.3963	0.0274
17	Region 7	-0.0091	0.0277	-0.0213	0.0239
18	Region 8	-0.1409	0.0249	-0.1580	0.0364
19	Round 7	-0.0611	0.0145	-0.0600	0.0179
20	Round 8	-0.4252	0.0174	-0.4205	0.0151
21	λ	-0.2642	0.0354	-0.2508	0.0495
	# Obs.	8,011		8,011	
	$\overline{R}^2$	0.2303		0.2341	

When we perform the selectivity correction for the full sample, the returns to an additional year of schooling are the same as in the uncorrected model, 4%. For all levels of education, except for complete secondary, the returns decline by about 5 percentage points, and in this specification they are more precisely estimated.[37] When we consider female and male subsamples separately, the results change. As Table 5.7 shows, the corrected estimate for the returns to education for females is higher than the uncorrected one, and the opposite seems to be true for males.

The reduction in the returns to human capital for males can be explained by the labor force participation pattern: as we mentioned in Section 4, labor force participation substantially increases with education (95% for people with post-graduate degrees as compared to around 70% for people with incomplete or complete secondary education). The highest marginal return to education by level is for university graduates. Hence we expect our uncorrected OLS estimates to be biased upward. The higher returns to education among women even after performing the

[37] Table A.4 in the Appendix presents the labor force participation equation that corresponds to the corrected results presented in Table 5.6.

selectivity correction might be explained by some additional sources of selectivity, in this case into certain occupations.[38] A study of this possibility and the appropriate way of taking it into account is beyond the scope of this paper but is high on our research agenda.

Table 5.7: Selection Corrected Returns to Education. OLS Estimates.

	Females		Males	
Variable	Estimate	Standard Error	Estimate	Standard Error
Years of Schooling	0.0592	0.0038	0.0263	0.0029
Secondary School	0.0800	0.0181	0.0703	0.0158
Vocational	-0.0223	0.0292	-0.0771	0.0229
Technical	0.1109	0.0250	-0.0015	0.0267
University	0.3185	0.0338	0.2110	0.0768
Graduate	0.0251	0.1125	-0.2175	0.0768
# Obs.	4,132		3,879	

Another possible source of bias in our estimations comes from the fact that we do not observe emigrants in our sample, or we observe them dropping from the survey. We might be concerned about being left with a sample of respondents that are likely to have a lower return to human capital because those with more resources are likely to migrate to other countries. This can also be considered a selection bias problem, but it is much more difficult to control for due to the unavailability of relevant data. However, we believe migration not to be a real problem for the interpretation of our results. Although we argue that it might be a factor for a portion of the educated population, the reality is that with respect to the total Russian population, the fraction of emigrants was 0.07%, as of 1992 (ISPR 1994). Furthermore, the evidence on Russian emigrants (Gregory and Kohlhase 1988, Ofer and Vinokur 1992) shows that they did not have high returns to education. Whether this is still true for current emigrants is an empirical question that is difficult to answer given the available data.

Finally, it is worth mentioning that although the RLMS was conceived as a survey of repeated cross-sections, it is possible to construct two panels, one for each phase of interviews. We follow Angrist and Newey (1991) to calculate the returns to education controlling for individual heterogeneity in a panel of around 1,000 workers present in rounds 6 to 8 of our data. The identification in this case comes from those who have changed their schooling in the period. Here we find low

[38] The fact that an individual works indicates that his or her productivity in the market exceeds their productivity in the home or in another unreported occupation. However, this does not necessarily mean that the most market productive individuals will be the ones observed working. In fact, our results for women indicate that exactly the opposite is true in our sample. See also Heckman (1980).

and insignificant returns to education. We do not report these results given that the identification procedure is likely to be weak with our data, as few people increase their education over the course of the period. Moreover, the measurement error in our variables of interest is likely to be amplified by the fixed effects approach, and ultimately, the results do not contribute substantially to our conclusions.

6 Conclusions

This paper presents one of the first estimates of returns to education in post-reform Russia, using the only representative sample of this ex-communist federation. We complement the traditional OLS regression techniques with an IV approach, utilizing changes in the educational system in the ex-Soviet Union in the 1950s and 1960s. We also perform a selectivity correction to account for our reliance on a sample of workers in obtaining our estimates.

The returns to education in Russia are among the lowest in the world. This was observed nearly a decade ago, and it was attributed to the combined influence of government wage-equalizing policies and market forces. Using data from the early 1990s, Brainerd (1998) suggests that as Russia has moved from government dominance toward a market democracy, returns to education have increased and will continue doing so. Our results, based on eight rounds of the RLMS, show that there is no improvement in returns to education in the post-reform period, 1992-99.

The absence of such an upward trend seems to indicate that the principal cause of wage differentials among workers of different education levels has not been the government egalitarian policy, whose influence has faded almost entirely over the last seven years, but rather an over-supply of well-educated workers in an economy in which blue-collar employees are in high demand. Moreover, the homogeneous supply of human capital across Russian regions suggests that differences in the returns to education are probably demand-driven.

Estimates using the IV approach show that we cannot reject exogeneity of the education variable, justifying our use of the OLS estimates. We also find that returns to education are consistently higher for women, even after performing a selectivity correction, which in fact results in a reduction of the estimated returns to schooling for males and an increase for females. The results of the corrected model imply that selectivity bias is a problem in our sample and that the correction is necessary to obtain the appropriate estimates of the returns to schooling in Russia.

Additionally, we find very low returns to tenure, which even become negative in certain spec-

ifications. This is not an unexpected result given the conjectures of earlier studies, but to our knowledge we are the first to verify this empirically.

The robust result of low returns to education has important policy implications. First, given the low mobility within the country, high levels of education could be correlated with an increasing rate of emigration. There is very little empirical evidence to support this, but the results of a survey from the late 1970s and early 1980s certainly suggest the existence of such a correlation. Anecdotal evidence of highly qualified Russians migrating to Western Europe and the U.S. also strengthens this conjecture. Second, with the traditional value placed on education beginning to fade, and with the poor returns to additional schooling in an economic environment that is not likely to improve in coming years, we conjecture that fewer and fewer Russians will pursue higher education and that investment in education at all levels is likely to diminish, ultimately deteriorating the education level and perhaps damaging one of Russia's few remaining comparative advantages, the human capital of its population.

References

Angrist, J.D., and W.K Newey (1991): "Over-Identification Tests in Earnings Functions with Fixed Effects," *Journal of Business and Economic Statistics*, **9(3)** 317–323.

Åslund, A., P. Boone, and S. Johnson (1996): "How to Stabilize: Lessons from Post–Communist Countries," *Brookings Papers on Economic Activity*, **1996(1)** 217–291.

Barro, R.J., (1991): "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics*, **106(2)** 407–443.

Becker, G. S., (1964): *Human Capital: A Theoretical and Empirical Analysis.* Third Edition, NBER, University of Chicago Press.

Benítez-Silva, H., M. Buchinsky, H-M. Chan, J. Rust and S. Sheidvasser (1999): "How Large is the Bias in Self-Reported Disability Status?" manuscript, Yale University. To be presented at the Winter Meetings of the Econometric Society, Boston, January 2000.

Brainerd, E., (1998): "Winners and Losers in Russia's Economic Transition," *American Economic Review*, **88(5)** 1094–1116.

Card, D., (1995): "Earnings, Schooling, and Ability Revisited", *Research in Labor Economics*, **14** 23-48.

Card, D., (1999): "The Causal Effect of Education on Earnings," forthcoming in *The Handbook of Labor Economics*, Vol. 3A.

Centre for Educational Research and Innovation (1997): *Education at a Glance.* Organization for Economic Cooperation and Development.

Chase, R.S., (1998): "Markets for Communist Human Capital: Returns to Education and Experience in the Czech Republic and Slovakia," *Industrial and Labor Relations Review*, **51(3)** 401–423.

Deaton, A., (1997): *The Analysis of Household Surveys.* Baltimore: Johns Hopkins University Press.

Dougherty, C., and G. Psacharopoulos (1977): "Measuring the Cost of Misallocation of Investment in Education," *Journal of Human Resources*, **12(4)** 446–459.

Filer, R.K., Š. Juraida, and J. Plánovský (1999): "Education and Wages in the Czech and Slovak Republics During Transition," *Labour Economics* **6(4)**, 581–93.

Foley, M., (1997): *Labor Market Dynamics, Unemployment Duration, and Multiple Job Holding in Russia during Economic Transition,* Yale University, Ph.D. Dissertation.

Gregory, P.R., and J.E. Kohlhase (1988): "The earnings of Soviet workers: evidence from the SIP," *Review of Economics and Statistics*, **70(1)** 23–35.

Griliches, Z., (1977): "Estimating the Returns to Schooling: Some Econometric Problems," *Econometrica*, **45(1)** 1–22.

Harmon, C., and I. Walker (1995): "Estimates of the Economic Return to Schooling for the United Kingdom," *American Economic Review*, **85(5)** 1278–1286.

Hausman, J.A., (1978): "Specification Tests in Econometrics," *Econometrica*, **46(6)** 1251–1271.

Heckman, J.J., (1979): "Sample Selection Bias as a Specification Error," *Econometrica*, **47(1)** 153–161.

Heckman, J.J., (1980): "Sample Selection Bias as a Specification Error with an Application to the Estimation of Labor Supply Functions," in *Female Labor Supply: Theory and Estimation,* J. P. Smith ed., 206–248.

Institute for Social and Political Research, ISPR (1994): *Demograficheskaia i migratsionnaya situatsiia v Rossii. (Demographic and migration situation in Russia.)* Russian Academy of Sciences, Moscow.

Jones, D.C., and K. Ilayperuma (1994): "Wage Determination Under Plan and Early Transition: Evidence from Bulgaria," *Hamilton College Department of Economics Working Paper Series.* Hamilton, N.Y.: Hamilton College.

Katz K., (1999): "Were There No Returns to Education in the USSR? Estimates from Soviet–Period Household Data," *Labour Economics*, **6(3)** 417–434.

Krueger, A.B., and J.S. Pischke (1995): "A Comparative Analysis of East and West German Labor Markets: Before and After Unification," in R.B.Freeman and L.F.Katz, eds., *Differences and changes in wage structure.* Chicago: University of Chicago Press.

Lenin, V., (1920): "The Tasks of the Youth Leagues," in *Collected Works,* **31** 283-299.

Maurer-Fazio, M., (1999): "Earnings and Education in China's Transition to a Market Economy. Survey Evidence from 1989 and 1992," *China Economic Review*, **10** 17–40.

Mincer, J., (1958): "Investment in Human Capital and Personal Income Distribution," *Journal of Political Economy,* **66(4)** 283–302.

Mincer, J., (1974): "Schooling, Experience and Earnings," National Bureau of Economic Research. New York: Columbia University Press.

Newell, A., and B. Reilly (1996): "The Gender Wage Gap in Russia: Some Empirical Evidence," *Labour Economics*, **3** 337–356.

Newell, A., and B. Reilly (1997): "Rates of Return to Educational Qualifications in the Transitional Economies," *Discussion Papers in Economics*, **03/97** University of Sussex.

Ofer, G., and A. Vinokur (1992): *The Soviet Household Under the Old Regime. Economic Conditions and Behaviour in the 1970s.* Cambridge: Cambridge University Press.

Orazem, P.F., and M. Vodopivec (1994): "Winners and Losers in Transition: Returns to Education, Experience and Gender in Slovenia," *World Bank Policy Research Working Paper No. 1342.* Washington, D.C.: World Bank.

Popovych, E., and B. Levin–Stankevich (1992): *The Soviet system of education.* Washington, DC: American Association of Collegiate Registrars, and Admission Officers: NAFSA, Association of International Educators.

Psacharopoulos, G., (1985): "Returns to Education: a Further International Update and Implications," *Journal of Human Resources*, **20(4)** 583–597.

Psacharopoulos, G., (1994): "Returns to Investment in Education: a Global Update," *World Development*, **22(9)** 1325–1343.

Schultz, T.W., (1961): "Investment in Human Capital," *American Economic Review,* **51(1)** 1–17.

Schultz, T.W., (1975): "The Value of the Ability to Deal with Disequilibria," *Journal of Economic Literature*, **13(3)** 827–846.

Schultz, T.P., (1999): "Labor Market Reforms: Issues, Evidence, and Prospects," *Economic Growth Center Discussion Paper, No. 802.* Yale University.

Sheidvasser, S., (1996): *Regional Disability Adjusted Life Years and Health Priorities in Russia,* New Economic School, Moscow, Master thesis.

Simanovsky, S., M.P. Strepetova, and Y.G. Naido (1996): *Brain Drain from Russia: Problems, prospects and ways of regulations.* Nova Science Publishers, Inc.

Stanovnik, T., (1997): "The Returns to Education in Slovenia," *Economics of Education Review*, **16(4)** 443–449.

TIMSS (1999): "Third International Mathematics and Science Study." National Center for Education Statistics. `http://nces.edu.gov/timss`.

Topel, R., (1991): "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority," *Journal of Political Economy*, **99(1)** 145–176.

Willis, R., (1986): "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions." In the *Handbook of Labor Economics.* Vol. 1.

Wu, D., (1973): "Alternative Tests of Independence Between Stochastic Regressors and Disturbances," *Econometrica*, **41(4)** 733–750.

Appendix

Figure A.1: Russian Educational System

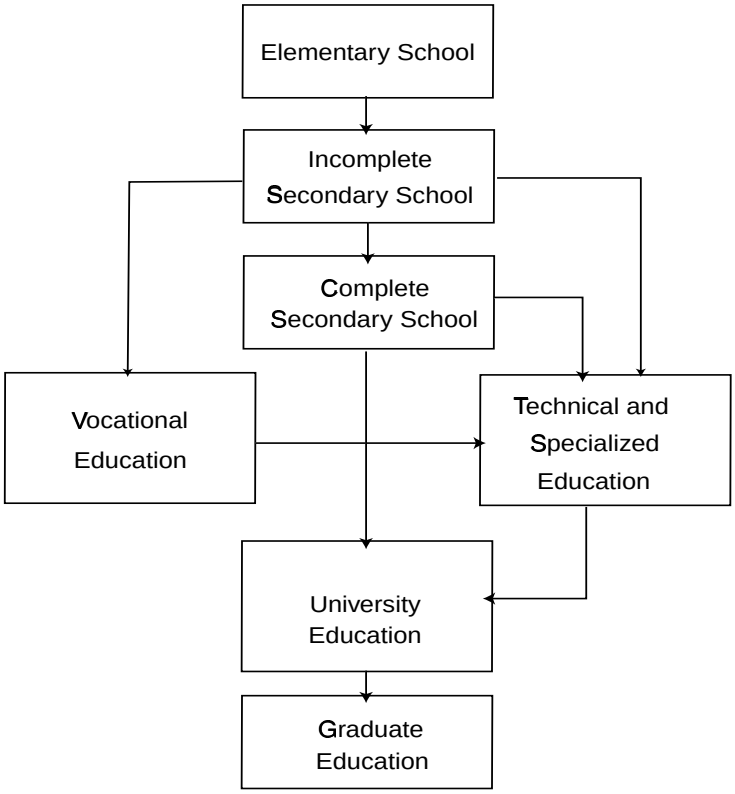


Table A.1: Characteristics of Respondents by Geographical Region

Variable	Moscow and St. Petersburg	Northern and North Western	Central & Black-Earth	Volga-V. and Basin	North Caucasian	Ural	Western Siberian	Eastern Sib. & Far East
N	2,428	2,110	5,505	5,303	4,148	4,414	2,941	2,965
Age	40.28	35.52	41.84	40.44	37.08	36.96	37.48	37.73
	(21.80)	(20.11)	(21.50)	(21.79)	(21.60)	(20.47)	(21.01)	(20.70)
Wage	297,144	260,835	174,864	141,811	160,838	172,452	347,774	240,593
	(308,390)	(306,591)	(180,341)	(170,839)	(206,405)	(149,274)	(444,053)	(363,898)
Schooling	12.71	11.15	10.92	10.63	10.89	10.97	10.79	10.90
	(3.80)	(3.43)	(3.78)	(3.81)	(3.53)	(3.41)	(3.71)	(3.71)
Female	55.64	55.07	56.73	55.59	54.34	56.55	55.22	53.59
Married	65.31	68.71	67.76	69.10	69.48	66.17	68.99	67.46
% Working	73.38	72.40	70.08	70.88	59.69	70.30	68.33	68.05
Rural	0.00	29.62	20.13	24.14	51.47	19.78	30.40	35.04
Gov. Firm	66.55	76.55	76.95	79.40	74.63	74.99	75.89	70.33
Foreign Firm	8.60	4.70	5.78	1.75	1.53	3.77	2.59	3.75
Russian Firm	45.26	28.98	31.76	24.05	25.77	33.64	27.63	34.26
Part-time	10.58	7.49	7.23	6.45	4.94	7.02	6.94	6.98
Second Job	7.81	4.69	3.73	2.92	4.18	4.08	4.66	4.91
Supervisor	30.72	22.83	22.40	19.60	21.91	18.72	24.57	23.95
Heavy workload	0.37	0.45	0.41	0.46	0.42	0.47	0.44	0.44
	(0.46)	(0.51)	(0.46)	(0.49)	(0.45)	(0.47)	(0.49)	(0.46)

Table A.2: OLS Estimates of the Wage Equation with Job Characteristics

		Using Years of Education		Using Levels of Education	
No.	Variable	Estimate	Standard Error	Estimate	Standard Error
1	Constant	11.4266	0.1279	11.7154	0.1195
2	Age	0.0333	0.0060	0.0345	0.0060
3	AgeSq	-0.0453	0.0071	-0.0482	0.0071
4	Female	-0.2240	0.0474	-0.2329	0.0475
5	Married	0.1823	0.0437	0.1830	0.0436
6	Married Female	-0.1865	0.0527	-0.1857	0.0526
7	Schooling	0.0280	0.0040	-	-
8	Vocational	-	-	-0.0032	0.0270
9	Technical	-	-	0.0622	0.0252
10	University	-	-	0.2283	0.0288
11	Graduate	-	-	-0.0785	0.0891
12	Tenure	0.0014	0.0013	0.0017	0.0013
13	Foreign Firm	0.2459	0.0533	0.2527	0.0533
14	Russian Firm	0.2220	0.0237	0.2236	0.0237
15	Part-time	-0.2539	0.0292	-0.2610	0.0292
16	Second Job	-0.1153	0.0500	-0.1113	0.0500
17	Supervisor	0.2723	0.0262	0.2642	0.0263
18	Heavy workload	-0.1209	0.0245	-0.1102	0.0246
19	Rural	-0.5332	0.0309	-0.5308	0.0308
20	Region 2	-0.0361	0.0472	-0.0401	0.0471
21	Region 3	-0.3790	0.0380	-0.3895	0.0378
22	Region 4	-0.5915	0.0402	-0.6033	0.0401
23	Region 5	-0.3968	0.0472	-0.4088	0.0471
24	Region 6	-0.3211	0.0401	-0.3251	0.0400
25	Region 7	-0.0148	0.0480	-0.0142	0.0479
26	Region 8	-0.1571	0.0485	-0.1744	0.0484
27	Round 7	-0.1315	0.0258	-0.1299	0.0258
28	Round 8	-0.4934	0.0252	-0.4909	0.0251
	# Obs.	6,351		6,363	
	$\overline{R}^2$	0.2650		0.2677	

Table A.3: IV Estimates of the Wage Equation

		First Stage		Second Stage	
No.	Variable	Estimate	Standard Error	Estimate	Standard Error
1	Constant	10.4000	0.3702	11.6176	0.9357
2	Age/Experience	0.1608	0.0216	0.0571	0.0174
3	Age/Exper. Sq.	-0.2009	0.0288	-0.0716	0.0216
4	Female	0.2864	0.0658	-0.4088	0.0335
14	Rural	-1.0636	0.0932	-0.6632	0.1014
15	Region 2	-1.2481	0.1496	-0.0859	0.1231
16	Region 3	-1.2055	0.1194	-0.4350	0.1160
17	Region 4	-1.3245	0.1251	-0.6962	0.1270
18	Region 5	-0.9297	0.1480	-0.4202	0.0975
19	Region 6	-1.3385	0.1253	-0.3858	0.1282
20	Region 7	-0.9620	0.1492	0.0140	0.0998
21	Region 8	-1.3099	0.1501	-0.1987	0.1274
24	Round 7	0.3578	0.1274	-0.0759	0.0281
25	Round 8	0.1685	0.1778	-0.4635	0.0430
22	Lgsc11	0.1520	0.0799	-	-
23	Lgsc8	0.3886	0.0795	-	-
24	Schooling	-	-	-0.0047	0.0909
	# Obs.	7,343		7,343	
	$\overline{R}^2$	0.0619		0.2200	

Hausman-Wu Test Statistic	0.6748	p-value:	0.2499
Overidentifying Restrictions Test Statistic	0.0949	p-value:	0.9536

Table A.4: Probit Estimates of the Corrected Wage Labor Force Participation Equation

No.	Variable	Estimate	Standard Error
1	Constant	-3.2910	0.1346
2	Age	0.1947	0.0067
3	AgeSq	-0.0023	0.0001
4	Female	0.1380	0.0422
5	Married	0.2793	0.0427
6	Married Female	-0.3251	0.0490
7	Schooling	-0.0042	0.0071
8	Secondary Sch.	-0.0638	0.0277
9	Vocational	0.2520	0.0293
10	Technical	0.4293	0.0341
11	University	0.5453	0.0477
12	Graduate	0.6697	0.2226
13	Spouse in labor force	0.2606	0.0269
14	Spouse Earnings ($\$10^6$)	-0.0001	0.0000
15	Parents need Help	-0.0672	0.0695
16	Female and Variable 15	0.0468	0.0941
17	Children under 12	0.0909	0.0344
18	Female and Variable 17	-0.1394	0.0446
19	Poor health	-0.5227	0.0381
20	Rural	-0.1071	0.0267
21	Region 2	0.0724	0.0567
22	Region 3	-0.0632	0.0473
23	Region 4	-0.0162	0.0480
24	Region 5	-0.2570	0.0506
25	Region 6	-0.0061	0.0485
26	Region 7	-0.0484	0.0524
27	Region 8	-0.0125	0.0525
28	Round 7	-0.0488	0.0267
29	Round 8	-0.2055	0.0265
	#Obs.	17,582	
	Log Likelihood	-0.5123	