

Northern Investment Risks in Human Capital Formation: Russian Experience

Elena Kotyrlo

Aging and Living Conditions Centre, Umeå University, Umeå, Sweden

*Corresponding Author: elena.kotyrlo@umu.se

Copyright © 2014 Horizon Research Publishing All rights reserved.

Abstract Historically, the northern Russian regions have been an object of a special socio-economic policy, united by extreme climate conditions, geographical isolation and rich natural resources reserves. Northern investment risks in human capital formation are proposed in the paper, as an indicator of investment conditions, which can be employed to improve policy of human development in the northern regions of Russia. Northern investment risks encompass uncertainties associated with extreme northern climate conditions, historically determined allocation of resources in the Russian northern regions and restrictions on labour mobility caused by geographic isolation and administrative rules. Investment risks in human capital, its measurement, methods of estimation are considered. Empirical estimation illustrates higher investment risks in the northern regions. Method of estimation can be employed widely to compare investment conditions in imperfect economies. Policy of insurance of private investment risks and current restrictions on its implementation in the northern regions of Russia are discussed.

Keywords The Russian northern regions, Human Capital Formation, Investment Risk, Lifetime Labour Supply, Northern Systematic Investment Risk, Returns on Investment

1. Introduction

Investment in human capital is a key issue of human development. Individuals are different in their investment potential. Returns expected on investment depend on their abilities and skills, as well as on social and economic conditions, in which their labour is employed. Stochastic nature of returns allows implementing investment risks to human capital. National policies can be associated with public investment and reducing private investment risks.

Returns and uncertainty of investment in human capital in the northern Russian regions are considerably determined by extreme climate conditions, history of exploration of northern territories and allocation of resources, and features

of their economy based on natural resources and national security priorities. The area of the Extreme North was legally defined in 1945 [29], then territories equated to the Extreme North extended the first definition [30]. Currently, the Russian North consists of eleven Russian regions and partially covers the territory of other 12 from 83 subjects of the Russian Federation¹. In general, returns on investment are lower in the northern regions compared to other regions by the next reasons. Geographic isolation drastically increases logistic costs. Low temperatures accelerate depreciation of physical capital. Returns on scale can be hardly reached in low populated northern areas. An exception is highly profitable, but relatively short in duration, natural resource extraction. As a rule, an exploration of a deposit of a natural resource gives a push to a local northern economy in an uninhabited place. Life cycle of such a kind of economy depends on depletion of the resource or the end of the program. Providing of services and production of goods depends on consumers' purchasing power, generated by the main production in the primary sector², and is most likely loss making in the North. Thus, compared to other Russian regions, the northern regions are less attractive for investments and highly dependent on national policy. At the same time, they play a big role for the Russian economy. The gross regional product per capita is significantly higher than in the average in Russia (Fig. 1).

Imperfect northern economies are characterized by non-elastic labour demand, since many of the settlements are one-factory towns. Thus, size of wage, as marginal returns on investment, strongly depends on labour legislation and bargaining power of labour unions. This is rather low, since labour unions were not evolving as a democratic institute during the Soviet period. They had and still keep quite a formal role in labour negotiations. Consequently, size of

¹ One of the definitions [33 p. 253] appeals to climatic restrictions and is based on impossibility to cultivate agricultures and develop a self-sufficient sustainable economy. The northern area roughly corresponds to the Circumpolar North [28 p. 21-22] and corresponds to the area 70% of the area Russian Federation [13 p. 155]. About 10 mln people live in the Russian North that is 85% of the world's Arctic residents [17 p. 460]. The major of the population has western kind of education and not involved in traditional economy.

² Though Arkhangelsk and Murmansk obl., and Republic of Karelia have quite a big share of secondary and tertiary sectors due to their hundreds year history of economic development. This makes their economies more sustainable compared to the rest of the North.

wage does not cover subsistent level of individual or family needs and causes under-investment in human capital. At a relatively high level of employment, poverty rates over 10 percent in major of other regions in 2011 [31 p.190-191] illustrate the current situation. Regional price levels and wage disparities also support that investment conditions in the northern regions vary greatly. Imperfectness of the northern economies is forced by restrictions on labour mobility, including compulsory registration of residence, required to enter local labour market or get social services, and rigidity of housing market³. Consequently, labour demand is mostly restricted by isolated local labour markets.

Northern investment risks, proposed in the paper, are considered as an approach to measure investment conditions in human capital formation, which is widely interpreted as consumption of goods increasing labour productivity and prolonging life labour supply. Northern investment risks encompass uncertainties associated with extreme northern climate conditions, historically determined allocation of resources in the Russian northern regions and restrictions on labour mobility caused by geographic isolation and administrative restrictions. Gross regional product per capita, nominal and real average wages are considered as indicators of labour productivity or returns on investment and social and private investment potentials. The purpose of the paper is to demonstrate that reducing of northern investment risks is as a vital subject of the northern human development policy.

Empirical analysis presents estimates of returns on investment in comparison northern and no-northern Russian regions. The analysis reveals that returns on investment are lower in the northern regions. Risk values are presented as probabilities of zero returns on investment. They are higher in the northern regions. Willingness to invest is assumed to be a function of returns on investment and their riskiness. Together they determine investment level and can cause under-investment as insufficient replenishment of human capital. It is shown on indicators of life expectancy, morbidity and food consumption that northern regions are characterized by under-investment in human capital formation. This can be explained by shortage of investment potential of individuals and higher investment risks in the northern economies.

Tax-subsidy mechanism is considered as an approach to reduce private investment risks and to provide public investment in human capital formation. Inter-regional and inter-resource rent redistribution can reduce northern investment risks. However, the current northern policy in Russia has not been changed much in the post-soviet period. In particular, this relies on administrative regulation and does not take into account differences in productivity in primary and other sectors.

The paper is structured as follows. Section 2 defines investment risks in human capital formation and northern

investment risks, approaches to measurement of investments and investment risks in human capital formation. Section 3 presents results on risk estimation on investment in human capital formation. They justify higher investment risks in the northern regions. In section 4, the results are summarized and illustrated by under-investment of goods prolonging lifetime labour supply and over-investment shortening it. Policy of reducing investment risks in the Russian northern regions is discussed. Conclusions are presented in section 5.

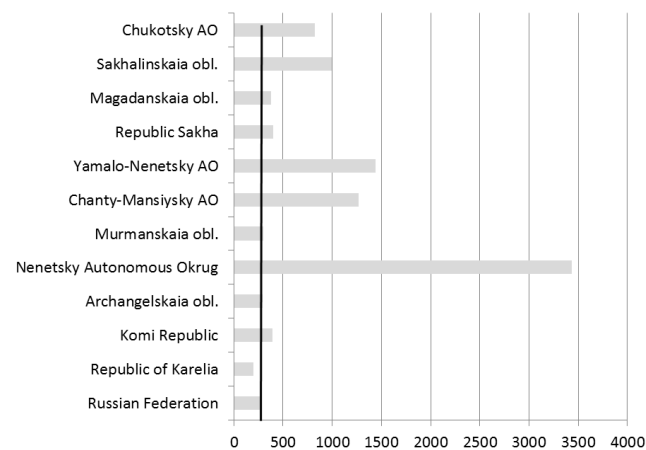


Figure 1. Gross Regional Product per Capita in the Northern Regions of Russia in 2010, thou. rub. National level (Russian Federation) is a reference: Calculation is based on source of data: [31 p. 20-27, 54-55]

2. Methods: Measurement of Investments and Investment Risks in Human Capital Formation

Uncertainty of returns on investment in human capital has been widely studied since the pioneer paper of Becker and Chiswick [3]. Wage is traditionally considered as a measure of returns on investment. In life perspective, the healthy capable period is associated with the working period or the period of getting returns on investment. Thus, investment in human capital formation can be determined wider than years of schooling and consider an individual consumption of goods increasing healthy period and labour productivity. Education, health, sport and recreational pursuits can be called as “investment goods”. Refusing of consumption of “bads” such as tobacco and alcohol can be also associated with investment in healthy life and capability.

Hazan [12], on the base of Ben-Porath model [4], derives a result, which states that longevity induces growth of investment in human capital and in lifetime labour supply⁴.

⁴ He introduces two terms lifetime utility consisting of lifetime consumption and disutility of work until retirement. Productivity of work is assumed to be a function of years of schooling s in exponential form. A budget constraint, as a difference of lifetime earnings and expenditures, is presented by two definite integrals, where the period of work is a period after schooling s and until retirement R and the period of consumption is a life span T . The optimal consumption c is derived as in (1):

$$c(s, R) = \frac{e^{\theta(s)}(e^{-rs} - e^{-rR})}{1 - e^{-rT}} \quad (1)$$

where r is a discount rate. This result shows that consumption increases in

³ However, 20% of population left the North after the fall of the Soviet Union [21 p. 116-120, 38 p. 54-55], despite high transaction costs of purchasing a new property or renting a flat.

This statement is very important to distinguish the process of investment in human capital formation in the northern regions, where life expectancy, i.e. life labour supply, is shorter. A positive effect of life expectancy on human capital investment is considered by Acemoglu and Johnson [1], Ben-Porath [4], Jayachandran and Lleras-Muney [14], Kalemli-Ozcan *et al.* [16]; Lorentzen *et al.* [26], Murphy and Topel [27], and Soares [34]. There are several empirical evidences that consumption of “investment goods” and “bads” depend on expected returns regarding to life span. In particular, mortality risk is considered as a factor of changes in human capital investment in the report of the World Health Organization [37], and in papers of Lorentzen *et al.* [26] and Fortson [10].

2.1. Investment Risks in Human Capital Formation

Risk related to human capital investment is associated with uncertainty on returns on education in labour income. Becker and Chiswick [3 p. 55] described returns on education in additive form with each component as a respected risk premium to different kinds of investments. Arrow and Lind [2], Hamilton [11], Judd [15], Laevhari and Weiss [25], and Williams [36] implement investment risk to compare uncertainty of private and public (social) investment and evaluate public investment decisions. Idiosyncratic and systematic risks are in consideration. There are not many papers extending classic portfolio approach to study investment risk in human capital. This can be explained by basic difference between human and physical capital, namely, non-diversifiable idiosyncratic risk of human capital [25 p. 950]. In contrast to assets or physical capital, human capital “cannot be bought or sold and cannot be separated from its owner” [ibid, p. 950] and investment risk in human capital is not proportional to the size of investment [15 p. 4]. These are strong constraints to implement portfolio analysis. Idiosyncratic risk is related to individual characteristics of a worker and associated with moral hazard caused by private character of employment contract [ibid p. 3]. In particular, Williams [36 p. 65] points on “ambiguous inputs in the production of skills, a risky rate of depreciation or obsolescence of existing skills, and a stochastic future wage”. Krebs [24 p. 715] describes two kinds of risks negatively influencing human capital investment. The first risk relates to human capital depreciation when job is terminated. Another risk is related to health deterioration. Systematic risk, as a systematic difference in returns on investment, can be observed in comparing returns in different economies or periods. This is employed in the paper to compare investment risks in the northern and no-northern regions.

duration of work and life span. Further calculation routines reveal that marginal productivity increases in working time (2):

$$\theta'(s) = \frac{r}{1 - e^{-r(R-s)}} \quad (2)$$

Consequently, marginal returns on investment are higher when life working time is longer. Thus, an increase in longevity induces an increase in schooling and in healthy period of life associated with work.

In portfolio analysis, risk is measured by such indicators as value at risk, conditional value at risk, and tail value at risk. However, “mean-variance” analysis underlies the measurements. Relative investment risk in human capital can be expressed as conditional probability to get wage for employee and marginal productivity for employer under a certain level. In the market economy wage and marginal productivity coincide, but this is not correct for imperfect economies such as northern economies. Absolute investment risk is related to the value of losses or the difference between expected and real wage (marginal productivity) or to the difference between projected and real gross regional product per capita in private and social meaning of investment, respectively.

Idiosyncratic risk is assumed to be exogenous, determined by individual characteristics. Carneiro and Heckman [7 p. 71] point out that it cannot be affected by individual decisions. However, in several papers, idiosyncratic risk is considered as endogenous [for example, 15 p. 8]. In contrast to non-diversifiable idiosyncratic risk, systematic risk can be reduced by general macroeconomic (or regional) policy.

Carneiro *et al.* [6 p. 25] emphasize that intrinsic uncertainty about future returns at the moment of making investment decision explains, why investment costs are more important than expected returns. This corresponds to the statement that there is no private, but social under-investment [11]. Krebs [24 p. 709] analytically proves that reduction in uninsurable idiosyncratic risk leads to a substitution of physical capital by human capital, which contributes to economic growth and social welfare. Thus, policy of insurance of idiosyncratic risk provides a decent level of investment in human capital formation, despite individual returns on investment can be lower than needed. Thus, the key policy issue is a discussion, how idiosyncratic risk can be insured for individuals. Such methods of insurance of idiosyncratic risk as regulation of employment contracts by collective agreements or tax-subsidy policies and combinations of them are considered in the row of papers (e.g. 2, 7, 15, 24). In assumption of endogeneity of idiosyncratic risk Judd [15 p. 5] shows that “the risk premium for human capital may depend on systematic components of risk, not on idiosyncratic risk”. This justifies policy of reducing northern investment systematic risks in human capital formation, which are higher, as shown below.

2.2. Northern Investment Risks

Northern investment risks are related to a shorter working life period, or lower returns on investment in a life perspective, in particular. Data proves that life span is shorter in the northern regions (Table 1) [see also 21 p. 114-117], even in such developed countries as Norway and Sweden [5 p. 28]. Thus, investment risks, related to job termination and health deterioration and defined by Krebs [24 p. 715] as idiosyncratic, have systematic character in the northern economies. Life cycle of jobs is relatively short, since the majority of jobs are terminated with depletion of a resource.

Faster health deterioration is caused by extreme climate conditions. Recognition of the northern systematic risks in human capital formation allows improving policy directed on equalization of investment conditions and evaluation of the effectiveness of the policy.

Not only extreme climatic conditions, but also differences in the proportion of manual workers in the economies affect life expectancy, since their working conditions are harder. This proportion is higher in primary sector dominating in the northern regions. Ethnic and cultural differences determine style of life and investment in health care service, as well. Consequently, expected life working time is shorter in the northern regions and total returns on education are relatively lower and investments are more risky. This doubles risks, since they include uncertainty of wage expected and uncertainty concerning the duration of working period. Increased risks discourage private investment from both individuals and firms. However, they can be insured by tax and subsidies policy in the interest of national economic growth. It should be mentioned, that investment costs are also higher in the northern regions, since lower supply of educational services [21 p. 132] and geographic isolation.

Besides acquisition of education, investments in human capital formation in the northern regions consist of everyday extra nutrition, home heating, and health care services to overcome negative climate externalities. In Arctic climate, people suffer from rarefied air and lack of oxygen on high latitudes, from polar nights and lack of light during long winters. Shortage of photoperiod and cold exposure suppress immune system and have an accumulation effect on human health, though not many studies have been conducted on humans [9, 37]. Table 2 exhibits higher rate of morbidity by majority of groups of diseases in the Russian northern regions⁵. To compensate this, marginal returns on investments, in particular, the size of wage in the Hazan model must be higher than the average.

3. Results

This paper presents a general methodology of risk estimation on investment in human capital formation. That is why indicators of investments and returns on investment are only variables of interest in empirical estimation. Complete description of the process generating data and the quality of models are left outside of the study. The main interests are estimates of marginal returns on investment and their volatility as indicators of uncertainty.

In general, different social, demographic and economic indicators can illustrate returns on investment in human capital formation. For example, fertility rates exhibit, how much society contributes in population growth as a determinant of labor supply. Life expectancy depicts returns on investment in healthy life style and quality of life. The average level of wages reflects revenues of acquisition of

education for individual and economic growth reveals social returns on investment. Indicators of consumption of “bads” and “goods” can be included in estimation in both ways, as levels of investment and as levels of returns on investment, since private or social capacity to invest in the presence depends on the size of investment in the previous period.

In previous studies, conducted on this topic, regional fertility and mortality rates, as the determinant of life expectancy, are considered as indicators of investment in human capital formation [23 p. 222-223]. Regional level of wages, regional budget expenditures and growth of the gross regional product reflect the size of private and social investment. The level of employment, dummies for macroeconomic shocks, and demographic indicators such as the sex ratio and the proportion of urban population are included into the estimation among explanatory variables. Marginal returns on education are estimated in the regional economic growth and the regional output of small enterprises in [18]. The value of a fixed asset, the annual average stock of employed, regional budget expenditures, the density of auto-roads, and the value of export are included as explanatory variables.

In the present empirical analysis, the northern investment risks are estimated as uncertainty of returns on education. The empirical model (3) is based on the Becker and Chiswick model [3 p. 359] and has two structural forms, for northern and no-northern regions, by introducing a dummy $N=0$ for no-northern, and $N=1$ for northern regions. Returns on education are considered as margins at the proportions of employed with higher professional education ($l_{\text{over } 15 \text{ years}}$), and the proportions of employed with primary professional, secondary, general or general basic education ($l_{10-11 \text{ years}}$). The sum of the proportions of employed with primary basic or without any general education (less than 9 years) and with incomplete higher and secondary professional education (12-14 years) is considered as a reference⁶. Other explanatory variables can be included but not discussed in the paper. Labour productivity y is measured in three different meanings. Gross regional product (GRP) is considered as a measure of labour productivity in terms of national economy or social returns on investment. The average monthly nominal accrued wage of people employed in the economy (nominal wage) and wage adjusted by regional minimal subsistent level (real wage) are associated with private returns on investment.

⁵ This indirectly shows a joint effect of underinvestment in human capital and negative climate externalities on human health.

⁶ One feature of returns on investment, general for the Russian regions, should be mentioned here. Returns on primary and secondary professional and incomplete higher education are negative compared to the level 10-11 year. This result is related to misalignment of signals on labor market noticed by many researchers. They explain it by growing accessibility of higher education due to introducing of tuition fee and corrupted system of control on quality of higher education. Another explanation is obsolescence of funds of primary and secondary professional education and transferring of this level of education from national to regional level of financing. Thus, two kinds of formal signals (secondary and university completed educations) are well recognizable in the labor market.

$$\log(y) = b_{01} + b_{11}l_{10-11 \text{ years}} + b_{21}l_{\text{over 15 years}} + b_{02} \cdot N + b_{12}l_{10-11 \text{ years}} \cdot N + b_{22}l_{\text{over 15 years}} \cdot N + \dots \quad (3)$$

Table 1. Life Expectancy 2000-2011 in the Northern Russian Regions

| | 2000 | | | 2011 | | |
|-----------------------|------------------|-------|-------|------------------|-------|-------|
| | Total Population | Men | Women | Total Population | Men | Women |
| Russian Federation | 65.34 | 59.03 | 72.26 | 69.83 | 64.04 | 75.61 |
| Republic of Karelia | 62.88 | 56.42 | 70.24 | 67.95 | 61.75 | 74.23 |
| Komi Republic | 63.53 | 57.75 | 70.05 | 67.95 | 61.62 | 74.58 |
| Archangelskaia obl. | 62.77 | 56.31 | 70.57 | 68.75 | 62.69 | 75 |
| including Nenetsky AO | 60.57 | 54.02 | 68.33 | 66.71 | 60.61 | 73.47 |
| Murmanskaia obl. | 64.51 | 58.54 | 70.96 | 68.93 | 62.97 | 74.62 |
| Khanty-Mansiysky AO | 65.87 | 59.86 | 72.55 | 70.91 | 66.03 | 75.73 |
| Yamalo-Nenetsky AO | 66.71 | 61.64 | 72.28 | 70.16 | 65.62 | 74.88 |
| Republic Sakha | 63.66 | 57.9 | 70.27 | 67.67 | 61.88 | 73.96 |
| Magadanskaia obl. | 62.02 | 55.73 | 69.97 | 65.99 | 60.18 | 72.64 |
| Sakhalinskaia obl. | 63.34 | 57.69 | 69.82 | 65.68 | 59.8 | 72.24 |
| Chukotsky AO | 60.17 | 54.91 | 67.07 | 61.58 | 57.53 | 66.35 |

National level (Russian Federation) is a reference. Source: [31 p. 82-83]

Table 2. Annual Morbidity per 1000 Population (registered patients for the first time diagnosed). 2011.

| Indicator | The Extreme North and territories equated to the Extreme North | Russian Federation |
|---|--|--------------------|
| Infectious and parasitic diseases | 41.0 | 32.4 |
| Malignant neoplasm | 12.3 | 11.0 |
| Diseases of the endocrine system | 12.8 | 10.3 |
| Blood diseases | 4.8 | 4.7 |
| Diseases of nervous system and organs of senses | 25.3 | 16.5 |
| Respiratory organs diseases | 417.8 | 338.8 |
| Digestive disorders | 48.3 | 33.3 |
| Urogenital diseases | 60.5 | 49.3 |
| Skin infections | 54.1 | 47.5 |
| Osteomuscular and connecting tissue disorders | 42.4 | 33.6 |
| Injuries and poisoning | 105.6 | 92.8 |

Source: [31 p.344-346, 39]

Table 3. Estimates of Returns on Education in the Northern and No-northern Regions

| | Northern regions | | | No-northern regions | | |
|--------------------------------------|------------------|-----------|-------|---------------------|-----------|-------|
| | Coef. | Std. Err. | P> z | Coef. | Std. Err. | P> z |
| Log GRP per capita (adjusted by CPI) | | | | | | |
| 10-11 years | 1.816 | 2.465 | 0.461 | 2.932 | 0.836 | 0.000 |
| over 15 years | 4.827 | 3.238 | 0.136 | 5.626 | 0.855 | 0.000 |
| Log Nominal Wage | | | | | | |
| 10-11 years | 4.441 | 0.576 | 0.000 | 6.179 | 0.629 | 0.000 |
| over 15 years | 9.020 | 1.119 | 0.000 | 10.409 | 0.845 | 0.000 |
| Log Real wage | | | | | | |
| 10-11 years | 1.574 | 0.472 | 0.001 | 2.228 | 0.249 | 0.000 |
| over 15 years | 1.243 | 1.118 | 0.27 | 1.654 | 0.528 | 0.003 |

The model is estimated on panel data for 11 northern regions and 55 no-northern regions for the period 2000-2002. Variables of interest have historical dependence and significantly differ from one region to another. Thus, estimation procedure should imply either including of lagged endogenous variable in the set of explanatory variables or period fixed effects. Since the sample is rather small, bootstrap procedure is employed in the estimation.

Post-estimation $b_{i,North} = b_{i1} + b_{i2}$, $i = 1, 2$ allows evaluating returns on investment and their riskiness for northern regions. Intercepts b_0 and $b_{0,North}$ (in random effects estimations) demonstrate differences in productivity between northern and no-northern regions not regarding to returns on investment in human capital formation. The estimates, as interregional differences in productivity, are exhibited in Table 3. The results reveal that social marginal returns on education, expressed in economic growth, are lower in the northern regions for both levels of education. The model confirms that there are resources, first of all, natural resources, providing benefit of economic activity, whereas labour use is at a loss. The estimates exhibit that private returns on education are lower in the northern regions, both in nominal and real wages measurement⁷.

This justifies huge out-migration from the northern regions during decades after the breakup of the Soviet Union. However, millions of people still work for the northern economy. Thus, obstacles to move out are quite strong. Those, who live, work and have their families in the northern regions, do not get extra-wage to compensate extreme climatic conditions. In the average, they do not receive even equal amount of returns on education compared to the no-northern regions. However, there are other factors, which can compensate employment in the northern regions for an individual. Productivity is high for primary industries such as oil and gas extraction. However, secondary (processing) and tertiary sectors (public and private services, health care, education etc.) do not have such a high productivity, as a rule. Large enterprises have positive scale effect on productivity and can redistribute revenues and expenditures within production process. Whereas, small business faces higher labour costs not compensated by labour productivity. Since, variation of regional wages is high across sectors, industries, professional occupations, and positions, those, who work for large enterprises, get greater benefit [see more in 19]. However, those who work for small firms, in general, have wage below subsistent level [21 p.127, p.183, 22 p.25]. Thus, inequality of economic agents must be taken into account in the northern policy.

Referring to the Hazan model, as the way to compensate extra-costs and to provide extra consumption, it can be concluded that there is no empirical evidence of higher productivity of labour in the Russian northern regions. Within market economy incentives to invest in human

capital formation are lower there, and disincentives are strengthened by lower life expectancy. Moreover, individuals do not get proper possibilities to invest, since the size of wage does not cover extra-costs of living in the northern regions.

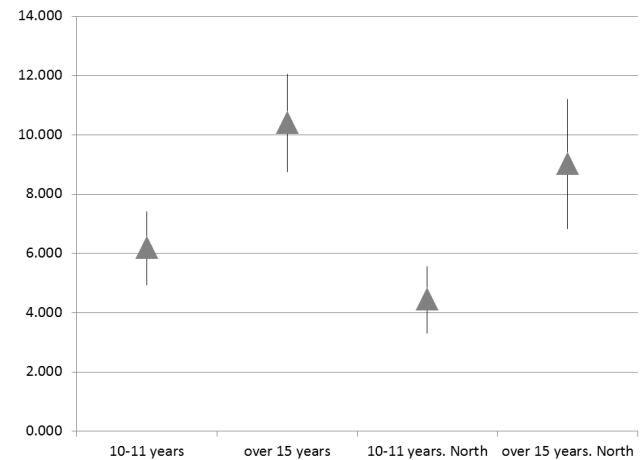


Figure 2. Returns on Investment in Nominal Wage with 95% confident interval (the log average monthly nominal accrued wage)

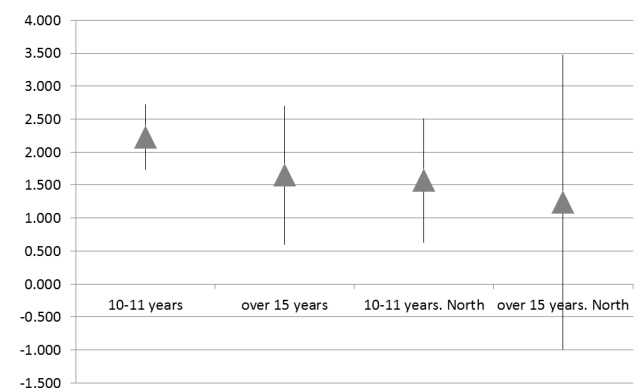


Figure 3. Returns on Investment in Real Wage with 95% confident interval (log real wage)

Beside low absolute value of marginal returns on investment, uncertainty of them is higher in the northern regions. Investment risks are presented as 95% confident intervals for the estimates (Fig. 2-4). The diagrams reveal that variance of marginal returns on education, associated with uncertainty, is much greater for northern regions. There are no big differences in variance of the parameters of nominal wages (Fig. 2). However, variance of estimates of marginal returns in real wage adjusted by regional price level is much greater (Fig. 3). This gives a reason to appeal to a “fat-tail” problem and state high level of riskiness of investment. In other words, expected returns on investment in the northern regions cannot be sufficiently predicted when individual is making an investment decision. Table 4 exhibits the northern investment risks as probabilities of not getting any returns on education $\text{Prob}(b_i < 0)$, $i = 1..3$. Since, there are no expectations of improvement of life conditions due to acquisition of education; people have no economic

⁷ It should be mentioned, that in real wages, secondary education provides higher marginal returns than university education. In other words, people do not get revenues on investment in university education, in general. This can be explained by imperfect conditions in the Russian labor market.

incentives to get it. This approach can be extended on other investment decisions such as healthy change in life style, reducing alcohol consumption and so on. People do not have economic incentives to invest and to expect benefit in the long run.

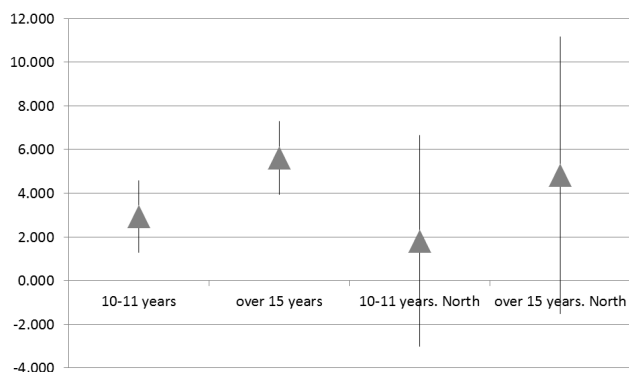


Figure 4. Returns on Investment in Regional Productivity with 95% Confident Interval (log GRP per capita)

Table 4. The Probabilities of not Getting Any Returns on Education

| | Northern Regions | No-northern Regions |
|------------------|------------------|---------------------|
| log_GRP | | |
| 10-11 years | 23.07% | 0.02% |
| over 15 years | 6.80% | 0.00% |
| Log Nominal Wage | | |
| 10-11 years | 0.00% | 0.00% |
| over 15 years | 0.00% | 0.00% |
| Log Real Wage | | |
| 10-11 years | 0.04% | 0.00% |
| over 15 years | 13.30% | 0.09% |

4. Discussion

4.1. Under-Consumption of “Goods” and Over-Consumption of “Bads”

There is an indirect evidence of under-investments in the northern regions which can be a consequence of relatively low returns on investment in the previous period. This effect of a negative multiplier in human development is known as “health-poverty trap” [32 p. 95]. Table 5 exhibits the proportions of expenditures on health care and educational services in total consumption per household can be interpreted as individual investments in labor productivity and life labor supply. For most of the northern regions these proportions are lower than in average in Russian Federation. Table 6 provides descriptive statistics on consumption of food. Many of the values are lower in the northern regions than in average in the Russian Federation, despite extra nutrition is needed to compensate living in extreme climate conditions.

Table 5. The Proportions of Expenditures on Health Care and Educational Services in Total Consumption per Household (%). 2011.

| Region | Health | Education |
|---------------------|--------|-----------|
| Russian Federation | 3.5 | 1.2 |
| Republic of Karelia | 3.2 | 1.2 |
| Komi Republic | 3.4 | 1.2 |
| Archangelskaia obl. | 2.4 | 1.4 |
| Nenetsky AO | 1.9 | 2.4 |
| Murmanskaia obl. | 3.1 | 1 |
| Khanty-Mansiysky AO | 2.5 | 1 |
| Yamalo-Nenetsky AO | 1.4 | 1.3 |
| Republic Sakha | 3 | 1.2 |
| Magadanskaia obl. | 2.3 | 1.6 |
| Sakhalinskaia obl. | 3.5 | 1.1 |
| Chukotsky AO | 1.8 | 0.9 |

National level (Russian Federation) is a reference. Source: [31 p.198-201]

Table 6. The Annual Consumption of Food (per capita). 2011.

| Regions | meat and meat products (kgs) | diary products (kgs) | eggs (units) | sugar (kgs) | vegetable oil (kgs) | potatoes (kgs) | vegetables and melons (kgs) | bread and cereals (kgs) |
|---------------------|------------------------------|----------------------|--------------|-------------|---------------------|----------------|-----------------------------|-------------------------|
| Russian Federation | 71 | 246 | 271 | 40 | 110 | 99 | 13.5 | 119 |
| Republic of Karelia | 70 | 234 | 240 | 42 | 111 | 80 | 11.7 | 116 |
| Komi Republic | 80 | 270 | 276 | 39 | 56 | 94 | 13.6 | 116 |
| Archangelskaia obl. | 58 | 158 | 254 | 39 | 76 | 78 | 12.6 | 109 |
| Murmanskaia obl. | 76 | 256 | 228 | 37 | 66 | 95 | 14.5 | 116 |
| Republic Sakha | 88 | 282 | 224 | 36 | 84 | 76 | 9 | 134 |
| Magadanskaia obl. | 75 | 235 | 203 | 36 | 72 | 86 | 14.1 | 114 |
| Sakhalinskaia obl. | 88 | 195 | 225 | 32 | 125 | 91 | 12.1 | 96 |
| Chukotsky AO | 49 | 61 | 185 | 34 | 53 | 12 | 21.9 | 63 |

National level (Russian Federation) is a reference. Source: [31 p. 206-213]

In the absence of incentives to invest caused by high investment risks and low expected returns on investment, people more likely consume health destructing commodities. Despite statistics does not support higher rates of consumption of alcohol, its consequences, such as alcohol addiction, as well as crime rates, are higher in the northern regions (Table 7).

Table 7. The Proportion of Expenditures on Alcoholic Beverages in Total Consumption per Household (%); Numbers of Registered Patients for the First Time Diagnosed, Suffering from Alcoholism and Alcoholic Psychosis per 100 thou. of People; and Annual Amount of Crimes Reported per 100 thou. of People. 2011.

| Regions | The Proportion of Expenditures on Alcoholic Beverages in Total Consumption per Household (%) | Alcoholism and alcoholic psychosis | The annual amount of crimes |
|---------------------|--|------------------------------------|-----------------------------|
| Russian Federation | 1.7 | 96.6 | 1682 |
| Republic of Karelia | 2 | 191.2 | 2224 |
| Komi Republic | 1.4 | 178.2 | 1928 |
| Archangelskaia obl. | 1.5 | 84.8 | 2033 |
| Nenetsky AO | 1.2 | 241.3 | 1826 |
| Murmanskaia obl. | 1.9 | 122.8 | 1437 |
| Khanty-Mansiysky AO | 1.5 | 120.9 | 2011 |
| Yamalo-Nenetsky AO | 1.9 | 153.7 | 1770 |
| Republic Sakha | 1.2 | 239.1 | 1578 |
| Magadanskaia obl. | 1.7 | 270.1 | 2071 |
| Sakhalinskaia obl. | 1 | 282.2 | 2021 |
| Chukotsky AO | 3.9 | 406.6 | 2121 |

National level (Russian Federation) is a reference. Source: [31 p. 196-197, 362-363, 39]

4.2. Northern Policy of Investment in Human Capital Formation

As mentioned above, policy, concerning idiosyncratic risks, can be applied to systematic risks causing interregional inequality in investment. Carneiro and Heckman [7 p. 74] advocate that subsidies to make investment in human capital formation a free good and elimination of inequality in investments would decrease investment risks or uncertainty in returns. Arrow and Lind [2 p. 366] mark that the government as an investor can better manage with uncertainty than private investors. They emphasize that “individual preferences as revealed by market behaviour are of normative significance for government investment decisions, and assert that time and risk preferences relevant for government action should be established as a matter of national policy” [ibid p. 366]. Tax-subsidy mechanism is considered as an approach to reduce private investment risks and to provide public investment in human capital formation in the presence of idiosyncratic risk [2, 3, 7, 24]. This equalises opportunity to invest for individuals with different idiosyncratic risks [3 p. 362].

Besides inter-individual level, the approach can be employed to inter-regional level, if regions are characterized by systematic investment risks. The basic idea is income redistribution, which can be interpreted as funding of labour in the northern regions, or insurance of the northern investment risks, by taxation of labour in the other regions. The tax-subsidy mechanism can be also implemented to

redistribute extra-costs between resources. Thus, private investment risks can be declined by redirection of part of benefits of natural resource extraction to public human capital formation investment.

Despite the formal end of transition period, the Russian economy is still highly hierarchic and rigid. Living conditions vary greatly across regions. The estimates prove insufficiency of current policy of human capital investment. The northern policies have not been changed much in the post-soviet period. The Soviet northern policy, which can be interpreted as a policy reducing the northern systematic risks, was worked out to 1945 [29] and mostly completed to 1967 [30]. As Crate and Nuttall [8 p. 87] notice, “Northern benefits... were generous and included incentives for moving to, living in, and returning from the North”. The system of compensation of extra-costs contains extra-wages (currently, up to 230% to the no-northern level); longer annual vacation period (almost double basic duration); compensation of expenditures for family summer travelling; 5 years earlier age of retirement, and housing costs compensation concerning after retirement out-migration to climatically favourable regions [detailed evolution is presented in 21 p. 226-253]. These administrative methods of reducing the investment risks cannot be suddenly cancelled, because this would significantly worsen the social contract for many northerners. Administrative regulation is still prioritised in the northern policies, besides each minor policy correction is to be approved by the national government, which drastically slowdown the processes of

equalization of investment conditions.

In the Soviet model, government was responsible for compensation of the northern investment risks. In the post-soviet model employer provides the whole bench of compensations, except earlier pension guarantee and housing costs when out-migrating. As a result, problem of enforcement of the policies grew up. In fact, northern policies are mostly directed on employees in public sector. Reducing of the northern investment risks of employed in private sector is an issue of individual and collective contracts and tripartite agreements. In the presence of lack of bargaining power of employees it, obviously, leads to decrease of individual returns on investment and feather under-investment in human capital formation. Crate and Nuttall [8 p. 87] remark that firms are unable to pay extra-costs and either abolish them or leave them unpaid.

The current northern policy does not take into account differences in productivity in primary and other sectors, as well as productivity gap between large enterprises, benefiting from scale, and small business [21 p. 181-185, 22 p. 25]. Equal claims to economically unequal agents cause high extra-costs of labour in small business and inability to compete in the market economy. That is one of the reasons, that the proportion of output of the formal small business is much lower in the northern regions.

The next problem is that the northern policy does not provide risk insurance for the population living in the northern regions. Policy relates to labour market participants and their families, some instruments are directed to students, retired and disabled people. However, a part of northerners has not got any compensation. Another problem is that policies for those who permanently live in the northern regions can cause discrimination in the labour market [21 p. 247]. Employer has options to hire seasonal workers from outside and avoid extra labour costs. This incentive is quite strong, but has not been studied, at the moment. Earlier retirement age is another disincentive to invest in human capital formation, since this makes accumulated returns on investment lower. Thus, transmission of the investment risks to enterprises causes impairment of conjuncture for small business and worse investment options in this sector. This also affects displacement of northern employees by seasonal workers, thus, further reducing of investment in human capital formation in the northern regions.

Arrow and Lind [2 p. 366] point out that public subsidies are self-limiting, since they may not bring benefit to society, as a whole. The empirical analysis proves that in the case of investment in the northern regions, it is profitable for the entire economy since the level of GRP per capita is much higher there (Fig. 1). Redistribution by tax-subsidy mechanism within interregional equalization is implemented in many countries. However, analysis of returns on education and differences in real wage (Table 3) do not support the idea of forcing redistribution between earnings in northern and no-northern regions. However, extra labour costs lowering returns on investment can be compensated by natural resource rent. Empirical analysis justifies this approach,

since there is a significant gap in GRP level per capita between northern and no-northern regions, related to natural resource extraction, playing a big role in the northern economies. This approach is successfully employed in Alaska (US) and Norway and based on accumulating of part of natural resource rent in National Funds providing development of social services and extra-payments to the northerners.

5. Conclusion

Despite quite a broad study of human capital investment, investment risks consideration has been relatively modest. One of the explanations is that idiosyncratic risk is individual, thus, needs individual treatment to reduce. Systematic investment risks are caused by macroeconomic factors. This allows considering economic conjuncture as an object to be treated to affect investment in human capital. Consideration of regional systematic risks, such as the northern investment risks in human capital formation, can give further development to this approach since risk reduction can be implemented in regional policy. The purpose of the paper is to show that regional investment risks should be taken into account and become an object of national and regional policy, in particular, regional labour market policy.

Two main risk factors can be extracted in relation to the northern investment risks in human capital formation. They are higher uncertainties of expected returns on investment and expected life labour supply period. The proposed methodology allows detecting a causal relation between riskiness of investment and observable under-investment in education, health care service, nutrition and healthy leisure activity, and over-consumption of alcohol and other “bads” in the northern regions.

Northern social policy, mostly developed in the Soviet period, needs further revision. One of the important approaches to response the current Russian socio-economic situation and needs in human capital formation is combining of interregional income tax-subsidy policy with intraregional natural resource rent transferring to subsidy labour in the northern regions.

Acknowledgments

The author sincerely appreciates the anonymous referee for providing valuable comments that benefit the manuscript. At the beginning of the study the support of the Nikolai Fedorenko International Scientific Foundation for Economic Research, and its Director Roman Kachalov, was vital to conduct data collection and empirical analysis and to get recognition among researchers involved in the Russian northern regions studies. I appreciate discussion of my doctoral thesis, related to the paper, with Professors Anatoly Doctorovich, Vera Smorchkova, and Alexander Scherbakov. This gave further development of categories of investment in

human capital formation and the northern investment risks, which are finally presented in the paper. The author appreciates Arctic Research Centre at Umeå University and its director Peter Sköld for financial support for publishing the paper.

I thank Prof. Thomas Aronsson, Prof. Magnus Wikström and participants of the seminar in Public Economics, Umeå University, and participants of the session “Arctic People and Resources: Opportunities, Challenges and Risks” at the Arctic Science Summit Week, Krakow, April 2013, for valuable comments and discussions.

REFERENCES

- [1] Acemoglu, D., Johnson, S., Disease and Development: The Effect of Life Expectancy on Economic Growth, Working Paper 12269, NBER, 2006.
- [2] Arrow, K., Lind, R., Uncertainty and the Evaluation of Public Investment Decisions, *The American Economic Review* Vol. 60, No. 3, 364-78, 1970.
- [3] Becker, G.S., Chiswick B.R., Education and the Distribution of Earnings, *The American Economic Review* Vol. 56 No. 1/2, 358-369, 1966.
- [4] Ben-Porath, Y., The Production of Human Capital and the Life Cycle of Earnings, *Journal of Political Economy* Vol. 75, 352-365, 1967.
- [5] Bogoyavlenskiy, D., Siggner, A., Arctic Demography. In: *Arctic Human Development Report: 27-4*, 2004.
- [6] Carneiro, P., Hansen, K., Heckman, J., Estimating Distributions of Treatment Effects with an Application to the Returns to Schooling, *International Economic Review* Vol. 44, No. 2, 631-422, 2003.
- [7] Carneiro, P., Heckman, J.J., Human Capital Policy. Institute for the Study of Labor IZA DP 821. 151 p., 2003.
- [8] Crate, S., Nuttall, M., The Russian North in Circumpolar Context, *Polar Geography* Vol. 27, No. 2, 85-96, 2003.
- [9] De Fabo, E.C., Arctic Stratospheric Ozone Depletion and Increased UVB Radiation: Potential Impacts to Human Health, *International Journal of Circumpolar Health* Vol. 64, No. 5, 509-522, 2005.
- [10] Fortson, J.G., Mortality Risk and Human Capital Investment: the Impact of HIV/AIDs in Sub-Saharan Africa, *The Review of Economics and Statistics* Vol. 93, No. 1, 1-15, 2011.
- [11] Hamilton, J.H., Optimal Wage and Income Taxation with Wage Uncertainty, *International Economic Review* Vol. 28, No. 2, 373-388, 1987.
- [12] Hazan, M., Longevity and Lifetime Labor Supply: Evidence and Implications, *Econometrica* Vol. 77, No. 6, 1829-1863, 2009.
- [13] Heleniak, T., Out-Migration and Depopulation of the Russian North during the 1990s, *Post-Soviet Geography and Economics* Vol. 40, No. 3, 155-205, 1999.
- [14] Jayachandran, S., Lleras-Muney, A., Life Expectancy and Human Capital Investments: Evidence From Maternal Mortality Declines, *Quarterly Journal of Economics* Vol. 124, No. 1, 349-397, 2009.
- [15] Judd, K., Is Education as Good as Gold? A Portfolio Analysis of Human Capital Investment. Stanford University and NBER WP. 25 p., 2000.
- [16] Kalemli-Ozcan, S., Ryder, H.E., Weil D.N., Mortality Decline, Human Capital Investment, and Economic Growth, *Journal of Development Economics* Vol. 62, 1-23, 2000.
- [17] Knapp, G., The Population of the Circumpolar North. In: M. Nuttall and T.V. Callaghan, eds., *The Arctic: Environment, People, Policy*. New York, NY: Taylor and Francis: 459-483, 2000.
- [18] Kotyrlo, E., Chelovechesky Kapital i Ekonomicheskyy Rost: Analiz Vzaimosvyazi Regionov Rossiyskogo Severa (Human Capital and Economic Growth: the Analysis of Interrelation for Regions of the Russian North), *Ekonomicheskaya Nauka Sovremennoy Rossii* Vol. 3, No. 39, 38-52, 2008a.
- [19] Kotyrlo, E., Effektivnost Severnogo Sotsialnogo Kontrakta (The Efficiency of the Northern Social Contract), *Trud i Sotsialnye Otnosheniya* Vol. 6, 22-32, 2007b.
- [20] Kotyrlo, E., Rohl Korporatsiy na Severnyh Rynkah Truda (Social Corporative Policy in the North and Labour Market), *Otechestvennye Zapiski* Vol. 3, No. 36, 169-178, 2007a.
- [21] Kotyrlo, E., Chelovechesky Kapital i Ekonomicheskoe Razvitiye Rossiyskogo Severa (Human Capital and Economic Development in the Russian North), *Sovremennaya Ekonomika i Pravo*. Moscow. 364 p., 2009.
- [22] Kotyrlo, E., Human Development and Regional Economic Growth in the Russian North. In: L. Heinen and K. Laine, eds. 2008. *The Borderless North* Ouluprint Oy. Oulu: 21-25, 2008b.
- [23] Kotyrlo, E., Incomes and Human Development in Comparative Analysis of the Russian North with Other Regions. In: L. Heinen and K. Laine, eds. *The Borderless North*. Ouluprint Oy. Oulu: 219-224, 2008c.
- [24] Krebs, T., Human Capital Risk and Economic Growth, *Quarterly Journal of Economics* Vol. 2, 709-744, 2003.
- [25] Levhari, D., Weiss, Y., The Effect of Risk on the Investment in Human Capital, *The American Economic Review* Vol. 64, No. 6, 950-963, 1974.
- [26] Lorentzen, P., McMillan, J., Wacziarg, R., Death and Development, *Journal of Economic Growth* Vol. 13, No. 2, 81-124, 2008.
- [27] Murphy, K.M., Topel, R.H., The Value of Health and Longevity, *Journal of Political Economy* Vol. 114, 871-904, 2006.
- [28] Nuttall, M., *Protecting the Arctic: Indigenous Peoples and Cultural Survival*. New York, NY: Routledge-Harwood, 1998.
- [29] Lgotah dlia Lits Rabotayuschih v Rayonah Kraynego Severa (On Benefits for Those Who Is Employed in the Far North), Ukaz Prezidiuma Verhovnogo Soveta SSSR (Decree of the Presidium of the Supreme Soviet of the USSR), 1945.

- [30] Rasshirenii Lgot dlia Lits Rabotayuschih v Rayonah Kraynego Severa i Mestnostyah, Priravennyh k Rayonam Kraynego Severa. (On the Extension of Benefits for Those Who Is Employed in the Far North and in the Areas Equivalent to the Far North), Ukaz Prezidiuma Verhovnogo Soveta SSSR (Decree of the Presidium of the Supreme Soviet of the USSR) N 1908-VII 1.09.1967. Vedomosti Verhovnogo Soveta SSSR, 5:74, 1983.
- [31] Rosstat (Federal'naya Sluzhba Gosudarstvennoy Statistiki), Regiony Rossii. Sotsialno-ekonomicheskie pokazateli (Regions of Russia. Socio-economic indicators.). Moscow, Russia: Rosstat, 2012.
- [32] Sala-i-Martin, X., On the Health-Poverty Trap. In: G. López i Casasnovas, B. Rivera, L. Currais, eds. 2005. Health and Economic Growth: Findings And Policy Implications. The MIT Press: 95-111, 2005.
- [33] Slavin, S., O ponyatii Sovetskiy Sever (On the Concept of the Soviet North), Problemy Severa Vol. 2, 252-265, 1958.
- [34] Soares, R.R., Mortality Reductions, Educational Attainment, and Fertility Choice, American Economic Review Vol. 95, No. 580-601, 2005.
- [35] Tkachev, A., Boyko, E., Gubkin, Z., Enodkrinnaya Systema i Obmen Veschestv u Cheloveka na Severe (The Endocrine System and Metabolism in Humans in the North). Syktyvkar: Komi Scientific Center. 156 p., 1992.
- [36] Williams, J.T., Risk, Human Capital, and the Investor's Portfolio, The Journal of Business Vol. 51, No. 1, 65-89, 1978.
- [37] World Health Organization, Macroeconomics and Health: Investing in Health for Economic Development, Report of the Commission on Macroeconomics and Health, 2001.
- [38] Online Available: http://demoscope.ru/weekly/ssp/rus_nac_89.php Demograficheskie pokazateli po 15 novym nezavisimym gosudarstvam: Rossia. (Demographic indicators for 15 new independent states: Russia 1989). Demoskop Weekly.
- [39] Online Available: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1140096401359. Rosstat (Federal'naya Sluzhba Gosudarstvennoy Statistiki), Ekonomicheskie i sotsialnye pokazateli rayonov Kraynego Severa i priravennyh k nim mestnostey v 2012 (Economic and social indicators of the Far North and equated areas in 2012). Moscow, Russia: Rosstat, 2012.