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What Drives Returns to Higher Education: Evidence from Russian Regions

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Abstract

In this study, we examine cross-regional variation in the rates of private return to higher education (RoRHE) in Russia. We obtain estimates of RoRHE for each of about 80 regions-subjects of the Russian Federation by estimating region-specific mincerian wage equations using micro-data from the Occupational Wages Survey conducted by Rosstat in 2005, 2007, 2009, 2011, 2013, and 2015. In any year, differences in regional RoRHEs were huge. For instance, in 2015 they ranged from about 38% to 125% (to the mean wage of workers with secondary education) against about 65% at the country level. Next, we regress estimates of RoRHEs on regional economic and labor market indicators, controlling for regional and time fixed effects. We find positive and robust correlation of RoRHEs with both regional per capita GDPs and relative stocks of workers with higher education. RoRHE also tend to be higher in regions with less favorable living conditions. Overall, our findings raise questions regarding the usefulness of the country-level approach to estimate return to education, at least in large countries, and may have important implications for cross-national research.

Key words: returns to education, Russian regions, Russia

JEL codes: I26, J31

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1. Introduction

The rate of return to education (RoRE) is an important indicator that guides individuals' and public decisions to invest in education (e.g., OECD, 2017). It also reflects how educational differences between people translate to general earnings and income inequality (Murphy & Welch, 1992). Therefore, it is not surprising that there are dozens of studies estimating RoRE in almost any country around the world. The general empirical fact is that RoREs enormously differ across countries (Card, 2001; Fink, Peet & Fawzi, 2015; Flabbi, Pasternostro & Tiongson, 2008; Harmon, Ooesterbeek & Walker, 2003; Montenegro & Patrinos, 2014; Peracchi, 2006; Psacharopulos & Patrinos, 2004; Trostel, Walker & Wooley, 2002). However, the patterns of this variation as well as factors that drive it have not fully understood yet.

G. Psacharopulos and H. A. Patrinos in an influential series of articles (Psacharopoulos, 1985; 1994; Psacharopulos & Patrinos, 2004) show that RoREs 1) tend to be higher in less developed countries and 2) fall with the level of education. As relatively high RoREs are generally regarded as a sign of underinvestment in education, these results imply that developing countries should invest more in their educational systems and expand enrollment, especially in primary education (Boissiere, 2004). More recent comparative studies, however, establish completely reversed patterns: 1) RoREs are, on average, higher in *developed* countries, and 2) it is *tertiary* education that provides the highest return (see Fink, Peet & Fawzi, 2015; Montenegro & Patrinos, 2014). The most recent up-date by G. Psacharopulos and H. A. Patrinos challenges that evidence in return (Psacharopulos & Patrinos, 2018).

Such inconsistencies between different studies are well expected due to serious methodological problems that inevitably arise in cross-national comparative research (Bennell, 1996). Another important issue is that countries are too heterogeneous objects that differ in many aspects including the level of economic development, technological capabilities, capital and labor market conditions, institutional settings, designs of educational systems, etc. As a result, it is extremely hard to single out any particular factor or group of factors responsible for relatively high or low RoRE. As Trostel, Walker & Wooley (2002) note in their study of RoRE in developed countries, "what may be the most puzzling aspect of the cross-country heterogeneity [in RoRE] is the lack of obvious explanations for it." In the same vein, Fink, Peet & Fawzi (2015) in the conclusion to their study of RoREs across developing countries note: "While some of the more extreme variations in returns to education are likely related to macro-economic instability, further research will be needed to better understand the sources of variations in the returns to schooling."

In this paper, we examine differences in RoREs between regions of Russia. The analysis of interregional differences in RoREs within one large country is a promising approach that helps to overcome the limitations of cross-national research. It allows to control differences in many observed and unobserved characteristics common to all regions (e.g., educational system, national institutions, cultural backgrounds, etc.) and focus on those factors that vary across them (first of all, relative supply of and demand for educated workers). In this regard, Russia is an excellent "laboratory" for such a study as it is a large and extremely regionally heterogeneous country notoriously known by its strong and persistent territorial differences in key socio-economic and labor market indicators (e.g., Kholodilin, Oshchepkov & Siliverstovs, 2012; Lehmann & Silvagni, 2013; Oshchepkov & Kapelyushnikov, 2015).

There are already a number of studies that estimated RoRE in Russia (see Lukyanova, 2010) but most of them did that exclusively at the country level. We are aware of only one published paper that considered the regional level: Benitez-Silva and Cheidvasser (2007) using the Russian Longitudinal Monitoring Survey (RLMS) data estimated RoREs across 7 Russian Federal districts and separately for two major cities, Moscow and Saint-Petersburg. According to the authors, these two cities as well as the Central Federal district exhibited the lowest RoREs (less than 1 %), while the highest RoRE was observed in Eastern Siberia and Far East (more than 7%). Although these findings were left without explanations, they suggest that RoREs substantially differ across Russian regions and that lower RoREs may be associated with relatively strong supply of educated workers.

In this paper, we estimate RoREs at a more disaggregated level of 78 regions-subjects of the Russian Federation using unique matched employer-employee micro-data from the Occupational Wages Survey (OWS). We use data from six consecutive rounds of OWS (2005, 2007, 2009, 2011, 2013, and 2015) and for each year and each region estimate RoRE using the conventional methodology based on the OLS estimation of mincerian wage equation (Mincer, 1974). We measure education as the highest educational level attained and focus on the return to higher education (RoRHE) taking the complete secondary education as a base. At the second step, we regress obtained estimates of RoRHE on different regional characteristics, taking into account the fact that those returns were estimated with different levels of precision (e.g., Hanushek, 1974; Lewis & Linzer, 2005; Saxonhouse, 1976) and controlling for regional fixed effects.

Our main findings may be summarized as follows. First of all, we find that differences in RoRHEs across Russian regions are really huge. For instance, in 2015 estimating the basic mincerian equation gives returns ranging from about 38% to 125% (to the average wage of workers with the secondary education) against about 65% at the country level. Controlling for industries and ownership leads to somewhat smaller but still substantial variation: from 54% to 127% with 79% at the country level.

Secondly, we reveal a positive and robust correlation of regional RoRHEs not only with demand side factors (regional per cap GDPs) but also with supply side factors (the relative number workers with higher education in the regional labor force), which suggests increasing returns to skilled labor in Russian regions.

At the same time, we find that RoRHEs tend to be higher in regions with less favorable living conditions. However, unlike studies on regional variation in college wage premium in US (e.g., Black et al., 2009; Kim et al., 2009; Moretti, 2013), we do not find any correlation of regional RoRHEs with housing prices but instead find robust negative correlation with life expectancy which may serve as a more appropriate generalized measure of the quality of regional living conditions in a country with the underdeveloped housing market. This result is perfectly in line with existing studies on spatial wage differentials in Russia (Berger, Blomquist & Sabirianova Peter, 2008; Oshchepkov, 2015).

Our findings may provide important insights for cross-national research on RoRE. Thus, they support a view that more developed countries should exhibit higher RoREs (at least to higher education) than the less developed ones. Moreover, they suggest that rising educational attainment should not always lead to declining RoRE and that relatively high RoREs do not obligatory signal the "underinvestment" in education.

At the same time, our results clearly illustrate the extent to which the standard country-level approach to estimate RoRE may oversimplify the reality. In the case of Russia, we receive that some regions exhibit RoREs comparable to (or even exceeding) those existing in developed countries, while RoREs in other regions correspond to those typically observed in developing countries. Although Russia, of course, is not a ‘representative’ country due to its size and strong regional heterogeneity, our findings raise serious concerns regarding the usefulness and substantive interpretation of the estimates of RoRE obtained at the country-level, at least in large and heterogeneous countries. As decisions to invest in obtaining or continuing education are made at the regional or even local level, a high average RoRE at the country level does not guarantee that private investments in education will be equally profitable in all regions. It is even possible that in regions with relatively low RoRE investments in education will be less profitable than investments in alternative options. In this regard, estimating RoRE at the regional level seems to be an important extension of the standard country-level approach.

The rest of the paper is organized as follows. In the second section, we discuss a general theoretical framework to analyze differences in RoREs. In the third section, we describe our data and methodology. In the fourth section, we present and discuss our main empirical findings. In the last section, we draw general conclusions.

2. Theoretical background

There are two different but related theoretical frameworks that were implicitly or explicitly used in the literature to explain differences in RoREs across countries or regions. The first one is based on the classic supply-demand model of the labor market that implies that the wage level increases (decreases) either due to growing (shortening) labor demand or due to contracting (growing) labor supply or due to both. If we consider two distinct labor markets, one is for more-educated workers and the other one for less-education workers, then the wage gap between them (which is strongly related to RoRE) should increase either when demand for more-educated workers increases more than demand for less-educated worker or when supply of the more-educated workers decreases more than supply of less-educated workers, or when both these changes take place. As Goldin and Katz (2008) show, this simple relative labor supply-labor demand framework (rLS-LD henceforth) is very powerful in explaining the evolution of college wage premium in USA during the 20th century (see also Katz & Murphy, 1992).

Adapting this simple and intuitive framework to the analysis of differences in RoREs *across* countries (or regions), one may expect that RoRE in one country will be higher than RoRE in another country either due to stronger relative demand for more-educated workers or due to weaker relative supply of educated labor, or due to both. Most cross-national studies of RoREs had exactly this expectation in mind when estimating correlations of RoREs with countries' per capita incomes and mean levels of education (e.g., Jain, 2001; Montenegro & Patrinos, 2014; Trostel, Walker & Wooley, 2002).

The second framework that is often used to analyze differences in RoREs across regions stems from the theory of equalizing differences (Rosen, 1987). A seminal work by Roback (1982) provides strong theoretical rationale for the fact that regions with relatively less favorable living conditions exhibit higher wage levels than regions with relatively more favorable conditions. Higher wages are aimed to compensate for regional disamenities and, as a result, workers in less favorable regions achieve the same utility level as workers in more favorable regions. Such a framework was further developed by Roback (1988) (also see Beeson, 1991) to allow different types of labor, in particular skilled and unskilled. As skilled workers have lower mobility costs and higher propensity to migrate than unskilled (Greenwood, 1997; Lkhagavasuren, 2014; Machin et al., 2012; Malamud & Wozniak, 2012), they are able to find regions with a better wage-(dis)amenity combination and thus receive higher wage compensations for regional disamenities than unskilled workers. As a result, the wage ratio between skilled and unskilled workers should be higher in less attractive regions than in the more attractive ones. On the other side, in regions with more pleasant conditions this ratio should be lower as skilled workers are richer and thus they are ready to spent more money on amenities which are normal or luxury goods (the so-called income elasticity hypothesis, IEH, see Broxterman & Yezer, 2015; Kim et al., 2009). Moreover, as regional (dis)amenities tend to capitalize in housing prices, the wage gap between skilled and unskilled workers should be lower in high-price regions (Black et al., 2009; Moretti, 2013).

It is worth to mention that these two frameworks have both differences and similarities. First of all, the compensating wage differentials framework (CWD henceforth) is basically a labor supply framework which is focused on the labor supply side and considers regional labor demand factors and shocks as short-run disturbing factors. In this regard, the rLS-LD framework is more general as it considers labor demand as an equal (and often a leading) 'partner' of the labor supply.

Secondly, a more substantive difference between these frameworks, which becomes more evident when one applies them to analyze differences in RoRE between regions within a country, concerns their assumptions on migration. While CWD generally proceeds from the assumption of 'absolute migration' (zero migration costs and no barriers for migration, for both skilled and unskilled workers), rLS-LD, in contrast, need to assume impediments to labor mobility, as only in this case regional differences in relative labor supply and demand may explain differences in RoREs in the long run.

Thirdly, both theoretical frameworks, at least in their original formulations, have an important limitation: they assume diminishing returns to scale, for both skilled and unskilled labor. While CWD assumes that migration raises the wage level in the sending regions and decreases it in the receiving region, rLS-LD assumes that rising relative labor supply leads to lower wage level. While in the case of unskilled labor this assumption seems to be innocent, in the case of skilled labor it may be wrong and misleading. Large literature indicates that more-educated / skilled labor may exhibit non-diminishing or even increasing returns to scale as its concentration may generate positive externalities (e.g., see review by Moretti, 2004) which may increase productivity and thus not allow wages to fall and may even lead them to rise. This should be taken into account when applying both frameworks in empirical research.

3. Data and Methodology

3.1 Data

OWS micro-data

To estimate region-specific returns to higher education in Russia we use a unique set of matched employer-employee micro-data from the Occupational Wages Survey (OWS). This survey is regularly held by the Russian Federal Statistical Agency (Rosstat) starting from 2005 one time in two years, in October. In our study we use data from six consecutive surveys of OWS (2005, 2007, 2009, 2011, 2013, and 2015).

OWS is a sample survey of employees working at large and medium Russian enterprises (having more than 15 employees) that regularly submit statistical information to the Rosstat. Almost all branches of the economy are covered except state administration, agriculture with fishery, and financial sector. The survey is representative for the whole country and for all its regions. The total number of Russian employees covered in one round exceeds 700,000; the average number of employees in a region reaches 10,000, while the minimum number exceeds 1,500 employees. Therefore, the size of regional sub-samples of OWS is far greater than that of RLMS, while for some regions the OWS sample size is comparable to the size of the *whole* RLMS sample.

OWS has the following design. At the first step, the complete list of enterprises (population) that have to submit economic and labor statistics to the Rosstat is formed separately for each Russian region. Further, each regional population of the enterprises is divided into two stratums. The first stratum includes the largest enterprises with more than 2000 employees, which are surveyed in a continuous mode. The second stratum that includes all other enterprises is stratified further by two qualitative attributes –the type of economic activity (40 stratums) and the type of ownership (2 stratums: public and private) - and one quantitative attribute –the average number of employees (no more than 6 stratums are distinguished). Then regional samples of enterprises are formed by random selection, independently from other regional samples. Finally, each enterprise selected to a regional sample selects employees to be covered by the survey. This selection is carried out randomly from the full list of employees who worked full-time and received wages in October in the reference year. The number of selected employees is proportional to the size of the enterprise.

This design implies that a relatively small number of observations in some regions does not imply large sampling errors as the population of enterprises is formed separately for each region. Another important advantage of OWS compared to population surveys is that it provides data from enterprise statistics which contain more accurate information on employees' characteristics including wages and suffers less from the under-representation of high-wage workers. The key differences between OWS and widely used in Russia population survey RLMS are summarized in Table 1.

A limitation of OWS compared to RLMS is that the former covers only large and medium enterprises and excludes three sectors: agriculture, public administration (including police and military forces), and finance. Therefore, one should be very careful in extending estimation results obtained using OWS to a regional labor markets as a whole, especially in regions where omitted industries represent a significant share of employment. It may be expected that omitting agriculture and finance leads to the underestimation of returns to education in all regions, as these two sectors represent bottom and top part of wage distribution in Russia, respectively. The question is, however, whether and to what extent this downward bias differs across regions. (In order to shed some light on this issue, we made a special empirical exercise. Its results suggest that omitting these sectors practically does not affect the ranking of regions by the rate of return and almost do not reduce the overall scale of the interregional differences in returns.).

Another feature of OWS is that employees' education is measured as the highest educational level attained. On the one hand, this complicates comparisons with studies that measure education in years. On the other hand, measuring education in levels looks more appropriate as individuals usually make decisions concerning levels of education but not years of education. Additionally, OWS data contain rich information on employees' socio-demographic and employment characteristics including age, gender, tenure, industry, occupation, enterprise size, and ownership type.

Aggregated regional-level data

At the second step of our analysis, we match regional returns to higher education estimated at the previous step with regional characteristics taken from the aggregated regional statistics collected by Rosstat (different issues of the yearbook "Regioni Rossii").

To measure the strength of regional demand for workers with higher education we use regional GDP per capita adjusted for price changes using regional indices of physical volume.

To measure the strength of relative supply of educated workers we use the ratio between the share of workers with higher education and the share of workers with secondary education in the regional labor force. Both shares are derived from Russian LFS.

Following studies on US (e.g., Black et al., 2009), we measure the relative level of (dis)amenities in Russia's regions using mean housing prices. However, as the Russian housing market is less developed and efficient than the US one, regional (dis)amenities may be not fully capitalized into housing prices, and thus cross-regional differentials in mean housing prices may poorly reflect differences in (dis)amenities. Moreover, a mean regional price may poorly represent regional housing prices due to the strong heterogeneity *within* Russian regions. Taking these considerations into account we also try three alternative generalized indicators of regional attractiveness: net migration rate (difference between in- and out-migration divided by the regional population), life expectancy at birth, and infant mortality rate. All these measures are taken from Rosstat. Descriptive statistics for all regional-level variables used in our study is presented in Table 2.

3.2. Methodology

Our empirical strategy consists of two steps. At the first step, for each year and region we estimate returns to higher education using the standard methodology based on the OLS estimation of a mincer-type wage equation (Mincer, 1974). We estimate two its specifications: basic and extended. The basic specification is:

$$Ln(W) = \alpha + \beta * Education + \gamma 1 * Exp + \gamma 2 * Exp^2 + \gamma 3 * Gender + \gamma 4 * Ln(Hours) + \varepsilon \quad (1)$$

where *Ln(W)* is ln of wage; *Education* reflects the highest level of education attained; *Exp* is worker's total labor market experience; *Gender* is dummy for gender; *Hours* is hours worked in the reference period; β, $\gamma 1$, $\gamma 2$, γ_3 and γ_4 are the corresponding slope coefficients to estimate; α *is* a constant term; ε is randomly and normally distributed errors.

Originally, J. Mincer measured education in years and estimated this equation only for annual earnings of men (Mincer, 1974). However, in hundreds of subsequent studies this equation has been estimated both separately and together for men and women; for hourly, weakly, and monthly earnings; and for education measured both in years spent and in levels (Heckman et al., 2003).

Measuring *Education* in levels has some advantages while keeping necessary connection with the theory of human capital. Firstly, the length of formal education is usually discrete. For example, in Russia, the existence of diploma of higher education means minimum 4 year of education spent at the university, while fewer years spent means the absence of diploma. Secondly, returns to an extra year of schooling is usually not the same at different levels of education (the so-called «sheepskin effect», e.g., Jaeger & Marianne, 1996).

We distinguish six levels of education: 1) higher and postgraduate education, 2) undergraduate, 3) vocational, 4) basic vocational, 5) complete secondary and 6) primary and below.[1] We are interested in the coefficient at higher education and take the workers with complete secondary education as a reference group. Therefore, the coefficient at higher education reflects the return to obtaining higher education in terms of the mean wage of workers having secondary education. Often, this coefficient is interpreted in terms of a percentage difference between mean wages of workers in the focus and reference group, relative to the mean wage of workers of the reference group (Halvorsen & Palmquist, 1980).:

[1] Originally, OWS distinguishes between primary education and no primary education. However, as the latter group is very small, we combine it with the primary education group.

$$\left(e^{\beta}-1\right)*100\% = \left(\frac{W_h}{W_s}-1\right)*100\% = \frac{W_h-W_s}{W_h}*100\% \quad (2),$$

where β is the estimate of coefficient at the higher education; W_h and W_s are average earnings of workers with higher and secondary education, respectively. The problem with Equation 2, however, is that β is not known and have to be estimated. A modification that reduces possible bias is ($e^{\beta-\frac{1}{2}Var(\beta)}-1$), where $Var(\beta)$ is an estimate of the variance of β, was suggested by Kennedy (1981). And although such an estimate is still not unbiased, the size of bias is not large (Giles, 1982; van Garderen and Shah, 2002).

We also estimate an extended version of Equation 1 that additionally includes ownership type and industry controls:

$$Ln(W) = \alpha + \beta * Education + \gamma 1 * Exp + \gamma 2 * Exp^2 + \gamma 3 * Gender + \gamma 4 * Ln(Hours) + \gamma 5 * Ownership + \gamma 6 * Industry + \varepsilon \ (3),$$

where *Ownership* is a dummy for state/private ownership of the enterprise and *Industry* reflects the industry of the enterprise (distinguished at the 1-st level of NACE).

At the second step, we regress obtained estimates of returns to higher education β on regional-level characteristics (RC):

$$\beta = \alpha + \mu * RC + \varepsilon \ (4)$$

To take into account the fact that dependent variables in Equation 4 were estimated at the first step with different level of precision, we estimate this equation using WLS (e.g., Hanushek, 1974; Lewis & Linzer, 2005; Saxonhouse, 1976).

4. Results

4.1. Returns to higher education across Russian regions

In 2015, estimating our basic wage equation (Equation 1) for the country as a whole produces the coefficient at higher education equal to 0.539, which corresponds to about 71% rate of return to higher education (relative to the average wage of workers with complete secondary education). Adding regional dummies only slightly reduces the size of return to 64.7%. Estimating Equation 1 separately for each region yields very different estimates. Fig.1 presents regional point estimates in descending order together with the boundaries of the 95% confidence intervals. Regional estimates of returns range from 0.32 in the Republic of Mordovia to 0.81 in the Tyva Republic, i.e., from about 38% to 125%. Fig.1 clearly demonstrates that these differences are statistically significant.

Estimating extended Equation 3 for the whole country yields the coefficient at the higher education equal to 0.596, which corresponds to 81.4% return to higher education. Therefore, controlling for the enterprise's ownership type and industry gives higher estimate of the return. This is not surprising as much of the university degree holders in Russia are concentrated in public sector. As in the basic specification, controlling for regional dummies slightly reduces the return from 81.4 to 78.9%. The variation in regional returns obtained from the extended equation is also huge. Fig.2 presents regional point estimates in descending order. The outsider is again the Republic of Mordovia with the rate of return equal to 0.43 (54%) and the leader is again the Tyva Republic with 0.82 (127%). In five regions including Tyva the return exceeds 100%, i.e., in these regions workers with higher education diploma receive two times higher wages than workers having only secondary education.

Overall, basic and extended wage equations produce remarkably similar rankings of Russian regions by RoRHE. Aside the Mordovia Republic among stable outsiders (bottom 10 regions in both rankings) are the Buryatia Republic, Belgorodsaya oblast', Kurskaya oblast', Tambovskaya oblast', Kaliningradlkaya oblast', and Tul'skaya obalst'. The positions of leaders are even more stable: 8 regions – the Tyva republic, the Dagestan Republic, Chukotka autonomous district, Sakhalinskaya oblast', Magadanskaya oblast', the Republic of Ingushetia, Zabaikal'skiy krai, Vologodkaya oblast', and the Altai republic - are among top 10 regions in both rankings. The correlation between two rankings is 0.93. Moscow and St. Petersburg are located at the 15th and 25th place, respectively, in the ranking based on basic wage equation and on the 31th and 37th place in the ranking based on the equation controlling for ownership type and industry.

Fig.3. presents regional returns to education (derived from the extended equation) on the map. It shows that regions with relatively low RoRHEs are concentrated in the European part of Russia, namely in the Central Federal District and neighboring with them regions of the South Federal District. At the same time, regions with relatively high returns tend to be located in the Urals (Permski krai, Sverdlovskaya oblast', Kurganskaya oblast', the Republic of Bashkiria), Siberia (especially in the South Siberia: the Tyva Republic, Zabaikalski krai, Irkutskaya oblast', the Altai Republic), Far East (Chukotka, Magadanskaya oblast', Khabarovski krai) and also in the North Caucasus (the Republics of Ingushetia, Dagestan, and Kalmykia).

It is worth to mention that our estimates of the return to higher education are substantially higher than estimates usually obtained using the RLMS data. One may expect that this difference in returns results from differences in sample composition between OWS and RLMS (remember

Table 1). Our additional exercise shows that making RLMS sample more similar to the OWS sample - by excluding enterprises with less than 15 people and belonging to industries not covered by OWS (agriculture, state administration and military, and financial sector) - makes RLMS estimates closer to the OWS ones. Taking into account that OWS data are derived from enterprise statistics and are regionally representative, the estimates of regional RoRHEs using these data seem to us more reliable than the estimates using RLMS, at least for the formal sector.

Dynamics

Fig.4 shows the dynamics of country-level estimates of returns to higher education from 2005 to 2015. Estimates derived from the basic specification slightly increase over time. On the contrary, estimates derived from the extended specification exhibit a declining trend. As a result, the gap between these two estimates shortens. A possible reason behind this trend is decreasing public-private wage gap due to large minimum wage increases and implementation of the so-called “May presidential decrees” (e.g., Gimpelson et al., 2015). Declining public-private wage gap means that the concentration of highly educated workers in the public sector less understates the overall rate of return to higher education.

Were these country-level trends in RoRHE homogenous across Russian regions? Fig.5 juxtaposes coefficients at the higher education obtained in 2005 with those obtained in 2015 across all regions. In the majority of Russian regions (64 out of 78) RoRHEs declined, similar to the changes occurred at the country-level. The largest decline in RoRHE took place in the Republic of Adygeya where it dropped from 138% to 71%. At the same time, in 14 out of 78 regions the rate of return has increased. The largest increase happened in Saint-Petersburg where the return jumped from 57% to 78.6%. The strong and negative correlation (-0.71) between the change in return from 2005 and 2015 and the level of return in 2005 implies that in initially high-return regions the return has declined more than in initially low-returns regions. In order words, in the period from 2005 to 2015 Russian regions converged in RoRHEs (beta-convergence). A similar impression of convergence (sigma-convergence) gives the dynamics of regional variation in returns in time (see Fig.6).

4.2. What drives returns to higher education?

In this section we present and discuss empirical results of the second step of our analysis where estimated regional RoRHEs are regressed on regional-level characteristics. We begin with results on regional characteristics suggested by the relative labor supply-labor demand framework. As Table 3 shows, returns obtained from basic mincerian equation (Equation 1) are positively related to both regional GDPs per capita and to the relative stock of workers with higher education. When returns obtained from the extended specification (Equation 3) are used as dependent variables, regional GRP per capita become insignificant. This is not surprising as regional GRP is strongly related to the regional economic structure, while returns from extended equation are already adjusted for this factor. The positive relationship between return to higher education and the relative stock of workers with higher education suggest positive externalities from skilled labor.

Next, we evaluated the relationship between regional RoRHEs and regional characteristics suggested by the compensating differences framework. Contrary to studies on US, we do not find regional returns are related to mean housing prices (see Table 4). Either regional (dis)amenities are poorly capitalized in housing prices due to inefficient and underdeveloped housing market, or the mean regional housing price is a poor indicator of regional housing prices. [2] All alternative generalized indicators of regional (dis)amenities except life expectancy are also insignificant, while life expectancy is positively related to regional RoRHEs, which, at first glance, completely contradicts the expectations of the theory of compensating differences.

However, to interpret this result appropriately one should remember that our regressions control for regional fixed effects which include, among other factors, fixed regional (dis)amenities related to regional geography and climate (e.g., mean temperature, sunny days, precipitation, proximity to the sea, etc.). If regions with less favorable geo-climatic conditions exhibit lower life expectancy (which is arguably true in the Russia case), then controlling for these conditions raises estimated coefficient at life expectancy. Estimation results without regional fixed effected (see Table 5) confirm this logic: not only life expectancy but also two other measures of regional attractiveness for living – infant mortality and net migration rates – become statistically significant and have expected signs.

Finally, we estimated a specification that combines regional characteristics suggested by both theoretical frameworks. As Table 6 shows, when returns from the basic equation are used as dependent variables, all factors - regional GDP per capita, H-to-S ratio, and life expectancy - keep their statistical significance and positive association with returns. When returns from the basic equation are used, regional GDP per capita expectedly loses its statistical significance, while two other factors keep their significance and sign.

5. Summary and Conclusion

[2] It also possible that rent prices may serve as a better indicator of regional level amenities than housing prices (see Winters, 2009) but, unfortunately, cross-regional data on these prices are not available in Russia.

In this paper, we first estimated returns to higher education in Russia at the level of 78 regions – subject of the Russian Federation. We found that regional variation in returns is very substantial: estimates range from 40%-50% to 125%, while the return estimated at the country level is about 70-80%. Such a regional variation calls into question the standard country-level approach to estimate returns to education which appears to be, at a minimum, not informative, or, at most, misleading.

At the second step, we regressed region-specific estimates of returns on a few regional-level characteristics. We found that both demand and supply factors are responsible for the regional variation in returns to higher education in Russia. An interesting result here is that the regional rate of return is positively related to the relative stock of educated workers in the region, which suggests that skilled labor supply creates positive externalities. Another finding is that regional rate of returns to higher education are negatively related to regional (dis)amenities level measured through life expectancy in the region, which is in line with the theory of compensating differences framework and existing studies on Russia.

Overall, our findings illustrate the extent to which country-level approach may mask and oversimplify the reality and may have implications for studies trying to understand factors driving variation in returns to education across different countries.

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Figure 1. Point estimates of coefficients at the higher education with their 95% confidence intervals across Russian regions in 2015 (using basic equation).

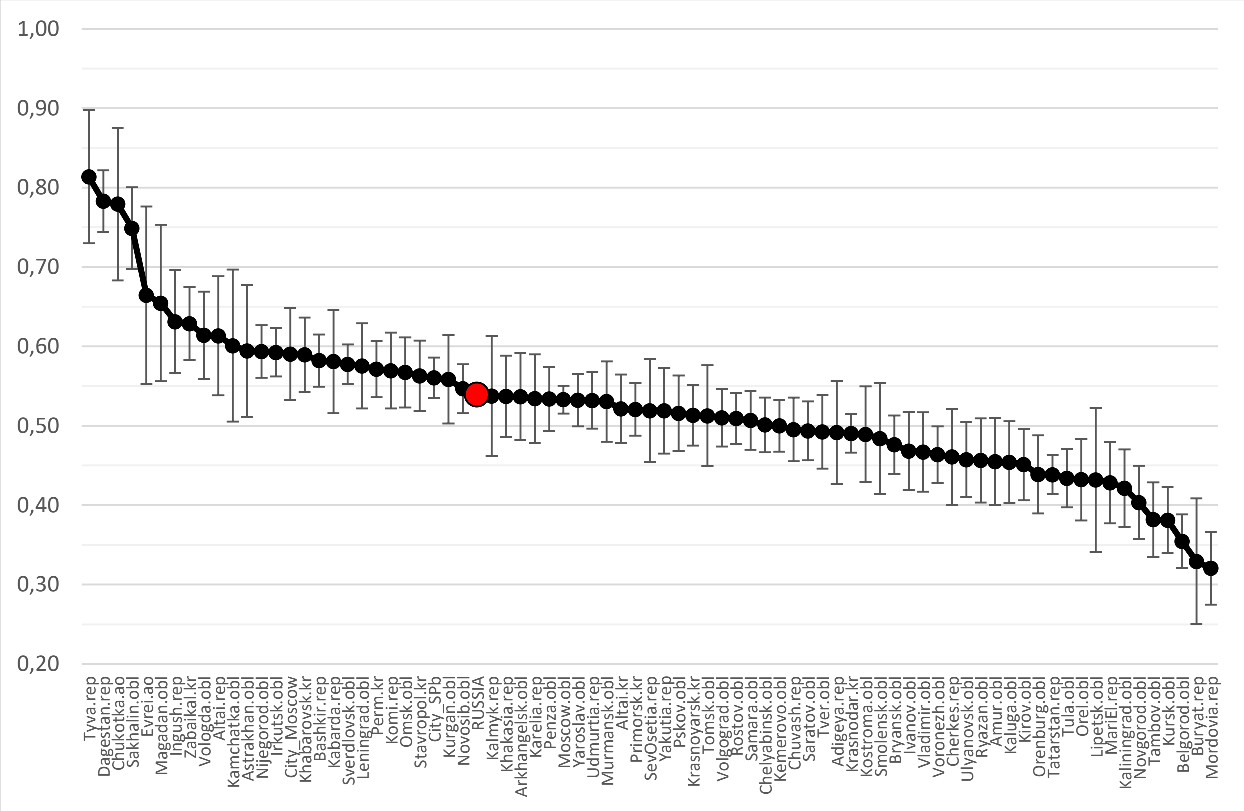

Figure 2. Point estimates of coefficients at the higher education (with their 95% confidence intervals) across Russian regions in 2015 (using extended equation).

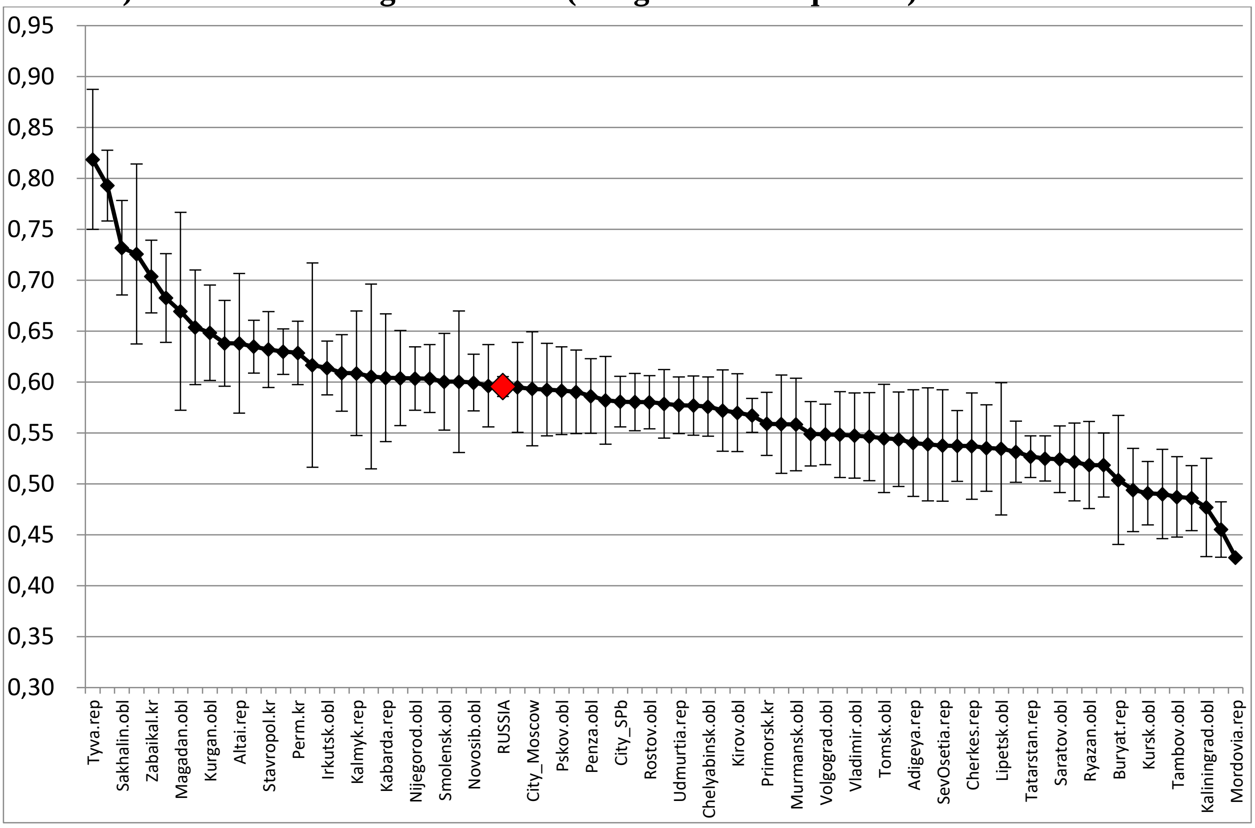

Figure 3. Choropleth map of returns to higher education (based on extended equation) across Russian regions in 2015.

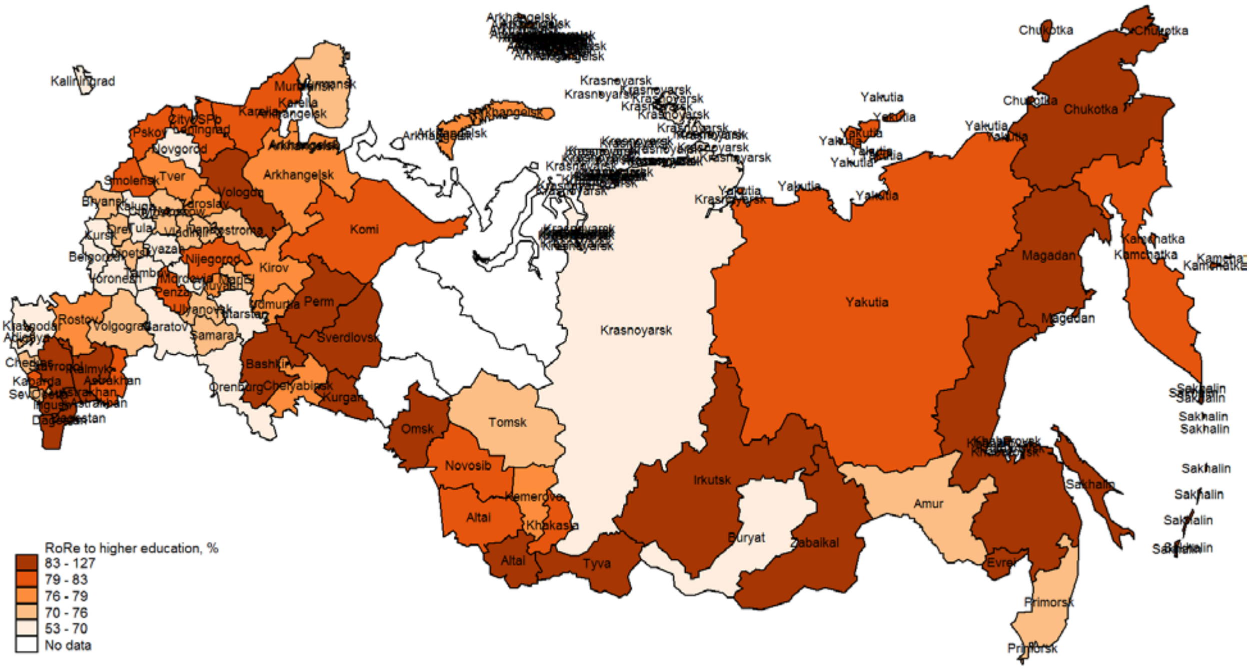

Figure 4. Returns to higher education at the country level, OWS data, 2005-2015.

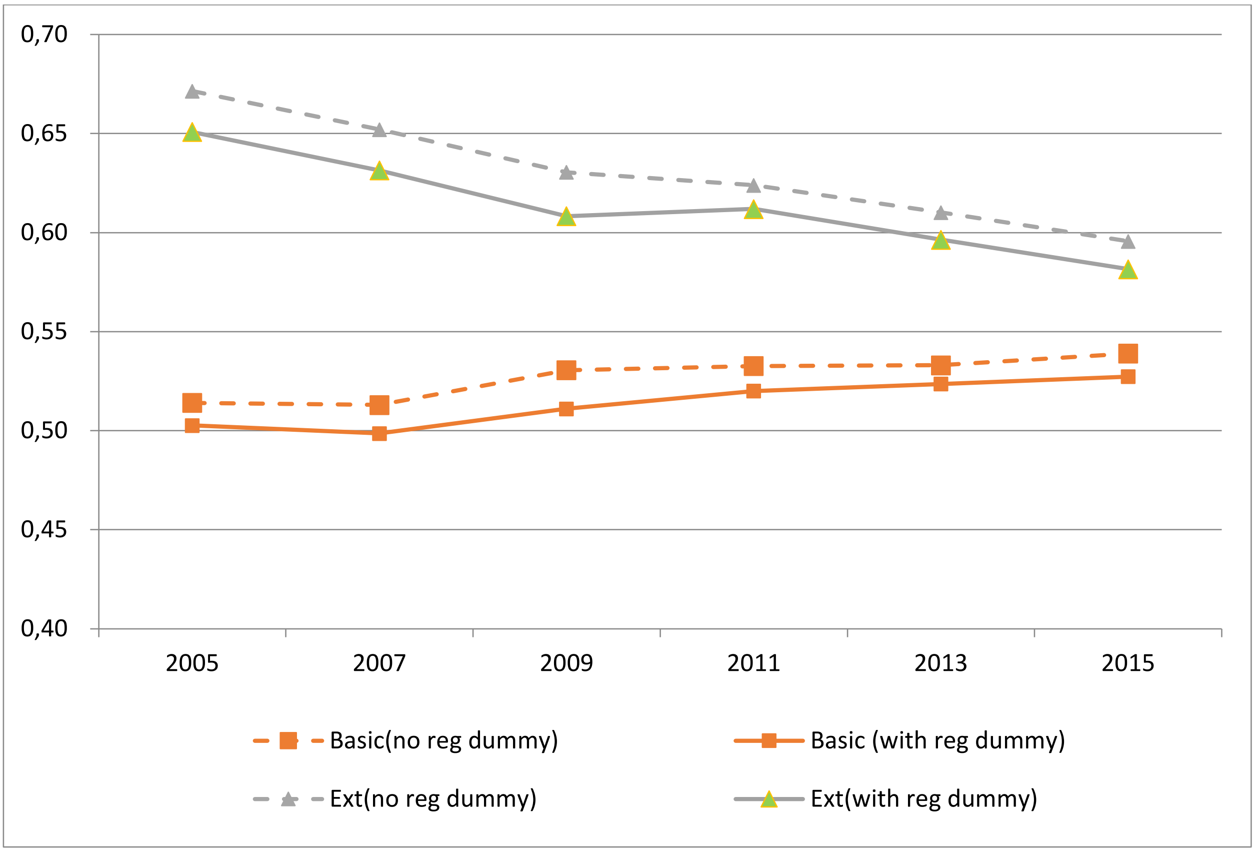

Figure 5. Returns to higher education across Russian regions in 2005 and 2015, OWS data

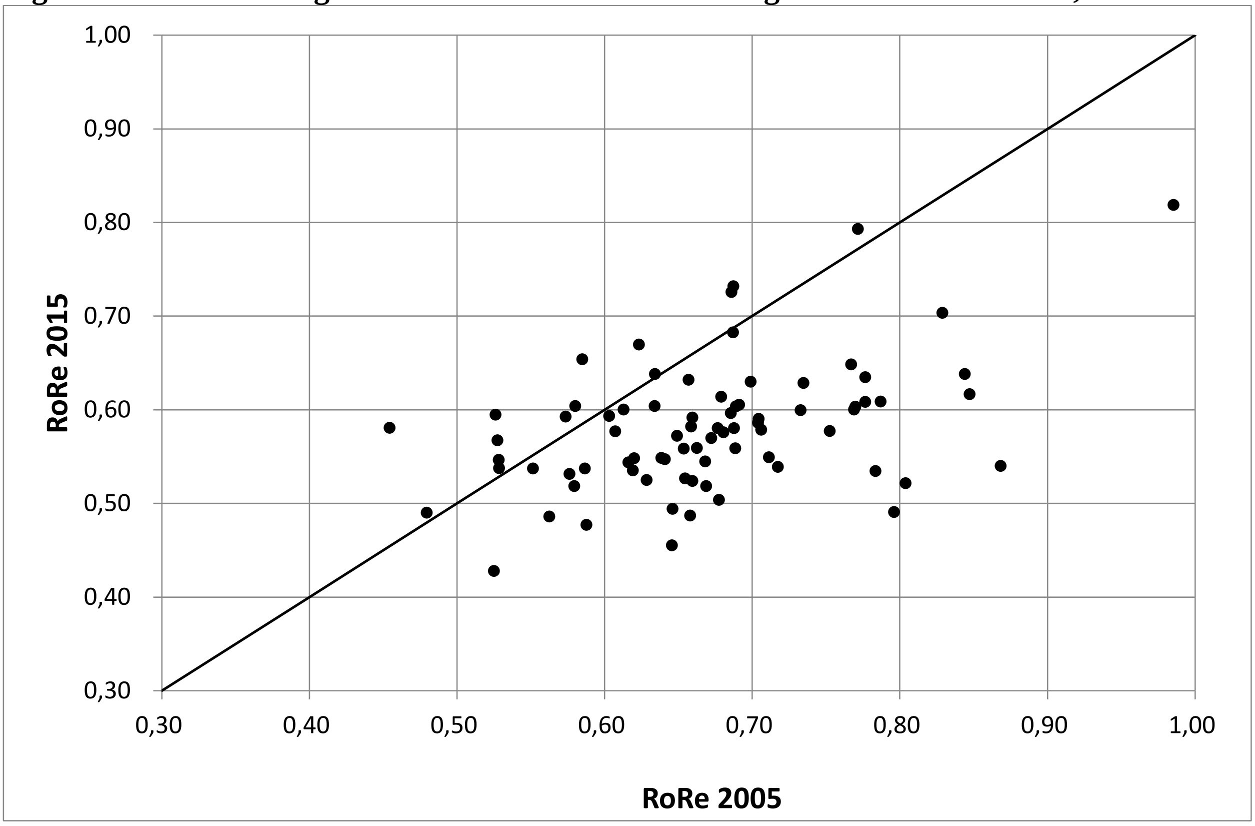

Figure 6. Regional variation in returns to higher education in time, OWS data.

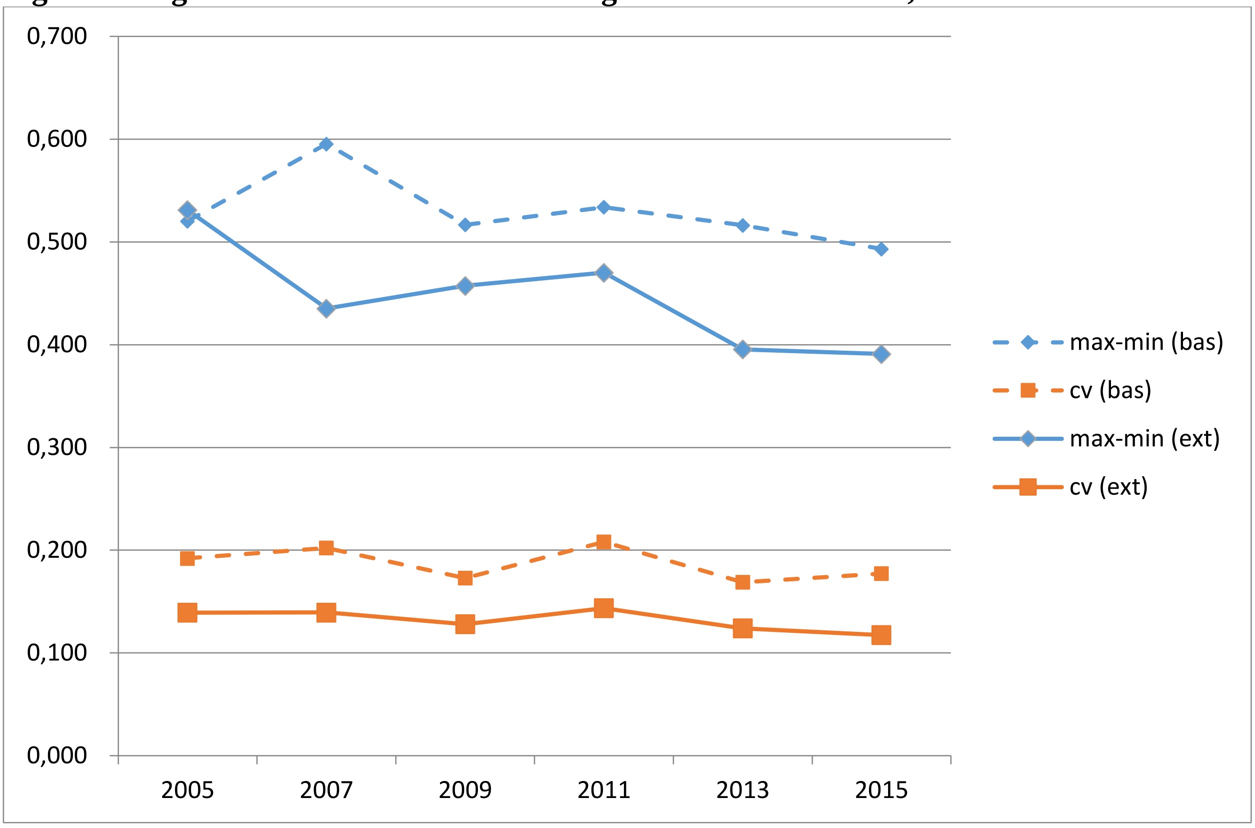

Table 1. Key differences between RLMS and OWS.

Feature	RLMS	OWS
Source of data	Population survey	Enterprise statistics
Representativeness	Representative for the whole country	Representative for the whole country as well as for all its regions
Enterprise size coverage	All, including self-employment	Large and medium enterprises
Industry coverage	All	All except agriculture, public administration, and finance
Sample size	Around 20,000	>700,000

Table 2. Descriptive statistics for regional-level variables used in the paper.

Variable	N	Mean	Std. Dev.	Min	Max
Beta estimate (bas)	468	0.522	0.098	0.281	0.877
Beta estimate (ext)	468	0.620	0.088	0.390	0.985
real GDP per cap (Rub)	468	22284	12057	3338	76737
% of LF with higher education	468	25.7	5.6	14.3	49.7
% of LF with secondary education	468	22.6	5.9	6.6	46.8
H-to-S ratio	468	1.25	0.67	0.44	7.21
Housing price (Rub for 1 sq. m)	462*	38216	19293	8556	187743
Infant mortality rate (per 1 000 infants born)	468	8.8	3.1	3.3	25.7
Net migration rate (per 10 000 citizens)	468	-7.8	61.2	-499	216
Life expectancy at birth (years)	468	68.0	3.4	55.8	80.1

Note: * information on housing prices is not available for the Chukotka autonomous district.

Table 3. RoRHEs, regional GDPs, and relative supply of workers with higher education.

	DV: RoRHEs from basic specification			DV: RoRHEs from extended specification		
	1	2	3	4	5	6
real GDP per cap (ln)	0,119*		0,137**	0,061		0,079
	(0,066)		(0,067)	(0,067)		(0,067)
H-to-S ratio		0,026**	0,029***		0,027**	0,029***
		(0,011)	(0,010)		(0,010)	(0,010)
cons	-0,650	0,486***	-0,854	0,054	0,624***	-0,144
	(0,649)	(0,016)	(0,663)	(0,654)	(0,017)	(0,657)
N	468	468	468	468	468	468
r2	0,687	0,687	0,696	0,698	0,704	0,708

note: *** p<0.01, ** p<0.05, * p<0.1. WLS estimates. Standard errors robust to heteroscedasticity and clusterization are in parentheses. Regional and years fixed effects are controlled. H-to-S ratio is the ratio between the number of people with higher education and number of people with secondary education in the regional labor force.

Table 4. RoRHEs and generalized indicators of regional (dis)amenities (controlling for region fixed effects).

	DV: RoRHEs from basic specification				DV: RoRHEs from extended specification			
	1	2	3	4	5	6	7	8
ln_price_house	-0,006				0,014			
	(0,022)				(0,021)			
life_exp		0,013***				0,017***		
		(0,005)				(0,004)		
mlad			0,003				0,003	
			(0,004)				(0,004)	
k_migr				0,000				0,000
				(0,000)				(0,000)
_cons	0,568***	-0,345	0,476***	0,512***	0,516**	-0,442	0,620***	0,651***
	(0,214)	(0,329)	(0,053)	(0,010)	(0,207)	(0,284)	(0,049)	(0,011)
N	462	468	468	468	462	468	468	468
r2	0,680	0,687	0,682	0,681	0,697	0,708	0,697	0,696

note: *** p<0.01, ** p<0.05, * p<0.1. WLS estimates. Standard errors robust to heteroscedasticity and clusterization are in parentheses. Region and year fixed effects are controlled.

Table 5. RoRHEs and generalized indicators of regional (dis)amenities (not controlling for region fixed effects).

	DV: RoRHEs from basic specification				DV: RoRHEs from extended specification			
	1	2	3	4	5	6	7	8
housing price (ln)	0,034*				0,000			
	(0,020)				(0,020)			
life expectancy at birth		-0,009**				-0,012***		
		(0,004)				(0,003)		
infant mortality rate			0,011***				0,010***	
			(0,003)				(0,003)	
net migration rate				-0,000***				-0,000***
				(0,000)				(0,000)
cons	0,176	1,119***	0,391***	0,512***	0,649***	1,403***	0,541***	0,655***
	(0,198)	(0,247)	(0,036)	(0,010)	(0,188)	(0,183)	(0,035)	(0,010)
N	462	468	468	468	462	468	468	468
r2	0,023	0,071	0,076	0,055	0,125	0,235	0,197	0,230

note: *** p<0.01, ** p<0.05, * p<0.1. WLS estimates. Standard errors robust to heteroscedasticity and clusterization are in parentheses. Year fixed effects are controlled.

Table 6. RoRHEs, regional GDPs, relative supply of workers with higher education, and life expectancy.

	DV: RoRHEs from basic equation	DV: RoRHEs from extended equation
real GDP per cap (ln)	0,164**	0,109
	(0,069)	(0,067)
H-to-S ratio	0,026**	0,025**
	(0,010)	(0,010)
life expectancy at birth	0,015**	0,018***
	(0,006)	(0,005)
cons	-2,100**	-1,584*
	(0,903)	(0,854)
N	468	468
r2	0,704	0,721

note: *** p<0.01, ** p<0.05, * p<0.1. WLS estimates. Standard errors robust to heteroscedasticity and clusterization are in parentheses. Regional and years fixed effects are controlled. H-to-S ratio is the ratio between the number of people with higher education and number of people with secondary education in the regional labor force.