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## Quality of Education as a Neighborhood Characteristic Determining Housing Prices: Evidence from Moscow City

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*The study reviews pricing models in the real estate market of Moscow, which include the quality of education provided at local schools, as well as attempts to estimate the impact made by education quality on the apartment prices. The paper reveals significant dependence between apartment prices and quality of education provided at schools assigned to the residence houses. Availability of a private school significantly affects the apartment price.*

*Keywords: education quality, social environment, housing prices.*

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### Introduction

There is a famous saying, according to which housing prices are defined by three basic characteristics: location, location, location (Hayes and Taylor, 1996). Economists see this formula only as a slight exaggeration, as, according to multiple researches, those are the basic characteristics of accommodation and its location, i.e. social environment, that usually substantiate the major part of the realty price. Housing prices tend to be lower in places with higher property tax, and higher in the districts with lower crime rate. Housing prices decrease as transport costs increase, and they rise with the improvement of environment, i.e. with the decrease in air pollution. A monetary bonus is paid for houses built near municipal parks and park belts, while houses near the

city dump or the industrial zone are sold with discounts.

There is also an idea that the quality of education provided at local schools may be one of the key factors determining the price of accommodation in the surrounding district or a large agglomeration. Education is the key determinant of social development; therefore, access to schools providing education services of better quality is relevant for many households (Updegrave, 2003)

The present work analyses the connection between the public school education quality and the real estate market prices. Hypothetically, one may suggest that the higher the school education quality, the higher is the accommodation price in the nearby house, while other characteristics remain the same. A natural question that arises

is whether it is possible to do a quantitative assessment of the impact made by school education factor on apartment prices. To answer this question, it requires to find an appropriate method of measuring the education quality first.

The present article is a sequel to the previous article (Chugunov, 2012), applying a hedonic method-based approach. In (Chugunov, 2012) it was manifested that the presence of a high quality public school in the surroundings does not make a significant impact on the apartment prices. However, the impact was claimed to be more significant for non-state (private) schools. The present work considers the results of previous researches on the assessment of the education quality impact on residence realty price: it introduces corrections into the previously described model, reviews the factors constituting the model, including education quality evaluation factors.

The research based on the data of the North-West Administrative Okrug (hereinafter NWAO) of Moscow demonstrates, that the quality of school remains a significant territorial characteristic in the accommodation price formation. Introducing various methods of measuring school education quality, the research proved, that the quality of education provided at schools assigned to the houses does matter for apartment buyers. The increase of quality indicator per one standard deviation increases the apartment price by up to 1.3 per cent. The scope of this effect is comparable with the rates calculated for France, constituting a little less than 2 % (Fack, Grenet 2010), but still lower than those of the USA and Great Britain.

According to the analysis results, access to a non-state (private) school, or presence of such schools within the social environment, is one of the significant factors determining the price of residence realty in the city of Moscow. Apartments located closer to private schools cost approximately 3-4 % more.

The present article is structured as follows. Section 1 is a review of existing literature on the issue of applying hedonic methods to the assessment of residence realty prices and of the influence the education quality makes on its cost. Section 2 contains data description. Section 3 provides a model of price formation and introduces some results. The conclusion formulates the final results and describes their practical applicability.

### 1. Literature review

The methods based on the revealed preferences are aimed at the analysis of individuals' behaviour in the markets of goods, related to a certain commodity in this or that way. One of such methods is the *hedonic method*, based on the analysis of commodity markets or production factors from the point of view of their connection to certain objects of the social environment. It is used to determine a difference in the cost of property (for example, an apartment or a house) in the districts with different social characteristics, or to assess the readiness of people to pay for the improvement of such characteristics, i.e. get an economic evaluation of such an improvement's cost.

The concept of hedonic prices was developed for the real estate market analysis and, at first, was exclusively applied to real estate economy. Among works using hedonic approach for the evaluation of real estate in the USA, the most famous are (Haas, 1922) in Minnesota, 1916-1919; (Bailey et al., 1963) in Saint Luis, 1937-1959; (Witte et al., 1979), based on the theory developed by (Rosen, 1974) in North Carolina, 1972; (Milton et al., 1984) in Florida; and (Mills, Simenauer, 1996) in several states of the USA, 1986-1992. Among works on European real estate it is important to mention the following: (Bender et al., 1994) in Geneva, 1978-1992; (Lansink, Thijssen, 1998) in the Netherlands, 1970-1988; (Maurer et al., 2004)

in Paris, 1990-1999; and (van Soest, Verbeek, 2010) in Moscow, 1994 and 1996.

In Russian theory of real estate economy the differentiation of urban apartment prices is explained by typical accommodation characteristics, such as floor area, type of construction, distance to the city centre or a municipal entity, the floor on which the apartment is located, presence of a balcony and an elevator (Magnus, Peresetskiy, 2010). It is also observed that a significant contribution into apartment price diversification is made by the distance to bus stops and metropolitan stations.

Later, the hedonic price method gained great momentum in the related sectors of economy, including economy of education. Hedonic approach implies, that residence royalty (no matter whether the subject matter is a house or an apartment) may be presented not only as a set of its internal properties (number and area of rooms, number of bathrooms, presence of a balcony, distance to downtown etc.), but also as a quality of its environment (air and water pollution, noise), as a beautiful view from the window, closeness to a park or a river, access to entertainment facilities (parks, theatres, cinemas), public health establishments, shops, malls etc.

In their attempts to determine the influence made by school quality on the cost of nearby houses, researchers face a number of challenges. They need to solve a series of additional tasks, including those concerning the problem of school quality assessment and determination of the schools forming the social environment of a certain house or an apartment.

The problem of quality assessment is associated with the challenge of determining school quality criteria (infrastructure, equipment, teaching programs, staff qualification) separately from the quality of its contingent. However, there are some reasons to suppose, that parents are

guided by various ratings based on school test results when choosing a school for their child (Black, 1999; Figlio and Lucas, 2004; Hastings et al., 2007). For this reason, sometimes school quality assessment is carried out with the test score on one or two subjects, usually mathematics and reading (Haurin and Brasington, 1996; Hayes and Taylor, 1996; Bogard and Cromwell, 1997; Black, 1999; Cheshire and Sheppard, 2004). It is important to keep in mind, that such records are often correlated with the social and demographic properties of students and their families, such as race and wealth (Hanushek, 1997; Bischoff, 2008; Chiodo, Hernandez-Murillo and Owyang, 2010). Therefore, reference variables should be thoroughly selected. The problem of multicollinearity may significantly complicate distinguishing between the effect caused by school quality from other factors influencing real estate prices.

Some researches, instead of using the student test score itself, operate indexes based on such (Davidoff and Leigh, 2007; Fack, Grenet, 2010). Usually these indexes are standardized by dividing each school's score by a corresponding standard sampling deviation. Practically, test score is transformed into mean square deviation value.

In addition to the school quality assessment problem, there exists a series of problems of defining school districts. The majority of authors do not go into detail explaining, how they outline school districts in their works or do not provide any definition of such. In some works, the approach of "nearby schools" is used, i.e. the regression equation includes characteristics of the schools situated closer to the residential houses than others (Cheshire and Sheppard, 2004). The authors using the present approach tend to remark, that, as the administrative territorial division does not always coincide with the school district division, the use of such an approach does

not raise the problem of shifts and does not make a relevant impact on the authenticity of results. This statement is confirmed by the research results presented in (Bogart and Cromwell, 2000), proving that the access to nearby schools makes a significant effect on the local accommodation price.

Coming to the question, which types and kinds of schools are to be included into the analysis, the researchers' opinions vary. Some of them remark a little effect caused by senior high schools and a major effect caused by elementary schools (Weimer and Wolkoff, 2001). On the opposite, others claim that secondary schools make a greater impact on accommodation prices than elementary ones (Cheshire and Sheppard, 2004). Meanwhile, there are researchers who insist that it is required to study the overall effect caused by various types of schools (Chiodo et al., 2010).

How much does the education quality influence accommodation prices? In foreign countries researchers have been studying this problem for several decades. Table 1 shows the results of some researches carried out in different countries (Australia, Great Britain, USA and France). For the compatibility of results, the effect made by school quality was converted into a general indicator, which is percentage-based influence of improvement per one standard deviation of education quality on the residential realty price. In general, in Great Britain the values of such influence are less for secondary schools (0.05 and 2 per cent), while the influence of elementary school quality varies from 2.1 to 10 per cent with the median value of 4 per cent. For the USA, the value varies from 1 to 14 per cent with the mean value of 5 per cent. In Australia the school quality is evaluated as 3.5 per cent of influence made on residential realty price, while in France this figure fluctuates from 1.4 to 2.4 per cent.

## 2. Methodology and research data

For the evaluation of the influence made by school quality on the real estate price in Moscow with the help of hedonic method, it was necessary to create a database of the analysed apartments and the schools located nearby. If the data on the apartments for sale are open to public access and are usually published on the real estate agency websites, the school data are usually closed. Information on the results of the Unified State Examination for the years 2010-2012 in the territory was kindly furnished by the Education Department for the North-Western Administrative Okrug of Moscow, thereby determining the geography of the research.

### 2.1 North-Western Administrative Okrug of Moscow

The North-Western Administrative Okrug is one of 12 administrative okrugs of Moscow. It encompasses 8 districts of the capital: Shchukino, Khoroshyovo-Mnyovniki, Pokrovskoe-Streshnevo, Strogino, Severnoye and Yuzhnoye Tushino, Mitino and Kurkino.

According to the data provided by the Government of Moscow, the population of the Okrug counts up to 805,4 thousand people<sup>1</sup>, which is comparable with the population of such Russian cities as Saratov and Krasnodar (827 and 834 thousand people correspondingly)<sup>2</sup>. The North-Western Administrative Okrug occupies the territory of 93,93 sq.km (8,6 % of the whole territory of Moscow)<sup>3</sup>, which is approximately equal to the areas of Lisbon or Copenhagen (84 and 88 sq.km correspondingly). The comparatively large area of the Okrug and the development level of Moscow real estate market provide the opportunity to use the hedonic method to the evaluation of the influence made by school quality factor on the NWAO residence realty market.

In its indicators of living comfort, NWAO is one of the three leaders of Moscow. Over

Table 1. Researches of the effect made by school education quality of residential realty prices (*effect expressed as influence made by one standard deviation in education quality on residential realty price*)

Research	Effect	Sampling	Education quality indicator
Australia			
Davidoff and Leigh (2007)	3,5 %	Secondary schools located in the capital territories of Australia	Semester test scores of 12 classes
Great Britain			
Cheshire and Sheppard (2002)	2.1 %	Elementary schools of Reading (England)	Share of 11 year old students passing the standardized final second-grade testing (3-6 forms) (mean value of tests in mathematics, English and science)
Cheshire and Sheppard (2002)	0.05%	Secondary schools of Reading (England)	Share of 15 year old students graded above “C” on at least five subjects in their secondary education certificates.
Gibbons and Machin (2003)	from 3% to 10%	Elementary schools of England	Share of 11 year old students passing the standardized final second-grade testing (3-6 forms) (mean value of tests in mathematics, English and science)
Gibbons and Machin (2006)	4%	Elementary schools of Greater London	Share of 11 year old students passing the standardized final second-grade testing (3-6 forms) (mean value of tests in mathematics, English and science)
Rosenthal (2003)	2%	Secondary schools of England	Share of 15 year old students graded above “C” on at least five subjects in their secondary education certificates.
USA			
Bayer, Ferreira and McMillan (2003)	2.4%	Schools of San-Francisco (USA)	Average test score for mathematics, literature and writing of 4 <sup>th</sup> , 8 <sup>th</sup> and 10 <sup>th</sup> forms
Black (1999)	2.5%	Elementary schools of Boston, USA	Average 3-year test score for mathematics and reading of 4 <sup>th</sup> forms (Massachusetts Education quality assessment program)
Downes and Zabel (2002)	14%	Secondary schools of Chicago, USA	Average district/ school score in reading of 8 <sup>th</sup> forms (Illinois Education quality assessment program)
Kane, Staiger, and Reigg (2005)	10%	Elementary schools of North Carolina, USA	3-5 forms’ mathematics and reading test results
Reback (2005)	from 3.8% to 7.7%	Elementary and secondary schools of Minnesota, USA	Index based on results of tests carried out in 3-10 <sup>th</sup> forms of 7 Minnesota districts
Weimer and Wolkoff, (2001)	from 1.0% to 8.3%	Elementary schools of Monroe, USA	English exam results of 4 forms
France			
Fack , Grenet (2010)	from 1.4% to 2.4%	Public and budget-funded non-state schools of Paris	Average score of the final secondary school exam. Ratio of the number of students continuing school education to the number of students entering vocational schools
Russia			
Chugunov (2014) ( <i>present research</i> )	from 0,3% to 1,3%	State and private schools of one district in Moscow	Average score of Unified State Examination in Russian language and mathematics

Source: Davidoff and Leigh (2007); results of the author’s review

40 % of the Okrug territory is occupied by large natural objects, such as water ponds and woodlands; there are lakes and small rivers. The average cost of 1 m<sup>2</sup> of residence realty in the pre-owned market of Moscow is around 160 thousand roubles (6-8 % higher than the average Moscow price)<sup>4</sup>. The most expensive accommodation in NWAO is that located in Khoroshevo-Mnyovniki and Shchukino (1 m<sup>2</sup> in the pre-owned market here costs 10-12 % higher than the district average), and the cheapest accommodation is in Mitino and Kurkino, located outside Moscow Ring Road, and Yuzhnoe Tushino. 84 % of houses in the NWAO are economy class accommodation, 16 % is business class, and elite housing constitutes less than 1 % of the real estate fund<sup>5</sup>.

The price of 1 m<sup>2</sup> of residence realty in the new buildings of the NWAO varies depending on the category of the house, district and construction state: from 135-140 thousand rub. (economy class in Mitino) to 300 thousand rub. (ready business-class accommodation in Shchukino and Khoroshevo-Mnyovniki). The majority of new buildings of the NWAO are in-situ brick houses of business class category.

### 2.2 Data on the NWAO real estate market

The database was based on the information on the apartment supply for April-May 2013. The database was complemented with the data for the

year 2010, collected in the approximately the same season analysed in (Chugunov, 2010). The data originated from databases of the most popular real estate agencies published on their websites ([www.cian.ru](http://www.cian.ru), [www.sob.ru](http://www.sob.ru), <http://kvartira.miel.ru/> etc.). All mentioned prices are supply prices, and they were used as the information on actual deal prices was not accessible. The database encompasses the offers of both primary and pre-owned markets.

The initial data contained 714 (354 for 2010 and 360 for 2013) observations on one-, two-, three-, four-room and larger apartments. The major part of the sampling is two- and three-room apartments (see Table 2), then followed by one-room and larger apartments of four rooms and more.

The information on the sold apartments included the following characteristics: address, total floor area of the apartment, useful floor area, kitchen area, floor of location, total number of floors in the house, type of construction, and name of the nearest metropolitan station.

**Factor selection rationale.** The floor on which the apartment is located and the total number of floors are both significant factors influencing the apartment price. Thus, the price of absolutely identical apartments located on different floors of the same house may be considerably different from each other. It is especially relevant for the ground floor and last floor apartments. Ground floor is considered

Table 2. Distribution of apartments by years and number of rooms

Number of rooms	2010	2013	Total
1	18.0%	24.1%	21.6%
2	34.4%	32.4%	33.2%
3	34.0%	32.4%	33.0%
Over 4	13.5%	11.2%	12.2%

Source: author

to be the least safe; it may also suffer of the noises produced by the elevator or the entrance door, unpleasant smells in the event of the basement isolation failure. The floors may be cold and the residents may suffer from the lack of privacy, as anyone can see the insides of the rooms through the windows. The ground floor apartments usually cost 10 % less than the same apartments located on other floors<sup>6</sup>. The last floor apartments are also a little cheaper (by 3-5 %)<sup>7</sup>. The last floor may also suffer of the mechanic elevator noises; the roof insulation failure may lead to leaks, and insufficient lagging may result in stuffiness and heat. To consider the ground and last floors' apartments, we introduce a "fictitious" LASTFLOOR variable.

In Moscow apartment prices are much influenced by the distance to the nearest metro station. To consider it, we introduce a new METRO variable which stands for the distance to the nearest metropolitan station.

Apartment price also depends on the material the house is made of. Different materials are usually divided into two groups: (i) the first group includes pre-engineered and bearing-wall houses; (ii) the second group includes brick, "Stalin", jointless houses.

To consider the value appreciation of apartments within the period of 2010-2013, the temporal ("fictitious") variable was introduced for the apartments put up for sale in 2013.

**Apartment database preparation.** Before using the data for calculation, they need to be ensured from misprints and mistakes. All the evident misprints, such as "kitchen area: 1 m<sup>2</sup>", or "floor < 0" were deleted, as they present impossible information. Moreover, the data were filtered pursuant to the following requirements:

- *Total floor area > 25.* If the total floor area of a one-room flat is under 25 m<sup>2</sup>, it is very likely that it is a so-called "hotel-

room type flat", which is the category not encompassed by the present research.

- *Useful area > 10.* It is hard to imagine a one-room apartment with the room area under 10 m<sup>2</sup>.
- *Kitchen area > 5.* The kitchen area under 5 m<sup>2</sup> may either denote a "hotel-room type flat" or be a misprint.
- *Non-residential area > 6.* It is unlikely that the corridor and the bathroom take up less than 6 m<sup>2</sup>.

With this filter, 130 items were removed from the total sampling, the database decreasing from 714 to 584 items. This "filtered" database was used for further analysis.

### 2.3 NWAO school data

**Current educational network.** The territory of the Okrug provides 110 schools and 133 pre-school educational institutions<sup>8</sup>. The network of educational institutions of various types and sorts, present in the Okrug today, provides easy access to high quality education for all categories of young students. A significant share of educational institutions available within the NWAO offers high-level education, mostly demanded by the local population: there are 7 gymnasiums, 3 lyceums, 12 schools specializing in certain subjects. All schools of the Okrug carry out profession-oriented and pre-profile training of students.

**School enrolment rules.** According to the current legislation, general education in Russia is compulsory and generally accessible<sup>9</sup>. The right of priority enrolment is enjoyed by citizens resident in the houses located nearby the educational institution<sup>10,11,12</sup>. The address list of territorial assignment of residence estates to educational institutions<sup>13</sup> is published on the website of Education Department of Moscow. A school may refuse to enrol a student only if it has no vacant places left. There are no entrance

exams for school enrolment. However, state and non-state schools offering advanced or profile studies of some subjects may introduce entrance exams for certain forms and grades.

**Education quality.** In the present work the indicator of school efficiency is the results of Unified State Examination (USE) obtained by school students in the academic years 2010/2011, 2011/2012 and 2012/2013. The selection of USE results as educational quality indicator is explained by the fact, that since the year 2009 all schools of the Russian Federation carry out essential exams in two subjects, mathematics and Russian language<sup>14</sup>, which serve as a unified assessment value for the knowledge of secondary school graduates. One of the evident advantages of USE is the unified difficulty level of the test materials for all the examined students and the opportunity of independent evaluation of the education level that it ensures. These factors let us consider USE to be the fairest of all available tools of education quality assessment.

Based on the USE data, the list of education quality indicators (indexes) was compiled: the

average score of each school was unified by dividing it by the root-mean-square deviation for all of the NWAO schools. Later the obtained school indicators were averaged out year-wise:

$$I_{MATH_i} = \sum_j^{n=3} \frac{MATH_{ij}}{SD_{MATH_j}} / n$$

where MATH is the mean math USE score of school  $I$  in the academic year  $j$ ,  $SD_{MATH_j}$  is the root-mean-square deviation of the math test score in the academic year  $j$  for all the NWAO schools.

**School database.** From the compiled list of schools (110 educational institutions), we selected those, where in the years 2010-2012 at least 10 people took the USE exam in mathematics and Russian language, and which provided the test results for all the three years. In the NWAO, there were 90 of such general education institutions, including 6 private ones. Later, for each of the schools its actual address was recorded, formatted as: *postal code, street, building, block*.

Table 3. List of abbreviations used in the research

LOGPRICE	apartment price logarithm (in roubles)
ROOMS	number of rooms
ROOM_AREA	logarithm of one average residential room area, ratio of useful area to the number of rooms (in sq. m)
KTCH/AREA	ratio of the kitchen area to the total floor area
YEAR2013	“fictitious” variable for the apartment sale date: (2013 – 1)
MATERIAL	construction material of the house where the apartment is located (0 – pre-engineered and bearing-wall houses; 1 – brick, in-situ houses).
FLOOR	floor where the apartment is located
LASTFLOOR	first and last floors (“fictitious” variable)
METRO	logarithm of distance from the nearest metro station (in meters)
RUS	education quality index: USE in Russian language
MATH	education quality index: USE in mathematics
PRIVATE	presence of a non-state (private) school in the surroundings (“fictitious” variable)
CONST	constant

#### 2.4 Assignment of schools to houses

According to the method suggested by (Black, 1999), the research was focused on the houses situated within walking distance from the school, in so-called “school localities”. The borders of such localities were established as the walking distance radius, or 1000 meters. In order to “bind” schools to houses within the walking distance radius, the geocoding method was used. Such method ascribes geographical latitude and longitude to physical objects. This way geographical coordinates of all apartments and schools from the database were obtained. Next, distances between the apartments and schools were calculated. Similarly, distances between the apartments and the nearest metro stations were calculated.

After all the distances between schools and apartments were obtained, the data for the apartment-school combinations were sorted in ascending order; those matching the walking distance radius of 1000 m were selected. If within the radius of 1 km several schools were found, then several pairs of schools and apartments were

formed. The number of items in the final database was 3235. The descriptive statistics of research variables is shown in Table 4 below.

#### 2.5 Model

In the present work, the hedonic method is used for extraction the part of the real estate price conditioned by the factor of nearby schools’ quality. Thus, buying an accommodation in a good neighbourhood with highly developed infrastructure, the population bears additional cost for purchasing the access to such advantages. Consequently, the research studies the readiness of individuals to pay for the access to better education. The traditional hedonic function of price, describing the balance between the real estate price  $p$  and its components, looks as follows:

$$\log(p_{ij}) = a + \beta_1 X_i + \beta_2 Z_j,$$

where  $(p_{ij})$  is the price of residence realty  $i$  in the district  $j$ . Vector  $X_i$  presents comparative (structural) characteristics of the residence realty

Table 4. Descriptive statistics of research variables

	Mean	Std. Dev.	Min	Max	Number of variables equal to 1 (fictitious variables)
LOGPRICE	6.98	0.21	6.6	8.1	
ROOMS	2.36	1.03	1	11	
ROOM_AREA	17.07	4.75	7.8	75	
KTCH/AREA	0.16	0.05	0.05	0.44	
YEAR2013	0.58	0.49	0	1	1861
MATERIAL	0.24	0.43	0	1	789
FLOOR	7.02	5.33	1	32	
LASTFLOOR	0.20	0.40	0	1	655
METRO	2.92	0.33	1.91	3.85	
RUS	10.13	0.93	7.88	13.09	
MATH	6.80	0.84	4.97	9.71	
PRIVATE	0.24	0.43	0	1	775

Source: calculations by author

$i$  (for example, number of rooms, total and useful areas of its premises etc.), while vector  $Z_j$  presents the characteristics of social environment of the district  $j$ .

The effect of realty cost change due to the difference in schools' quality is usually determined with the multiple regression method. There is a series of requirements applied to the factors included into econometric models. Firstly, such factor needs to be theoretically substantiated. Secondly, it is sensible to include only the major factors making significant impact on the studied indicators. At the same time, the total number of factors used in a model shall not exceed 1/3 of the total number of the sampling items. Thirdly, the factors shall not be linearly dependent; such dependence means, that they characterize the same properties of the studied phenomenon. Inclusion of linearly interdependent factors into the model leads to the emergence of multicollinearity, which negatively affects the model quality. Fourthly, one model may not include the cumulative factor and the component factors that compose it. Simultaneous inclusion of such factors leads to undue increased impact on the dependent indicator, i.e. to the distortion of the real situation.

The hedonic function for accommodation prices, used in the current work, is the following:

$$\ln(p_{iaj}) = a + \beta_1 X_i + \beta_2 Q_a + P + \varepsilon_{iaj},$$

where  $(p_{iaj})$  is the price of residence realty  $i$  in the district  $j$  with the nearby school  $a$ . The vector  $X_i$  presents comparative (structural) characteristics of the residence realty  $i$  (for example, number of rooms, total and useful area of the apartment etc.), and vector  $Q_a$  characterizes the quality of the school  $a$  located in the district  $j$ , and  $\varepsilon_{iaj}$  is a constant. As a proxy, the model was also complemented with the fictitious variable  $P$  which acquires value

of 1, if within the social environment of the apartment a private school is located, i.e. there is a private school available within the radius of 1 km from the apartment.

Later, a regression analysis of equations with successive inclusion of one education quality index ascribed to the nearby school is carried out. There were at least two reasons for including school quality indicators into the equations. Firstly, it was important to ensure that each of the indicators made a relevant impact on the realty costs under other equal conditions. Secondly, the USE results are strongly correlated with each other (the correlation coefficient equals to 0,88), which would lead to multicorrelation and a negative effect on the evaluated model quality if all the variables had been included simultaneously into one equation.

There is a reason to suggest, that the only schools that make difference for the apartment residents are the schools, territorially assigned to their houses, as the access to schools, present in the social environment but not bound to their house, may be restricted. In order to study the influence of such territorial ascription of schools to residential houses a regressive analysis of equations, considering the quality of education provided at the "assigned" schools, was performed.

Real estate prices depend on a number of other factors which are not considered in the present research as relevant: local environment, beautiful view from the window, security of the territory, quality of construction and decoration and many others. Cumulative influence of these factors is expressed by the constant value of the assessed equations.

### 3. Empirical results

#### 3.1 Interpretation of the regression results

Table 5 presents the results of the equation evaluation carried out with the least squares

Table 5. Regressions' results: dependent variable – price logarithm

	All sampling (state and private secondary schools of general education)		"Assigned" school and non-state educational establishments		Only "assigned" schools	
Constant	6.164***	6.186***	6.073***	6.106***	6.069***	6.113***
ROOMS	.177***	.177***	.173***	.173***	.171***	.171***
ROOM_AREA	.012***	.013***	.012***	.012***	.011***	.011***
KTCH/AREA	.608***	.610***	.678***	.680***	.634***	.639***
YEAR2013	.069***	.069***	.067***	.067***	.058***	.058***
MATERIAL	.096***	.096***	.096***	.094***	.098***	.096***
FLOOR	.005***	.005***	.007***	.007***	.007***	.007***
LASTFLOOR	-.078***	-.078***	-.083***	-.085***	-.080***	-.083***
METRO	-.018***	-.018***	-.013*	-.012*	-.007*	-.007*
RUS	.004**		.012**		.013**	
MATH		.003*		.013**		.013*
PRIVATE	.035***	.034***	0.031***	.034***	.037***	.039***
Number of obs	3235	3235	685	685	533	533
Adj R-squared	0.82	0.82	0.83	0.83	0.83	0.83
* statistically significant coefficient at the significance point of 0.01						
** statistically significant coefficient at the significance point of 0.05						
*** statistically significant coefficient at the significance point of 0.1						

Source: calculations by author

method. The analysis proved the hypotheses on the influence of the internal characteristics of the apartment on its price. The main determinants of the apartment price are its floor area and the number of rooms. The location floor also makes its contribution to the general cost: apartments located on the ground and the last floor cost in the average 8 % less than others, and the costs increase by, averagely, 0.5 %-0.7 % for each higher floor. Distance to the nearest metropolitan station makes a negative dependence with the prices. The difference in the prices of two identical apartments, located, for example, 100 and 1000 meters away from the station, may count up to 18 % of their price.

The hypotheses on the influence made by the education quality of nearby schools on the apartment price were also proved. Moreover, for

all the schools located within 1 km radius from the house, the effect constituted 0.3-0.4 per cent of the apartment price, while for the schools territorially assigned to residential blocks, the effect composed up to 1.3 per cent.

It is also interesting that accommodation buyers are ready to pay extra for the access to non-state (private) schools, i.e. for their presence in the social environment. According to the research results, the price of apartments is 3-4 % higher, if they are located close to a private school.

### 3.1 Analysis of the obtained results

According to the obtained results, urban citizens are not indifferent to the quality of education provided at the nearby educational institutions as they choose accommodation and the district where it is located. The access

to public schools providing better services of education explains up to 1.3 per cent of the apartment cost variation. In other words, the increase in the quality of education provided at a school, territorially assigned to a residential estate, per one square deviation (SD), increases the price of an apartment, located in such estate, by 1.3 per cent, or by 150 thousand roubles in the standing prices for the year 2013. Considering, that the spread in values constitutes up to 6 SD, the difference in the prices of two identical apartments, one of which is situated closer to a “better”, and another to a “worse” school, may count up to 900 thousand roubles.

Besides, today the non-state sector of educational services lives under market rules. According to the results of the research made for financially stable individuals, among significant factors of choosing accommodation there is an access to a private school, i.e. the presence of such in the neighbourhood.

Today private schools attract more and more interest of parents. Choosing a private school for their child, they regard it as an opportunity to provide them with better education, more attention of teachers and educators, interesting and useful leisure. Private school advantages are not only in the comfort of facilities, less number of children in one class, better qualification of teachers, healthy nutrition and appropriate medical service, but also in the absence of children from dysfunctional families. Almost all private schools

have a multilevel structure and, besides a school, include a kindergarten attached. Together they constitute an integrated system of continuous education. Moreover, many private schools have contracts with higher educational institutions (for example, the International Secondary School of General Education “Integration XXI Century” is a base school for National Research University – Higher School of Economics, which provides a guarantee for a child to be submitted to a university after graduation).

Making a decision to purchase some accommodation, individuals choose to pay extra for the access to a private school which may count up to 3.1-3.9 % of the total cost of the apartment. For the prices of 2013, this extra constitutes 340-430 thousand roubles, which is comparable with at least one year of tuition at a private school (see Table 6).

### Conclusion

Applying hedonic model to the real estate pricing model, the current research was focused on the influence made by the quality of education, provided at local schools, on the cost of apartments in the city of Moscow. The results witness, that the accommodation buyers are not only perfectly aware of the differences in the school education quality, but also demonstrate their preferences in favour of better schools, paying extra for living closer to them. The analysis also suggests that the extra paid for the

Table 6. Tuition fees of non-state (private) schools of NWAO

Title of the educational institution	Yearly tuition fee for 2013/2014
“Integration XXI Century” School ( <i>Moscow, NWAO</i> )	490 000 roubles
“Juvenes” School ( <i>Moscow, NWAO</i> )	405 000–450 000 roubles per year ( <i>depending on a class</i> )
Waldorf School “Family Harmony” (“Semeynyy Lad”) ( <i>Moscow, NWAO</i> )	234 000 roubles

Source: information published on the official school websites

school education quality is a constituent part of the residence realty cost.

However, the greatest value for the residence realty buyers is created not by all the schools, but only by those territorially assigned to the house where the apartment is located. The increase of the education quality of such a school by one root square deviation increases the price of the apartment by 1.3 per cent, or by 150 thousand roubles in the comparable prices for the year 2013.

A significant factor determining the residence realty cost is an access to a non-state (private) school, which means the presence of such in the social environment. According to the analysis results, the apartments, located closer to private schools, cost by approximately 3-4 per cent higher. For the prices of the year 2013 such extra equals to 340-430 thousand roubles, which is comparable to the cost of minimum one year of tuition at such a private school.

The obtained results may be used in various fields of economy. First of all, the immediate scope of their use is the real estate market itself. The quantitatively determined information on the influence made by education quality factor on realty prices may correct the behaviour of all market participants, such as, buyers, sellers,

property company agents etc. The obtained results may be of more value for construction companies and for city administration.

The evaluation of the influence made by school education quality factor may be used for further development of economic methods of education quality evaluation, which measures readiness of the population to pay for higher quality education. Consideration of school quality factor while shaping up the land market is a tool for implementation of new economic policy in the cities, based on the sensible combination of economic and educational principles in the urban land use.

Leasing of buildings to private school administrators, i.e. opening non-state schools in the neighbourhood may make a positive impact on other factors of the social environment, on the general welfare of the district and the accommodation costs. At the same time, construction of “elite” or expensive accommodation makes more sense in the districts, where a private school is already present, and the social environment is on a higher development stage. This aspect is important for both issuing permissions for accommodation construction by the municipal property administrators, and for choosing sites by construction companies.

<sup>1</sup> <http://www.mos.ru/authority/structure/szao/>

<sup>2</sup> City Population — Statistics & Maps of the Major Cities, Agglomerations & Administrative Divisions for all Countries of the World // [http://citypopulation.de/Sweden-Mun.html#Stadt\\_gross](http://citypopulation.de/Sweden-Mun.html#Stadt_gross)

<sup>3</sup> <http://www.mos.ru/authority/structure/szao/>

<sup>4</sup> Real estate in North-Western Administrative Okrug // <http://www.russianrealty.ru/>

<sup>5</sup> Ibid.

<sup>6</sup> Factors influencing accommodation costs. URL: <http://www.royale-estate.ru/>

<sup>7</sup> Ibid.

<sup>8</sup> Introductory page on the Education Department of the North-Western Okrug of Moscow // <http://schools.techno.ru/szo/str-viz.htm>

<sup>9</sup> Constitution of the Russian Federation as of December 12, 1993.

<sup>10</sup> Houses located nearby from educational institutions are the houses within the availability radius, which is under 0,5 km of walking distance.

<sup>11</sup> Besides, the priority right for enrollment to the first grade is granted to orphans and children deprived of parental care; children from multi-child families; children who have brothers and sisters studying in the educational institution etc.

<sup>12</sup> Decree of the Education Department of Moscow No. 712 dated November 12, 2012.

<sup>13</sup> [http://obrmos.ru/dop/docs/prikr/docs\\_prikr\\_dom\\_ZAO\\_1\\_5.html#](http://obrmos.ru/dop/docs/prikr/docs_prikr_dom_ZAO_1_5.html#)

<sup>14</sup> Law of the Russian Federation No. 3266-1 “On Education” dated 10.07.1992 (rev. 27.12.2009). Federal Law No.125-FZ “On Higher and Post-Graduate Professional Education” dated 22.08.1996 (rev. 02.02.2011).

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## **Качество образования как фактор социального окружения, определяющий стоимость жилой недвижимости: на примере г. Москвы**

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*В статье рассматриваются модели ценообразования на рынке недвижимости г. Москвы, включающие факторы, характеризующие качество образования, предоставляемого в местных школах, и делается попытка количественно оценить влияние качества образования на стоимость квартир. Установлена значимая связь между ценой квартиры и качеством образования, предоставляемого в школах, закрепленных за жилыми домами. Большое влияние на цену квартиры также оказывает наличие вблизи дома негосударственной (частной) школы.*

*Ключевые слова: качество образования, школьное образование, социальное окружение, стоимость жилья.*

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