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Analysis of Potential "Bubble" on Russia's Real Estate Market[1]

Since 2000 onward the real estate market prices were steadily growing in Russia. Most obviously this situation was true of the Moscow region where from 2005 till mid-2008 housing market price index went up 3-3.5 fold. At the same time, at the outset of 2004 the real estate market price growth, in particular, housing market prices, significantly outstripped in rate terms both the inflation rate and the real personal income rate. This gap was most noticeable in the largest Russian cities, especially in Moscow and St. Petersburg. In different periods of time similar course of events was observed on real estate markets in many developed countries, for example, in the US, Japan, Great Britain and Spain. However, in spite of the fact that externally these events take similar course, their origins, as a rule, significantly differ from one another. For example, in the US housing demand and consequently housing market price growth in mid- end of 1980s was explained by changes in the fiscal policy and tax breaks for the majority of households, where in Japan the monetary policy implemented by the authorities played a major role.

On the one hand, it is commonly supposed that housing price hikes observed in Russia to a large extent are explained by the growth of demand on the part of population which was determined by the real income growth and stable economic development in the circumstances where there was a limited housing supply, prolonged periods of construction and projects cost recovery, shortage of plots for the development or lack of infrastructure facilities such as plots of land. In this event we can talk about a sustainable market structure change which with time should lead to redistribution of demand and supply flows, which in the future, perhaps, would result in the growth of suburbs of large cities and satellite towns.

On the other hand, there is a belief that a so called price "bubble" is feasible on the real estate market where higher-than-anticipated growth of prices is explained by a speculative demand on housing. If there is such price "bubble" then its burst will negatively affect the general economic situation.

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[1] This paper has been written on the basis of publication by S. Drobyshevsky et. all. "Analysis of Potential "Bubble" on Russia's Real Estate Market". Moscow, IET, 2009, Working Papers № 128.

Approaches and Methods of Analysis of Real Estate Market

At the beginning, let us look at the theoretical approaches which describe different mechanisms of price effect on the real estate and other factors. As a rule, housing supply is considered fixed in short-term that is why housing prices are determined by the real estate demand dynamics. The majority of publications pay attention to the effect of expectations demand in the interest rate developments, inflation rates and proper real estate prices, as well as interaction between behavior and choice of agents with tax system and credit institutions, namely rights of obtaining and repayment of mortgage loans.

Ranney's article (*Ranney, 1981*) is dedicated to the analysis of mortgage lending effect (where there is an initial installment) on current prices and housing demand in the assumption that economic agents have absolute foresight regarding future developments on the real estate market, in particular regarding price fluctuations. Theoretical model is build on the basis of the consumption model, namely, two-period model of the life cycle, where during the first period the agent works and has a chance to accumulate savings, and during the second period he retires and only then spends his wealth accumulated during the first period. It is also assumed that the real estate supply, prices on other goods as well as other assets' yield remains fixed during the life time of the agents. Moreover, it is assumed that mortgage lending rate exceeds household savings yield.

The author studies behavior of the four types of economic agents. Among the first type are those agents who spend all their initial savings on repayment of the initial installment on mortgage credit. It should be assumed that within this type of the economy these are least wealthy agents or those agents who to a greater extent value comforts supplied by housing. Among the second type are those agents who spend only part of their savings on house purchase but resort to mortgage lending. Among the third type are those agents who do not resort to mortgage lending but all their initial savings they spend on house purchase, to be exact, they buy as bigger house as they can afford without resorting to loans. Among the last, fourth type are the wealthiest or the less appreciating housing services agents, namely, those who, first, do not resort to mortgage lending, and second, their savings are in the positive immediately after the house purchase.

Following the article's logic, let's analyze changes of partial equilibrium on the real estate market under a subsequent housing price growth.

It is assumed that housing supply is fixed and indefinitely divisible, supply of other goods is absolutely elastic, i.e. price changes on housing do not affect other goods and services' prices as well as on the type of agent. Moreover, as aforementioned agents have

absolute foresight regarding subsequent price growth. Let us our start with the simplest case, i.e. with the analysis of the fourth type agents' behavior.

In the event where credit is not used Ranney considers that agents will be neutral to the future price growth and as before will be choosing such point of consumption where housing yield and alternative investments' yield will be equal. It is shown that expected price growth leads to the following three results: first, initial price growth is equal to the given price growth in the future; second, utility and consumption are invariable; third, general savings levels decrease.

The situation is similar in the event of second type agents. It is shown that anticipated price growth also leads to the current housing price growth, however, to a lesser extent than in the event of fourth type, as well as to an increase in the housing demand. In the event of first and second type agents, anticipated price change does not affect the decision about the size of house purchase, because in the first case all available funds are spent on the initial installment, and in the third – on the purchase of the entire house. Thus, if there is no housing demand growth in the current period than the prices are initially permanent.

It is worth noting that conclusions are drawn for each case parting from an assumption that the economy consists of any one type of agent. In reality, it is most likely that there will be some separation of agents at their financial potential and preferences. That is why the market will always react with current price growth to the anticipated future price increase. However, it will grow at a lower magnitude than given at the current time anticipated price due to the availability of mortgage lending market.

Schwab (*Schwab, 1983)* has analyzed the effect of anticipated inflation change to the housing demand within the life cycle model and has studied in detail the real estate market distortions generated by the mortgage lending imperfection. The author has no aim to test his findings by means of empirical data. However, presented in the article model is worthy of notice because it represents one more possible approach to the analysis of the housing demand behavior.

In order to estimate the effect of anticipated inflation on the housing demand, Schwab spreads out the effect of inflation change into two effects: income and substitution. It is demonstrated in the publication that the aggregate substitution effect should be negative. In an assumption that consumers can not resort to credits except to purchase houses, it is shown that income effect will also have a minus sign. Thus, due to negativity of both effects consumer demand on housing falls under the anticipated inflation growth.

Schwab applies imitation method for further development of the model.[2] He explains his choice, first, by the fact that the offered model is correct only for those consumers for whom limitation of markets' perfection is important and it would be difficult to single them out. Second, in practice anticipated inflation growth has also different consequences. For example, reduction of real costs on housekeeping after taxes. Moreover, some consumers can view house purchase as an insurance against anticipated inflation. When using the imitation model, one can derive "net" results from offered proposals.

In the course of the imitation model analysis, Schwab has shown that granting perfect capital markets, the consumer will be buying housing of larger size than in the event of the standard mortgage lending system. He also has calculated the elasticity of demand for housing at different factors. The results of these calculations are presented in *Table 1*.

Table 1

Elasticity of Demand for Housing

Elasticity of demand for housing at anticipated inflation	–0.211
Elasticity of demand for housing at real interest rate[3]	–0.562

As proceeds from *Table 1* the elasticity of demand for housing at anticipated inflation rates is negative, but, nevertheless, is lower at absolute value than elasticity at real interest rate. Thus, Schwab arrives to the following conclusions. First, housing demand is not only a function of real variables, but can be distorted due to changes in the anticipated inflation rates and capital markets imperfection including mortgage lending market. In order to avoid distortions, it is necessary to introduce mortgage lending system which takes into account price fluctuations. Second, according to suggested imitation housing demand at anticipated inflation and real interest rate differ significantly. Reacting to the real interest rate growth, the consumer will be reducing demand on housing stronger than in response to the anticipated inflation growth.

Schwab has not checked his findings by means of empirical data explaining it by the fact that they most likely will be observed only under very strict premises. However, a number of other authors whose works have been studied further on have tested some of the

[2] For this aim Schwab defines a function (utility function) for consumer and his budget constraints which include exogenous shocks and their anticipations. Further, the consumer solves his problem by evaluating his current and future possibilities including anticipated inflation and mortgage lending interest rate.

[3] During simulations it was assumed that nominal interest rate numerically was equal to the sum of real interest rate and inflation rates, in which connection real interest rate in this model is an exogenous value.

suggested hypotheses by means of actual data including a hypothesis about a distorting effect of the anticipated inflation on housing demand under fixed nominal rates.

In particular, within a model which belongs to the asset-market model and which analyzes the real estate market, Poterba (*Poterba, 1984*) analyzes the effect of the anticipated inflation fluctuations on the real property prices and on the equilibrium volume of the real estate fund in the economy. Under the term of real estate he understands private housing. In particular, special attention is paid to real estate users' costs and their change due to anticipated inflation fluctuations and nominal interest rates fluctuations under different taxing schemes of taxation of income, property as well as granting tax interest deductions.

According to the US tax legislation, paying off a mortgage credit interest is not income taxed, that is why higher nominal interest rates (for example, due to high inflation) result in the fact that real expenses on house maintenance are falling and, consequently, house purchase becomes more profitable in relation to purchase of other types of assets. It is assumed that by purchasing a house people equalize marginal utility obtained from housing services consumption with the costs.

In order to formally suggest this presumption, Poterba introduces the following assumption. First, all houses are subject to wear and require maintenance and running repair expenses; second, real estate is subject to taxation according to some fixed rate; third, all economic agents are subject to the income tax and they are allowed tax-deductibility of the mortgage interest and the property tax payments. Moreover, individuals may take and loan any amount of liquidity. When taking decisions, the individuals equate house maintenance marginal costs with marginal benefits of housing services.

Housing demand is modeled in the article parting from an assumption that the current housing price is present value of the future services cost discounted by interest rate taking taxation into account. The real estate market supply depends on the housing prices (it is assumed that construction is absolutely competitive). Having determined the equilibrium values of prices and housing stock, Poterba starts analyzing the anticipated inflation effect on the housing market.

At the beginning he studies equilibrium parameters change under anticipated inflation fluctuations. In equilibrium relative housing prices are constant because the housing supply is constant. In the event of inflation shocks, according to author's calculations, user cost of housing will be decreasing is nominal interest rates in response to the inflation growth will grow at a lower then 1 or 1/3% in response to a percent of the inflation growth. In order to test whether it is so in reality, Poterba suggests estimating sensitivity of the nominal

interest rate to the inflation in the economy. Potential evaluation method is provided in the article, analyzing rates on short-term and mortgage lending rate, i.e. long-term credits, as well as correspondingly short-term and long-term anticipated inflation.

Poterba assumes that the long-term interest rates directly affect the individuals decision-taking regarding housing purchase, meanwhile short-term rates should be selected in such a way that they should satisfy the condition of arbitrage absence, in other words, homeownership income in each period should be equal to other assets ownership income. With regard to housing this assertion seems doubtful because it obviously underestimates the fact that, first, housing per se if a consumer good and, second, it is much less liquid than the majority of assets. Another Poterba's observation that the short-term interest rate may affect the individual's decision whether to purchase a house during this period or in the future period seems more logical.

In order to analyze real estate market dynamics and possible ways for coming into equilibrium, Poterba studies a system of equations setting real prices and housing volumes.

He studies a case with reduction of user cost of housing for households which leads to the demand growth on housing services and, as a result, to the real price growth. Within the offered model under some shock the market will be coming into the new equilibrium, meanwhile in the short-term the housing volume remains fixed, that is why the real prices should reach the new, higher value in order for the system to come to the new equilibrium. This case conforms to the rational expectations of the economic agents. Where economic agents' expectations are adapted or are static, in other words, the housing volume is assumed to be fixed, then immediately after the shock is over the economy passes into the new equilibrium which is characterized by higher real prices than in the event of rational expectations.

Thus, the aforementioned model offers a mechanism which explains price fluctuations on the real estate market which are conditioned, first of all, by the changes taken in the agents' expectations regarding future inflation. In order to check by means of empirical data, Poterba has resorted to the demand function estimate on housing done in publication (*Rosen, 1979*), and estimated the housing supply function as the investment function into the houses construction in the following specification:

$$INV_t = \beta_0 + \beta_1 Q_t + \beta_2 QN_t + \beta_3 W_t + \beta_4 Credit_t + \varepsilon_t ,$$

where Q – effective real prices on "constant quality" housing, in other words, these prices take into account costs incurred by the constructor during the period between home construction and its sale; QN – prices on alternative real estate, i.e. not for habitation; W –

average salary in the construction industry; *Credit* – variable characterizing credit accessibility.

By way of variable characterizing investments, the author used investments into housing construction and their share in GDP. Moreover, in order to consider the fact that housing construction requires time, Poterba substituted variables Q and QN with their anticipated values, and the lags of these variables used as the instruments in estimation.

In the derived estimates, investment elasticity at real price Q amounted from 0.5 to 2.3 depending on the specification, moreover, coefficient in QN has also proved to be significant and negative, as is presumed in theory. It is also worth noting that coefficient in *Credit* is significant and positive and its introduction into regression greatly improves its quality. Thus, Poterba draws a conclusion that the accessibility of loans, first of all, affects the housing supply and not the demand side.

As a result, derived estimates were used in order to estimate within aforementioned model the influence of changes in expectations regarding future inflation under different income tax rates. Here are findings received by Poterba only for the case where the income tax rate $\theta = 0{,}25$ and all changes are indicated in percent from the initial level *(Table 2)*.

Table 2

	Anticipated inflation changes, in %			
	0–0.02	0–0.05	0–0.08	0.03–0.09
Price change under static expectations	8.3	23.8	44.4	35.3
Price change under rational expectations	5.1	13.6	23.4	18.7
Equilibrium price change	2.7	7.4	13.1	10.6
Equilibrium modification of the market volume	5.5	15.3	27.8	22.3

In such a way, derived findings testify in favor of the proposed real estate market theory. Moreover, according to this findings price fluctuations on this market including cases of rapid price hikes with their subsequent reduction can be explained by the changes in the agents' expectations regarding future inflation in the economy. Highest price fluctuations will be observed in case of static agents' expectations regarding housing supply, i.e. such when the agents assume the housing market volume to be fixed. In the event where the agents are aware of a possible increase in the market volume, the price growth will be less. This model feature can serve as an explanation of the fact that in different regions and cities housing prices grow

disproportionately. For instance, where inhabitants consider their city densely built-over, then, most likely, in this kind of cities anticipated inflation prices will grow faster than in the cities where there are still enough areas for development, in other words, where housing supply increase is feasible.

The article by Kearl (*Kearl, 1979*) shows that inflation even in case where agents command absolute anticipation quality regarding its future value may lead to distortions of relative prices on housing and correspondingly affect agents' decisions regarding housing purchase and capital saving. Inflation is not neutral in relation to the real variables due to a number of constraints imposed by the US legislation on the mortgage lending, namely, due to constant nominal mortgage payments.

Main idea of the article consists in the following: where the economy awaits inflation rates growth, then mortgage lending rates (as, thought, all other too) will grow even now because the banks are prohibited to change the volume of nominal payments during the loan repayment term. In this event, the household by purchasing a house even now is forced to carry on a larger burden of credit repayments both in real and in nominal terms, meanwhile its income in nominal terms grows only in subsequent periods in accordance with inflation. This results in the fact that during present period a household is forced to save more in order to make first deposit and make payments on the mortgage credit and consequently consume less. Thus, constant nature of the nominal payments and inflation, where expectations regarding its future values are correct, affects the volume of initial payments, contracts duration and potential risks due to mortgage lending. Kearl's main idea consists in that these negative effects increase real user cost of housing which leads to a reduction in demand and fall of relative prices on housing. Moreover, decrease of relative prices on housing results in the fact that this sector becomes less attractive to investors, in other words construction rates of new homes slide.

The article presents an equilibrium model for the real estate market. It is assumed that households make a demand not for the proper dwelling but for the housing services. In other words, features inherent in the real estate as a good are coming to the foreground. Supply of these services (housing stock) is fixed in the short-term period. Thus, one may consider that precisely demand is responsible for the equilibrium marker prices.

According to this article, housing demand, i.e. on housing services, may be presented as a function from the price on services provided by housing (for example, rent price) disposable income, prices on other goods and services, as well as specific characteristics of

households. On the other hand, real estate acts as an asset and here the demand, most likely, will be influenced by its relative yield.

It is assumed that distortions introduced by inflation are reflected in the real estate attractiveness as means for maintaining wealth. In Kearl's judgment, the initial deposit represents a parameter which is mostly responsible for these distortions. Moreover, Kearl points out that the credit repayment period also may affect the housing demand. This statement he supports with the following arguments. Under an extension of the credit repayment period, on the one hand, periodical credit payments decrease, on the other hand, under inflation repayments during subsequent periods falls in real terms, i.e. under higher inflation effective periods of the credit repayments diminish.

Housing supply is determined by the volume of investments into housing construction. Moreover, current construction activity in no way affects current real estate prices. From these assumptions Kearl draws a conclusion that although demand is absolutely elastic in the housing construction sector, contrary to it, supply of real estate stock is absolutely inelastic at present prices.

The article does not provide joint study of these equations and search for equilibrium or analysis of external shocks. One may say that demand function on the real estate and investment supply in construction are given, more likely as justification for subsequent econometric calculations which is based on the demand function estimate. Empirical estimators were performed for one-family occupied housing.

During econometric estimates all variables under consideration proved to be significant and having anticipated values. According to the findings, nominal interest rate affects housing demand because coefficients with variables characterizing the volume of the initial deposit and effective credit repayment period are significant and negative.[4] However, here are two main effects of the inflation influence on the real estate demand. On the one hand, anticipated inflation leads to interest rates growth and, as a consequence, to the initial payments growth due to a negative value at the initial deposit which results in demand decrease. On the other hand, there is an inverse effect, namely, decrease of effective period of credit repayment due to a reduction of the real values of subsequent payments. In other words, reduction of repayment periods results in the real estate demand growth.

In order to interpret these findings, Kearl calculates elasticity for initial deposit and efficient period of the credit repayment at the nominal interest rate. Both these elasticities are

[4] Both these variables are derivative from the nominal interest rate.

nonlinear, the first increases and the second decreases at the interest rate. Nonlinear character of these elasticities involves nonlinear behavior of relative prices on real estate. For instance, under low interest rates elasticity grows and than under rather high mortgage lending rates begins falling verging towards zero.

Kearl presents four effects which may appear in the economy with inflation and constant nominal payments on mortgage credits. First, according to the US legislation interest paid on mortgage credit is deductible from the tax base while paying the income tax. That is why higher nominal rates may lead to a reduction of real user cost of housing. Second, funds allocated on purchasing other types of assets, as a rule, are not tax-deductible. This fact differs housing from other types of assets, in other words, it makes it more attractive at higher interest rates. Third, due to state regulation of mortgage lending rates in the wake of high inflation[5] certain households may find mortgage lending an attractive solution of their financial problems. Finally, under high inflation rates the majority of households switch over to the investments into nonmonetary assets, among which real estate is the most popular type. Thus, one may conclude that under high inflation rates housing demand will, probably, grow. It is also worth noting that in estimated regressions variable "permanent household's income" proved to be significant only in one of the estimated specification.

The article also presents investment function estimate in the housing construction where alongside with relative prices by way of direct costs as explanatory variables were used the same variables that had been used at the demand function estimate (comprehensive specification). In this event the initial deposit volume and efficient repayment period proved to be significant as in the case of demand function, first – negative, second – positive, which, apparently, testifies to the feasibility of distortions caused by inflation on the housing construction market. In particular, Kearl comes to a conclusion that during the mentioned period from 1961 through 1974 these distortions led to a reduction of housing capital accumulation rates.

Among Kearl's article features one may single out. First, the author does not directly use nominal interest rates and neither has he used anticipated inflation series as theory orders to. Instead of this, Kearl decomposes the nominal interest rate into two variables: initial deposit and efficient period of mortgage credit repayment. Such decomposition allows studying more delicate effects of anticipated inflation influence on prices and supply side on the housing market. Second, directly demand function estimate, i.e. there is an assumption

[5] Kearl indicates that during the period of high inflation of 1973, the US government introduced a cap on the maximum rate of mortgage credits.

that in the short-term period prices are determined exclusively by demand side because supply is considered to be fixed. Finally, both in the model and in the estimates agents' expectations regarding future prices have not been included. It is considered that the nominal interest rates include expectations, namely agents' anticipation is perfect. This presupposes constancy of the real interest rates which is not always true to reality.

The article by Poterba, Weil, Shiller (*Poterba, Weil, Shiller, 1991*) explores a large number of empirical estimates, meanwhile it's major messages are similar to those which were used in the articles by Schwab (*Schwab, 1983*) and Kearl (*Kearl, 1978, 1979*).On the basis of quarterly dataset regarding different cities, the following type equations were estimated:

$$\Delta p_{it} = \delta_0 + \delta_1 \Delta c_{it} + \delta_2 \Delta d_{it} + \delta_3 \Delta y_{it} + \delta_4 \Delta u_{it} + v_{it},$$

where p_{it} – is a logarithm of a real median price of housing; c_{it} – is a logarithm of real construction costs; d_{it} – is a logarithm of demand estimate based on the age structure of the population; y_{it} – is a logarithm of real per capita income; u_{it} – is an indicator of real user cost of owner-occupied housing.[6]

The regression also included such variables as median marginal federal income tax rate and price index on land. In the majority of specifications variables responsible for demographic demand and taxes proved to be insignificant, meanwhile per capita income and construction costs are significant in all specifications. It is also worth noting that in comparison with other variables, the coefficient at the price index on land of rather small, i.e. dynamics of the housing prices only in small-scale depends on the changes on land price. In order to check this hypothesis, Poterba et. all build a separate regression: dependence of housing prices on the land prices (in logarithms) where coefficient at land prices proved to be significant and equal 0.29.

Empirical conclusion made in this article about that the behavior of housing prices may have a large forecasting volume regarding future personal income:"10% housing price growth in the current year anticipates 0.40% income growth rate in the next year." In other words, anticipating subsequent real income growth, already now people make higher demand on housing. Most likely, this conclusion is applicable only to the US real estate market due to well developed mortgage lending system and credit market which allows agents to smooth

[6] Includes such variables as nominal interest rates and anticipated inflation rate.

their consumption in time and orientate to decision taking to a large extent at the aggregate discount income and not entirely at the current one.

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The review of theoretical and empirical publications regarding real estate market research allows making a number of significant conclusions which will serve as a basis for subsequent empirical analysis for the Russian housing market.

1. Real estate demand

The real estate, in particular housing, can not be solely viewed as an ordinary good or solely as an asset because it combines features of them both. On the one hand, in the majority of cases people purchase real estate, a house or an apartment in order to live there, in other words, to consume services provided by this type of property. On the other hand, if an agent does not require housing, i.e., for example, he already has one, he then can purchase housing with an aim of investment, for instance, for hire or for subsequent resale at the anticipated housing price growth. Thus, there are two different types of agents present on the real estate market who are making the demand: households and investors. The former view housing as a good and in the end makes demand not on the proper housing but on housing services; latter view housing as an asset bringing yield. Naturally, different factors can variously influence the demand on the part of investors and households.

Housing as a good. Housing is one of goods consumption of whose services increases household's utility, namely utility can significantly depend on their quantity and the quality of such services. Main characteristics of apartments which determine services and consequently influencing household's utility are: floorspace, number of rooms, and close by availability of required infrastructure, for example, parks, shops, clinics, schools, and kindergartens. Different households may have different priorities regarding these features, however, other things equal demand for housing on the part of the households definitely depends on those features.

Housing is a durable good. That is why when purchasing it a household looks not only at its current budget constraint, but at the anticipated subsequent constraints, as well as at the anticipated inflation rates. Anticipated growth of future income leads to a demand growth on condition that the households can redistribute their income between periods by means of mortgage lending and short-term crediting. The influence of anticipated inflation growth on the demand on the part of households is not clear. On the one hand, according to Schwab and Stein (*Stein, 1995)*, due to constant nature of nominal payments on mortgage loans and assuming that the real interest rates are constant under anticipated inflation growth the

demand for housing will be falling because nominal interest rates will increased even before the high inflation bursts out. On the other hand, according to Poterba's article, where a household can deduct interest paid on mortgage debt from the income tax base, then under anticipated inflation growth the demand will grow too because real user cost of housing will go down. Moreover, according to the imitation analysis findings the demand hike will significantly depend on the type of expectations – adaptable and rational. Thus, it remains unclear, precisely which of these effects finally will be dominant.

Nevertheless, other things equal housing demand goes down in the event of an increase of relative prices on the real estate. First, under the growth on relative prices due to substitution effect, households redistribute their consumption in favor of consumption of other goods. For example, by purchasing housing a household chooses a house or an apartment of lesser floorspace or, on the whole, postpones its decision about the purchase. Second, under a considerable price change and the lack of excess to the perfect credit markets will make fewer households to afford housing due to income effect. It means that housing demand on the part of households is negatively dependable on the relative housing price.

Thus, main factors which affect the demand on the part of households are relative housing prices, housing specifications, household's income, interest rates on mortgage lending and short-term credits and accessibility of these types of loans to the population.

Real estate as an asset. As an asset real estate also has a number of features which distinguish it from other type of assets. Correspondingly, these types of features create special characteristic relevant to the demand made on the part of investors. First, in order to purchase an apartment or a house an investor requires large financial investment in comparison with a purchase, for example, of a share. In other words, real estate represents a discrete asset with high price per a unit. That is why only wealthy investors can invest in the real estate. Second, real estate is sold on local markets and con not be transferred beyond their borders. That is why, most likely, investors will be making a strong demand on large markets, for example, in large cities where thee is a better chance to resell housing in the future. Granting this premise, it becomes clear that even small number of rather wealthy investors may represent a considerable share of aggregate demand on a separate market. Third, in comparison with financial assets housing is less liquid due to legislatively specified periods set for the transactions conducted with real estate as well as to special features inherent in this market.[7] Fourth, in contrast to more traditional financial assets, there are user costs of owner-occupied

[7] As a rule, a house or an apartment "stays" in the market for several months.

housing which includes maintenance expenses, running and major repairs, property tax, etc. These features are usually taken into consideration by the investors when forming the demand.

Investor usually is interested in housing characteristics not as a good, but only as an asset, i.e. its anticipated yield in relation to other type of assets, liquidity and investment risks. Naturally, when calculating expected return, the potential investor takes into account the user cost of housing as well as possible difficulties arising with its urgent purchase or sale. Where the investor purchases property with an aim of subsequent resale, then anticipated price growth should be well enough to cover the user costs of housing during low price period. Where the investor purchases property with a subsequent aim of letting it, then, naturally, anticipated discount profit should exceed purchase cost and the user cost. In the first case, formation of a price "bubble" is feasible because the investor is guided by the anticipated price, whereas in the second case the investor is guided by the future demand on the part of households for housing services and, so, to a greater extent by the fundamental housing value.

Thus, major factor influencing demand on the part of investors is the expected housing yield in relation to other types of assets taking into consideration the user cost of housing. If we consider a set of financial instruments accessible for investors as a restricted one, then the factor influencing demand one may consider affordability of investment into the real estate in comparison with other types of assets.

2. Real estate supply

Until now all conclusions have been drawn in an assumption that there is a fixed real estate volume, which is marketed at a given period of time, and which is quite justifiable in the short-term perspective. However, such assumption is wrongful in the long-term perspective. The real estate market consists of two submarkets: the new-built property and secondary real estate. On the new-built property market supply is formed by the volume of new-built property at a given moment, therefore, it is determined during previous periods of time and does not depend on current prices. On the secondary real estate market supply is proportionate to the aggregate housing stock, in which connection the share of this stock put up for sale at this moment may significantly depend on current prices, especially at the availability of a large number of apartments which are unoccupied.[8]

From the point of view of construction companies, housing construction will be the more profitable, the more expensive housing is relative to other types of property. Where

relative anticipated housing prices are going up then construction companies other things equal will build more dwellings. In other words, their current decisions regarding construction volumes may affect future housing volume put up for sale on the market. Moreover, important role at decision taking regarding construction volumes are being played by the construction costs, such as: workers' wages, construction materials and land prices, as well as expected time required for the sale of all built units, because the company also incurs the user costs for unsold housing.

Main factors which affect housing supply on the market at a given moment are: anticipated relative prices formed during previous periods (at the start of construction) as well as constructor's costs incurred during previous periods, i.e. construction workers' salaries, construction materials cost, etc.

Thus, main factors are revealed which affect demand and supply on the property market. During empirical analysis on the basis of available data we will construct variables which will estimate these factors; econometric models will be built which will be used to check hypothesis about assumed effect of the factors under consideration.

Empirical Analysis of Formation of Speculative "Bubble" on the Housing Market in Russia

Model specification and choice of explanatory variables

Subsequent empirical calculations are given in this paper are built on assumption that the volume of new-built property market characterizes activity on the housing market as a whole. The following assumptions are made in the paper. First, investors, first of all, are interested in new-built property due to the fact that it is relatively cheaper that the secondary real estate,[9] and, consequently, under expected price growth has a higher yield. It is also assumed that purchase and registration of the new-built property requires less red tape. Moreover, new-built property requires less user cost for housing and running repairs. Second, households make demand both on the new-built property market and on the secondary real estate one. If we assume that the rental market is poorly developed and a household which is selling a house inevitably will require a new one, then at a growing number of households additional demand finally will be felt on the new-built property market. Thus, we may

[8] According to the US statistics, the volume of transactions on the housing market is substantially higher under growing prices than under falling ones.

[9] New-built property may be bought at the construction stage or even at the stage of construction project.

consider that under zero volumes of the new-built property market the volume of the secondary real estate market will also be small.

It is worth noting that in order to solve main task of this paper, namely to reveal speculative component on Russia's housing market, it would be better to use aforementioned empirical methods for determining two components of housing demand: housing as a service and as an asset. The second component will allow identifying a potential "bubble". However, Russia started to publish official statistical data on housing prices quite recently – since 2002. That is why it is not feasible to built acceptable length time series by means of this dataset. Due to this reason, in order to solve the problem we have singled out two types of variables: responsible for speculative and fundamental housing demand.

It stands to reason that ideally it is necessary to estimate separately only two demand equations: on the part of investors and on the part of households because they are different factors. In reality investors' demand can not be separated from households' demand because as a variable which characterizes general demand only price progression and housing-price index are available. That is why by means of empirical data we can estimate only the inverse function of housing demand on the part of both types of agents. Moreover, there is no chance to divide new-built property market from secondary real estate one by means of statistical data because there are no available data on the transactions volume made on the whole housing market. There is information regarding only placing in service of new-built property. Thus, in order to carry on with estimates, it is necessary to make an assumption that new-built property put up on the market in the current year was placed in service this year or during previous years.[10]

We have at our disposal only annual data of price index changes and commission of the new housing, that is why, it will be natural to estimate simultaneous demand and supply equations system only on the new-built property market. However, such an approach can not be justified in case of our task due to the following reasons: first, housing supply is determined not by current construction costs and housing prices, but correspondingly by their values and anticipated values which were formed during previous periods. Second, in an assumption that agents has static expectations, housing demand which is determined by their expectations relative to future income, liquidity constraints, etc., actually will be determined by previous values of these variables. Thus, due to specifics of this type of asset, housing, the

[10] It is also possible that apartments in officially placed in service dwellings turn out on the market later that the commission date because official and real commission dates may differ considerably.

use of instrumental variables in this situation is more justifiable that estimation of simultaneous equation system.

Now let us turn to the analysis of demand and supply equations. At the beginning, let us study two types of demand: on the part of investors and on the part of households.

Investors' demand on the new-built property D_t^{Invest} :

$$D_t^{Invest} = d^{Invest}(ind\_PH_t, ind\_PH_{t+1}^{\exp}, \pi_{t+1}^{\exp}, PA_{t+1}^{\exp}, credit_t),$$

where ind_PH_t – housing price growth rate; $ind\_PH_{t+1}^{\exp}$ – anticipated housing price growth rate in the next period; $\pi_{t+1}^{\exp}$ – anticipated inflation in the future period; $PA_{t+1}^{\exp}$ – expected yield on alternative assets; $credit_t$ – variable, which characterizes credit affordability.

Within this paper agents' expectations are considered to be static, that is why by way of expected values we use current or previous variables' values.

Inverse function of demand on the part of investors on the new-built property, which will be used for empirical calculations, has the following form:

$$ind\_PH_t^{Invest} = \alpha_0 + \alpha_1 invhouses_t + \alpha_2 rts_t + \alpha_3 credit_t + \alpha_4 start_t + \varepsilon_t,$$

where $ind\_PH_t^{Invest}$ – ratio of housing prices in current period to housing prices in basic period (1st quarter of 2002); $invhouses_t$ – share (in percent to the overall volume) of investment into housing – proxy-variable for housing purchase yield; characterizes anticipated housing price rate growth in the future period $ind\_PH_{t+1}^{\exp}$; $start_t$ – housing supply on the new-built property market.

In the paper we used per cent rise in relation to the past year of RTS stock exchange index – rts_t as proxy- variable for π_t^A – price change rate of alternative asset; $credit_t$ [11] – variable, which characterizes affordability of mortgage credit (in the paper we used per capita mortgage debt volume index in Rubles); H_t^{new} – housing supply on the new-built property market equal to the new commissioned houses in the current period.

When forming demand equation on the part of households we will follow the logic inherent in Kearl's papers (*Kearl, 1978, 1979*). Then households' housing demand Dh_t looks the following way:

$$D_t^{household} = d^h(ind\_PH_t, area\_fit_t, income_t, \pi_{t+1}^{\exp}).$$

Inverse function of households' demand can be written this way:

$$ind\_PH_t^{household} = \beta_0 + \beta_1 income_t + \beta_2 cpi_t + \beta_3 start_t + \beta_4 area\_fit_t + \varepsilon_t,$$

where $income_t$ – real household's income expressed in Rubles 2002; cpi_t – inflation rate; $start_t$ – housing supply on the new-built property market; $area\_fit_t$ – total housing stock per capita minus dilapidated and critical dwellings.

By way of principal factor which characterizes households' demand it is better to use rental cost, however, this type of data is, unfortunately, unavailable for Russian regions.

Thus, housing price growth rate has the following form:

$$ind\_PH_t^H = \alpha_0 + \alpha_1 invhouses_t + \alpha_2 rts_t + \alpha_3 credit + \beta_1 income_t + \beta_2 cpi_t + \beta_3 start_t + \beta_4 area\_fit_t + \mu_t \quad (1)$$

Housing supply on the part of construction companies $start_t$:

$$start_t = s(ind\_PH_t^{\exp}, ind\_PEs_t^{\exp}, c_t),$$

where $ind\_PH_t^{\exp}$ и $ind\_PEs_t^{\exp}$ – anticipated housing price growth and price growth on other types of property in period t, formed in the past period; c_t – construction costs (for instance, workers' salary in the construction industry, construction materials cost).

In such specification assumption on competitiveness of construction services market and possibility existing for companies to choose between construction of housing and non-residential units is implicitly present. In other words, the construction companies may choose those construction projects which, as they think, will bring them highest yieldt.

Linearized form of supply equation has the following form:

$$start_t = \gamma_0 + \gamma_1 ind\_PH_{t-1} + \gamma_2 invbuilds_{t-1} + \gamma_3 pi\_bcw_{t-1} + \nu_t \quad (2)$$

where $start_t$ – new-built property supply in the moment t; ind_PH_t – housing price growth rate in previous periods; $invbuilds_{t-i}$ – share of investments in non-residential construction projects (buildings and structures) as proxy-variable for construction yield of non-residential projects; pi_bcw_{t-i} – construction and installation work cost index (base – December 2002) as proxy-variable for construction workers' salary.

[11] This factor was attributed to speculative ones due to the fact that the crediting system in Russia has been poorly developed and the majority of population has no access to it due to either distrust or high interest rates.

Construction takes time[12] that is why in response to a change in demand, housing supply can not be changed rapidly and the value of indicated variables of previous years influences to a greater extent on the current housing supply.

Thus, equations (1) and (2) are estimated in the paper. At that, the following values are expected at explanatory variables, i.e. it is intended to examine the following hypotheses:

1. Housing demand depends both on variables which characterize investors' demand and on variables which determine households' demand, i.e. in the equation (1) simultaneously significant are both α_i, and β_j, $i = \{1,2,3\}$, $j = \{1,2,3,4\}$. Thus, we consider that the first three variables in equation (1) are factors of speculative demand and remaining four are factors of fundamental demand.
2. Housing demand positively depends on anticipated housing price growth rates and negatively – on anticipated price growth rates on alternative assets, i.e. in equation (1) coefficient α_1 – positive, and α_2 – negative. If this hypothesis is not discarded then will allow making a conclusion about investor's demand present on the market, because it is assumed that households when purchasing housing do not take into account alternative ways of investment because they purchase housing as a good and not as an asset bringing profit.
3. Credit affordability allows a large number of agents to make demand on the housing market including those who are unable to repay mortgage debt in the future. Thus, in those circumstances demand may not be secured by fundamental income growth and in this paper attributed to a speculative one. If this hypothesis is correct, then coefficient α_3 must be significant and positive.
4. Households' income growth leads to housing demand growth on their part which is considered as normal good. On the one hand, this assumption is rather evident in a premise that real estate is a normal good, on the other hand, in a number of empirical publications which analyze the US real estate market such dependence has not been revealed which may be explained by well developed level of mortgage lending market (*Kearl, 1979*). In Russia mortgage lending appeared quite recently

[12] Unfortunately, there is no data in Russia about average construction periods of residential projects; however, one can assume that between one to three years are needed for building a dwelling.

and is not a widespread phenomenon.[13] That is why the coefficient β_1 at variable I in equation (1) is expected to be significant and positive.

5. The housing demand positively depends on anticipated inflation, i.e. the coefficient β_2 in equation (1) is positive. This hypothesis is based on the premise that households strive to cut their money holdings under high inflation rates, in other words, they try to purchase goods and commodities as soon as possible.

6. The higher housing supply on the new-build property market, the lower the prices on that market, in other words, the coefficient β_3 in the function (1) must be negative.

7. From the households' point of view the higher the level of housing provision, the less they are ready to pay for additional dwelling unit, that is why the coefficient β_4 must be negative. At the same time, the high level of adequate dwelling provision, most likely, will testify about the size of the property market in a given region: the higher the level of adequate housing provision the higher volume of dwellings can stay on the market. On big markets property becomes more liquid, in other words, more attractive for the investors, that is why, the coefficient β_4 must be positive.

8. The new-built housing supply must positively depend on the past periods anticipated housing price growth rates, i.e. the coefficient γ_1 in the function (2) must be positive.

9. In the premise that the construction companies can choose the most profitable projects, from their point of view, and their production capacities are limited, the alternative construction yield growth should lead to a reduction in supply on the housing market due to the fact that the construction companies will build less dwellings and construct more other types of property (for instance, office buildings). Thus, the coefficient γ_2 in the function (2) must be negative. It is assumed that a change in expectations of construction companies should result in redistribution of construction capacity between different types of construction. That is why, in this paper the expected yield of alternative construction is characterized by the investment share in building of non-residential facilities and buildings.

[13] In the US mortgage debt ratio to GDP amounts to about 15% where in Russia this ratio does not exceed 1%.

10. Construction costs growth (salaries or builders and construction materials prices) other things equal result in housing supply reduction, i.e. in the function (1) the coefficient γ_3 must be negative.

Bench-mark data for the research

For our analysis we have taken data on housing prices dynamics and socio-economic indices for 62 Russia's regions for the period 2002-2006. Rosstat's (the Federal Russian Statistical Service) and the RF Central Bank's publications have provided these data. In order to be sure that this information reflects actual state of affairs we have compared housing price series recorded in Moscow and posted on Rosstat's site with the series built by the analytical center "Property market indicators" (IRN.RU)[14]. Methodology used by IRN for constructing average square meter price as well as appeal of this index among commercial market research allows viewing this index as the most correctly reflecting housing price dynamics in Moscow.

Thus, first we want to verify reliability of the data published by Rosstat by means of comparing it IRN's data. *Fig.1* presents housing price dynamics in Moscow according to the data from Rosstat and IRN[15].

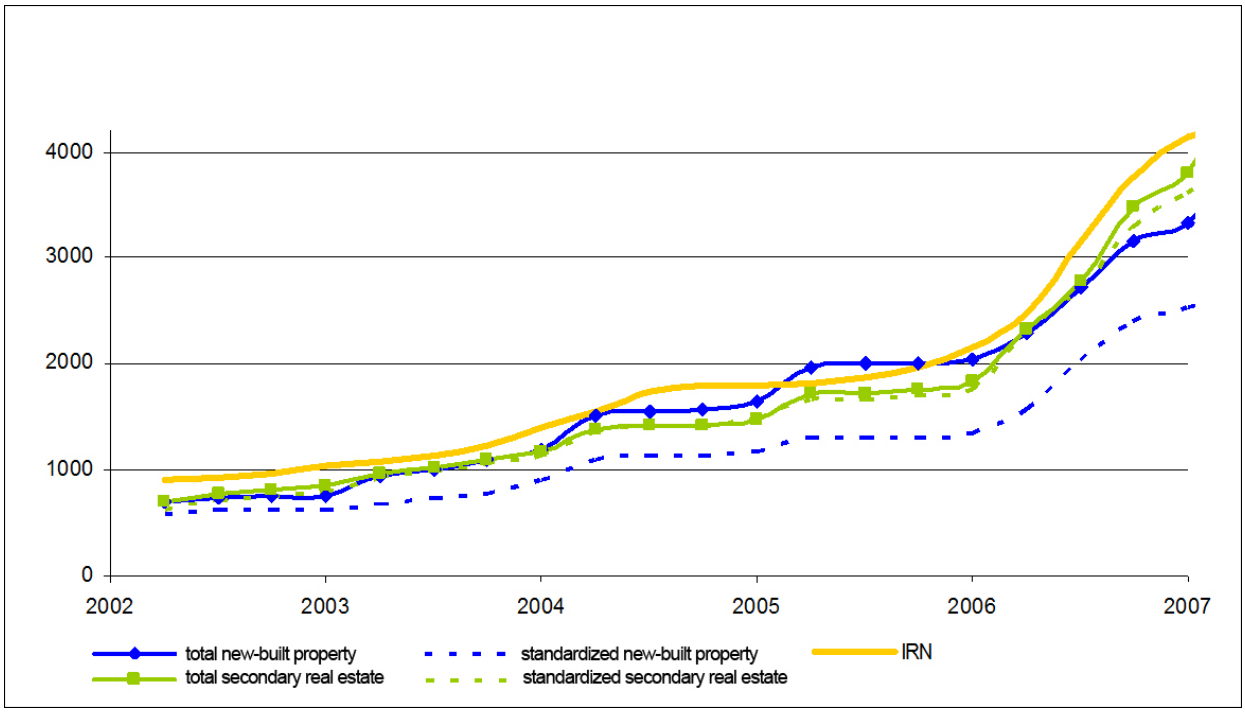

Fig. 1. Housing price per sq.m. in Moscow

[14] Calculation methodology is described in detail on the web site: http://www.irn.ru/methods/.
[15] Rosstat published 4 price series: total and standardized apartments on the new-built property market, total and standardized apartments on the secondary real estate market.

Table 3

Housing price correlation in Moscow according to Rosstat and IRN data

Rosstat/IRN	New-built/ Total	New-built /Standardized	Secondary/Total	Secondary/Standardized
Correlation	0.982	0.997	0.983	0.997

Thus, on the basis of *Fig.1* and correlation indices coefficient values (*Table 3*) we assume that the Rosstat data can be taken as objectively reflecting the situation formed on Moscow's housing market. Unfortunate, there is no way to conduct a similar comparison for other cities and regions due to the lack of alternative information. Nevertheless, Moscow's housing prices demonstrate the highest volatility dynamics, that is why the change for making a error is higher than in other regions.

As explanatory variables *start* and *ind_PH* we chose: commissioning of residential housing and price index for new-build property market for all apartments. The choice of these indicators can be explained by, first, regarding commissioning of new-built property the Russian statistic service provides data only regarding residential housing, i.e. overall square floor space of new-built property and new apartments in units. Both indicators have flaws. For example, the first one includes not only apartments but individual houses as well. The most significant drawback of the second indicator is the fact that Rosstat published information only on Russia as a whole and not regarding separate regions.

Price index calculated by Rosstat requires a more accurate analysis. First, as was shown before, it is well consistent with the alternative IRM indicator regarding Moscow. However, this consistency is nothing but a weak argument in favor of equally important official housing price index calculated for other regions. The Moscow market is the biggest and the most dynamic housing market in Russia and, that is why, it is the most interesting for investors to turn to. In view of this, when calculating its indicators and average price levels Rosstat can rely on these alternative estimates.

It is commonly supposed that, as a rule, housing prices, especially in the period under consideration are measured in US dollars. That is why it is possible that it was worth taking into consideration a change in ruble-dollar ratio. However, all indicators used in calculations represent price indices in rubles, i.e. they are uniform from currency point of view. Under such price change accounting, there is no need to resort to any additional variables except consumer price index required for price change accounting as a result of general inflation.

Estimate outcome

Demand equation estimate (1) and supply equation estimate (2) were performed by way of instrumental variables and the generalized method of moments (GMM) with the help of instrumental variables. At the outset auxiliary pool-estimations were performed. Then panel data estimates with fixed effects were carried out. The Hausman test testifies in favor of fixed effects models. For testing non-correlatedness of errors and instruments for each regression were took Sargan tests, which results provided us with a possibility to choose the best tools.

Demand equation

Equation to estimate (1):

$$ind\_PH_t^H = \alpha_0 + \alpha_1 invhouses_t + \alpha_2 rts_t + \alpha_3 credit + \beta_1 income_t + \beta_2 cpi_t + \beta_3 start_t + \beta_4 area\_fit_t + \mu_t$$

At the outset let us analyze demand equation estimates results built on all data without taking into account panel data structure, i.e. so called pool-estimations presented in *Table 4*. For variable *start* we used two sets of instruments: installation and construction work price index and investment share in non-residential buildings and facilities construction in current and previous periods.[16] Resultant regressions on the whole, proved to be significant to which high *F*-statistics testify. Moreover, the majority of coefficients at explanatory variables proved to be resistant to the chose of specification and estimation method.

Table 4

Dependent variable *change in housing price index, ind_PH* [17]
(Pool-estimates 2003–2006, 62 regions)

A. Instrumental variable for start: pi_bcw, invbuilds.

	ind_plIV	***ind_pl1IV***	***ind_plGMM***	***ind_pl1GMM***
start	–0.669***	–0.626***	–0.637***	–0.776***
area_fit	0.073***	0.070***	0.074***	0.084***
credit	0.070**	0.094***	0.074*	0.089***
income	0.088***	0.078***	0.083**	0.098***
cpi	–0.044**	–0.029	–0.044***	–0.016
rts	–0.078	–0.125	–0.079	–0.161
invhouses	–	0.023**	–	0.027***
_cons	4.958**	3.043	4.915**	1.182
Sargan-st-c[18]	0.211	0.076	0.167	0.011
F-statistic	21.047	20.855	20.026	21.020

[16] Actually, in the analysis we tried earlier lags of these variables as instruments, however, their use as instruments resulted in estimation results becoming weaker.
[17] The following regression names were used: *ind_plIV* – for 2SLS with instrumental variables, *ind_plGMM* – for generalized method of moments with instrumental variables.
[18] Presented P-value.

N	247	247	247	247

B. Instrumental variable for start: pi_bcwL[19], invbuildsL.

	ind_plIVL	***ind_pl1IVL***	***ind_plGMML***	***ind_pl1GMML***
start	–0.740***	–0.630***	–0.746***	–0.693***
area_fit	0.075***	0.070***	0.074***	0.091***
credit	0.065**	0.094***	0.065	0.104***
income	0.098***	0.079***	0.099**	0.082**
cpi	–0.044**	–0.029	–0.044***	–0.023
rts	–0.092	–0.127	–0.092	–0.178
invhouses	–	0.023***	–	0.025***
_cons	4.911*	3.023	4.924**	1.854
Sargan-st-c	0.942	0.010	0.928	0.001
F-statistic	18.943	21.460	22.259	26.473
N	247	247	247	247

* Coefficient is significant at 10% level.
** Coefficient is significant at 5% level.
*** Coefficient is significant at 1%level.

Owing to the fact that the hypothesis about the absence of individual effects for the regions has been rejected, in our interpretation we will be supported by estimations of 2SLS obtained on the panel data with fixed effects use because they take into account regional specifics which, most likely, is not explained by available variables. Estimations assessment of housing demand equation based on panel data with using individual effects is presented in *Table 5*.

Table 5

Dependent variable *index of change in housing prices, ind_PH*

(Panel-estimates, 2003–2006, 62 regions)

A. Instrumental variables for start: pi_bcw, invbuilds.

	ind_pnlIV[20]	***ind_pnl1IV***	***ind_pnlGMM***	***ind_pnl1GMM***
start	–4.080	–2.690**	–2.816	–1.231
area_fit	1.146**	0.901***	1.002	0.759***
credit	0.145***	0.127***	0.128**	0.111***
income	0.036	0.023	0.022	0.006
cpi	0.037	0.015	0.023	0.003
rts	–0.271	–0.228*	–0.223	–0.163
invhouses	–	0.024	–	0.010
_cons	–23.723*	–17.350**	–22.112*	–16.651*
Sargan–st-c	0.524	0.494	0.398	0.398

[19] Letter *L* at the end of the variable's name stands for first lag.
[20] The following regression names have been used: *ind_pnlIV* – for 2SLS with instrumental variables, *ind_pnlGMM* – for generalized method of moment (GMM) with instrumental variables.

F-statistic	22.442	40.182	24.334	37.815
N	247	247	247	247

B. Instrumental variables for start: pi_bcwL, invbuildsL.

	ind_pnlIVL	***ind_pnl1IVL***	***ind_pnlGMML***	***ind_pnl1GMML***
start	-2.633***	-2.427***	-2.833	-2.423
area_fit	0.880***	0.851***	0.917***	0.878***
credit	0.131***	0.125***	0.133***	0.126***
income	0.021	0.020	0.022	0.018
cpi	0.015	0.011	0.017	0.012
rts	-0.195*	-0.211**	-0.202**	-0.212**
invhouses	-	0.020	-	0.020
_cons	-16.659***	-16.009***	-15.786***	-15.507***
Sargan-st-c	0.578	0.385	0.517	0.324
F-statistic	48.408	47.616	54.759	52.110
N	247	247	247	247

* Coefficient is significant at 10% level.

** Coefficient is significant at 5% level.

*** Coefficient is significant at 1% level.

Coefficient at the variable *housing supply on the new-built property market* as was expected proved to be negative. However, in one of the specifications this coefficient proved to be nonsignificant.[21] Thus, the new-built property supply volumes reduce housing price growth rates during the current year. In other words, not all new-built property is sold at the construction stage and part of it gets on the market when a dwelling has been put in service.

Coefficient at the variable *per capita real income* proved to be significant and positive solely in some specifications that is why our hypothesis that the income growth results in housing market demand growth can not be discarded out right. Let us note that in many foreign papers empirical estimations assessments demonstrated that the current real personal cash income do not affect the housing demand because the consumers can with relatively low transaction costs to distribute their income over time by means of well developed mortgage lending system. Thus, it is reputed that the positive coefficient at *personal income* does not reject our hypothesis that by no means all households can flatten their consumption by means of lending institution.

[21] P-value equals 15%.

Further as was expected, coefficients at variables *per capita adequate dwelling provision*[22] and *average per capita mortgage debt* proved to be significant and positive for the demand equation. Adequate dwelling provision characterizes the market volume in a given region that is why a large number of dwellings can be on the "market". Most likely, such regions provide more chances for the investors to resell housing, that is why it is one of major reasons for more dynamic development of such markets development. Moreover, it is also possible that the regions with large property markets are the regions with wealthier inhabitants.

Positive coefficient at the variable *average per capita mortgage debt* is the evidence of the fact that in the regions with better developed mortgage lending institutions housing prices will grow faster due to additional demand growth. Coefficient at variable *RTS index rate* proved to be negative and significant as well as resistant to the choice of estimation method. Thus, property and investment in Russian companies' shares represent interchangeable alternatives for the investors.

Coefficients at variables *consumer price index* and *investment share in housing construction* proved to be nonsignificant. Possibly, it is connected with poor quality of the data or with the fact that these variables are not very good for testing agents' expectations regarding subsequent property ownership yield. Moreover, it is know that the data published by Rosstat on the inflation rates, on the one hand, is not perceived by the majority of people as true, on the other hand, it reflects only price change on basic groups of consumer goods and services, which is possible doest not interest investors too much.

Supply equation

Equation to estimate (2):

$$start = \gamma_0 + \gamma_1 ind\_PH_{t-i} + \gamma_2 invbuilds_{t-i} + \gamma_3 pi\_bcw_{t-i} + \nu_t$$

Just as in the case of demand supply, supply equation at first was estimated by means of pool-method including all observations. Further estimations were performed on panel data with fixed effects whose availability was not rejected by the Hausman test. Outcome of pool-estimations and panel data estimations are represented in *Tables 6* and *7* correspondingly. As instrumental variables for *housing price change index ind_PH* were used *per capita adequate housing provision, per capita average mortgage debt and RTS index rate*, in other words the most stable variables in the housing demand equation.

[22] In Kearl's article (*Kearl, 1979*) coefficient at analogous variable which characterizes adequate dwelling provision proved to be negative, which seems to be more logical. Possibly, this testifies about relatively even

Table 6

Dependent variable *new-built property, start* [23]

(Pool-estimates, 2003–2006, 62 regions)

A. Instrumental variables for ind_PH: area_fit, credit, rts.

	start_pnlIV	start_pnl1IV	start_pnlGMM	start_pnl1GMM
ind_PH	0.418***	0.418***	0.289***	0.289***
pi_bcw	–0.316**	–0.316**	–0.158	–0.158
invbuilds	0.000	0.000	0.000	0.000
_cons	0.349***	0.349***	0.432**	0.432**
Sargan-st-c	0.022	0.022	0.249	0.249
F-statistic	27.965	27.965	17.875	17.875
N	247	247	247	247

B. Instrumental variables for ind_PHL: area_fitL, creditL, rtsL.

	start_pnlIVL	start_pnl1IVL	start_pnlGMML	start_pnl1GMML
ind_PHL	0.751***	0.751***	0.649**	0.649**
pi_bcwL	–0.694***	–0.694***	–0.568	–0.568
invbuildsL	–0.000	–0.000	–0.000	–0.000
_cons	0.446***	0.446***	0.556**	0.556**
Sargan-st-c	0.475	0.475	0.625	0.625
F-statistic	16.760	16.760	9.647	9.647
N	246	246	246	246

* Coefficient is significant at 10% level.

** Coefficient is significant at 5% level.

*** Coefficient is significant at 1% level.

For understanding the results we will use estimates obtained on the panel data with fixed effects.

Table 7

Dependent variable *new-built property, start*

(Pool-estimates, 2003–2006, 62 regions)

A. Instrumental variables for ind_PH: area_fit, credit, rts.

	start_pnlIV	start_pnl1IV	start_pnlGMM	start_pnl1GMM
ind_PH	0.418***	0.418***	0.289***	0.289***
pi_bcw	–0.316**	–0.316**	–0.158	–0.158
invbuilds	0.000	0.000	0.000	0.000

development of the US real estate market in comparison with the Russian housing market development.

[23] The following names of regressions were used: *start_plIV* – for 2LSL with instrumental variables, *start_plGMM* – for the generalized method of moments (GMM) with instrumental variables.

_cons	0.349***	0.349***	0.432**	0.432**
Sargan-st-c	0.022	0.022	0.249	0.249
F-statistic	27.965	27.965	17.875	17.875
N	247	247	247	247

B. Instrumental variables for ind_PHL: area_fitL, creditL, rtsL.

	start_pnlIVL	***start_pnl1IVL***	***start_pnlGMML***	***start_pnl1GMML***
ind_PHL	0.751***	0.751***	0.649**	0.649**
pi_bcwL	–0.694***	–0.694***	–0.568	–0.568
invbuildsL	–0.000	–0.000	–0.000	–0.000
_cons	0.446***	0.446***	0.556**	0.556**
Sargan-st-c	0.475	0.475	0.625	0.625
F-statistic	16.760	16.760	9.647	9.647
N	246	246	246	246

* Coefficient is significant at 10% level.

** Coefficient is significant at 5% level.

*** Coefficient is significant at 1% level.

As was envisaged, epy housing price growth results in the supply growth, and costs growth results in supply reduction: the coefficient at variable *housing price change* is positive, and at variable *construction goods producers' price index* is negative. At the same time, quantitative effect of these factors on property supply is roughly similar: coefficients values are close to each other, and the property price growth and the installation and construction works' price growth are measured in hundreds percent. Thus, in the event that housing prices and construction goods prices are changing by the same value, then housing supply on average remains unchanged.

Current commissioning of housing best of all is explained by current values of housing and installation and construction works price rates growth.[24] This result may be linked, first, with the fact that these variables values and their lags are highly correlated. Second, in construction companies are to a larger extent are set at discount profit, i.e. take into consideration subsequent price fluctuations.

Coefficient at variable *investment share in construction of non-residential premises and buildings* proved to be nonsignificant. Possibly, this represents the fact that the companies can not choose freely in which type of construction to engage, i.e. they have certain specialization and government contracts. Nevertheless, significance of this coefficient

[24] It was expected that lagged values for these variables will better explain housing supply in the current period. However, as a result of calculations it proved t be wrong due to lack of regressions where as explanatory variables 2nd and 3rd lad are taken.

may speak about poor correlation between the chosen variable and expected construction benefits.

Decomposition of demand into components

This research paper is also aimed at identifying the housing demand structure because in an assumption that fixed supply in short-term period it is the demand that determines housing market prices. To estimate the input of every explanatory variable we have chosen a regression *ind_pnl1IVL*:

$$ind\_PH = -16{,}009^{***} - 2{,}427start^{***} + 0{,}851^{***}area\_fit + 0{,}125^{***}credit + 0{,}020income + 0{,}011cpi - 0{,}211^{**}rts + 0{,}020invhouses. \quad (3)$$

In this equation as instrumental variables for *new-built property commission* were used lagged values *construction services price growth rates* and *investments share in construction of non-residential buildings and facilities*. Decomposition of demand into component was performed in the following way. For each variable in the equation (3) its average cross regions values for the period of 4 years – from 2003 through 2006 was calculated. Average input of a variable was calculated as a product of a corresponding coefficient in the equation and average value of this variable for each of 4 years *(Table 8)*. Only input of significant variables was considered significant.

Table 8

Input of explanatory variables in the housing price growth over the years

	Coeff.	Averg.03[25]	Averg.04	Averg.05	Averg.06	Input03	Input04	Input05	Input06
Start	**–2.427**[26]	0.563	0.627	0.664	0.768	**–1.366**	**–1.521**	**–1.612**	**–1.864**
area_fit	**0.851**	20.148	20.365	20.711	21.077	**17.146**	**17.331**	**17.625**	**17.937**
Credit	**0.125**	0.818	1.804	3.854	6.376	**0.102**	**0.225**	**0.482**	**0.797**
income	0.020	3.632	4.418	6.082	9.700	0.073	0.088	0.122	0.194
Cpi	0.011	112.833	112.445	111.015	109.069	1.241	1.237	1.221	1.200
Rts	**–0.211**	0.580	0.083	0.833	0.707	**–0.122**	**–0.017**	**–0.176**	**–0.149**
Cons	**–16.009**	1.000	1.000	1.000	1.000	**–16.009**	**–16.009**	**–16.009**	**–16.009**

Further, we calculated aggregate input for separate years for all variables studied in our paper as characterizing investors' demand, i.e. speculative (line 3 in *Table 9*). To the variable characterizing speculative demand we referred *RTS index growth* and *per capita mortgage debt* (variable *investments share in housing construction* is not considered here, because the coefficient of this variable proved to be insignificant). Further, we calculated the

[25] Indicator defines corresponding year. For example, aver.03 – average value of a corresponding variable for the year 2003.
[26] Significant variables are marked in bold.

share of significant speculative components in the aggregate input of all components in demand (line 4 in *Table 9*). As may be seen from presented calculations, the share of speculative factors in the overall demand is growing across time.

Further by year we calculated price growth due to speculative component. For that price growth in percent from the previous period was multiplied by the share of speculative factors in demand. Results are presented in the last line of *Table 9*. In order to calculate aggregate component for speculative demand in housing prices for the whole period, i.e. by the end of 2006, inputs for the previous years were summed. The result was that by the end of 2006 cumulative speculative component in the housing price growth amounted to 30%. For the four year period – from 2003 through 2006, housing prices in Russia went up by 2.3 fold, i.e. by 130%, at that 30% of this growth was due to speculative investors' demand. In other words, in the absence of speculative demand, housing prices would have gone up by 100% on average for this period (2003-2006).

Table 9

Input of speculative component in aggregate housing demand

	Aggr.03	**Aggr.04**	**Aggr.05**	**Aggr.06**
Aggregate input of all components	1.065	1.335	1.652	2.105
Aggregate input of all significant components	–0.249	0.009	0.310	0.711
Input of significant speculative components	–0.020	0.208	0.306	0.648
Share of speculative components in price growth	–0.019	0.156	0.185	0.308
Price growth percent due to speculative factors	–0.000	0.039	0.073	0.161

Moreover, for all performed regressions we ran tests for aggregate significance of the factors which are responsible for investors' demand, i.e. tests of aggregate significant of coefficients on variables *per capita mortgage debt, RTS growth index, share of investments in housing construction*. We also included *consumer price index* in order to control minimal housing price changes. Findings are presented in *Table 10*. As a result, practically in all specifications test reject hypothesis of non-significance of speculative component.

Table 10

Test of hypothesis on significance of speculative factors in the demand equation

First version of group factors		**Second version of group factors**	
Regression name	**H_0: *cpi* = 0, *rts* = 0, *credit* = 0**	**Regression name**	**H_0: *cpi* = 0, *rts* = 0, *invhouses* = 0, *credit* = 0**
ind_plIV	0.000	ind_pl1IV	0.000
ind_plGMM	0.000	ind_pl1GMM	0.000
ind_plIVL	0.003	ind_pl1IVL	0.000

ind_plGMML	0.003	ind_pl1GMML	0.000
ind_pnlIV	0.012	ind_pnl1IV	0.000
ind_pnlGMM	0.016	ind_pnl1GMM	0.001
ind_pnlIVL	0.000	ind_pnl1IVL	0.000
ind_pnlGMML	0.000	ind_pnl1GMML	0.000

Thus, on the basis of our research, it is possible to speak about the presence on the Russian housing market by the end of 2006 of a significant share of demand due to speculative component, i.e. actually a "bubble" in the volume of 30% of the real price growth for the considered period of four years.

* * *

This paper presents analysis of Russia's housing market based on the dataset across Russian regions. Analysis of foreign economic literature allowed revealing major differences between housing market and other types of markets. In the event of Russia, a model of demand and supply has been suggested. The demand has been divided into two components – fundamental and speculative, for which households' and investors' demand is correspondingly accountable. The latter consider housing as an investment and not consumer good. On the basis of dataset which included explainable and explanatory variables valid for 62 Russian regions for the period since 2002 through 2006 demand and supply equations have been estimated. The majority of explanatory variables proved to be significant and of expected value.

As a result of performed calculations, it is possible to draw the following conclusions. First, there are two types of demand present on the Russian housing market – on the part of households, and on the part of the investors, which does not reject a hypothesis that housing represents simultaneously a consumer and investment good. Among fundamental factors of demand we have singled out supply on the new-built property market, adequate provision of housing, personal income and inflation, consistently significant proved to be only the first two. Thus, the supply growth results in the reduction of housing price growth rates. If we take into consideration the following fact that prices on the new-built property market and secondary real estate market are closely interconnected, then, most likely, the supply growth on the one market results in the reduction of price growth rates on both markets. The second result proved to be more interesting, i.e. positive connection between adequate provision of housing and price growth rates. This result, evidently, testifies to the uneven development of the housing market in Russia. In the regions with high adequate provision of housing a large

number of apartments may stay on the market including the new-built property one required for the market maintenance. Thus, prices posted in the regions with high level of adequate provision of housing to a higher extent represent market prices. That is why they can be higher than in the regions where the housing marker is underdeveloped. Alternative explanation may be that the regions with higher level of adequate housing provision are better off and due to this prices grow faster there.

Among speculative factors the most significant proved to be variable characterizing accessibility of loans and RTS index change rate, in which connection as was expected, first of these factors increases investors' demand, and the second – reduces investors' demand. Moreover, performed estimates have confirmed that housing price growth was partly caused by a wider access of the people to mortgage lending, that is why (from the economic policy point of view) mere access to the mortgage lending without creating conditions for additional housing construction will solely result in price growth and will not simplify access to housing.

We have estimated housing supply equation where significant factors proved to be price change on residential property and on installation and construction works. Significance of these variables and expected values testify that the construction companies may adequately react to the market signal. It is worth noting that we rejected a hypothesis that such variables as the share of investments in residential (nonresidential) construction can reflect expected yield on the investment in various building sectors It is possible that this is connected with the fact that in part of the regions the share of investments in certain types of construction at the given stage was exogenous value, for example, due to financing of any large scale projects.

Estimate of an aggregate input of the investment (speculative) demand in the overall housing demand demonstrates that up to 30% of the housing price growth accounts for this component. Thus, we can speak about the presence of the price "bubble" on the housing market at the end of 2006. Evidently, the situation has not drastically changed from that period that is why in the wake of the crisis the Russian housing market may experience considerable difficulties including a sharp price fall.

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