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Tatyana D. Polidi

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RESEARCH ARTICLE

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ABSTRACT
Housing unaffordability and unavailability are major socio-economic problems in modern Russia, and result from market failure to provide a sufficient volume of new housing at reasonable prices. About 29% of new newly constructed housing units are self-build single-family houses produced outside the market. Professional builders are specialized mainly in constructing multifamily houses, generally in urban areas. This study analyses the efficiency of this market segment of housing construction, and shows that: (1) it is characterized by low price elasticity; (2) the responsiveness of new housing supply to demand changes is weak due to various supply restrictions and the imperfectly competitive behaviour of building companies and (3) self-built housing construction helps limit the market power of builders, which is stronger in more developed (and more profitable) regional markets and weaker in less developed ones.

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KEYWORDS
Housing, Supply price elasticity, Competition, Land, Construction

摘要
俄罗斯居民楼建设：供给弹性与竞争． 令人负担不起的房价和可居住住房的缺少是当代俄罗斯主要的社会经济问题，也是市场无法提供足够价格合理的新住房的结果。29%的新建住宅为市场外的自建独户住宅。专业建筑公司主要专门从事建造城市地区的居民楼。本研究分析了房屋建筑业居民楼这一部分市场的有效性，指出：（1）房屋建筑业的这部分市场以低价格弹性为特征；（2）由于各种供给限制和建筑公司的不完全竞争行为，导致新建住房供给对需求变化的响应能力较弱；（3）自建住房建设有助于限制建筑公司控制市场的能力，他们控制市场的能力在较发达（和能产生更多利润）的区域较强，而在欠发达地区较弱。

关键词
住房, 供应价格弹性, 竞争, 土地, 建设

CONTACT
polidi@urbaneconomics.ru
The Institute for Urban Economics, Tverskaya street, 20, build.1, 125009 Moscow, Russian Federation

RESUMEN

Construcción de edificios de viviendas en Rusia: elasticidad de oferta y comptencia. La falta de acceso y disponibilidad de viviendas asequibles supone uno de los principales problemas socioeconómicos en la Rusia moderna, y son el resultado de la incapacidad del mercado de ofrecer un volumen suficiente de nuevas viviendas a precios razonables. El 29% de las nuevas viviendas recién construidas son casas unifamiliares autoconstruidas fuera del mercado. Los constructores profesionales están especializados en construir principalmente edificios de viviendas, sobre todo en áreas urbanas. En este estudio analizamos la eficacia de este segmento del mercado en el sector de la construcción de viviendas y demostramos que: (1) el segmento del mercado de la construcción de viviendas se caracteriza por una baja elasticidad de precios; (2) la capacidad de respuesta de la oferta de nuevas viviendas a fluctuaciones en la demanda es deficiente debido a diferentes limitaciones de suministro y el comportamiento poco competitivo de las empresas constructoras; (3) las viviendas autoconstruidas limitan el poder de mercado de los constructores, que es más fuerte en mercados regionales más desarrollados (y más rentables) y más débil en los menos desarrollados.

PALABRAS CLAVE

Vivienda, Elasticidad de precios de oferta, Competencia, Tierra, Construcción

АННОТАЦИЯ

Низкая обеспеченность жильем и низкая доступность жилья представляют одну из наиболее серьезных социально-экономических проблем в современной России. 29% новых жилых единиц ежегодно производится вне рынка – это индивидуальные дома, которые строит население. Профессиональные девелоперы строят преимущественно многоквартирные дома и в основном в городах. В данной работе представлены результаты анализа эффективности этого рыночного сегмента жилищного строительства, которые показывают, что: (1)этот сектор характеризуется низкой ценовой эластичностью предложения; (2) слабая чувствительность предложения нового жилья в многоквартирных домах обусловлена различными институциональными ограничениями и несовершенно конкурентным поведением застройщиков; (3) индивидуальное жилищное строительство способствует ограничению рыночной власти застройщиков, которая сильнее в более экономически развитых (и более прибыльных) регионах и слабее в менее экономически развитых регионах.

КЛЮЧЕВЫЕ СЛОВА

жилье, ценовая эластичность предложения, конкуренция, земля, строительство

I. INTRODUCTION

According to the Russian Institute for Urban Economics (IUE), in 2011 only 27.1% of households could afford to buy a standard flat using a mortgage loan. According to other surveys 40–60%[1] of the total number of households in Russia need better housing—more living space and/or higher quality housing conditions. Per capita residential floor space in Russia is significantly lower than in developed countries, standing at about 22.5 m^2 compared with 65 m^2 in the U.S.A and 40.1 m^2 in Germany. A low level of housing availability is accompanied by a low quality of housing and urban environments in Russian cities and towns (see Kosareva and Puzanov, 2012).

The key reason for low affordability and availability of housing is market failure to provide a sufficient volume of housing by reasonable prices. During the period of high economic growth in Russia from 2000 to 2008 (on average 7% annually) real housing prices increased at

10% annually, while the volume of housing construction shrunk from 2.87 m^2 to 1.77 m^2 per 1 mn roubles of aggregate household real income.

The housing development sector is still dominated by negative factors such as explicit and implicit regulatory restrictions: unequal and limited access of building companies to municipal communal infrastructure (mainly central heating, water and sanitation systems), land plots (which in urban areas are generally in state and municipal property), long procedures for receiving various permissions and agreements, and corruption. These restrictions varied from one region to another. Potentially more profitable markets (in more economically successful regions) are more attractive for building companies and subject to less competitive behaviour. In this case regulatory restrictions not only increase construction costs but prevent the market entry of new firms adding pressure on housing prices and supply elasticity.

Another important feature of Russian housing markets—alongside high institutional barriers—is a large share of self-build housing construction of single-family houses: direct construction by a person or family on their own land plot, with an outside workforce hired to perform several types of work. Such housing could be considered a good substitute for developer-constructed housing in multifamily buildings. In this context the presence of self-built sector should affect *market* supply (i.e. housing in multifamily buildings) price elasticity.

The purpose of this study is to analyse the efficiency of the multifamily housing construction market in terms of the sensitivity of supply to demand shocks and the forces affecting market performance in various Russian regions. More specifically, it seeks to answer two questions: (1) Is new housing construction supply in Russia perfectly elastic? and (2) Do differences in the responsiveness of supply to demand changes among Russian regions stem from differences in regulatory restrictions and the strength/weakness of supply-side competition?

To answer the first question we: (1) after pretesting the data, firstly test the hypothesis of real housing prices stability over time using a panel of 76 regions between 2000 and 2010 and (2) estimate various housing market models to identify the price elasticity of new housing supply using panel of 76 regions and 4 sub-panels between 2000 and 2010.

To answer the second question we: (1) estimate the simple model of the new housing supply separately for each of the 61 regions, for which we had sufficient data and (2) after obtaining housing supply elasticities, perform a cross-sectional regression where estimated elasticity is the dependent variable.

In the rest of this paper Section II contains brief literature review. Section III provides a short overview of Russian housing construction. The results of pretesting the data are given in Section IV. The results of two-stage estimation of supply elasticity are set out in Section V. The results of the econometric analysis of supply elasticity constraint factors in new housing construction in the Russian regions are presented in Section VI. Conclusions and suggestions for further research are discussed in Section VII.

II. LITERATURE REVIEW

Econometric research of the supply elasticity of new housing construction exists for various countries including the U.S., the U.K, Australia (see Ball & Wood, 1999; Follain, 1979; Green, Malpezzi, & Mayo, 2005; Malpezzi & Maclennan, 2001; Muth, 1960, etc.). The earliest studies by Muth (1960) and Follain (1979) regressed the volume of housing construction (in terms of money or the number of construction permits issued) on relative real housing prices and real input prices. Follain (1979) extended the series from 16 to 29 years and addressed the problem of serial correlation and biased estimates caused by simultaneous determination of the equilibrium levels of supply volume and price. Both papers concluded that new housing supply in the U.S. is perfectly elastic. The elasticity of housing supply in the new housing construction markets was estimated using official national statistical data, assuming the homogeneity of local U.S. markets. Afterwards various other models were tested for the U.S. and other countries:

- Model of dependence of new housing supply (in terms of money, the number of building permits issued, number of housing unit completions, rate of growth of residential floor space, number of units in total housing stock) on relative housing prices or relative housing prices and real input prices (building materials prices, wages, interest rate) or on the growth rates of such prices (Ball, Meen, & Nygaard, 2010; Blackley, 1999; DiPasquale & Wheaton, 1994; Gitelman & Otto, 2012; Green et al., 2005; Mayer & Somerville, 2000b). These models afforded direct estimates of supply elasticity in new housing construction markets;
- Model of dependence between relative real housing prices and income, population size and existing housing stock, that is, the so-called reduced model (Gitelman & Otto, 2012; Harter-Dreiman, 2004; Malpezzi & Maclennan, 2001; Stern, 1992). These methods requires separate price- and income-based estimates for housing demand elasticity, which are used to determine price-based estimates for new housing supply elasticity.

These new housing supply elasticity estimates are based on both time series and panel data, aggregated at the country, city, metropolitan and/or firm level. Most studies indicate that new housing supply is relatively price insensitive. Yet the responsiveness of new housing supply to demand side shocks varies across countries, ranging from 0 to 30 in the U.S. (Green et al., 2005), 0 to 4.5 in the U.K. (Malpezzi & Maclennan, 2001), 0 to 1 in Australia (Gitelman & Otto, 2012), and 2.8 to 5.6 in China (Wang, Chan, & Xu, 2012). Researchers generally associate low new housing supply elasticity as well as high growth rates of housing prices to stringent regulatory environments where land use and planning rules and growth control policy restrict the supply of development land (Mayer & Somerville, 2000a). *Ceteris paribus* more rigid regulation of urban development leads to supply shortages and higher housing/real estate prices (Malpezzi, 1996; Malpezzi & Mayo, 1997; Mayo & Sheppard, 2001; Noam, 1983). However, we know little about the impact of competition policy on market performance, that is, market power of building firms and its influence on housing prices and excessive profits.

Some authors consider the impact of regulation on market structure and competition across various sectors of the economy, including housing construction. Noam (1984), for examples, tests for a correlation between the stringency of regulation in the construction sector and the market power of firms. He shows that more rigorous regulation leads to lower concentration in the construction sector and reduces the market power of firms. The reason why is that greater consolidation allows more efficient lobbying that eventually leads to a weaker regulatory environment. Somerville (1999) shows that homebuilder firms act as monopolistically competitive suppliers of differentiated products rather than as perfectly competitive firms selling homogeneous products. The larger building companies operate on more active markets with a bigger supply of land.

Fisman and Allende (2010) examine the impact of entry regulation on market structure or the level of competition (both static and dynamic), as well as on the national economic structure. Government regulation should correct market failures, but by preventing the entry of new firms in sectors with low natural entry barriers (e.g. non-capital-intensive production, production not displaying increasing returns to scale), it increases the size and market power of incumbent firms and reduces efficiency. Djankov, La Porta, Lopez-de-Silanes and Shleifer (2002) conducted a cross-country comparative study that showed that market entry regulation often implies large-scale corruption and the development of a hidden economy rather than better quality public and private goods.

Suzuki (2012) analysed the influence of land-use regulation on limiting hotel industry entry in Texas, U.S. Seven indicators of the level of regulation were defined: political leverage; whether it is difficult to introduce amendments to land use and development rules, or to get project approval (the number of state bodies whose permission is required); density constraints (minimum land plot size); requirement to provide open public spaces; requirement to invest in infrastructure; average durations of building permit applications. Empirical analysis showed that stiffening land-use regulation increased sunk costs by 24% and augmented revenue per room by 12%.

III. HOUSING CONSTRUCTION IN RUSSIA

According to the 2010 census data and the Federal State Statistic Service,[2] the population of Russia was 142.9 mn people and the existing housing stock amounted to 3.2 bn m^2, or 57.2 mn housing units. In 2011, the level of new housing development reached 62.3 mn m^2, or 786,000 new housing units, 29% of which was self-built single-family housing and 71% was multifamily one.

The share of self-built single-family housing in new construction is smaller in big cities than in small ones but nevertheless this segment remains significant in large urban areas. Of course some of this housing comprises second homes and cannot compete with market housing. Although, we lack suitable data to separate these two forms of usage of new single-family houses, we attempt to check whether the self-built housing sector affects the sector of market housing construction operated by professional building companies.

In 2000–2010, the population of Russia shrunk by 2.4% from 146.3 -to 142.9 million and population redistribution was a significant trend. Only a few regions enjoyed positive population growth: examples included Moscow and Moscow Region, Krasnodar Krai, Tyumen Region and Belgorod Region, mainly as a result of net migration gains induced by a relatively high level of economic development. Many regions 'lost' people who moved to a few well-developed cities (Moscow, Saint Petersburg, Krasnodar, Yekaterinburg etc.).

At the same time, the number of annual housing units completions increased in 2001–2008, reflecting among others, the growth of demand for housing driven primarily by household income growth and the expansion of mortgage lending (see Figure 1). New housing supply diminished slightly in 2009–2010 as a result of the economic crisis. However, this indicator varied significantly across regions. Some regions (Moscow Region, Penza Region, Krasnodar Krai, Novosibirsk Region, Omsk Region, etc.) enjoyed steady growth; others (such as Tatarstan, Tver Region, Pskov Region, etc.) experienced a certain volatility.

Real mean income and real prices on new housing construction markets climbed steadily in 2000–2008 (i.e. before the crisis). On average, real housing prices doubled over the period, while real mean income grew by nearly 150% (see Figure 2). Most regional markets experienced accelerated growth of real housing prices in 2006, that can probably be explained by unsatisfied demand for housing, which accumulated over 2000–2005 and became apparent only in 2006, when the demand spurred among other things, by the extension of mortgage lending (Kosareva & Tumanov, 2012).

According to some estimates rapid growth of housing prices was also spurred by speculative investment demand, contributing about 30% to this increase (see Drobyshevsky, Narkevich, Pikulina, & Polevoy, 2009). In some cities, speculative factors could trigger a price bubble on housing markets. Sternik and Sternik (2009) examined the evolution of Moscow housing prices in 1990–2009 and identified a short hot *speculative* housing market phase in October 2007–August 2008 followed by a mortgage-driven housing demand increase in 2005–2006.

Actually it is very difficult to separate accurately speculative and fundamental drivers of housing prices in Russian cities due to a lack of data. In our analysis housing is considered a consumer good rather than a financial instrument, and so we ignore the risks of housing market price bubbles.

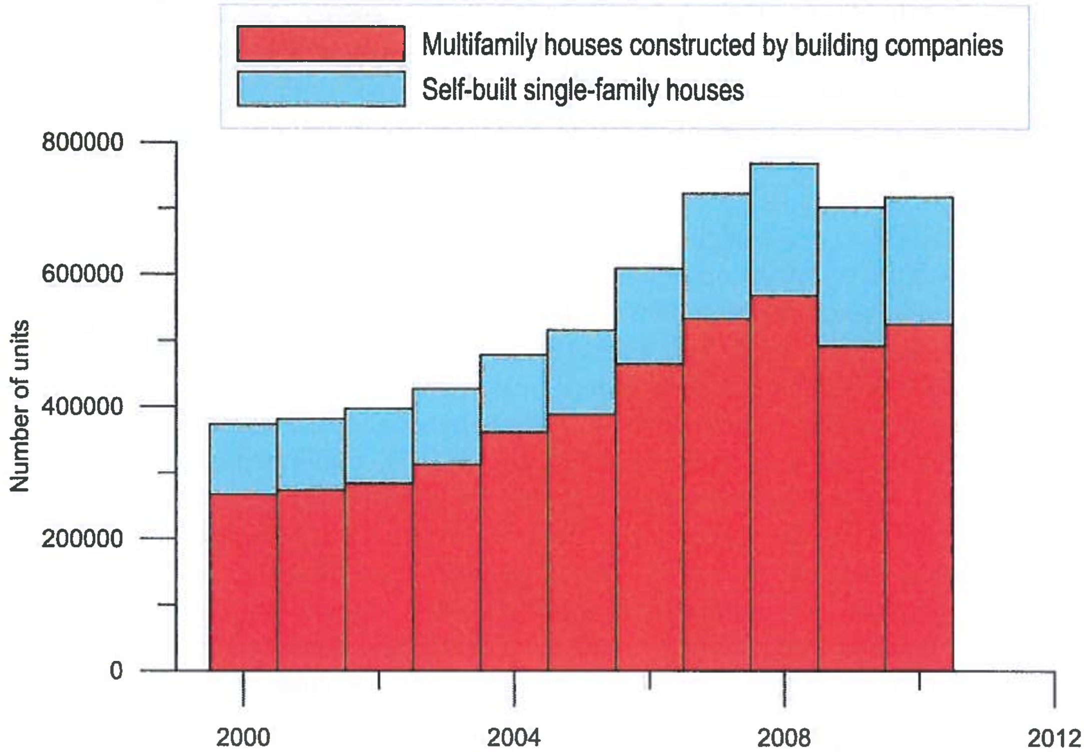

Figure 1. New housing supply dynamics in Russia in 2000–2010 (housing units in newly built by building companies multifamily houses and in self-built single-family houses).

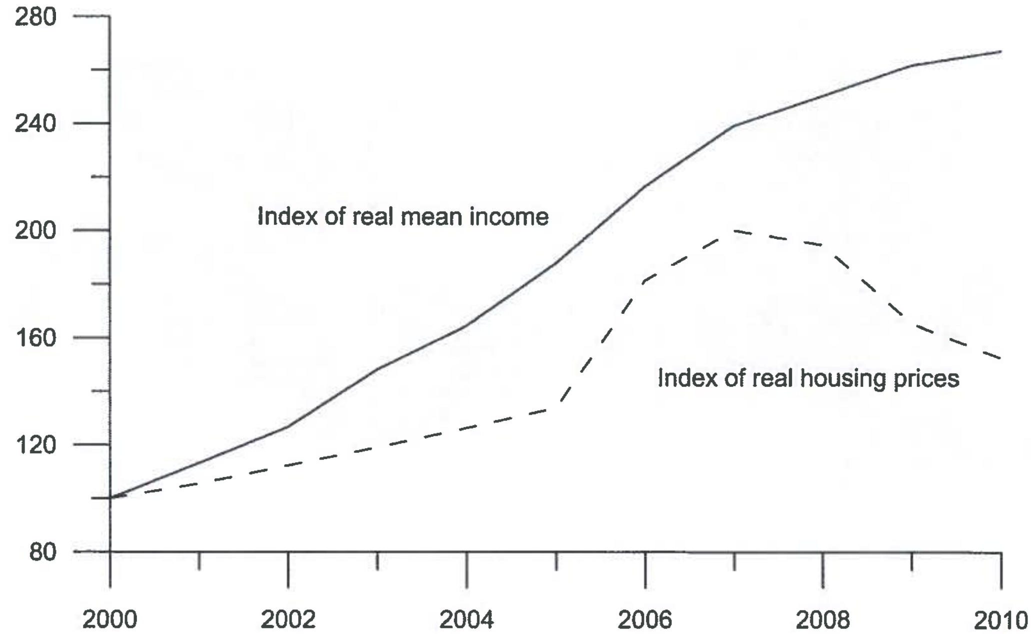

Figure 2. Indices of real mean income and real prices on newly built multi-family housing in Russia in 2000–2010.

The housing development sector is still dominated by negative factors such as explicit and implicit regulatory restrictions: unequal and limited access of building companies to municipal communal infrastructure (mainly central heating, water and sanitation systems), land plots (which in urban areas are generally in state and municipal property), long procedures for receiving various permissions and agreements, and corruption (Yasin, 2006).

According to a survey of administrative barriers in housing construction in Russia conducted by the IUE (on order of the National Association of Builders) in 43 Russian regional capital cities in 2011, construction of a multifamily building requires that a developer pass, on average, 100 administrative procedures[3] over a 3 year period, spending 25 mn roubles, including utilities connection costs (on average, 21 mn roubles). In fact, the related expenditures may account for 10% of construction project costs, and in some cities, may reach 30%.

Russian regions differ significantly in level of economic and social development. The IUE (see Kosareva, Polidi, & Puzanov, 2015, pp. 87–103) elaborated a typology of regions (on order of the Agency for Housing Mortgage Lending) by general economic conditions and specific housing market indicators, such as the level of mortgage lending development, new construction activity and housing affordability (see Figure 3). Using Principal Components, *k*-means and hierarchical methods these regions were grouped using four criteria: population's housing needs; household incomes and housing affordability; adequacy of housing supply; and regional economic characteristics affecting the housing market and new housing construction activity. All but three regions excluded for lack of data were grouped into eight clusters. Four clusters include just one region with quite specific characteristics that require separate consideration (Tyumen' Oblast, Sakhalin Oblast, Murmansk Oblast and Republic of Ingushetia). The other four housing 96% of the national population are:

Cluster 1. developing regions with a moderate potential for housing market development (39 regions). Main characteristics: a low or negative net migration inflow, and new

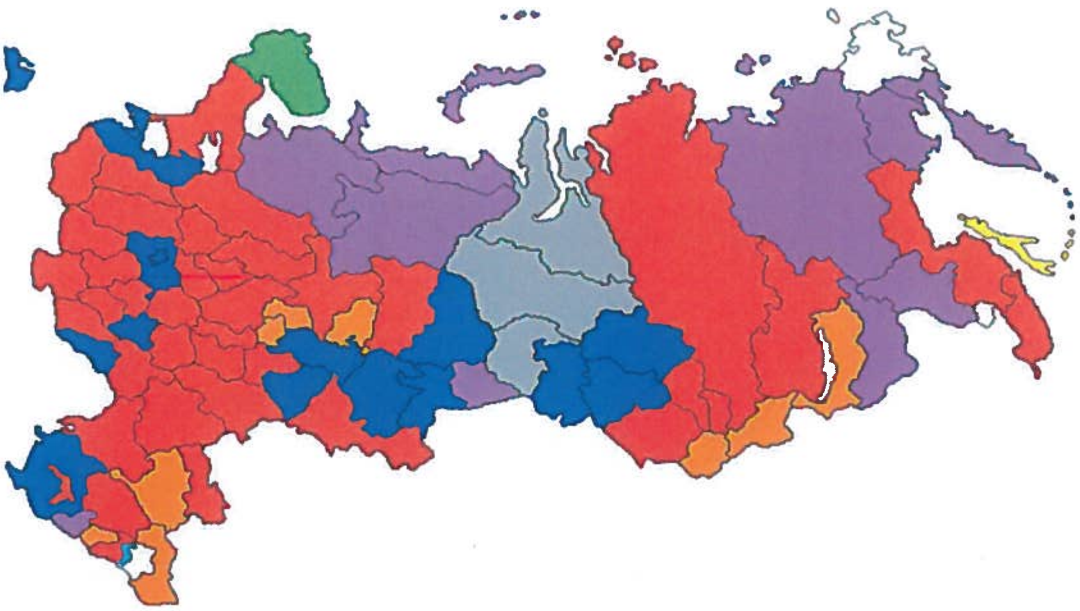

Figure 3. The map of distribution of the Russian regions by general economic conditions and specific housing markets' indicators such as the level of mortgage lending development, new construction activity and housing affordability (the borders of Russia as of 2011). red—cluster 1; blue—cluster 2; orange—cluster 3; purple—cluster 4; green—Murmansk Oblast; grey—Tyumen' Oblast; yellow—Sakhalin Oblast; apple green—Republic of Ingushetia; white—no data.

housing supply level and income growth rate at national average. Most of these regions are situated in the European part of Russia; they account for nearly 44% of the country's population;

Cluster 2. investment—attractive regions with developed housing markets (15 regions). Main characteristics: economic growth rate and new housing supply level above national average, and highly positive net migration inflow. Most of these regions are also situated in the European part of Russia; they account for nearly 40% of the country's population;

Cluster 3. regions of migration outflow and vague perspectives for housing market development (9 regions). These regions are mainly situated in the Russian Extreme North and Far East; they account for only 5% of the country's population;

Cluster 4. regions with a depressed economy and housing markets (9 regions). Despite population growth, these regions have depressed economies (relatively low level and growth of income per capita), which are not beneficial for real estate market development. They represent 6% of the country's population.

IV. DATA

Data

Estimations of the price elasticity of supply on new housing construction markets were based on annual data for 76 of 81 regions (in 2010) for which there was the following Federal State Statistic Service (Rosstat) data for 2000–2010: (1) index of real prices of newly built housing units in multifamily buildings (year to year nominal price index adjusted for the regional consumer price index, 1999 = 100%); (2) the number of newly built housing units in multi-family buildings (units) for each region; (3) real mean income (nominal mean income adjusted for regional consumer price index, roubles per capita in 1999 prices) for each region and (4) population size (end of year, thousands) for each region.

In the analysis of real estate markets median, hedonic or repeat sales price indices are commonly used. Usually such indices are calculated for specific cities and metropolitan statistical areas (MSAs), reflecting price dynamics in local housing markets. These indices are of course not perfect. The median price index, for example, returns price dynamics for a typical housing unit, although the median housing unit can change over time both in terms of its quantitative and qualitative specifications. The resale price index is a fixed quality index but is very difficult to compute because, once a property has been sold, it can take very long before it is resold, so that regular price dynamics data is unavailable. One of the advantages of this index is that it is based on real transaction prices. A hedonic price index uses information obtained from the hedonic regression (see, e.g. Dorsey, Hu, Mayer, & Wang, 2010). The first step is to estimate the regression of housing unit market price or rental rate on its various qualitative and quantitative features. The resulting coefficients are used in step two to estimate the price of a standard housing unit. Such regressions are estimated annually for each local market. A hedonic price index has a firm conceptual and intuitive basis but requires more data, which is usually unavailable for many markets and long time periods.

Official statistics in Russia includes regularly collected regional data on average housing prices and related indices. Rosstat publishes separate price indicators for newly constructed housing units and other units on the market, drawing mainly on transactions involving units in multifamily buildings of different types (classes). Statistically these indices are computed as Laspeyres price indices, that is, they reflect price dynamics for a certain bundle comprising housing units with different characteristics (various numbers of rooms, construction materials, etc.) within the certain market segment (from low- to high-quality apartments).[4] But these indices are not fixed quality (at least in terms of location) and fixed quantity (in terms of total floor space of housing unit) housing price measures, and reflect average regional prices (based on a sample of several municipalities), although no region affords a unified housing market. This paper nonetheless uses official Rosstat data on housing price dynamics since it's the only source of such data for most regions over a relatively long period of time.

Official Russian statistics do not contain any regular data on the number of building permits issued over a relatively long period of time. However, Rosstat monitors the total volume of housing construction in terms of number of completed housing units and total floor space in these units separately for multifamily buildings and self-built single-family houses. For the purposes of this research, we have separated the number of housing units in multi-family buildings developed by construction firms from the total number of housing units completed, and only analyse price dynamics for newly built housing units in multifamily buildings. 'Housing prices' will henceforth mean a price index for newly built housing units in multifamily buildings, unless otherwise specified.

We use mean regional per capita income as a proxy for mean regional household income due to lack of the estimates for the latter. According to some research, median household income in Russia is 20–30% lower than mean per capita income.

Testing for unit root and cointegration

A unit root in a time series is a sign of a non-stationary process, which can lead to spurious results. However, the results of an ordinary least squares (OLS) regression of real housing prices on average per capita income and population size—in logs—can be acceptable if these indicators' series are cointegrated. Therefore, we ran the Augmented Dickey–Fuller test for a unit root in real housing prices, followed by the Johansen cointegration test. The tests were run on a full panel across all regions and four groups of regions: clusters 1–4.

The Dickey–Fuller test results did not allow us to reject the null hypothesis of individual unit roots in the logarithm of housing prices neither for the full panel nor by cluster (see Table 1 and Appendix, Table A1). As a result of the Johansen test, we were able to reject the hypothesis that there is no cointegration between housing prices, average per capita income and population size at the 5% significance level, both for the full panel and by cluster (see Table 2).[5] Cointegration of time series implies that there is consistent interdependence between them, and helps avoid spurious results when using OLS estimates because in this case, regression residuals represent a stationary process.

It seems rather logical to conclude that there is consistent interdependence between new housing prices, per capita income and population size because, in 2000–2008, a vast majority of regions experienced housing prices growth, mean income increase and depopulation, while the relations between the three trends were relatively stable (as proven by the fact of cointegration between them).

Testing of time trend

First, we tested the hypothesis that housing prices are constant over time, that is, that a regression of logarithm of real housing prices against a time trend yields a zero coefficient. This test was run both on the full panel and for four regional clusters for two time periods: 2000–2008 and 2000–2010.

Table 3 shows that in all the regressions estimated, the time variable was significant at a 1% significance level, verifying statistically that real prices of new housing were growing steadily over the 2000s. Before the economic recession of 2008, real housing prices were generally growing by 10% per year. This means that the supply of new housing was not perfectly elastic because real equilibrium prices grew steadily from 2000, which is only possible when supply grows more slowly than demand. Note that, a steady growth of real prices in elastic supply environment could be explained only by improvement in the quality of housing. But no such tendency in housing construction was observed over the period considered.

Table 1. Results of the augmented Dickey–Fuller test for unit root in log price on new housing construction markets on full panel and four regional.

All regions	Stat.	Prob.**
ADF—Fisher chi-square	16.9039	1.0000
ADF—Choi Z-stat	10.6347	1.0000
Total (balanced) observations: 610		
Regions of cluster 1	Stat.	Prob.**
ADF—Fisher chi-square	9.68355	1.0000
ADF—Choi Z-stat	8.37624	1.0000
Total (balanced) observations: 370		
Regions of cluster 2	Stat.	Prob.**
ADF—Fisher chi-square	3.67569	1.0000
ADF—Choi Z-stat	5.12896	1.0000
Total (balanced) observations: 150		
Regions of cluster 3	Stat.	Prob.**
ADF—Fisher chi-square	0.19191	0.9957
ADF—Choi Z-stat	2.38819	0.9915
Total (balanced) observations: 20		
Regions of cluster 4	Stat.	Prob.**
ADF—Fisher chi-square	3.02356	0.9954
ADF—Choi Z-stat	3.20000	0.9993
Total (balanced) observations: 60		

Table 2. Results of the Johansen test for 'no coitegration' between the logs of real housing prices, real per capita income and population size on full panel and four regional clusters.

Johansen fisher panel cointegration test				
Trend assumption: linear deterministic trend				
	Fisher Stat.* (from trace test)	**Prob.**	**Fisher Stat.* (from Max–Eigen test)**	**Prob.**
All regions	601.3	0.0000	542.2	0.0000
Included observations: 836				
Regions of cluster 1	355.5	0.0000	315.8	0.0000
Included observations: 440				
Regions of cluster 2	174.7	0.0000	163.1	0.0000
Included observations: 176				
Regions of cluster 3	10.23	0.0367	8.471	0.0758
Included observations: 88				
Regions of cluster 4	54.20	0.0000	49.34	0.0000
Included observations: 99				

Table 3. The results of testing the stability of real housing prices on full panel and four regional, 2000–2010 and 2000–2008 periods.

Period: 2000–2010					Period: 2000–2008				
Variable	Coefficient	Std. Error	*t*-Stat.	Prob.	Variable	Coefficient	Std. Error	*t*-Stat.	Prob.
All regions									
C	4.61	0.01	360.03	0.00	C	4.52	0.01	426.47	0.00
@TREND	0.07	0.00	31.45	0.00	@TREND	0.10	0.00	45.02	0.00
Total panel (unbalanced) observations: 674					Total panel (unbalanced) observations: 552				
Regions of cluster 1									
C	4.61	0.02	295.73	0.00	C	4.52	0.01	367.31	0.00
@TREND	0.07	0.00	25.85	0.00	@TREND	0.10	0.00	38.63	0.00
Total panel (balanced) observations: 407					Total panel (balanced) observations: 333				
Regions of cluster 2									
C	4.59	0.03	167.98	0.00	C	4.50	0.02	192.49	0.00
@TREND	0.07	0.00	14.71	0.00	@TREND	0.10	0.00	20.49	0.00
Total panel (balanced) observations: 165					Total panel (balanced) observations: 135				
Regions of cluster 3									
C	4.76	0.07	65.48	0.00	C	4.66	0.06	72.57	0.00
@TREND	0.10	0.01	7.52	0.00	@TREND	0.13	0.01	9.22	0.00
Total panel (unbalanced) observations: 23					Total panel (unbalanced) observations: 19				
Regions of cluster 4									
C	4.66	0.05	98.78	0.00	C	4.56	0.04	109.46	0.00
@TREND	0.06	0.01	7.88	0.00	@TREND	0.10	0.01	11.23	0.00
Total panel (balanced) observations: 66					Total panel (balanced) observations: 54				

V. ESTIMATION RESULTS

The degree of inelasticity can be estimated and the situation in different regions can be compared after testing the reduced and standard models of the supply of new housing. In order to identify the price elasticity of new housing supply, estimates of the income coefficient obtained from these models and several sets of housing demand parameters found in the literature were used. The analysis was conducted using panel data for 76 regions and separately for the four groups of regions.

The existing literature follows two approaches to modelling housing supply and demand. The first approach implies that at any given moment of time, housing demand is a share of the desirable increase in the housing stock (Malpezzi & Maclennan, 2001). In other words, there is a certain desirable level of the housing stock that depends on income per capita and population; attaining this stock may take several years. This is due to the fact that housing is a durable good, housing construction is not an instantaneous process, and buying housing involves substantial transaction costs. In the second approach, this adjustment takes only one year, in other words, the demand for housing is exactly equal to the desired increase in the stock of housing (Malpezzi & Mayo, 1997). The first approach involves a stock adjustment model; the second a flow model. Usually, such models are estimated using time series data.

Due to a very short time span (11 years) we estimated reduced new housing market models using panel data for 76 regions and four regional clusters described above.

The stock model has the following form:

$$\log(hpi_{it}) = const_i + coef_1 * \log(i_{it}) + coef_2 * \log(pop_{it}) + coef_3 * \log(hs_{it-1}) + \varepsilon_{it}. \quad (1)$$

The dependent variable is the log of the index of real housing prices in region i in year t (1999 = 100%). Among the explanatory variables are the log of real income per capita (in 1999 roubles), population and the log of the lagged size of the housing stock (in square meters). The model also includes the constant individual effect $const_i$ of region i.

The flow model has the following form:

$$\log(hpi_{it}) = const_i + coef_1 * \log(i_{it}) + coef_2 * \log(pop_{it}) + \varepsilon_{it}. \quad (2)$$

Table 4 records the results of OLS estimations for two specifications of each model: with and without including a first order autoregressive term (to adjust for autocorrelation of regression error terms). All the models were tested with the use of White's heteroscedasticity-consistent correction for the covariance matrix. We estimated a pooled regression model and a model including random effects but the fixed-effects model turned out to be more suitable.

For nearly all of the regressions, the coefficient of the log of real income is significantly different from 0, suggesting imperfectly elastic supply. Adding a lagged dependent variable whose coefficient is significantly different from 0 in both models helps alleviate autocorrelation in the regression residuals, more than doubling the Durbin–Watson statistic value.

The AR(1) term $(\log(hpi_{it-1}))$, while significant, did not make a qualitatively large difference in the estimation of these models except ones estimated on panel data for cluster 3 (stock model) and for cluster 4 (flow model), in which Cochrane–Orcutt correction made the income coefficient insignificant. One can conclude that prices and income do correlate, which proves once again that supply elasticity on new housing construction markets is imperfect. In all cases, this dependence is stronger in regions with a developing economy and a moderate potential for the development of housing markets (cluster 1) than in regions with developed, investment-attractive economies and housing markets (cluster 2). In other words, the stock model with Cochrane–Orcutt correction is preferable from the point of view of theoretical validity; moreover, it yields the most robust estimates.

Table 5 shows the results of calculations of the supply elasticity calculated by the formula derived by Malpezzi and Maclennan by solving the housing market model, where the supply elasticity is expressed as a function of housing demand parameters and the stock adjustment rate:

$$\epsilon = \delta * \left(\frac{\alpha_2}{coef_1} + \alpha_1\right),$$

where

ϵ is the price elasticity of housing supply in new housing construction markets;

δ is the rate of adjustment of the housing stock to the desired level;

α_1 is the price elasticity of the demand for housing;

α_2 is the income elasticity of the demand for housing;

$coef_1$ is the coefficient of the log of real income in the stock model (1).

Making assumptions about α_1, α_2 and δ, or in other words about the price and income elasticities of demand, and the stock adjustment rate (Malpezzi & Maclennan, 2001), Table 5 records values for the price elasticity of new housing supply. These values vary: from –0.01 to

Table 4. Results of the estimation of models (1) and (2).

	Flow					Flow + AR(1)				
	All regions	Regions of cluster 1	Regions of cluster 2	Regions of cluster 3	Regions of cluster 4	All regions	Regions of cluster 1	Regions of cluster 2	Regions of cluster 3	Regions of cluster 4
Constant										
Coef	9.27	5.02	14.7	7.29	17.51	−2.04	−15.8	12.19	−10.99	−7.83
t-Stat.	3.45	0.58	3.07	0.34	2.07	−0.56	−2.05	2.87	−1.51	−0.44
p-value	0.00	0.56	0.00	0.73	0.04	0.57	0.04	0.005	0.15	0.66
Log i										
$Coef_1$	0.58	0.61	0.57	0.93	0.52	0.53	0.67	0.51	0.75	0.33
t-Stat.	7.49	6.58	8.41	3.63	3.93	2.36	2.95	2.45	1.66	1.23
p-value	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.12	0.23
Log pop										
$Coef_2$	−1.20	−0.66	−1.78	−1.4	−2.54	0.39	2.15	−1.42	1.51	1.6
t-Stat	−3.06	−0.58	−2.94	−0.5	−2.15	0.72	2.13	−2.12	2.08	0.6
p-value	0.00	0.57	0.00	0.62	0.04	0.47	0.03	0.04	0.06	0.56
Log hs_{t-1}										
$Coef_3$										
t-Stat										
p-value										
AR(1)										
$Coef_4$						0.62	0.6	0.64	0.76	0.68
t-Stat						4.17	3.71	4.18	7.14	7.09
p-value						0.00	0.00	0.00	0.00	0.00
R^2	0.81	0.81	0.81	0.86	0.83	0.88	0.86	0.89	0.86	0.91
DW	0.8	0.89	0.72	0.71	0.69	1.5	1.58	1.45	1.68	1.47
Number of obs.	674	407	165	23	66	611	370	150	20	60
Number of cross sections	63	37	15	3	6	62	37	15	2	6
Number of periods	11	11	11	11	11	10	10	10	10	10

	Stock					Stock + AR(1)				
	All regions	Regions of cluster 1	Regions of cluster 2	Regions of cluster 3	Regions of cluster 4	All regions	Regions of cluster 1	Regions of cluster 2	Regions of cluster 3	Regions of cluster 4
Constant										
Coef	15.07	22.91	14.99	87.18	20.43	16.41	31.90	22.06	−20.34	−4.98
t-Stat.	5.55	3.44	2.73	2.41	2.67	2.2	2.43	2.28	−0.6	−0.28
p-value	0.00	0.00	0.01	0.03	0.01	0.03	0.02	0.02	0.56	0.78
Log i										
$Coef_1$	0.82	0.88	0.63	1.61	0.8	0.87	1.02	0.82	0.71	0.58
t-Stat.	5.09	4.98	3.68	4.43	4.65	3.64	4.77	2.55	1.38	2.16
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.19	0.04
Log pop										
$Coef_2$	0.16	0.33	−1.26	0.98	−0.52	1.46	1.63	−0.17	1.51	3.81
t-Stat	0.14	0.25	−1.08	0.43	−0.38	2.01	2.02	−0.15	2.11	1.72
p-value	0.89	0.81	0.28	0.67	0.71	0.05	0.04	0.88	0.05	0.09
Log hs_{t-1}										
$Coef_3$	−1.69	−2.63	−0.45	−10.28	−1.91	−2.78	−4.52	−2.03	0.98	−2.02
t-Stat	−1.51	−2.08	−0.37	−2.68	−1.45	−2.14	−2.8	−1.24	0.27	−1.87
p-value	0.13	0.04	0.71	0.02	0.15	0.03	0.01	0.22	0.79	0.07
AR(1)										
$Coef_4$						0.62	0.58	0.67	0.76	0.69
t-Stat						5.7	5.31	5.65	7.3	8.3
p-value						0.00	0.00	0.00	0.00	0.00
R^2	0.82	0.82	0.81	0.91	0.83	0.89	0.88	0.89	0.86	0.92
DW	0.78	0.86	0.71	1.21	0.71	1.64	1.71	1.61	1.68	1.63
Number of obs.	673	407	165	23	66	611	370	150	20	60
Number of cross sections	63	37	15	3	6	62	37	15	2	6
Number of periods	11	11	11	11	11	10	10	10	10	10

Table 5. Parametrical estimates of the price elasticity of the new housing supply obtained from the estimation of model (1) with Cochrane–Orcutt correction.

			Income coefficient in reduced-form equation of price				
			All regions	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Price elasticity of demand	Income elasticity of demand	Adjustment coefficient	0.87	1.02	0.82	0.71	0.58
−0.5	1	0.3	0.19	0.14	0.22	0.27	0.37
−0.1	1	0.3	0.31	0.26	0.34	0.39	0.49
−0.5	0.5	0.3	0.02	0.00	0.03	0.06	0.11
−0.1	0.5	0.3	0.14	0.12	0.15	0.18	0.23
−0.5	1	0.6	0.39	0.29	0.43	0.55	0.73
−0.1	1	0.6	0.63	0.53	0.67	0.79	0.97
−0.5	0.5	0.6	0.04	−0.01	0.07	0.12	0.22
−0.1	0.5	0.6	0.28	0.23	0.31	0.36	0.46
−0.5	1	1	0.65	0.48	0.72	0.91	1.22
−0.1	1	1	1.05	0.88	1.12	1.31	1.62
−0.5	0.5	1	0.07	−0.01	0.11	0.20	0.36
−0.1	0.5	1	0.47	0.39	0.51	0.60	0.76

0.88 in cluster 1 regions; from 0.03 to 1.12 in cluster 2 regions; from 0.06 to 1.31 in cluster 3 regions and from 0.11 to 1.62 in cluster 4 regions.

The main conclusion of these results is that these intervals are very narrow and close to 0. Compared, for instance, with the U.S and U.K, for any given set of assumptions about the parameter values, presented in Malpezzi and Maclennan (2001), the Russian market is less elastic.

VI. ESTIMATING MULTIFAMILY HOUSING SUPPLY ELASTICITY CONSTRAINT FACTORS

To analyse the factors affecting housing supply elasticity, market performance indicator estimates are needed for each region. The existence of data for just 11 years is a serious constraint preventing the econometric estimation of models with many variables. Therefore, we decided to estimate only the following simple supply models for each region:

$$\log(cons_t * h/pop_t) = const + coef * \log(hpi_{t-1}) + \varepsilon_t, \qquad (3)$$

where

$cons_t$—the number of newly built housing units in multifamily buildings in year t;

h—household size according to the 2010 census;

pop_t—population size in year t;

hpi_t—real housing price index in year t.

The left-hand variable in each of these regressions is the number of newly constructed housing units, multiplied by average household size and divided by the population. This transformation is a proxy for the percentage change in the housing stock. Such a proxy is used in order to handle the problem of simultaneity in defining equilibrium prices and housing supply. The same method was used by Green et al. (2005), for example. The right-hand side of Equation (3) is the lagged index of real housing prices in natural logs. This choice is explained by the fact that the length of the new construction cycle, from the decision to build until completion, is at least 1 year, and in the Russian settings the construction period can reach 3 years or more. The available data, however, only permit a 1-year lag.

Table 6 shows the results of model (3) estimations performed separately for the 61 regions for which data were available. Statistically, significant (at 5% significance level) estimates of the new multifamily housing supply elasticity across Russian regions vary from 0.34 in Republic of Tatarstan to 2.95 in Leningrad Oblast. In 13 of the 61 regions, housing elasticity supply estimates are not significantly different from 0 at the 5% significance level. Four of the thirteen are from the first cluster of the most developed regions (Moscow, Lipetsk Oblast, Republic of Bashkortostan and Belgorod Oblast); 6 of the 13 are developing regions (Tver Oblast, Perm Krai, Primorsky Krai, Stavropol Krai, Republic of Adygea and Kostroma Oblast) and the remaining 3 are economically depressed regions (Komi Republic, Republic of Buryatia and Republic of Kalmykia).

It is important to know that the new housing supply elasticity is not homogenous within any given cluster. On the contrary, it varies: from 0 to 2 in cluster 1 (39 regions); from 0 to 2.95 in cluster 2 (15 regions); from 0.1 to 1.4 in cluster 3 (2 regions) and from 0 to 1.7 in cluster 4 (6 regions). These differences are explained by differences in local housing markets characteristics. Despite the use of a substantially smaller data set, the estimates obtained from model (3) are similar to those from the two-stage estimation presented in Section V.

The estimates of new housing supply elasticity point to the extremely low sensitivity of the housing construction sector to demand shocks. In theory, the supply of a good/service can be considered elastic if its price elasticity exceeds 1. However, the values of the elasticity coefficient can lie within the range between 0 and infinity. For instance, according to estimates for the U.S cities (Green et al., 2005) housing supply elasticity was equal to 1.77 in Boston, 1.43 in Pittsburg, 21.6 in Atlanta and 29.9 in Dallas. Boston and Pittsburg are considered to be compact MSAs, while Atlanta and Dallas are 'sprawl cities'. Green et al. (2005) consider an elasticity below 3 low.

Housing supply elasticity in Russian regions corresponds, therefore, to the lowest US values (between 0 and 3). A low elasticity is determined by different factors in different regions. In Moscow, for example, the development sector's weak response to demand side shocks is mainly due to very limited land availability, although there are still vast industrial areas that could be used for residential development. At the same time, huge housing demand is concentrated exactly in Moscow. A low supply elasticity in Tyumen Region result from a lack of demand for permanent accommodation in the region despite high per capita income (the Yamalo-Nenets Autonomous Okrug, which is part of Tyumen Oblast, accounts for more than 90% of total natural gas extraction in Russia). A challenging environment, especially climatic conditions, stimulates intensive capital outflow from the high-income Tyumen' Oblast into the housing markets of other regions.

Russia significantly differs from countries with long market traditions. Housing markets in Russia have a number of special features that are typical of developing economies, such as immature land markets, non-transparent regulatory frameworks, a huge number of barriers for doing business in housing construction, corruption, underdeveloped mortgage systems and construction project financing. The development of housing markets unfolds in a setting dominated by conflicts of interests between business (developers), federal and regional authorities, local administrations and public utilities' companies. At present, the balance of interests of these players is far from Pareto optimal. Unfortunately, more than 20 years of a market economy in Russia has not seen any serious progress in addressing the problem of housing shortage, both in terms of housing availability and quality.

Table 6. Results of the estimation of model (3).

No.	Region	Cluster	Const	p-value	Coef	p-value	R^2	F-Stat	p-value	DW
1	Moscow city	2	6.64	0.03	−0.89	0.15	0.24	2.58	0.15	0.71
2	Kostroma Oblast	1	2.03	0.45	−0.17	0.76	0.01	0.10	0.76	1.25
3	Republic of Komi	3	0.67	0.64	0.13	0.62	0.03	0.26	0.62	0.65
4	Republic of Bashkortostan	2	0.41	0.61	0.29	0.10	0.30	3.38	0.10	1.30
5	Republic of Adygea	1	−0.79	0.87	0.29	0.76	0.02	0.11	0.76	1.64
6	Lipetsk Obl	2	0.29	0.76	0.32	0.11	0.29	3.27	0.11	0.93
7	Republic of Tatarstan	2	0.74	0.32	0.34	0.05	0.41	5.51	0.05	1.72
8	Belgorod Obl	2	0.53	0.59	0.35	0.11	0.29	3.32	0.11	1.16
9	Vladimir Oblast	1	−0.51	0.36	0.39	0.00	0.65	14.91	0.00	1.38
10	Tver' Obl	1	−0.78	0.47	0.43	0.07	0.36	4.45	0.07	2.12
11	Republic of Mari El	4	−1.09	0.15	0.48	0.01	0.64	14.04	0.01	1.37
12	Republic of Udmurtia	4	−1.29	0.11	0.50	0.01	0.62	13.03	0.01	2.15
13	Republic of Kalmykia	4	−1.79	0.81	0.54	0.72	0.02	0.14	0.72	1.60
14	Pskov Obl	1	−1.55	0.04	0.56	0.00	0.72	20.28	0.00	2.43
15	Tyumen' Obl	7	−0.18	0.77	0.59	0.00	0.75	24.05	0.00	1.87
16	Tomsk Obl	2	−1.27	0.12	0.69	0.00	0.75	24.08	0.00	0.89
17	Smolensk Obl	1	−1.40	0.19	0.69	0.01	0.57	10.74	0.01	0.72
18	Volgograd Obl	1	−2.61	0.09	0.82	0.02	0.51	8.28	0.02	1.23
19	Republic of Chuvashia	4	−2.03	0.05	0.82	0.00	0.74	22.45	0.00	1.11
20	Perm' Krai	1	−2.58	0.39	0.84	0.18	0.22	2.21	0.18	1.32
21	Chelyabinsk Obl	2	−2.59	0.03	0.87	0.00	0.73	21.99	0.00	1.44
22	Samara Obl	2	−2.22	0.25	0.91	0.05	0.41	5.51	0.05	2.11
23	Ulyanovsk Obl	1	−3.16	0.14	0.95	0.04	0.42	5.86	0.04	1.45
24	Kaluga Obl	1	−2.95	0.06	0.98	0.01	0.60	12.23	0.01	1.92
25	Tambov Obl	1	−3.33	0.01	0.99	0.00	0.77	27.10	0.00	2.04
26	Moscow Obl	2	−2.10	0.07	1.02	0.00	0.75	23.88	0.00	1.33
27	Vologda Oblast	1	−3.46	0.00	1.04	0.00	0.91	80.36	0.00	1.79
28	Kirov Obl	1	−3.90	0.08	1.06	0.02	0.49	7.82	0.02	1.87
29	Voronezh Obl	1	−2.82	0.04	1.07	0.00	0.72	20.36	0.00	2.13
30	Nizhniy Novgorod Obl	1	−3.80	0.00	1.10	0.00	0.84	41.44	0.00	1.37
31	Krasnoyarsk Obl	1	−3.88	0.03	1.12	0.00	0.65	15.18	0.00	1.21
32	Bryansk Obl	1	−4.04	0.06	1.13	0.02	0.53	9.18	0.02	1.01
33	Ivanovo Obl	1	−5.02	0.03	1.17	0.01	0.56	10.25	0.01	1.94
34	Saratov Oblast	1	−4.34	0.00	1.19	0.00	0.87	52.70	0.00	1.42
35	Primorsky Krai	1	−4.62	0.14	1.21	0.08	0.33	3.99	0.08	1.91
36	Sverdlovskaya Obl	2	−5.02	0.01	1.27	0.00	0.74	22.55	0.00	1.44
37	Yaroslavl Obl	1	−4.90	0.00	1.28	0.00	0.92	96.19	0.00	3.12
38	Altai Krai	1	−5.70	0.00	1.31	0.00	0.73	21.14	0.00	1.58
39	Rostov Obl	1	−4.73	0.06	1.33	0.02	0.51	8.38	0.02	1.04

(Continued)

Table 6. (Continued).

No.	Region	Cluster	Const	p-value	Coef	p-value	R^2	F-Stat	p-value	DW
40	Novgorod Obl	1	−5.36	0.00	1.38	0.00	0.83	39.73	0.00	1.28
41	Orenburg Obl	1	−5.79	0.02	1.39	0.01	0.61	12.33	0.01	1.03
42	Amurskaya Obl	3	−5.80	0.00	1.40	0.00	0.79	30.07	0.00	2.64
43	Kemerovo Obl	1	−5.41	0.00	1.40	0.00	0.88	57.06	0.00	0.76
44	Omsk Obl	2	−5.27	0.06	1.41	0.02	0.52	8.79	0.02	0.80
45	Penza Obl	1	−5.56	0.00	1.48	0.00	0.79	30.16	0.00	1.83
46	Orel Obl	1	−5.29	0.01	1.50	0.00	0.76	25.61	0.00	0.76
47	Republic of Khakasia	1	−6.17	0.00	1.53	0.00	0.91	76.59	0.00	3.05
48	Republic of Mordovia	1	−6.51	0.00	1.60	0.00	0.80	32.40	0.00	1.15
49	Khabarovsk Krai	1	−6.40	0.00	1.62	0.00	0.80	31.48	0.00	0.64
50	Tula Oblast	1	−6.66	0.00	1.66	0.00	0.81	34.10	0.00	2.16
51	Saint Petersburg City	2	−5.18	0.01	1.69	0.00	0.74	23.27	0.00	1.27
52	Republic of Buryatia	4	−6.60	0.28	1.73	0.22	0.18	1.76	0.22	0.54
53	Republic of Altai	4	−7.89	0.07	1.74	0.05	0.39	5.08	0.05	3.08
54	Ryazan Obl	1	−6.87	0.00	1.80	0.00	0.88	56.79	0.00	1.09
55	Kursk Obl	1	−6.54	0.01	1.86	0.00	0.74	23.12	0.00	1.27
56	Krasnodar Krai	2	−7.23	0.00	1.88	0.00	0.74	22.86	0.00	1.94
57	Arkhangelsk Obl	1	−8.66	0.00	1.93	0.00	0.82	37.08	0.00	1.70
58	Republic of Karelia	1	−8.72	0.01	2.04	0.00	0.67	16.24	0.00	1.86
59	Novosibirsk Obl	2	−8.89	0.03	2.19	0.01	0.58	11.24	0.01	1.15
60	Leningrad Obl	2	−11.78	0.06	2.95	0.03	0.45	6.43	0.03	1.28
61	Stavropol Krai	1	−18.51	0.29	4.34	0.26	0.16	1.49	0.26	0.58
62	Astrakhan Obl	1	Sufficient data are not available							
63	Irkutsk Obl	1	Sufficient data are not available							
64	Republic of Severnaya Osetia-Alania	1	Sufficient data are not available							
65	Kaliningrad Oblast	2	Sufficient data are not available							
66	Zabaykalsky Krai	3	Sufficient data are not available							
67	Kamchatka Obl	3	Sufficient data are not available							
68	Republic of Karachaevo-Cherkessia	3	Sufficient data are not available							
69	Kurgan Obl	3	Sufficient data are not available							
70	Magadan Obl	3	Sufficient data are not available							
71	Republic of Sakha (Yakutia)	3	Sufficient data are not available							
72	Republic of Dagestan	4	Sufficient data are not available							
73	Murmansk Obl	5	Sufficient data are not available							
74	Sakhalin Obl	6	Sufficient data are not available							
75	Republic of Kabardino-Balkaria	4	Sufficient data are not available							
76	Republic of Tuva	4	Sufficient data are not available							

The hypothesis that this paper seeks to prove is that one of the key reasons for such a failure is quite weak competition in housing construction driven by factors mentioned above. A relatively large proportion of self-built housing in newly constructed housing units is considered evidence of a crowding-out effect—people are forced to construct houses rather than buy completed housing units by high prices on new housing units in multifamily buildings set by developers who may exercise excessive market power.

Under *certain conditions*[6] housing built by professional developers (market agents) and self-built housing can be considered to be substitute goods in terms of consumption. The easier it is to switch from a good to its substitute, the higher the good's price elasticity of demand (in absolute terms) and therefore price elasticity of supply if consumer preferences are indifferent between these two kinds of housing. Actually, single-family housing and apartment in multi-family building cannot be considered as perfect substitutes in terms of quality characteristics such as location (including access to transport and social infrastructure), which depends on zoning and urban planning strategies, and maintenance costs which depend on existing regulation in the sphere of housing management. Beside this self-build housing construction depends not only on consumer preferences but also on project feasibility: opportunity costs of household (income) which reflect decisions about the allocation of time between employment and constructing a family house. It seems that in the context of high inequality in income distribution, a large share of households with low incomes and high prices for housing, the strategy of self-built housing construction could be reasonable for households which own or have legal rights to land plots.

In fact, if total satisfied housing demand is 100%, its structure appears as follows: 16%—purchases of newly built by building companies housing units, 78%—purchases from within existing housing stock and 6%—self-built housing.[7] In other words, self-built housing comprises nearly one-third of the total number of new housing units completed. Self-built housing construction in Russia expanded by 80% in the 2000s (from 106,179 housing units in 2000 to 192,499 housing units in 2010), while its share in the total number of new housing units built was stable in the range of 24–29%.

In a perfectly competitive context, the price elasticity of housing supply provided by professional developers should not depend on the share of self-built housing. In an imperfectly competitive context, developers' market power weakens insofar as consumers can opt to switch to a different kind of consumption, that is, self-built housing construction. In an imperfectly competitive market, the price elasticity of housing supplied by professional developers reflects among other supply restrictions, their market power and, all other things being equal, should increase if the share of households that prefer self-built housing increases.

Nearly 80% of the total area of all Russian cities, towns and villages is in public ownership. Access to such land (for potential tenants or landowners) is enabled through open land auctions. We have used data on the total area of state and municipal land allocated for residential development in order to construct a proxy for assessing the complexity of implementing investment development projects. The proxy indicates the gap between potential and actual new housing construction on land plots provided for residential construction and, therefore, reflects the strength of various supply restrictions such as access to municipal infrastructure, long procedures for receiving building permits and others.

According to the results of the 2009 monitoring of the efficiency of regional authorities performed by the Ministry of Regional Development,[8] the total space of land plots provided to building companies for residential construction amounted to 45,000 hectares in 2007, 50,000 hectares in 2008 and 45,000 hectares in 2009. If we assume a 3-year lag between getting access to land and completing a multifamily house, in 2010 and 2011 200 mn m2 and 180.4 mn m^2 of residential floor space could be potentially constructed.[9] Actually only

32.9 mn m^2 and 25.5 mn m^2 of residential floor space was completed in 2010 and 2011, that is, only 15% of the potential.

However, this underproduction cannot be explained by the economic recession that began in 2008. New housing construction did not really go down too much during the crisis: in 2007 developers built 532,900 housing units, and in 2010 525,800 housing units, or just 1.3% fewer. Total land for residential development available at public auctions stayed stable in 2007–2009.

This data leads to a conclusion that the crisis did not have much impact on developers' strategies, and that the gap between potential and actual housing construction is due to intentional supply constrains (anticompetitive behaviour), regulatory and other supply restrictions.

The following model was used to estimate the impact of the aforementioned factors on new housing supply elasticity:

$$\log(e_i) = const + coef_1 * \log(gap_i) + coef_2 * \log(sb_i) + coef_3 * \log(hpi_i) +, \\ + coef_4 * \log(dpop_i) + \varepsilon_i \tag{4}$$

where

e_i is the estimate of new housing supply elasticity for region i obtained from model (3);

gap_i is the gap between potential and actual new housing construction in region i in 2010 (%);

sb_i is the share of housing units in self-built houses in the total number of newly built housing units in region i in 2010 (%);

hpi_i is real price index for new housing construction in region i in 2010 (1999 = 100%);

$dpop_i$ is population density in region i in 2010 (inhabitants per km2).

Other model specifications have been estimated. They included the following variables: net migration inflow per 1000 permanent residents, resident population, number of real estate transactions, share of housing sales using mortgage loans and total residential stock. However, all these factors turned out to be non-significant. The model does not include income tax and property tax variables because they are nearly universal across regions. It also did not take land tax into account. Even though the land tax rate is determined in each city by the local administration, it does not really have any impact on the market situation because it is negligibly small and does not differ much across regions.

Model (4) estimation results for all the regions and clusters 1 and 2 are shown in Table 7. (There was not enough data to estimate the model for clusters 3 and 4.) The results for some coefficients may seem unexpected. Population density turned out to be non-significant in all the regressions. In theory, higher population density should lead to lower housing supply elasticity. Insignificance might be due to the fact that the analysis was based on the average density of the population in each region, although it may vary dramatically for cities within one region, especially in Siberia and the Far East.

New housing supply elasticity is lower in regions with higher housing prices. At the same time, there might also be a relationship in the opposite direction: if housing supply elasticity is low in a region, real housing prices might increase.

As we had anticipated, we have found out that self-built housing and various institutional barriers (described by the gap between potential and real new housing supply) do have an impact on new housing supply elasticity. The supply elasticity of housing built by professional developers was higher in regions with a substantial share of self-built housing in the total new housing supply, proving that the availability of a substitute good (i.e. self-built housing) constrains developers' market power.

The coefficient of the share of self-built housing in the estimation of Equation (4) for cluster 1 regions (developing regions with a moderate potential for housing market

Table 7. Results of the estimation of model (4).

Dependent Variable: LOG(E)				
All regions				
Included observations: 59				
Variable	Coefficient	Std. Error	*t*-Stat.	Prob.
C	4.242795	0.839313	5.055081	0.0000
LOG(GAP)	−0.343276	0.140949	−2.435469	0.0182
LOG(SB)	0.238216	0.043280	5.504129	0.0000
LOG(HPI)	−0.524818	0.160796	−3.263867	0.0019
LOG(DPOP)	−0.046715	0.036390	−1.283715	0.2047
R^2	0.550332	Akaike info criterion		0.775036
Adjusted R^2	0.517023	Schwarz criterion		0.951098
F-stat	16.52216	Hannan–Quinn criterion.		0.843763
Prob(*F*-stat)	0.000000	Durbin–Watson stat		2.173954
Regions of cluster 1				
Included observations: 36				
Variable	Coefficient	Std. Error	*t*-Stat.	Prob.
C	2.597449	1.053246	2.466137	0.0194
LOG(GAP)	−0.297867	0.108863	−2.736151	0.0102
LOG(SB)	−0.113783	0.125750	−0.904834	0.3725
LOG(HPI)	−0.300088	0.187236	−1.602727	0.1191
LOG(DPOP)	−0.030463	0.050100	−0.608049	0.5476
R^2	0.306874	Akaike info criterion		0.237223
Adjusted R^2	0.217439	Schwarz criterion		0.457156
F-stat	3.431234	Hannan–Quinn criterion.		0.313986
Prob(*F*-stat)	0.019622	Durbin–Watson stat		1.584469
Regions of cluster 2				
Included observations: 15				
Variable	Coefficient	Std. Error	*t*-Stat.	Prob.
C	10.50061	2.119853	4.953461	0.0006
LOG(GAP)	−4.744601	1.317378	−3.601549	0.0048
LOG(SB)	0.406325	0.067596	6.011095	0.0001
LOG(HPI)	−0.668413	0.317879	−2.102729	0.0618
LOG(DPOP)	0.069281	0.078539	0.882129	0.3984
R^2	0.887741	Akaike info criterion		0.874372
Adjusted R^2	0.842838	Schwarz criterion		1.110388
F-stat	19.77002	Hannan–Quinn criterion.		0.871858
Prob(*F*-stat)	0.000097	Durbin–Watson stat		1.089648

development) was non-significant, although for cluster 2 regions (investment—attractive regions with developed housing markets) it was significant and turned out to be nearly twice as large as in the full panel results. This means that the existence of self-built housing sectors constrains developers' imperfectly competitive behaviour in regions with active and highly developed economies and housing markets, where such uncompetitive behaviour is preferable for builders.

Institutional barriers proved to be a highly significant factor in all the regressions. Its coefficient in model (4) equals -0.34 (-0.3 in cluster 1, and -4.74 in cluster 2). Therefore, the impact of institutional barriers on new housing supply elasticity is higher in regions with a relatively developed economy and housing market, perhaps because competition in the sphere of housing construction is higher in low-demand regions than in high-demand regions. This is quite logical because potential excessive profit is much higher in the markets with high demand, stimulating imperfectly competitive behaviour among developers and decreasing housing supply elasticity.

VII. SUMMARY AND CONCLUSIONS

This research has led to the following key results. First, new housing construction markets in Russia exhibit a relatively low price elasticity, varying from 0 to 3. Second, various supply restrictions such as unequal and limited access of building companies to municipal communal infrastructure (mainly central heating, water and sanitation systems), land plots (which in urban areas are generally in state and municipal property), long procedures for receiving various permissions and agreements, and corruption have a significant adverse impact on new housing supply elasticity. These restrictions have significantly more negative impact on supply elasticity in well-developed regions rather than in less-developed ones. Third, self-built housing construction is a factor that constrains developers' imperfectly competitive behaviour in the economically developed regions with high demand for new housing.

This research was limited due to lack of available statistical data. First, insufficient data exists for the whole of over 20 years of economic transformation in Russia. Second, existing statistics on Russian housing markets suffer from a number of methodological limitations. Therefore, this research amounts only to the initial stage of analysing housing supply elasticity in Russia and its drivers, and could be developed further by estimating new housing supply elasticity in large Russian cities, evaluating and applying hedonic price indices, analysing the factors that determine the dynamics and share of self-built housing construction in total new housing supply in Russia and evaluating the impact of secondary housing markets on the behaviour of developers.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author.

NOTES

1 See, for example, Rosstat survey 'Incomes, expenditures and consumption of the Russian households' http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1140096812812; Bessonova (2011).

2 Based on Rosstat data: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/main/.

3 According to research data, the process of going through administrative procedures involves the obtaining of a document (agreement, act, permit, certificate, receipt, extract from a state register, conclusion, inquiry, letter, etc.) at the state (municipal) agency or authorized organization. The full report of the research is available on the web-site www.nostroy.ru.

4 http://www.gks.ru/free_doc/new_site/prices/icpvr_data.htm.

5 However, the assumption does prove to be true for some regions, such as Moscow, Pskov Region, Altai Republic, Leningrad Region (see Appendix, Table A2).

6 Under *another conditions*, housing built by professional developers (market agents) and self-built housing can be considered to be complementary goods, for example, household could use the flat in multifamily building in the city as the main house and single-family house on the suburb as the second home.

7 Based on the data on real estate transactions registered with the Federal Service of State Registration, Land Register and Mapping (https://rosreestr.ru/wps/portal/p/cc_ib_ros_reestr/cc_ib_statistical_inform/cc_ib_analytical_statistical_information) in 2010 and Rosstat data on the number of new housing units (https://gks.ru).

8 In 2013, this Ministry was reorganized into the Ministry of Construction, Housing and Public Utilities.

9 The author's estimation is based on the data provided by the Russian Ministry of Regional Development, with average residential density of 4000 m^2 per hectare. At the moment of preparing this research the data were available on the website of the Ministry.

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APPENDIX

Table A1. The results of unit root tests (ADF-test).

Cross-section	Prob.
Adygea_republic	Dropped from test
Altai_krai	0.9467
Altai_repub	0.9019
Amur_obl	0.9835
Arhang_obl	0.9646
Astrah_obl	0.7785
Bashkortostan_repub	Dropped from test
Belgor_obl	0.9316
Briansk_obl	0.9023
Buryat_repub	0.9475
Cheliabinsk_obl	0.4262
Chuvash_repub	0.9740
Dagestan_repub	0.9603
Habarovsk_krai	Dropped from test
Hakasia_repub	0.9960
Irkutsk_obl	0.8318
Ivanovsk_obl	Dropped from test
Kabard_repub	0.9409
Kaliningr_obl	Dropped from test
Kalmikia_repub	Dropped from test
Kalug_obl	0.5769
Kamchatka	0.8466
Karachaev_repub	Dropped from test
Karelia_repub	Dropped from test
Kemerovsk_obl	0.8539
Kirovsk_obl	0.9167
Komi_repub	0.9772
Kostroms_obl	0.9418
Krasnodsr_krai	0.9389
Krasnoyarsk_krai	0.9690
Kurgan_obl	0.6371
Kurskaya_obl	Dropped from test
Leningrad_obl	0.9586
Lipetsk_obl	0.9507
Magadan_obl	0.9324
Mari_El_repub	Dropped from test
Mordovia_repub	0.9662

(*Continued*)

Table A1. (Continued).

Cross-section	Prob.
Moscow	0.9863
Moscow_obl	0.8244
Murmansk_obl	0.8696
Nigegorod_obl	Dropped from test
Novgorod_obl	0.8808
Novosib_obl	0.6842
Omsk_obl	0.9012
Orenburg_obl	0.8705
Orlovsk_obl	0.5070
Penzensk_obl	0.9379
Permsk_krai	0.8253
Primorsk_krai	0.9238
Pskov_obl	0.8561
Riazan_obl	0.9841
Rostov_obl	0.8866
Sahalin_obl	0.9108
Saint-Petersburg	Dropped from test
Samara_obl	0.9278
Saratov_obl	0.8059
Sev_Osetia_repub	0.9869
Smolensk_obl	Dropped from test
Stavropol_krai	0.8418
Sverdlov_obl	0.9883
Tambov_obl	0.6510
Tatarstan_repub	0.9504
Tuva_repub	0.8509
Tomsk_obl	Dropped from test
Tula_obl	0.9713
Tumen_obl	0.9793
Tver_obl	0.8483
Udmertia_repub	0.8796
Ulianovsk_repub	0.9829
Vladimir_obl	0.8917
Volgograd_obl	0.9662
Vologod_obl	0.7111
Voroneg_obl	0.9359
Yakutia_repub	0.9131
Yaroslavl_obl	Dropped from test
Zabaikal_krai	0.8393

Table A2. The results of Johansen cointegration tests.

Hypothesis of no cointegration	Trace test		Max–Eign test	
Cross section	Stat.	Prob.**	Stat.	Prob.**
Adygea _repub	49.7423	0.0001	37.1497	0.0001
Altai_krai	32.4377	0.0243	22.3393	0.0337
Altai_repub	23.7193	0.2126	13.2485	0.4296
Amur_obl	14.8316	0.7909	7.7767	0.9168
Arhang_obl	22.9273	0.2497	14.5984	0.3180
Astrah_obl	Dropped from test			
Bashkortostan_repub	61.6907	0.0000	43.3868	0.0000
Belgor_obl	28.4239	0.0714	18.3247	0.1182
Briansk_obl	26.1696	0.1237	19.5817	0.0812
Buryat_repub	58.6729	0.0000	48.9070	0.0000
Cheliabinsk_obl	35.9989	0.0085	20.3790	0.0634
Chuvash_repub	24.2925	0.1884	16.8047	0.1814
Dagestan_repub	Dropped from test			
Habarovsk_krai	54.1325	0.0000	40.2256	0.0000
Hakasia_repub	24.2997	0.1881	19.6067	0.0806
Irkutsk_obl	Dropped from test			
Ivanovsk_obl	64.7736	0.0000	47.2875	0.0000
Kabard_repub	Dropped from test			
Kaliningr_obl	Dropped from test			
Kalmikia_repub	28.9495	0.0624	15.0931	0.2824
Kalug_obl	41.4326	0.0015	36.4831	0.0002
Kamchatka	Dropped from test			
Karachaev_repub	Dropped from test			
Karelia_repub	37.8254	0.0048	19.3818	0.0863
Kemerovsk_obl	24.1756	0.1931	15.6256	0.2475
Kirovsk_obl	53.6966	0.0000	36.9553	0.0002
Komi_repub	36.3669	0.0076	24.5611	0.0158
Kostroms_obl	19.6312	0.4482	11.0688	0.6405
Krasnodsr_krai	32.3137	0.0251	21.6095	0.0428
Krasnoyarsk_krai	28.8608	0.0638	20.7315	0.0568
Kurgan_obl	Dropped from test			
Kurskaya_obl	40.0377	0.0024	21.5007	0.0444

(Continued)

Table A2. (Continued).

Hypothesis of no cointegration	Trace test		Max–Eign test	
Leningrad_obl	27.9868	0.0797	16.7203	0.1856
Lipetsk_obl	36.3155	0.0077	23.9082	0.0198
Magadan_obl		Dropped from test		
Marii_El_repub	36.4652	0.0074	28.8455	0.0034
Mordovia_repub	53.0557	0.0000	37.3108	0.0001
Moscow	18.4466	0.5332	11.4121	0.6062
Moscow_obl	39.7794	0.0026	28.8085	0.0034
Murmansk_obl		Dropped from test		
Nigegorod_obl	50.2634	0.0001	38.5061	0.0001
Novgorod_obl	29.8611	0.0492	26.4510	0.0081
Novosib_obl	46.0612	0.0003	32.2940	0.0009
Omsk_obl	38.8301	0.0035	33.0623	0.0007
Orenburg_obl	27.4854	0.0903	16.8448	0.1794
Orlovsk_obl	31.4821	0.0317	21.3589	0.0465
Penzensk_obl	27.7073	0.0855	18.0924	0.1264
Permsk_krai	25.9788	0.1293	19.1426	0.0928
Primorsk_krai	35.7296	0.0092	21.0321	0.0516
Pskov_obl	23.3661	0.2285	12.2532	0.5229
Riazan_obl	40.4186	0.0021	24.7311	0.0149
Rostov_obl	26.2527	0.1213	16.8094	0.1812
Sahalin_obl		Dropped from test		
Saint-Petersburg	44.7133	0.0005	32.3297	0.0009
Samara_obl	32.5116	0.0238	23.8486	0.0202
Saratov_obl	37.8883	0.0047	22.5847	0.0310
Sev_Osetia_repub		Dropped from test		
Smolensk_obl	36.6575	0.0069	19.6078	0.0805
Stavropol_krai	35.6288	0.0095	26.0841	0.0092
Sverdlov_obl	38.9174	0.0034	26.5319	0.0079
Tambov_obl	29.9752	0.0477	22.5637	0.0312
Tatarstan_repub	54.1953	0.0000	45.3432	0.0000
Tuva_repub		Dropped from test		
Tomsk_obl	44.3572	0.0006	36.8196	0.0002

(Continued)

Table A2. (Continued).

Hypothesis of no cointegration	Trace test		Max–Eign test	
Tula_obl	27.2257	0.0962	17.5091	0.1493
Tumen_obl	30.9265	0.0369	20.4773	0.0615
Tver_obl	53.9767	0.0000	41.2536	0.0000
Udmertia_repub	33.1127	0.0200	18.6426	0.1076
Ulianovsk_repub	54.3477	0.0000	45.0389	0.0000
Vladimir_obl	28.7953	0.0649	19.4578	0.0843
Volgograd_obl	26.5139	0.1141	11.5920	0.5882
Vologod_obl	22.9986	0.2461	17.9275	0.1326
Voroneg_obl	25.8629	0.1329	17.5062	0.1494
Yakutia_repub	Dropped from test			
Yaroslavl_obl	28.8718	0.0636	18.4651	0.1134
Zabaikal_krai	Dropped from test			

**MacKinnon-Haug-Michelis (1999) p-values.