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Economic Criteria for Cities' Readiness for the Renovation Program

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Abstract
There are a number of issues that are relevant and high priority for many large cities around the world. Among them are the following: renovation of the housing stock and ensuring the development of residential areas, creating favorable living conditions for citizens and increasing housing supply to better serve unmet demand (housing per capita).
The program of housing stock renovation in large cities should be developed based on individual scenarios. To ensure the effective implementation of such a program for each region (city), in each case there need to be developed a model that takes into account such major factors as features of the regional economy, the structure of the existing housing system, and other specifics of the current situation in a local market.
In this article, the authors define the main indicators that reflect the economic readiness of the city for a renovation program.

Key-words: Housing Stock Renovation Program, Real Estate Market, Economic Readiness for Renovation.

1. Introduction

The issues of housing stock renovation, ensuring the development of residential areas, creation favorable living conditions for citizens and increasing the level of provision of the population with living space are on the agenda of many large cities around the world. The program of housing renovation in large and large cities should be developed according to individual scenarios, taking into account a number of factors, including the features of the regional economy, the structure of the existing housing system, and other peculiarities of a local market [1, 2]. Before developing the

program, it is necessary to study the main indicators reflecting the economic readiness of a city for renovation.

In this article we focus on criteria characterizing the need and potential for renovation. As an illustrative example we use regions of the Russian Federation, where the 20 largest cities of Russia (in terms of population are located). 15 of them are cities with a resident population of one million or more people (as of January 1, 2020) – Table 1.

Table 1- Housing Construction and Renovation Needs of Largest Cities in Russia

№	City	Housing commissioning in 2019, thousand sq. m.	Proportion of buildings (by area) that are potential participants in the renovation program to the housing stock in the city (Z), %	Total area of housing to be replaced, thousand sq. m.	Construction cost of 1 sq. m. of housing in a region, (Dec. 2019), thousand rubles / sq. m.
1	**2**	**3**	**4**	**5**	**6**
1	Moscow *	5 021	7%	16 400	96,67
2	St. Petersburg	3 471	21%	29 692	89,43
3	Krasnodar	1 850	16%	5 616	47,28
4	Yekaterinburg	1 344	25%	9 580	60,21
5	Rostov-on-Don	1 259	n/a	n/a	54,03
6	Voronezh	1 217	23%	7 161	44,75
7	Tyumen	1 090	n/a	n/a	56,37
8	Novosibirsk	1 061	29%	12 343	52,65
9	Kazan	1 014	32%	10 614	57,07
10	Saratov	908	n/a	n/a	40,31
11	Krasnoyarsk	893	34%	9 410	48,17
12	Ufa	720	24%	6 433	58,29
13	Samara	619	29%	9 875	54,12
14	Chelyabinsk	612	32%	10 102	39,50
15	Perm	543	21%	5 442	49,86
16	Izhevsk	417	n/a	n/a	45,02
17	Volgograd	412	35%	8 843	46,36
18	Nizhny Novgorod	358	27%	8 560	59.00
19	Omsk	307	29%	8 354	42,34
20	Togliatti	176	n/a	n/a	54,12

** Data are for comparison.*

Sources of information for Table 1:

- *The volume of housing commissioning in 2019 is given according to Rosstat data.*
- *The proportion of buildings (by area) that are potential participants in the renovation program was calculated by CIAN Analytical Center ("Rating of the largest regional markets by the*

proportion of buildings, that can potentially participate in the renovation program" https://spb.cian.ru/stati-kazhdyj-pjatyj-dom-v-regionah-mozhet-popast-pod-renovatsiju-302351/).

- *According to the CIAN Analytical Center methodology, the group of potential participants in a renovation program included four-, five- and six-story panel block houses built in 1955 - 1975, as well as some brick houses with similar characteristics (average floor area of an apartment does not exceed 50 sq. m.). Due to the peculiarities of the CIAN methodology, the indicator has not been calculated for Rostov-on-Don, Tyumen, Saratov, Izhevsk, Togliatti.*
- *In order to estimate the total area of housing to be replaced, the authors use information on the total area of residential premises (Rosstat) as of 2019 and data in column 4.*
- *The data on cost of construction of 1 sq. m. of housing in the regions of the Russian Federation was provided by the Union of Cost Estimating Engineers (as for November 2019) http://www.souzsmeta.ru/cgi-bin/main.pl. This is the total cost of construction of residential buildings of mass-market, multiplied by one square. m. of the total area of apartments in residential buildings.*

In terms of the volume of new houses commissioned (Table 1), the largest cities of Russia with a comparable population differ significantly. For instance, in Krasnodar more than 1.8 million square meters are being commissioned per year, while and in Omsk, Nizhny Novgorod and Perm there are commissioned less than 550 thousand square meters. At the same time, Krasnodar, Yekaterinburg, Rostov-on-Don and Voronezh have the highest rates in terms of housing commissioning in 2019 per citizen after the obvious leaders of Moscow and St. Petersburg.

At the same time, the indicator of housing per population (the total area of residential premises per capita on average, EMISS, https://fedstat.ru/indicator/40466) varies significantly: from 19.39 in Moscow to more than 30 in Krasnodar and Saratov.

According to the calculations of the CIAN Analytical Center, the largest proportion of houses that have a potential to participate in renovation from the total housing stock of these cities is noted in Volgograd (35%), Krasnoyarsk (34%), Chelyabinsk (32%) and Kazan (32%). These cities developed during the Soviet era as large industrial centers. Broad arrays of five-story buildings were constructed there to provide housing for industrial giants. The smallest number of houses that can be potentially demolished is in Krasnodar (16%), where active housing construction has been completed in the last

15 years. St. Petersburg as well has a relatively low index value (21%), due to the high proportion of pre-revolutionary houses in this city.

While the need of Russian cities to replace the aging and decaying housing stock is obvious (in cases when the overhaul is not possible or economically unjustified), an assessment of the economic feasibility of such a program and the definition of a further strategy for each specific region comes to the fore. If there is no economic feasibility, but a region has an actual need to reorganize areas with housing in disrepair, combination solutions may take place. These solutions imply principles and approaches of renovation at the first stage with the subsequent investors involvement in the program implementation.

It is undoubted, that a renovation program has a complex impact on the social and economic development of the urban environment. However, for the possible implementation of the program economic factors are crucial. Otherwise, it turns out to be a social project, where the requirements and obligations of the renovation program cannot be applied. Thus, for renovation, as for any project evaluated from an economic point of view, economic feasibility is important, i. e. achieving a positive result, while the project generates more money than it is necessary to spend for its implementation. The experience of the renovation in Moscow can be regarded as a prime example [3].

2. Methods

The initial experience accumulated to date in the implementation of the Moscow Renovation Program can be viewed as successful, and its main methodological approaches can be recommended for an expanded use [4]. Within the framework of the Renovation Program in Moscow, as of mid-2020, 700 thousand square meters of housing have already been built (58 houses). There are 148 old houses in the settlement: 18.5 thousand residents have already moved to new apartments, another 10 thousand Muscovites are in the process of moving. 261 houses with a total area of 4.1 million sq. meters are being designed and built, as the Complex of urban planning policy and construction of Moscow reports (https://stroi.mos.ru).

Thus, the city authorities become direct participants in the real estate market, development activities in the city. Moreover previously not stated components of the costs and results of the Renovation Program appear.

The key cost item for the program is the cost of construction of residential buildings (which includes both housing for resettlement and for sale). However, it should be taken into account

that in different cities of the country the situation with the provision of territories with engineering and road transport infrastructure may differ significantly and it requires separate research, and costs in future.

The income part is generated through the purchase of space by residents of the relocated houses, as well as the open sale of housing in renovated houses on the market. Following the principle of economic feasibility, we will accept the positive difference between the cost of housing construction and the sale price of residential real estate as a key factor determining the possibility of renovation.

Next, we will assess the possibility of renovation in cities at the expense of funds initiated by the program itself. We will consider a situation when the financial results exceed the government spending.

Notations are the following:

I – income (results) from the sale of housing (then parking spaces and commercial areas can be added).

$\mathbf{I = S_{sale} * I_{selling}}$, где

$\mathbf{S_{sale}}$ – housing for sale (assume that it is of the same type), thousand square meters;

$\mathbf{I_{selling}}$ – selling price of 1 sq. m. of housing (market price).

E – expenses of construction of housing for resettlement ($\mathbf{E_{resettlement}}$) and housing construction for sale ($\mathbf{E_{sale}}$).

These expenses depend on the volume and cost of construction.

$\mathbf{E = E_{resettlement} + E_{sale.}}$

$\mathbf{E_{resettlement} = S_{resettlement} * E_{resettlement}}$

$\mathbf{E_{sale} = S_{sale} * E_{sale}}$, where

$\mathbf{S_{resettlement}}$ – housing area for resettlement, $\mathbf{S_{resettlement} = S_{demolished} * K_{resettlement}}$,

($\mathbf{S_{demolished}}$ – demolished area, $\mathbf{K_{resettlement}}$ – resettlement rate, the ratio of provided and demolished housing).

$\mathbf{C_{resettlement}}$ – construction cost of 1 sq. m. of housing for relocation (for ease of calculations, this cost includes the costs of relocation and demolition).

$\mathbf{S_{sale}}$ – housing area for sale.

$\mathbf{C_{sale}}$ – construction cost of 1 sq. m. of housing for sale.

Criterion of the explored possibility:

$\mathbf{I - E \geq 0}$ or

$\mathbf{S_{sale} * I_{selling} - S_{resettlement} * C_{resettlement} - S_{sale} * C_{sale}} = 0$, hence

$\mathbf{S_{sale} (I_{selling} - C_{sale}) = S_{resettlement} * C_{resettlement}}$

Next, we will take the difference between the selling price of one square meter of housing and the cost of building one square meter of housing for sale for delta ($\mathbf{\Delta}$), that represents a source of funds for renovation:

$\mathbf{I_{selling} - C_{sale} = \Delta.}$

$\mathbf{S_{sale} * \Delta = S_{resettlement} * C_{resettlement.}}$

Since it is known that $\mathbf{S_{resettlement} = S_{сн} * K_{resettlement}}$, hence

$\mathbf{S_{demolished} * K_{resettlement} * C_{resettlement} = \Delta * S_{sale}}$

$$S_{demolished} = \frac{\Delta * S_{sale}}{K_{resettlement} * C_{resettlement}} \qquad (1)$$

The formula 1 allows us to calculate the total area in the replaced housing, which can be demolished ($\mathbf{S_{demolished}}$) as part of the renovation, if housing built at the expense of the city ($\mathbf{S_{sale}}$) sold on the real estate market and a positive difference between the selling price and the cost of construction (Δ) is received. The calculation implies that the construction costs of 1 sq. m of housing for resettlement ($\mathbf{C_{resettlement}}$) and the coefficient of resettlement ($\mathbf{K_{resettlement}}$) for each city can be considered constant values [5, 6], or there can be taken an average value. In this calculation construction cost of 1 sq. m. of housing for resettlement equals the cost of construction of 1 sq. m. m. of housing for sale.

The parameters $\mathbf{S_{sale}}$ and $\mathbf{\Delta}$ in Formula 1 depend on the market situation in each city: how high is the profitability of home sales and how much new housing the market can absorb. The volume of demolition depends on these parameters linearly.

For the practical organization of renovation processes in cities, the formula 1 can be transformed into a function of the following type $\mathbf{S_{sale}} = f(\mathbf{S_{demolished}}, \mathbf{\Delta})$. Then we obtain a calculation formula for determining the required volume of sales (2). Summing this volume with the area of housing required for migrants, we obtain the total volume of new construction for renovation.

$$S_{sale} = \frac{S_{demolished} * K_{resettlement} * C_{resettlement}}{\Delta} \qquad (2)$$

Formula 2 shows the volume of housing for sale needed to be built in order to break even the program.

The ratio $\frac{K_{resettlement} * C_{resettlement}}{\Delta}$, i.e., the dynamic factor in formula 2 is denoted by $\mathbf{\beta}$.

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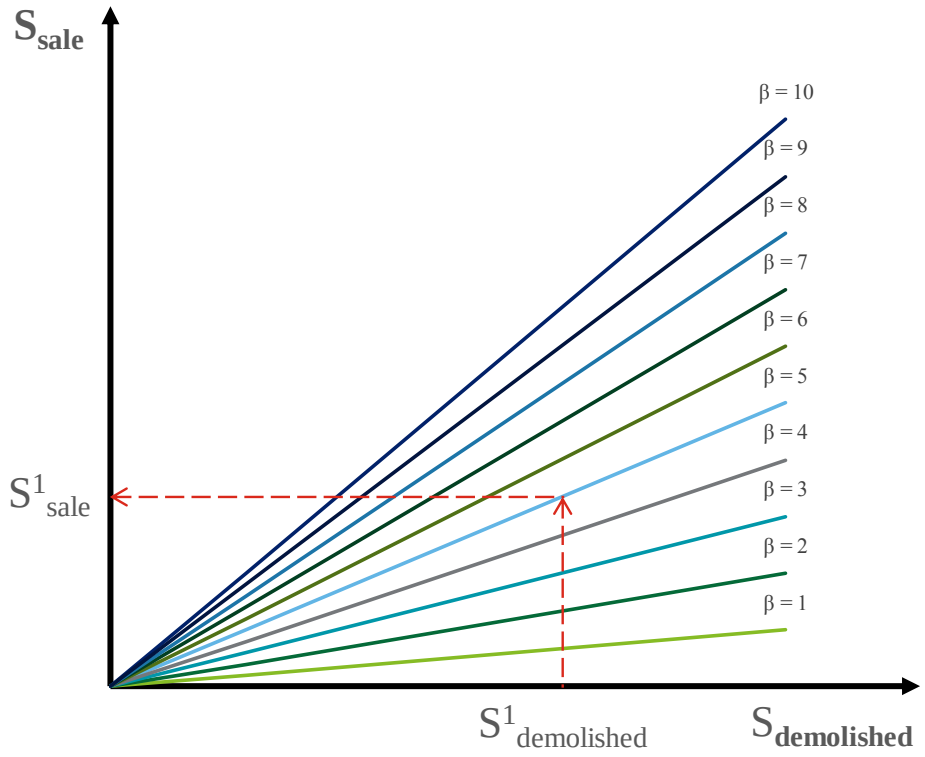
$$\beta = \frac{K_{resettlement} * C_{resettlement}}{\Delta} \quad (3)$$

The **β** multiplier shows how much housing needs to be sold to build 1 sq. m. for resettlement. Taking into account the coefficient **β**, the formula 2 is transformed into a set of linear dependences of the following type:

$$S_{sale} = \beta * S_{demolished} \quad (4)$$

Further, we will show the formula 4 graphically (Exhibit 1).

Exhibit 1- A set of graphs $\mathbf{S_{sale}} = f(\mathbf{S_{demolished}}, \boldsymbol{\beta})$



Stating the unconditional importance of sales for the implementation of the basic scenario of the renovation program, the authors considering the following questions. Will the new volume of commissioning in a particular city (region) be absorbed by the real estate market? Do the population have sufficient funds to purchase?

3. Results and Discussions

For specific calculations and analysis of actual variations according to formulas 1, 2, 3, 4 and Exhibit 1 we will expand the used statistical base for the 20 largest cities of Russia (Table 2).

Table 2- Real Estate Market in the Largest Cities of Russia

№	City	The difference between the price per square meter in a new housing and the cost of construction		The volume of absorption in the housing market, sq. m. (data on the regions of the Russian Federation where the cities are located)	The ratio of the average price of 1 sq. meters (the total area) in the primary housing market to the average monthly net wages (γ)*
		thousand roubles. / sq. m. (Δ)	%		
1	**2**	**3**	**4**	**5**	**6**
1	Moscow	92,83	96%	3 785 300	1,96
2	St. Petersburg	18,40	21%	2 712 887	1,69
3	Krasnodar	-0,61	-1%	2 497 675	1,12
4	Yekaterinburg	11,19	19%	1 893 830	1,55
5	Rostov-on-Don	-2,11	-4%	1 709 576	1,33
6	Voronezh	4,10	9%	1 120 333	1,40
7	Tyumen	6,13	11%	955 095	1,17
8	Novosibirsk	10,68	20%	1 602 976	1,51
9	Kazan	22,69	40%	1 639 503	2,02
10	Saratov	-10,31	-26%	1 722 700	0,91
11	Krasnoyarsk	6,68	14%	1 567 189	1,17
12	Ufa	5,15	9%	2 046 557	1,50
13	Samara	-3,11	-6%	1 543 700	1,31
14	Chelyabinsk	-2,28	-6%	2 290 725	1,00
15	Perm	11,97	24%	1 192 081	1,53
16	Izhevsk	10,25	23%	759 202	1,56
17	Volgograd	0,82	2%	1 105 251	1,43
18	Nizhny Novgorod	8,50	14%	1 121 645	1,62
19	Omsk	0,68	2%	1 206 164	1,18
20	Togliatti	-13,86	-26%	n/a	1,20

** housing affordability indicator: the lower the indicator value, the more affordable housing is.*

The authors used the following sources to calculate the indicators presented in the Table 2:

- *The selling price of apartments in new housing provided by the Domofpond.ru for the end of 2019 (https://www.domofond.ru/nedvizhimost-tseny-goroda-prodazha). The cost of construction is estimated at the full cost of construction of residential buildings of mass-market per one square meter of the total area of apartments in residential buildings (data of the Union of Estimating Engineers http://www.souzsmeta.ru/cgi-bin/main.pl data for November 2019).*
- *The difference between the sales price and the construction cost is calculated by the authors. Negative values of the delta Δ parameter in a number of cities are due to the underestimation of the price of apartments by buyers in statistical materials.*

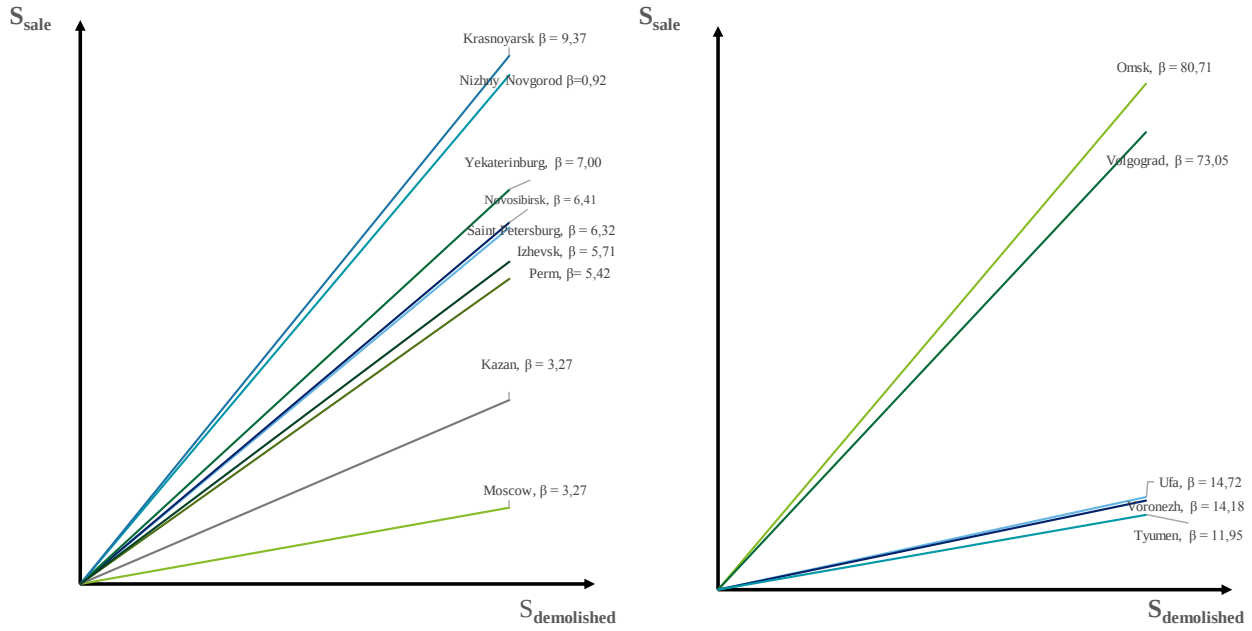
The analytical material of the Bank of Russia emphasized that the demand for apartment housing largely depends on the availability of mortgage lending [7]. According to experts "Expert Rating Agency" (https://www.raexpert.ru/researches/banks/ipoteka_2019) [8], mortgage is the main market tool for acquiring housing in new housing: more than 50% of transactions are concluded with involving it. Therefore, to estimate the volume of absorption in the housing market (the actual volume of apartments sold for a certain period of time), we use the volume of mortgage loans issued by the constituent entities of the Russian Federation in 2019 (according to the Bank of Russia, https://www.cbr.ru/banking_sector/statistics/). Considering that the half of the funds for new housing is invested by citizens themselves, the absorption should be twice the amount of mortgage loans. However, taking into account the observed active growth of mortgages, we accept for the calculation (Table 2, column 5) a conservative correction factor to the amount of loans of 1.5 for absorption volumes.

In order to determine the ratio of the average price of 1 sq. meter of the total area in the new housing market to the average monthly net salary, the authors used Domofpond.ru data at the end of 2019 (https://www.domofond.ru/nedvizhimost-tseny-goroda-prodazha) and the data of the RIA Rating (https://ria.ru/20191007/1559447334.html, estimations of RIA Rating according to Rosstat, in which average salaries by city (net of personal income tax) are calculated on the basis of municipal statistics for January-June 2019 for large and medium-sized enterprises). The use of average wages by city is less accurate for estimation than the use of average per capita income, however, it allows using the existing statistical base without additional research and gives a lower bound on the purchasing power of citizens.

An analysis of the summary data on the real estate market in the largest cities of Russia (Table 2, columns 3 and 4) shows the following. The difference between the price per square meter of an apartment on the new housing market and the cost of construction is about 11.7% on average for the sample (except Moscow and St. Petersburg). This difference for Moscow is 96%. St. Petersburg, Yekaterinburg, Novosibirsk, Kazan, Perm, Izhevsk are in the range from 19% to 40%. Voronezh, Tyumen, Krasnoyarsk, Ufa, Volgograd, Nizhny Novgorod, Omsk show a positive difference. There are some cities in a negative zone: Krasnodar, Rostov-on-Don, Saratov, Samara, Chelyabinsk, Togliatti. Apparently, statistics for these cities is significantly distorted, and it is worth conducting a special and more detailed study, taking into account the possible localization of construction areas and their discrepancy with areas of active sales.

The data in Table 2 allows us to calculate the specific diagrams for cities (Exhibit 2) according to the model suggested in the Exhibit 1.

Exhibit 2- A Set of Graphs for Calculating the Volume of Necessary Sales to Ensure Renovation in Cities (Graphs are given for Cities for which **β** > 0)



After calculating the required volume of sales (to ensure the demolition of all old uncomfortable housing), it is necessary to compare this volume with the potential of the city. First, it is required to calculate the entire volume of new construction, i.e. to sum up housing for resettlement and housing for sale (**$S_{demolished}$ + S_{sale}**).

Secondly, the volume of new construction should be compared with possible capacity constraints (the presence of contractors and design organizations, construction equipment and materials) [9, 10].

Thirdly, it is necessary to estimate the ability of the real estate market in each city to absorb the calculated sales volume (**S_{sale}**), that is, to set the upper bar, i. e. sales limit (**L)** [11]. Here, the growth in sales can be considered equivalent to the growth in the number of mortgage taken by citizens, which can double as much as possible compared to the current level, that is, per year **lim S_{sale} = L.** The value of the limit L was calculated by the authors according to the data in Table 2: absorption volume multiplied by 2 (doubling sales).

Leaders of the sample in terms of sales limit are the following: Moscow (7.57 mln sq. m.), St. Petersburg (5.42 mln. sq. m.), Krasnodar (4.99 mln. sq. m.), Chelyabinsk (4,58 million sq. m.), Ufa

(4.09 million sq. m.). The lowest rates are in Izhevsk (1.51 million sq. m.) and Tyumen (1.91 million sq. m.).

It is noteworthy that Krasnodar, which has the lowest prices in the housing market entered the top three in terms of the potential sales limit. The high absorption rate is explained by the following facts. In terms of housing commissioning in 2019, Krasnodar follows Moscow and St. Petersburg. At the same time, according to EMISS estimates, the Krasnodar region has the highest housing affordability among the considered subjects of the Russian Federation (60% is the share of households that have the opportunity to purchase housing using their own and borrowed funds).

Indirect evidence of the relevance of assessing the sales limit through the volume of absorption and mortgage loans is the actual data on the increase in mortgages. For example, over the past five years (since 2014) in Moscow and St. Petersburg, the volume of mortgage loans has doubled (with a simultaneous decrease in the rate from 12.5% to 8.97% in Moscow and 8.83% in St. Petersburg by the end of 2019).

The possibility of an increase in the interest of city residents in the buying (with the help of mortgage loans) new housing in the areas of renovation (areas of existing development) is associated with the following factors: level of socio-economic development of the city, the welfare of citizens. It can be characterized, in particular, by the ratio of the average price of 1 sq. meters of total area in the new housing market to the average monthly net wages (calculated coefficient **γ**) - see table 2, column 6. The lowest values of this ratio (indicating a relatively higher affordability of housing) are in Saratov (0.91) and Chelyabinsk (1.00). The highest values are in Kazan (2.02), Moscow (1.96), St. Petersburg (1.69).

The difference between the cost of construction and the price of sales, in addition to creating a fundamental opportunity (i.e., a source of funds) for renovation, predetermines the main parameters of the program. In addition to the resettlement coefficient (**$K_{resettlement}$**), it includes, in accordance with the accepted methodological approach [12, 13, 14, 15], the renovation coefficient (**$K_{renovation}$**). This coefficient shows the ratio of newly built areas (for resettlement and sale) to the demolished. In an integral way it characterizes a way the decisions in territorial development plans for renovation areas are made.

$$K_{renovation} = \frac{S_{resettlement} + S_{sale}}{S_{demolished}} \qquad (5)$$

Putting the formula 1 in the formula 5, considering **$S_{resettlement} = S_{demolished} * K_{resettlement}$** we get a function of a type **$K_{renovation} = f(\Delta)$**, namely:

$$K_{renovation} = K_{resettlement}\left(1 + \frac{C_{resettlement}}{\Delta}\right) \qquad (6)$$

This expression for the renovation coefficient shows that it is always higher than the resettlement coefficient (in order to provide all resettled persons with housing during the renovation process), and that at a constant construction expenses it is inversely related to the parameter **Δ** (Exhibit 3).

Exhibit 3- The nature of the variation of the renovation coefficient with the parameter **Δ** while $\mathbf{C_{resettlement}}$ **= const**

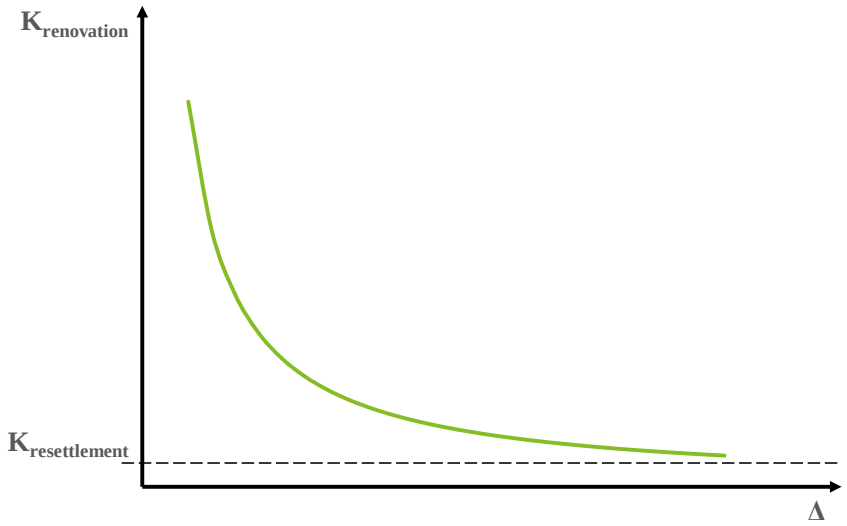


Exhibit 3 demonstrates that the low difference between the sales and the construction expenses of the housing being sold makes it necessary to provide for a high renovation ratio in territorial development plans, to significantly increase the number of storeys and building density above the level required for the resettlement of citizens. As sales efficiency grows, the **Δ** increases, and the $\mathbf{K_{renovation}}$ ratio decreases, asymptotically approaching the $\mathbf{K_{resettlement}}$ level. With $\mathbf{K_{resettlement}}$ = 1.3 (according to Moscow's experience) and the ratio $\mathbf{C_{resettlement}}$ /**Δ** = 1 (the cost of housing construction for resettlement equals **Δ**), the renovation coefficient ($\mathbf{K_{renovation}}$) is 2.6, thus a comfortable level of urban planning is provided.

Considering the paramount importance of sales profitability for assessing the parameters of renovation in cities, formulas (1) and (5) can be transformed into the function $\mathbf{S_{sale}} = f(\mathbf{S_{demolished}}, \mathbf{\Delta})$. We will introduce the reciprocal of **β** (see formula 3), – additional parameter of specific profitability of sales (**ω**):

$$\omega = \frac{\Delta}{K_{resettlement} * C_{resettlement}} \qquad (7)$$

From formula (7), taking into account expression (4), we obtain:

$$S_{sale} = \frac{1}{\omega} * S_{resettlement} \qquad (8)$$

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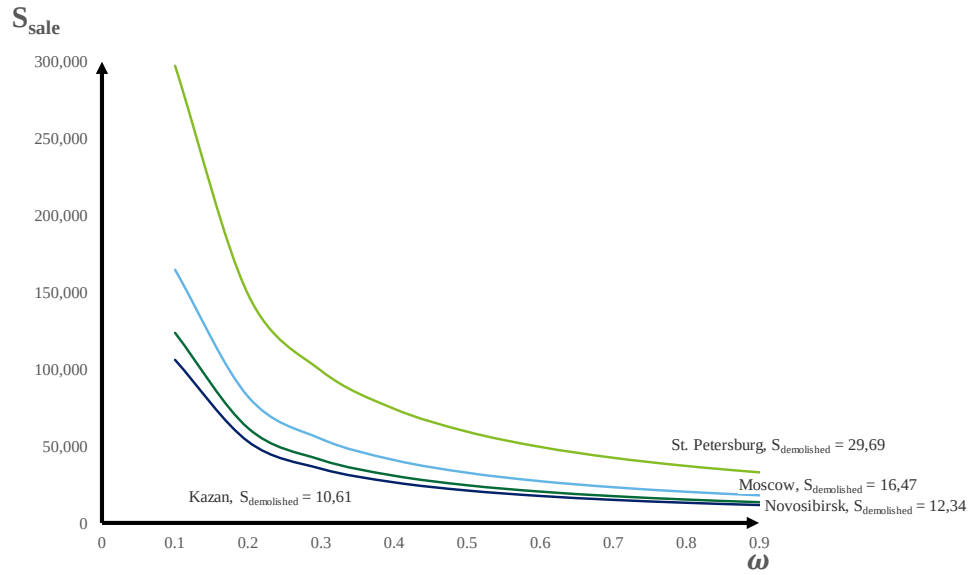
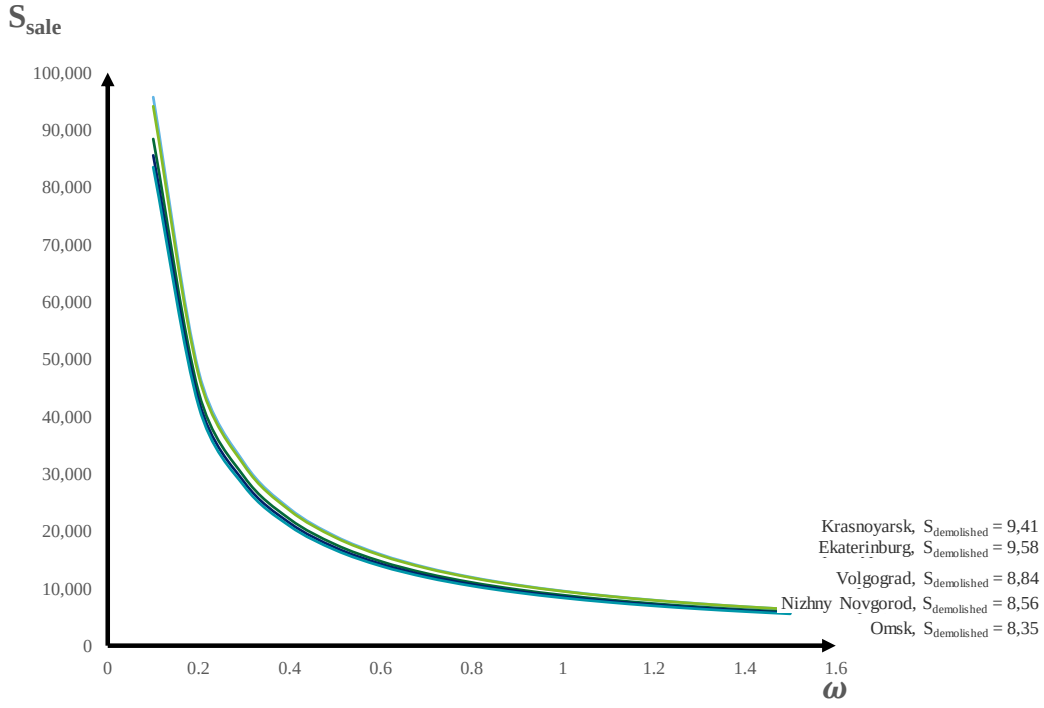
The higher the specific return, the less housing needs to be sold to support resettlement and demolition. According to Tables 1 and 2, a set of hyperbolas was calculated with the use of a formula (8) for the cities of Russia considered in this article (for which data on assessing the volume of housing areas to be replaced is available.

Exhibit 4- Variation of the Required Volume of Sales during the Renovation with the Specific Profitability (the Graphs are Built with Averaged Positive Values of **ω** in the Range from 0.1 to 1.5)

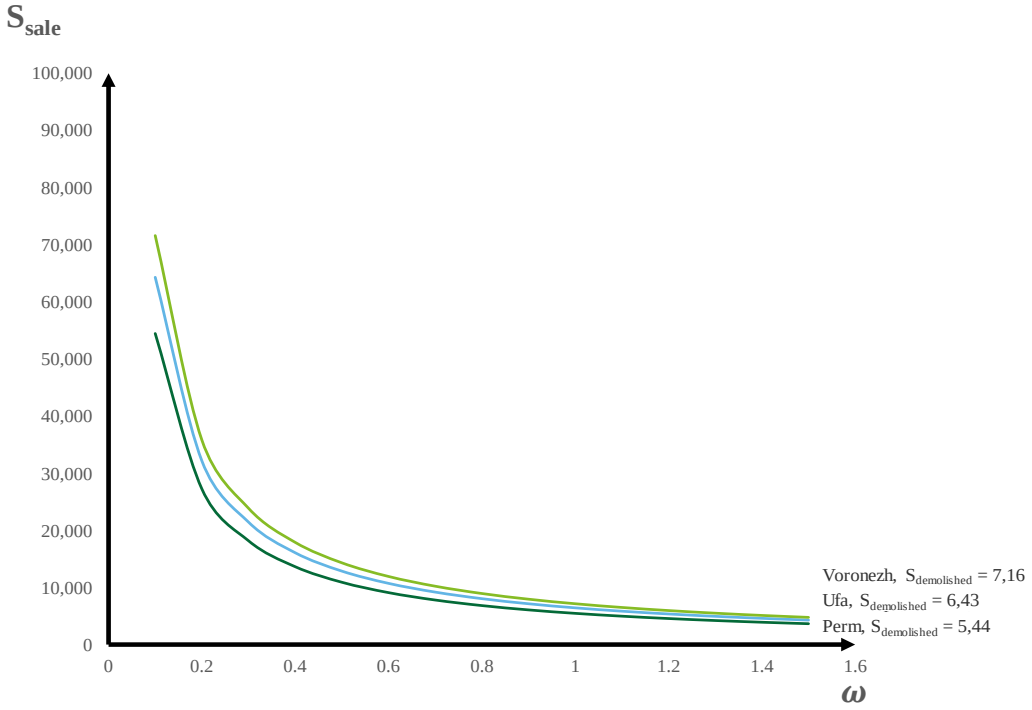
a) Cities with a Total Area of housing to be Replaced over 10 Million Square Meters



b) Cities with a Total Area of housing to be Replaced from 8 to 10 Million Square Meters



c) Cities with a Total Area of Housing to be Replaced Leaa Thea 8 Million Square Meters



For example, in St. Petersburg, where the potential area of housing to be replaced is estimated at 29.7 million square meters, with a ratio of specific profitability ω = 1.1, it is necessary to sell 26.9 million sq. m., and with ω = 1.5, you will need to sell 19.8 million sq. m. (27% less).

In order to determine the total duration of the renovation program, the organizational modes of construction at the demolition site, the possibility of using launch sites during the deployment period, the duration of the resettlement of residents, etc. should be taken into account.

4. Conclusion

Thus, there are the major calculated parameters: the specific profitability of sales (**ω**), The ratio of the average price of 1 sq. meters (the total area) in the primary housing market to the average monthly net wages (**γ**), sales limit (**L**) the proportion of buildings (by area) that are potential participants in the renovation program in the city's housing stock (**Z**). These parameters allow to comprehensively assess the possibility of renovation in a particular city.

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