

Comparative Analysis and Forecast of the Housing Dynamics in the Volga District Regions

Tatyana A. Ignasheva

Lyudmila P. Bakumenko

Tatyana V. Sarycheva

Mari State University, 424000, Yoshkar-Ola, Russia
Email: tvdolmatova@bk.ru

Doi:10.5901/mjss.2015.v6n3s7p317

Abstract

Necessary condition of steady functioning of housing branch in the Volga district regions is existence of the warning information promoting adoption of the reasonable timely decisions directed on elimination of the reasons of the possible negative phenomena and stabilization of housing market development. Carrying out the comparative analysis of a condition of the Volga district Republics housing sector allows to reveal the existing tendencies of development and to plan further prospects. The role of the forecasts allowing to expect further dynamics of the studied phenomenon increases in a modern economic situation. Application of the adaptive methods of forecasting allowing to consider not the average level of process, but the tendency which developed by the time of the last supervision allows to receive forecast values of further housing dynamics on the near-term outlook. In real data often there are no distinctly expressed regular components. Separate supervisions contain a considerable mistake whereas it is necessary not only to pick out regular components, but also to construct the forecast. Dynamic series of housing branch are subjected to seasonal effect in connection with reindexation of construction cost in each next reporting year that indicates on necessity of seasonal effect researching. The methodology of autoregression and integrated moving average (ARIMA) allows to consider the specified conditions. This method is extremely popular in many appendices, and practice confirms its power and flexibility. The complex of the forecast models offered in this research can be useful during the planning of regions housing branch, efficiency and an optimality of further development.

Keywords: tendency of dynamic series, seasonal component, correlogram of autocorrelation function, partial autocorrelation function, forecast estimates.

1. Introduction

1.1 Actualizing the problem

Now development of the housing sphere received a new impulse. The system of mortgage lending which is actively developing in recent years gives to the population opportunity to improve the living conditions; in this connection dynamics of houses total area input has a positive tendency (Ashrapov, 2004). Carrying out the comparative analysis of level of volumes of housing over the past few years on regions of the Volga Federal District allows to reveal the existing regularities of development and to calculate forecast values on prospect (Bakumenko, 2013; Ignasheva, 2007, 2014). The received information can be used in activity of estimated and analytical services and realtor organizations, and also when planning a production activity of contract organizations.

1.2 Status of a problem

The housing sphere is the most important part of the Russian economy in which more than 20% of the reproduced real estate are the share of housing stock (Schneiderman, 2014). The basis of the housing sphere of the city is made by housing stock: houses, specialized houses (hostels, maneuverable fund, houses boarding schools for disabled people, veterans, etc.), inhabited service premises, other premises in other structures, suitable for accommodation (Batrakova, Permichev, 2004).

The problems of the analysis and estimation of housing sector existing in Russia are expenses of formation of the real estate market. The Russian market of real estate it is possible to call actually the market with a big stretch as in

Russia nowadays there is not a market of real estate objects as those, and the market of separate elements of a real estate object – apartments, offices, warehouse, etc., up to rooms. The most developed segment of the real estate market in the Russian Federation is the housing market.

Acquisition of own housing – prime requirement for each family: without satisfaction of this requirement it is impossible to speak about any social priorities of society. Therefore, realization of the rights of citizens for the worthy dwelling is considered as the major social and economic problem (Buzyrev, Chekalin, 2001).

Transition to the market relations, restructuring of a national economy, sharp decrease in investment activity of the enterprises and organizations put before a construction complex of the country a number of complex economic and organizational problems (Bakumenko, Petukhova, 2013; Sarycheva, 2012, 2013).

Use of market conditions in a root changed relationship of investors with builders. Till 1991 the economy developed on the basis of deficiency of capacities and unlimited demand for construction production. Now at preservation of production capacity of branch the volume of investment sharply decreased (Baranov, Pavlov, 2004), and customers had an opportunity to choose the contractor, that is there were competition sprouts.

So, the housing market started functioning, the structure of housing stock on forms of ownership changed. However the housing problem remains still very actual. The essence of housing problem consists in an acute shortage of the housing conforming to standard and consumer requirements of considerable part of the population (Selyutina, 2014).

The housing problem has some important aspects:

- deficiency of housing – quantitative aspect;
- discrepancy of structure of housing stock to demographic structure of families – structural aspect;
- discrepancy of the available housing stock to requirements to consumer qualities of housing – qualitative aspect;
- discrepancy of requirements to maintenance of housing stock – operational aspect.

Characterizing quality of housing, it is necessary to consider the inhabited environment in general, from town-planning, architectural and planning, social, ecological, esthetic and some other aspects. For example, until recently in mass housing standard panel multi-storey buildings with a high density of housing stock and the population on territory unit dominated. According to experts, similar housing structures form the destructive inhabited environment which isn't meeting the requirements of environmental friendliness and comfort.

It is also necessary to note that quality of the inhabited environment in many respects depends on the level of the maintenance of houses and house adjoining territories. In this sphere also there is a number of unresolved questions: untimely carrying out capital and current maintenances, low level of service of the engineering and sanitary equipment of residential buildings, unsatisfactory sanitary maintenance of staircases and house adjoining territories, etc.

Thus, the housing problem is very many-sided, demanding considerable efforts on its decision.

In the countries with the developed market economy considerable experience of the solution of housing problems is saved up. Now in these countries 23-25% of gross investments (in the USA about 30%) and from 20 to 25% of personal accumulation of citizens are the share of reproduction of housing stock on average. However the tendency to reduction of investments into new housing was outlined recently. It is caused, on the one hand, by reduction of demand for housing of the most provided part of the population, with another — by decrease in demand from less provided categories of the population. In a number of the countries, such as France, Austria, Sweden, Denmark, etc., volumes of the state housing increase and systems of the state subsidies and soft loans for purchase or construction of housing are created. It becomes to satisfy housing requirements of the population with the low income (Kiyanenکو, 2003).

Strategy of the solution of housing problem in our country demands deep complex reorganization of all housing system, from social bases of definition of the quality standard of the modern dwelling to the financial mechanism, a rent and part of the population needing social protection. It is about creation of essentially new concept of financing of housing and housing and communal services (Borodkin, Preobrazhensky, 2004), and also new model of all housing system of the country founded on the principles of market economy.

Transition from planned and distributive system to market in the housing sphere — rather difficult process which it is possible to carry out only in some stages (Dubrova, 2004). And here very useful in some cases can be an experience of foreign countries with the developed market economy.

According to the Russian architectural and construction encyclopedia, for achievement at least of modest security of Russians with housing – about the room by the person – the housing stock of the country is required to be increased by 1,5 times. For this purpose even without leaving it should build forthcoming decade about 1 sq. m. of housing per annum per capita, as in the USA, Germany, and in the last years and in China. If to consider, what even in rather safe pre-crisis years it was the housing twice less, such task is represented very difficult. However examples of similar acceleration of housing are known not only from history of foreign countries – Japan, Germany, Norway, but also Russia

– at the end of 50 – the beginning of the 60th years.

2. Methodological Framework

2.1 The tasks of the research

Research problems are:

- 1) Carrying out the comparative analysis of dynamics living space input volumes in regions of the Volga district, detection of the available regularities.
- 2) Offer of short-term forecasting algorithm of a production activity indicators of the housing enterprises and organizations.
- 3) Calculation of housing volumes forecast estimates in regions of the Volga district on the near-term outlook.

2.2 Methodological base of research

The methodological base of research is represented by works of domestic and foreign scientists according to the analysis of housing market, activity of the construction organizations, questions of statistics, econometrics, mathematical modeling and forecasting.

3. Results

3.1 Stages of research carrying out

The algorithm of research includes some stages:

- 1) Formation of the total living space input dynamics schedules in regions of the Volga district: in the Mari El Republic, the Mordovia Republic, the Tatarstan Republic, the Udmurt Republic, the Chuvash Republic, from January, 2009 till December, 2014 inclusive in a section on months, their visual analysis (Kuranov, 2014).
- 2) Carrying out of time series seasonal decomposition for the purpose of a row structural components identification: main tendency of development, seasonal component, cyclic component, component of "white noise" (Yuzbashev, 2003).
- 3) The analysis of seasonal component structure on additivity (multiplication) of a dynamic row levels concerning amplitude of seasonal fluctuations.
- 4) Reduction of time series structure to a stationary condition.
- 5) Determination of forecast models parameters and choice of an estimation method (Ryabikin, 2005; Ryabushkin, 1987; Savchenko, 1999).
- 6) Interpretation of modeling and forecasting results.

3.2 The procedure and results of the investigation

As a result of housing dynamics schedules formation of the Volga district regions following results (fig. 1-5) are received:

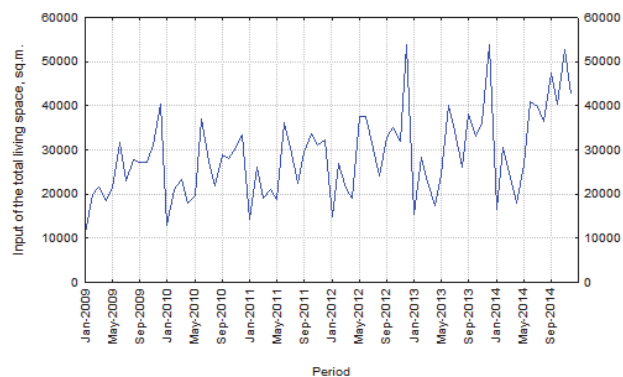


Figure 1. Dynamics of housing volumes in the Mari El Republic

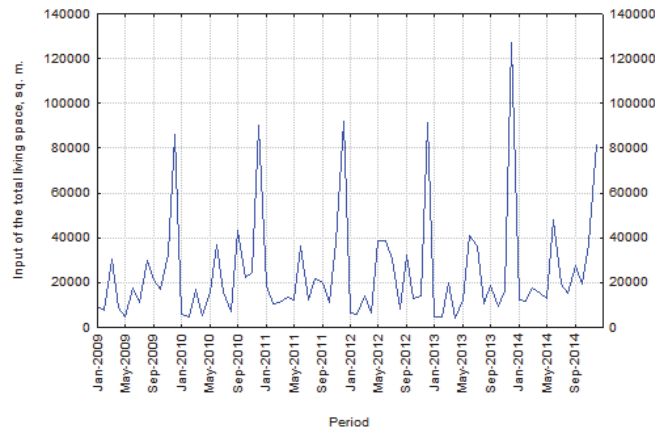


Figure 2. Dynamics of housing volumes in the Mordovia Republic

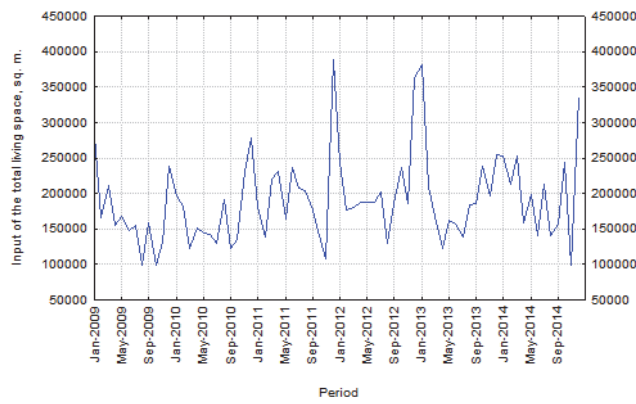


Figure 3. Dynamics of housing volumes in the Tatarstan Republic

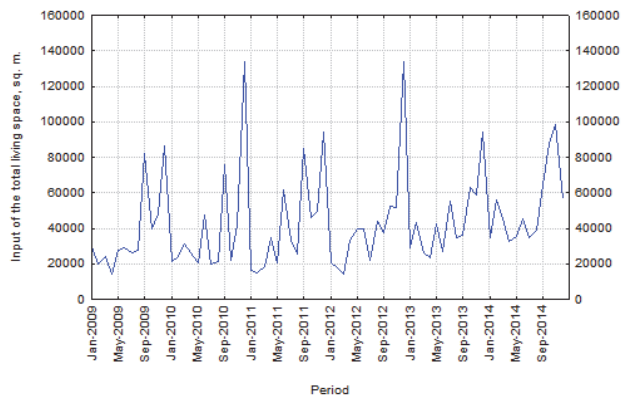


Figure 4. Dynamics of housing volumes in the Udmurt Republic

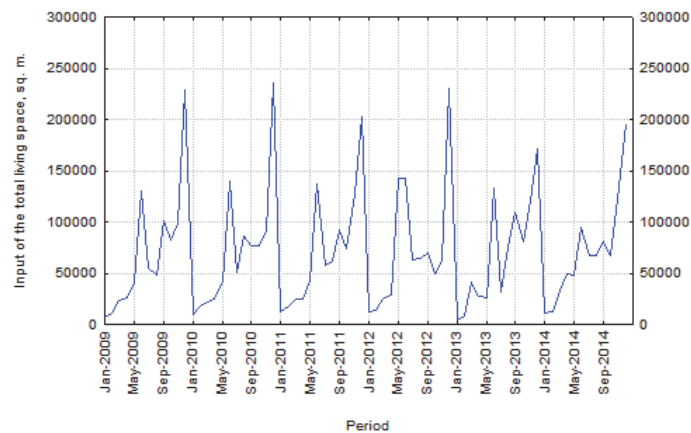


Figure 5. Dynamics of housing volumes in the Chuvash Republic

The visual analysis of schedules allows formulating the following conclusions:

- 1) All presented dynamic series are characterized by identical structure: absence of accurate expressed trend components and existence of a distinct seasonal component with the period of fluctuations in 12 months. The lower bound of periodically repeating structures falls on January of each financial year and characterizes volumes of incomplete housing. The upper bound falls on December of every year; its existence is explained by aspiration of the construction organizations as much as possible to finish objects under construction by the end of financial year in connection with reindexation of construction cost in next reporting year. This aspect is especially actual in the sphere of housing for participants of share construction. A seasonal component of the studied time series has multiplicative structure that is visible from the changeable amplitude of periodic fluctuations. Thus, each level of dynamic series is put into dependence from seasonal component values.
- 2) The Mari El Republic is characterized by the smallest volumes of housing in a year – from 10 to 55 thousand sq.m of the total living space input for the studied period. Besides, attached to the low volumes of construction it is observing the existence of high values of incomplete construction volumes that testifies about low rates of production construction works, and, in general, acts as the factor characterizing rather low level of economic and social situation of the Republic.
- 3) The average level of production activity in the field of housing is characteristic for the Udmurt Republic and the Mordovia Republic. Attached to the volumes of the total living space input to 130 thousand sq.m per annum these regions are characterized by rather low volumes of incomplete construction, in the Udmurt Republic from 10 thousand sq.m per annum, in Mordovia – on average from 5 thousand sq.m per annum.
- 4) The Chuvash Republic represents the region with rather developed sphere of housing: to 230 thousand sq.m per annum, at the low level of incomplete construction volumes – about 10 thousand sq.m per annum.
- 5) The Tatarstan Republic as region with rather high level of the population living has the most developed infrastructure of housing. Volumes of annual input of housing in Tatarstan vary in the range from 100 to 380 thousand sq.m per annum. Rather high level of incomplete construction is explained by existence of a large number of objects under construction.

Existence in the studied time series of the identical structures which are characterized by presence of an indistinct trend component and distinct seasonality testifies about not stationarity of dynamic sequences. The technique of a forecasting method of autoregression and integrated moving average (ARIMA) assumes for establishment of model parameters initial reduction of time series structure to a stationary condition. The similar algorithm of stationarity establishment including initial smoothing of seasonal fluctuations amplitude by natural logarithming of levels of a row, elimination trend component by a capture of a difference of the first order and elimination of a seasonal component by a difference capture with the number of lags equal to the 12-timesyachny period of fluctuations was applied to all studied time series in connection with their identity. Further research of correlograms of autocorrelation (ACF) and partial autocorrelation (PACF) functions, and also of histograms of residuals distribution allowed formulating a conclusion about reduction of the studied time series structures to a stationary condition.

Research of ACF and PACF correlograms structures, histograms of residuals distribution after reduction of series to a stationary condition allows identifying the forecast models of housing volumes, best in the substantial plan, in the

Volga district regions as follows:

- 1) In the Mari El Republic – model $(1,0,1)(1,0,0)$.
- 2) In the Mordovia Republic – model $(0,0,0)(2,0,0)$.
- 3) In the Tatarstan Republic – model $(0,0,1)(1,0,0)$.
- 4) In the Udmurt Republic – model $(0,0,0)(1,0,0)$.
- 5) In the Chuvash Republic – model $(0,0,0)(2,0,0)$.

Parameters of models are statistically significant at a significance level $\alpha = 0,05$ (tab. 1):

Table 4. Statistical criterions of an estimation of the ARIMA models parameters

Parameter	Value	Asymptotic standard error	t-criterion	Significance level
<i>Housing volumes in the Mari El Republic – model $(1,0,1)(1,0,0)$</i>				
Constant	30582,480	6418,570	4,765	0,000
p(1)	0,970	0,057	17,081	0,000
q(1)	0,900	0,105	8,630	0,000
Ps(1)	0,810	0,064	12,711	0,000
<i>Housing volumes in the Mordovia Republic – model $(0,0,0)(2,0,0)$</i>				
Constant	24810,780	6489,278	3,823	0,000
Ps(1)	0,360	0,108	3,360	0,001
Ps(2)	0,570	0,117	4,815	0,000
<i>Housing volumes in the Tatarstan Republic – model $(0,0,1)(1,0,0)$</i>				
q(1)	-0,250	0,123	-2,029	0,046
Ps(1)	0,926	0,032	29,315	0,000
<i>Housing volumes in the Udmurt Republic – model $(0,0,0)(1,0,0)$</i>				
Ps(1)	0,930	0,027	34,149	0,000
<i>Housing volumes in the Chuvash Republic – model $(0,0,0)(2,0,0)$</i>				
Constant	71385,390	15792,800	4,520	0,000
Ps(1)	0,410	0,090	4,318	0,000
Ps(2)	0,530	0,100	5,371	0,000

Schedules of the constructed models are given in fig. 6-10:

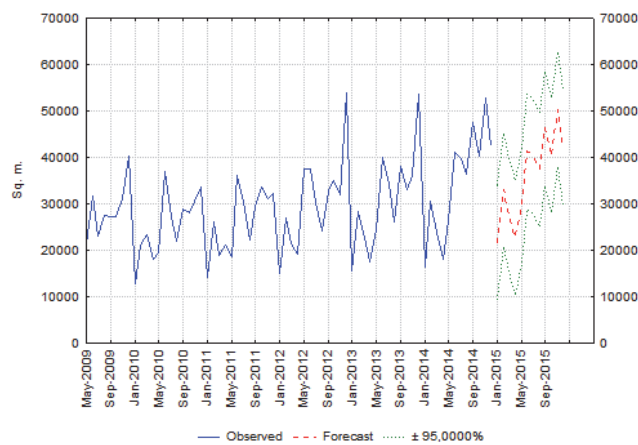


Figure 6. The ARIMA $(1,0,1)(1,0,0)$ model of housing volumes in the Mari El Republic

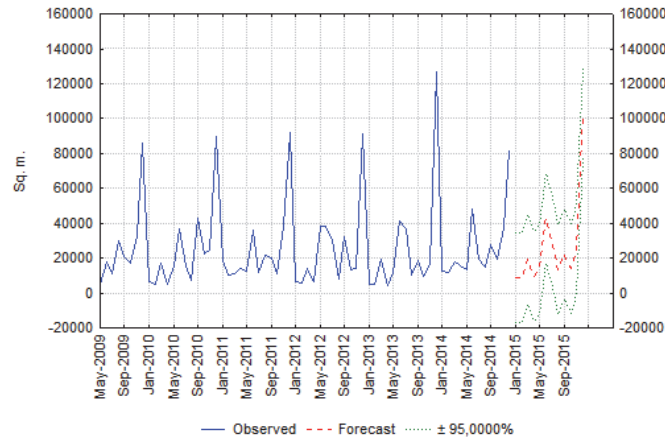


Figure 7. The ARIMA (0,0,0)(2,0,0) model of housing volumes in the Mordovia Republic

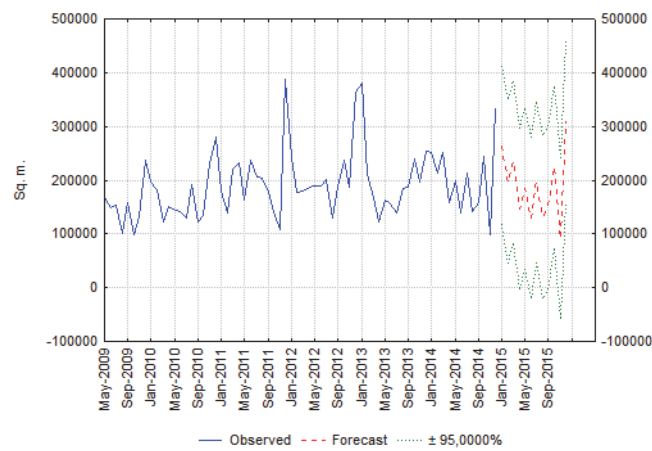


Figure 8. The ARIMA (0,0,1)(1,0,0) model of housing volumes in the Tatarstan Republic

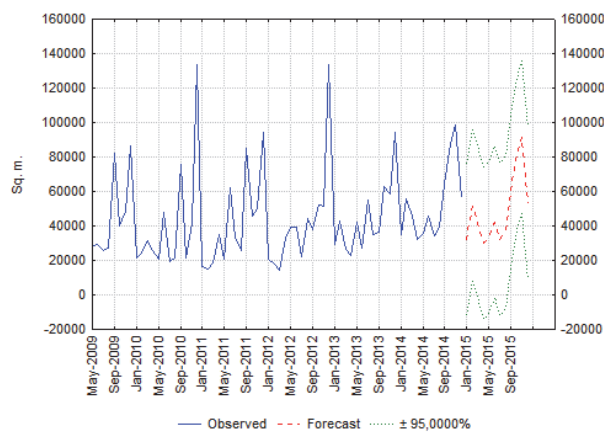


Figure 9. The ARIMA (0,0,0)(1,0,0) model of housing volumes in the Udmurt Republic

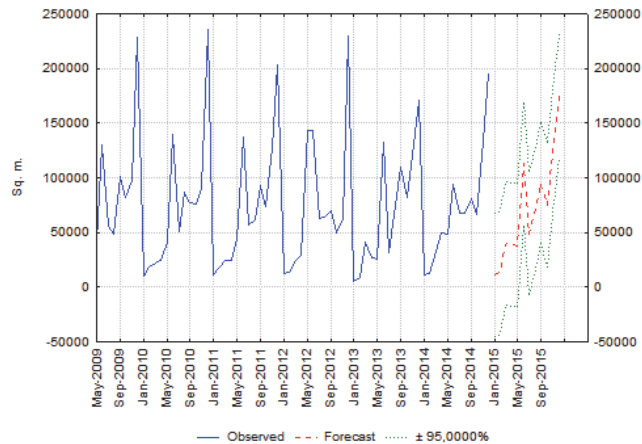


Figure 10. The ARIMA (0,0,0)(2,0,0) model of housing volumes in the Chuvash Republic

4. Discussions

The constructed forecasting models of housing volumes in regions of the Volga Federal District have the similar structures with dynamics of observed time series which aren't contradicting to development of process from the economic point of view. Dynamics of forecast values testifies about preservation of the developed tendencies of seasonality and an irregularity of housing input that, first of all, is caused by investment activity peculiarity in the sphere of construction. This circumstance allows assuming preservation of degree of competitiveness of the construction sphere of the Volga district regions at the present level.

The comparative analysis of forecast dynamics of construction output production in the studied regions shows the general annual decrease in input of living space in 2015 reporting year that, in our opinion, first of all, it is possible to explain with a present crisis economic situation in the country.

5. Conclusion

Using of formation methodology of short-term Box-Jenkins forecasts – ARIMA reports rather exact expected results on the near-term outlook. A basis of self-training of this class of the models representing family of adaptive methods of forecasting is the recurrent method attached to an adaptation parameter choice. Exactness of a method increases with increase in extent of observed dynamic series.

Results of the carried out research can be useful by drawing up production and investment programs of the housing organizations of the Volga district regions, in definition of their optimality and efficiency.

6. Acknowledgments

This article was prepared under a grant of the Russian Humanitarian Science Foundation (project "Demoekonomichesky potential of the region: macrosystemic approach" # 15-02-00567).

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