Government Control of Regional Agricultural Economic Systems under Institutional Transformations

Alexey N. Gerasimov

Yevgeny I. Gromov

Alexey V. Nesterenko

Tatiana Y. Bezdolnaya

Juliya E. Klishina

Stavropol State Agrarian University, 355017, Russia, Stavropol, Zootechnical Lane, 12

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Abstract

Concepts of improvement of tools of regional economic systems government control have been grounded. Authors proposed concrete recommended practices on assessment and forecasting development indicators. In particular, complex econometric model of verification of integral indicators of development level of sub-systems of regional agricultural economic system. This model formed the base for diagnosis of perspective state of such systems in accordance with the most probable proactive scenarios for short-term and medium-term period. It allowed identifying effective managerial decisions for improvement of mechanism of agricultural production and assessment of possible results of their practical implementation.

Keywords: *government control, regional agricultural economic system, integral econometric model, scenery forecast.*

1. Introduction

Present stage of development of economy of Russian Federation (RF) requires solving economically and socially important problems that have been accumulated in society. The most important are problems of overcoming agricultural crisis, raising level of food and agricultural consumer goods provisioning to population (Erokhin *et al.*, 2014; Gerasimov *et al.*, 2015).

While measures to overcome crisis have not yet been completed and it is necessary to renew economic relations in the structure of economy, change of institutional approach to agricultural production development became pressing problem that is proved by statements of official documentary sources that draw attention of scientists to fundamental research in the system of agricultural production and local single-product markets (Gerasimov *et al.*, 2014; Glotova *et al.*, 2014; Sklyarov *et al.*, 2013).

The most important strategic task of state economy is stabilization of agricultural production that should rise on the new level of efficiency and on this base get higher potential of balanced and sustainable growth (Gerasimov *et al.*, 2014; Tatuev *et al.*, 2015). Still practice shows that the problem of market saturation with agricultural products may not be solved only by multi-subject character of agricultural sphere and introduction of private ownership of land (Tomilina *et al.*, 2013; Lescheva *et al.*, 2014). Complicated and multifaceted character of post-crisis development of Russia is caused by a number of problems related to the necessity of radical improvement of the quality of government control in social and economic area and change of the way of interaction between state and subjects of RF (Tatuev, 2012; Agarkova, 2007), reaching agreement and balance of their interests (Trukhachev *et al.*, 2014), streamlining methods and ways of promoting regional social and economic systems by state (Tatuev, 2010; Barsukov and Molchanenko, 2014), revealing possibilities, ways of innovative development of regions(Skripnichenko, 2011; Bershitski *et al.*, 2014), interaction of state and subject of RF in conducting government control (Uglitskikh and Klishina, 2014).

2. Results

Scientists and professionals in regional economy pay much attention to improvement of methods of state agricultural

policy on governing industry-specific economic systems (Sklyarov *et al.*, 2015).

Lack of adequate and effective forms and methods of state impact on regional economy is one of the reasons of territorial differentiation, decrease of interest of investors with parallel growth of crisis manifestations in many regional social and economic systems and increase of the number of threats to economic security with pronounced regional character.

It requires setting high priority tasks of state regional policy that correspond to the interest of economic security of Russia with simultaneous revealing factors of reduction of threats to economic safety of a region. Being set in this way the problem focuses research process on study of economic, manufacturing, social and institutional problems that have been accumulated in regional agricultural policy. So attention should be focused on analysis of development of regional market system in meso-economic area.

Analysis of state impact on agricultural sector has two dimensions. On one hand, it is earnings of agricultural economic subjects and on the other hand, more important is state and regional authorities' support of agricultural economy.

According to the results of 2014 in two Federal Districts (North Caucasian Federal District and Southern Federal District) only regional budget of Stavropolski Krai had surplus (Rubles M1855.4). Krasnodarski Krai and Rostov region had the greatest sum of income of regional budgets (M168647 and M123192.9 Rubles, respectively). Collection of taxes and non-tax payments to consolidated budget of Stavropolski Krai in 2014 was 51199.9 million that was 18.5% higher that year before. Positive processes in economy of the region support uninterrupted trend of growth of percent of earnings from all mentioned sources from 2006 in each entry of taxes and non-tax payments of accounting system of Stavropolski Krai (Tatuev and Bahturazova, 2014).

Medium-term development programs are the part of general regional development concept aimed at support of manufacturers and achievement of general economic targets. These are necessary for development of regional industry-specific market systems.

Today there are many programs of development of agricultural sphere and control of markets of agricultural goods, raw materials and food. According to these programs, Russian agricultural production has two possible ways of development: optimistic and pragmatic.

In optimistic variant in medium-term perspective Russia may become one of leading players in some sectors of global agricultural market and food market. Pragmatic variant forecasts 1.3 times growth of gross agricultural product to 2020 (comparing with 2009). At optimistic variant it should be not less than 2-2.1 times (Trukhachev *et al.*, 2015; Economy of agriculture of Stavropolski Krai, 2014).

In the situation of post-crisis development it is difficult and unreasonable to discuss the problem of perspectives of Russian economy development not only to 2020 but for longer period – up to 2030-2050 as well as to define absolute indicators of development of agricultural economy for 20-40 years.

Development and improvement of methods of collection, processing and analysis of economic information that characterize results of functioning of regional agricultural economic system considering existing situation in all its dimensions: economic, production and social is one of the main tasks in post-crisis economy (Bobryshev *et al.*, 2014). This problem may be solved only under the condition of application of complex approach to revealing the most important factors and conditions of all variety of existing conditions and affecting factors and assessment of their impact on efficiency of implemented measures in the system of regional economy. Econometric method of constructing complex models for assessment of results of functioning of regional economy by separate territories and sectors is the best for this purpose (Uglitskikh and Klishina, 2013).

Practical use of econometric models allows deeper understanding and quantitatively assessing relationship of studied processes and phenomena. It helps to come to objective conclusions basing on these results and work out reliable forecasts of indicative characteristics of development of territorial and industry-specific entities of regional economy. The possibility of grounding of effective managerial decisions is one of important tasks of econometric approach that allows considering variability of possible consequences on the base of quantitative assessment of influence of factors included in the model (Gerasimov *et al.*, 2015).

We propose method of constructing complex econometric models (see Fig. 1) to model and forecast results of functioning of regional industry-specific economy systems. It is realized on an example of regional agricultural system of Stavropolski Krai. Is consists of the following main stages:

- Identifying productive (endogenous) indicators of complex econometric model with further formalization of main groups of factor indicators, basing on the results of structural and dynamic analysis of conditions of functioning of subjects in agricultural production;
- construction of structural and logical scheme of relationship of productive indicators and factor indicators as

the base of formalization of dependencies in developing system of econometric indicators;

- development of information base of analyzed aggregate in context of set system of factor indicators;
- specification of equations of complex econometric model using iterative procedures of selection of essential exogenous variables;
- parametrization of econometric equations of the system with special methods of assessment of coefficients of model dependencies (two-step least-squares method) that consists of the following procedures;
- assessment of practical use of equations of structural form of the model;
- using statistically essential econometric models of the system for forecasting of values of endogenous variables that characterize the main results of functioning of regional system of agricultural production in the following order:
- specification of trend models to construct predictive point estimate on factor variables selected for equations of the system for each of observation objects;
- defining of confidence bounds of the forecast (upper and lower) reflecting optimistic and pessimistic variants of scenery change of indicators in short term;
- calculation of generalizing value of predictive estimate of productive indicators for region in general as aggregate result over the aggregate of observation objects;
- analysis of obtained results of modeling and scenario forecasting of analyzed indicators to work out complex of measures on stimulation of further development of regional system of agricultural production and overcoming post-crisis manifestations.

In accordance with obtained results in second chapter of dissertation theses main conditions and factors that impact state and development of regional economic system were formalized in the context of the following 10 related blocks:

1. Indicators of social security of population: X_1 - average monthly total salary due, rubles; X_2 - number of unemployed people, seeking employment and registered in employment service for the end of a period; X_3 - consumption of flour products, ton; X_4 - consumption of meat products, ton; X_5 - consumption of milk products, ton; II. Nature and climate: X_6 - average ambient temperature in degrees; X_7 - average annual rainfall, mm; III. Indicators of the scope of activity in crop raising: X_8 - total crop area of agricultural crop, thousand hectares; X_9 - crop area of grain cultures, thousand hectares; X_{10} - yield of crop cultures in agricultural companies, center per hectare; X_{11} - yield of sunflower in all types of economy, thousand ton; X_{12} - grain production in all types of economies, thousand ton; X_{13} - sunflower production in all types of economies, thousand ton; X_{14} - grain sold by agricultural economies, thousand tons; VI. Indicators of the scope of activity in cattle breeding: X_{15} - cattle stock in all types of economy for the beginning of a year, thousands of animals; X_{16} - number of pigs in all types of economies, thousands of animals; X_{17} - number of sheep and goats in all types of economy for the beginning of a year, thousands of animals; X_{18} - average milk yield per cow in agricultural companies, kg; X_{19} - production (breeding) of meat of all types in all types of economy, ton (live weight); X_{20} - calf crop in agricultural companies per 100 cows, animals; X_{21} - loss of cattle (all ages) in agricultural companies, animals; X_{22} - procurement of fodder per one notional animal, center of fodder units; X_{23} - cattle and fowls sold by agricultural companies, thousand tons; X_{24} - milk sold by agricultural companies, thousand tons; X_{25} - wool sold by agricultural companies, thousand ton; V. Provisioning of fertilizers to agricultural companies: X_{26} - fertilizer treatment of all agricultural crops, thousand centers; X_{27} - fertilizer treatment of all agricultural crops per 1 hectare of fertilized area, centers; X_{28} - fertilizer treatment of all grain crops per 1 hectare of fertilized area, centers; X_{29} - fertilizer treatment of all agricultural crops by organic fertilizers per 1 hectare, ton; X_{30} -fertilizer treatment per 1 hectare, ton; VI. Provisioning of machines to agricultural companies: tractors total, units; X_{31} - tractors per 1000 hectare of crop area, units; X_{32} -number of tractors per 1000 of crop area, units; X_{33} -- crop area per one tractor, hectare; X_{34} - availability of harvester thresher total, units; X_{35} - harvester thresher per 1000 hectare of grain area, units; VII. Economic indicators of crop farming: X_{36} - production costs of 1 center of grain, Rubles; X_{37} - average stable price of grain sold by all channels, Rubles per hundred kilograms; X_{38} - ratio of average stable price of 1 hundred kilograms and average in a region; X_{39}

profitability (lack of profitability) of grain crop with subsidy and compensations, %; VIII. Economic indicators of cattle breeding: X_{40} - production cost of weight gain of cattle, Rubles per hundred kilograms; X_{41} - production cost of weight gain of swine, Rubles per hundred kilograms; X_{42} - production cost of weight gain of sheep, Rubles per hundred kilograms; X_{43} - production cost of milk, Rubles hundred kilograms; IX. Financial indicators of agricultural companies: X_{44} - loan payable, millions of Rubles; X_{45} - share of overdue loan payable in total loan payable, %; X_{46} - accounts receivable, millions of Rubles; X_{47} - share of overdue accounts receivable in total accounts receivable, %; X_{48} - ratio of loan payable and accounts receivable; X. Indicators of investments, availability, state and capital stock flow: X_{49} - capital stock at year end, millions of Rubles; X_{50} - wear factor, %; X_{51} - coefficient of renewal, %; X_{52} - index of actual volume of investments in % of previous year; X_{53} - index of actual volume of quantity of work in % of previous year.

Probable dependencies are presented as structural and logic scheme of relationship between endogenous variables ($Y_1 - Y_4$) and main groups of factor indicators (see Fig. 1).

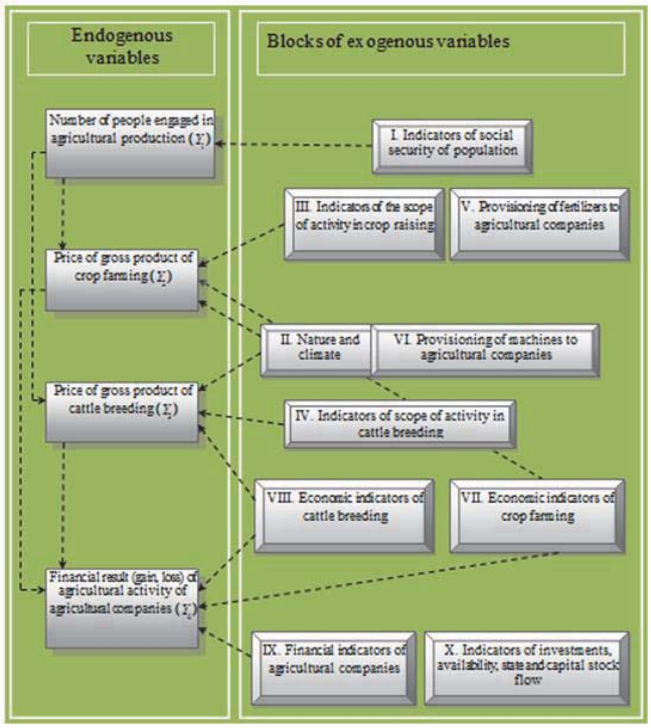

Figure 1. Structural and logic scheme of relationship between endogenous variables ($Y_1 - Y_4$) and main groups of factor indicators that characterizes conditions of functioning of a system of regional agricultural production.

In general terms specification of equations of the model may be presented as follows:

$$\hat{Y}_1 = a_{10} + a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + a_{14}X_4 + a_{15}X_5 \quad (1)$$
$$(R^2 = 0,489;\ \hat{R}^2 = 0,411;\ \text{F=31,258};\ \text{Sig.=0,000})$$

$$\hat{Y}_2 = a_{20} + a_{21}X_8 + a_{22}X_9 + a_{23}X_{10} + a_{24}X_{11} + a_{25}X_{12} + a_{26}X_{13} + a_{27}X_{14} + a_{28}X_{26} + a_{29}X_{27} + a_{210}X_{28} + a_{211}X_{29} + a_{212}X_{30} + a_{213}X_{31} + a_{214}X_{32} + a_{215}X_{33} + a_{216}X_{34} + a_{217}X_{35} + a_{218}X_{36} + a_{219}X_{37} + a_{220}X_{38} + a_{221}X_{29} + \alpha_{21}Y_1 \quad (2)$$
$$(R^2 = 0,889;\ \hat{R}^2 = 0,852;\ \text{F=88,354};\ \text{Sig.=0,000})$$

$$\hat{Y}_3 = a_{30} + a_{31}X_{15} + a_{32}X_{16} + a_{33}X_{17} + a_{34}X_{18} + a_{35}X_{19} + a_{36}X_{20} + a_{37}X_{21} + a_{38}X_{22} + a_{39}X_{23} + a_{310}X_{24} + a_{311}X_{25} + a_{312}X_{31} + a_{313}X_{32} + a_{314}X_{33} + a_{315}X_{34} + a_{316}X_{35} + a_{317}X_{40} + a_{318}X_{41} + a_{319}X_{42} + a_{320}X_{43} + \alpha_{31}Y_1 \quad (3)$$
$$(R^2 = 0,901;\ \hat{R}^2 = 0,890;\ \text{F=81,695};\ \text{Sig.=0,000})$$

$$\hat{Y}_4 = a_{40} + a_{41}X_{36} + a_{42}X_{37} + a_{43}X_{38} + a_{44}X_{39} + a_{45}X_{40} + a_{46}X_{41} + a_{47}X_{42} + a_{48}X_{43} + a_{49}X_{44} + a_{410}X_{45} + a_{411}X_{46} + a_{412}X_{47} + a_{413}X_{48} + a_{414}X_{49} + a_{415}X_{50} + a_{416}X_{51} + a_{417}X_{52} + +a_{418}X_{53} + \alpha_{41}Y_1 + \alpha_{42}Y_2 + \alpha_{43}Y_3 \quad (4)$$
$$(R^2 = 0,711;\ \hat{R}^2 = 0,682;\ \text{F=21,556};\ \text{Sig.=0,000})$$

3. Discussion

Models (1)-(4) have linear form. Endogenous variables in some equations are productive, and in other equations are exogenous being in right side. This approach allows reflecting diversity of relationships in modelling indicative characteristics of state and development of regional industry-specific economic systems on the base of complex econometric models.

On the next step it is necessary to select essential exogenous variables in models (1)-(4) that allow radically improving their practical value. As all potentially valuable conditions and factors of effective functioning of studied regional industry-specific economic system have been considered in the first step in forming the system of factor indicators, in further processing only the most important should remain in the model selected by procedure of step-be-step selection.

Practical implementation of procedure of step-be-step selection of factor variables may be carried out by different algorithms that gave very similar results.

Main results of selection of essential factor variables of models (1)-(4) are listed below:

$$\hat{Y}_1 = a_{10} + a_{11}X_1 + a_{14}X_4 \quad (5)$$
$$(R^2 = 0,865;\ \hat{R}^2 = 0,723;\ \text{F=81,245};\ \text{Sig.=0,000})$$

$$\hat{Y}_2 = a_{20} + a_{25}X_{12} + a_{26}X_{13} + a_{215}X_{33} + a_{219}X_{37} + \alpha_{21}Y_1 \quad (6)$$
$$(R^2 = 0,803;\ \hat{R}^2 = 0,769;\ \text{F=127,3};\ \text{Sig.=0,000})$$

$$\hat{Y}_3 = a_{30} + a_{33}X_{17} + a_{34}X_{18} + a_{35}X_{19} + a_{36}X_{20} + a_{39}X_{23} + a_{317}X_{40} + a_{320}X_{43} + \alpha_{31}Y_1 \quad (7)$$
$$(R^2 = 0,853;\ \hat{R}^2 = 0,811;\ \text{F=169,3};\ \text{Sig.=0,000})$$

$$\hat{Y}_4 = a_{40} + a_{44}X_{39} + a_{46}X_{41} + a_{47}X_{42} + a_{413}X_{48} + \alpha_{42}Y_2 + \alpha_{43}Y_3 \quad (8)$$
$$(R^2 = 0,752;\ \hat{R}^2 = 0,731;\ \text{F=63,117};\ \text{Sig.=0,000})$$

In general, obtained models (5)-(8) allows concluding that they are the most valuable because all equations has *F*-test for which $p \le 0,001$. Value of *F*-test of Fisher for these models has grown significantly as a result of application of step-be-step algorithms of elimination of low-value variables. For model (6) correlation between factor and residual dispersion has grown from 88.4 to 127.3; for model (7) more than twice. The same is for the rest equations.

Parameters of model (5) should be defined by simple least square method independently of the rest equations of the system because there is no endogenous variable from the other models in right side of this regression relationship. As a result of regression analysis the following equation of linear multiple regression was obtained:

$$\hat{Y}_1 = 5.312 - 0.00502X_1 + 0.00215X_4$$
$$(R^2 = 0,865;\ \hat{R}^2 = 0,723;\ \text{F=81,245};\ \text{Sig.=0,000}) \quad (9)$$

Low growth of monthly average gross payroll of workers (X_1) does not lead to growth of the number of people

working in agricultural production in average for municipal regions of Stavropolski Krai while dependency in this case should be opposite. This situation may be explained by insufficient growth rate of income of workers engages in agricultural production that makes attractiveness of this activity for population of the region significantly lower. It is also interesting that basing on this model dependency of the level of engagement in agricultural production and consumption of main food products per capita was revealed.

Theoretical values of endogenous variables were used for calculation of parameters of structural equations of the system in models (10)-(12) and derived from these equations.

The following equation of linear multiple regression was obtained as a result of regression analysis for characteristic of factor dependency of variation of population of the region:

$$\hat{\hat{Y}}_2 = 102,358 + 2,138X_{12} + 12,511X_{13} - 1,142X_{33} + 3,725X_{37} + 5,262\hat{Y}_1 \quad (10)$$

$$(R^2 = 0,867;\ \hat{R}^2 = 0,812;\ \text{F=202,5};\ \text{Sig.=0,000})$$

In general obtained equation is characterized by tight dependency of variation of productive indicator of factor variables and by greatest statistical value. Variation of price of gross product of crop farming in the region (Y_2) in accordance with model (10) was explained by change of factor variables on 86.7%.

Analysis of fractional coefficients of determination shows that of all explained variation of price of gross product of crop farming (Y_2) of 86.7%, greater share (34.8%) has the factor of average stable prices on grain sold by all channels. Factor of grain production in all types of economies (X_{12}) effects 22.9% of explained variation of productive indicator. Variation of endogenous variable Y_1 (number of workers engaged in agricultural production) explained 7.7% of change of price of crop products in the region.

Further modelling of the rest structural equations of system (11)-(12) allows obtaining the following main results of correlation-regression analysis:

$$\hat{\hat{Y}}_3 = 2136.1 + 0.523X_{17} + 0.276X_{18} + 0.101X_{19} + 4.281X_{20} + \\ + 11.529X_{23} + 0.0345X_{40} + 0.341X_{43} - 12.917\hat{Y}_1;$$

$$(\mathrm{R}^2 = 0,853;\ \hat{\mathrm{R}}^2 = 0,801;\ \mathrm{F} = 142,916;\ \mathrm{Sig.} = 0,000) \quad (11)$$

$$\hat{\hat{Y}}_4 = 2651.314 + 808.127X_{39} - 6.512X_{41} - 4.753X_{42} - 6.831X_{48} + \\ + 91.834\hat{Y}_2 + 47.163\hat{Y}_3.$$

$$(R^2 = 0,752;\ \hat{R}^2 = 0,731;\ \text{F=63,117};\ \text{Sig.=0,000}) \quad (12)$$

Exogenous variables of two factors: indicators of scope of activity and economy are the most essential of selected factor characteristics in model (11) that characterize variation of price of cattle products produced by agricultural companies of the region. 72.5% of explained variation is the share of exogenous variables that characterize the scope of activity of business-subjects of regional economic system in cattle breeding that were included in the model and the effect of economy is only 9.6%.

Results of modelling by the model (12) that is the key model of the system fully reflects existing situation. According to the model growth of crop production on 1 million Rubles in average causes growth of gross income of agricultural companies on 91.8 thousand Rubles.

In the final stage obtained forecasted values of variables (both exogenous and endogenous) were introduced in first side of models (9)-(12) for each of observation objects. That aggregated result of forecasted values was defined for the region as a whole. Aggregated values of productive indicators in the scope of optimistic and pessimistic approaches were calculated in similar way.

Graphical representation of productive variables in the scope of derived system of econometric models is presented in Figs. 2-5.

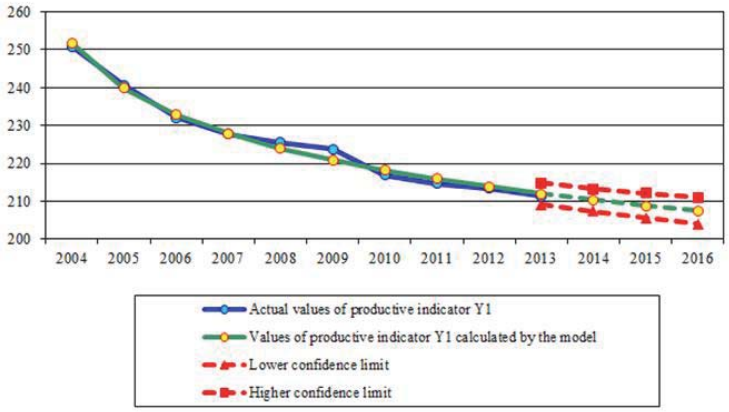

Figure 2. Forecast of the number of people engaged in agricultural production by model (9) in relation with change of functioning of regional economic system

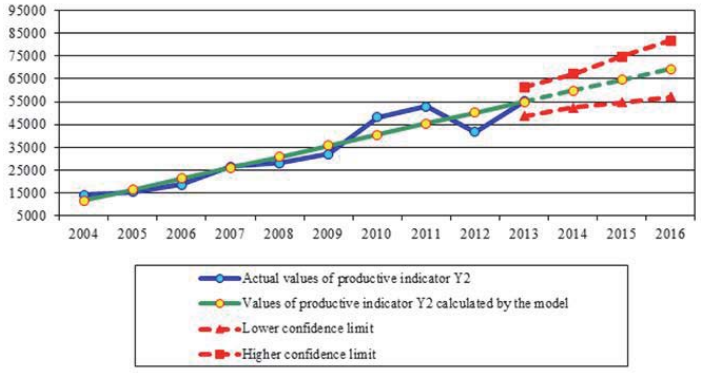

Figure 3. Forecast of price of gross product of crop farming by model (10) under transformation of regional economic system

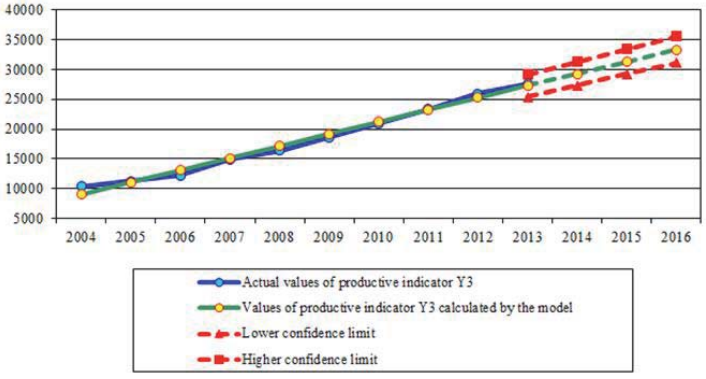

Figure 4. Forecast of price gross product of cattle breeding by model (11) in accordance with changing parameters of functioning of regional economic system

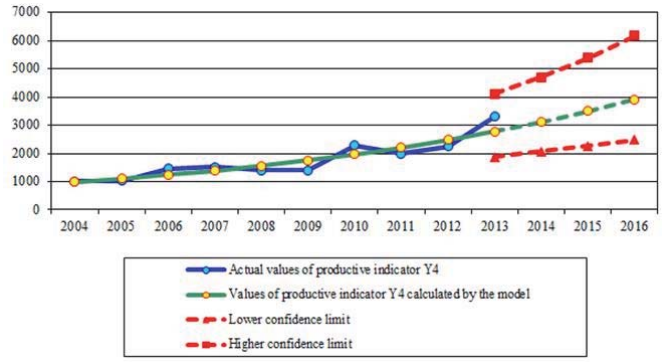

Figure 5. Forecast by model (12) of financial results of activity of agricultural goods producers of regional economic system

4. Conclusion

The following essential characteristics and the most valuable results of proposed methods realized on an example of Stavropolski Krai and main forecasted results of functioning of regional agricultural system require special attention. At first, forecasting by derived models that define respectively change of price of crop production produced in the region and gross income of agricultural companies was made with account for structural changes in domestic market of agricultural products (in particular, sharp variations of grain prices both in the country and in global market). Secondly, complex economic model may be significantly widened and added in future depending on aims and extent of granularity of studied processes and phenomena in agricultural production. This model required regular correction and adding to reflect processes correctly and account for changing conditions in all analyzed spheres of regional agricultural production to get credible results of modelling and forecasting. Thirdly, developed imitative and forecasting complex economic model may serve as relatively effective instrument of making managerial decisions on revealing high priority directions of improvement of agricultural production mechanism and assessment of possible consequences of practical realization in all spheres of regional system of agricultural production.

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