Bulgarian Journal of Agricultural Science, 27 (No 1) 2021, 51–58

Autoregressive approach for exploring the gross value added in agriculture and the number of agricultural holdings in Bulgaria

Tsvetana Harizanova – Metodieva[1*] and Hristina Harizanova – Bartos[2]

[1]*Agricultural Academy, Institute of Animal Science, 2232 Kostinbrod, Bulgaria*
[2]*University of National and World Economy, 1700 Sofia, Bulgaria*
[*]*Corresponding author:* ts_harizanova@abv.bg

Abstract

Harizanova – Metodieva, Ts. & Harizanova – Bartos, H. (2021). Autoregressive approach for exploring the gross value added in agriculture and the number of agricultural holdings in Bulgaria. *Bulg. J. Agric. Sci., 27 (1)*, 51–58

Development of agriculture in Bulgaria is of a great importance for reaching sustainability in rural areas in the country. The aim of this research is to find some of the factors, influencing gross value added (GVA) in agriculture and the number of agricultural holdings in Bulgaria, using autoregressive distributed lag (ARDL) models.

The study includes two parts. In the first part the theoretical basis of some of the most important factors, influencing GVA and number of agricultural holdings are revealed. In the second part, autoregressive distributed lag (ARDL) models are developed for the GVA in agriculture and for the number of agricultural holdings. According to the results some conclusions are made.

The ARDL model for the gross value added in agriculture is highly significant with R^2 of 0.9872. The dummy variable is also highly significant, showing that there is a significant difference in the GVA in agriculture before and after the EU accession of Bulgaria. The difference in the GVA in agriculture appears with one-year lag after the accession (from 2008). According to the long-run model, the employed persons with higher education influence significantly over GVA in agriculture. The coefficient in front of the employed persons with higher education is a positive number, meaning that with the increase of persons with higher education, GVA also increases and vice versa. So the human factor appears to be of a great importance for the gross value added in agriculture. The coefficient of the foreign direct investments in agriculture is a positive, but an insignificant number in the long-run. The speed of adjustment is 79.24%, highly significant and a negative number.

The model for the number of agricultural holdings is highly significant with a coefficient of determination of 0.9984. The population number significantly influences the number of agricultural holdings in a long – run, as well as in a short-run and the processes of decline of population, have a direct impact on the number of agricultural holdings. It means the smaller the population number, the smaller the number of agricultural holdings in Bulgaria. In the long-run model the coefficient in front of the average utilized agricultural area is negative and insignificant. The speed of adjustment is 47.76%.

The results and conclusions of the study can be used as an instrument for benchmarking of the Bulgarian agriculture.

Keywords: ARDL models; gross value added in agriculture; agricultural holdings

Introduction

The disclosure of factors, influencing the development of the agrarian sector will contribute to its better governance. Gross value added in agriculture is an important indicator for the state and development of the sector. It can be used in international analyses and as a comparative tool between the countries (Sojková & Stehlíková, 2004). Furthermore, the correct interpretation of the factors, influencing on GVA in the sector, can be used for the development of some principles, criteria and indicators for assessment of Bulgarian agrarian sustainability. Also, GVA in agriculture can be traced how it is changing over time and on this basis to prepare some general conclusions.

The models, concerning the competitiveness of agricultural sector, are measured by Bachev et al. (2017) according to the change of gross value added and the share of direct payments in the net income. According to Campos et al. (2010) the share of gross value added from agriculture and the agricultural employment display the regional economy's structure.

A research, concerning the member states joined EU since 2004, has established a link between agricultural structures and the agrarian GDP, leading to differences in development of the agrarian sector (Buchenrieder et al., 2007). There is an evident of existing heterogeneity among the CEE countries in terms of economic development status, land tenure and endowment, education and employment (Buchenrieder et al., 2007). According to the applied investment theories by the authors (Dixit & Pindyck, 1994; Žídková et al., 2011), one of the factors, which influences on increasing value of GVA, is the investments.

In countries as Italy and Netherland, researches reveal links and reasons for a change in gross value added. According to Tarditi (2000) this change is due to structural shifts in the agrarian sector, consolidation of farms, higher education of people, and investments in public support for national agricultural research systems; Pardey et al. (1989) stress that these processes are mainly driven by CAP support.

The number of agricultural holdings is an important indicator for the development of the agrarian sector. Usually it leads to structural changes (Buchenrieder et al., 2007). According to Giannakis & Bruggeman (2015), privatization and redistribution of agricultural land lead to decline in number of agricultural holdings in Eastern Europe, including Bulgaria.

The number of population in Bulgaria is an important indicator, connected with the perspectives for the future development of the agrarian sector as a whole. The population is the source of working force, entrepreneurship and the main consumer of the produce. So the dynamic of changes in Bulgarian population inevitably reflects over the image of agriculture. Since 2000 to 2017, the population in Bulgaria has decreased with 13.5%: from 8149500 in 2000 to 7050034 in 2017 (National Statistical Institute, Republic of Bulgaria). In this study we tried to explore how this negative tendency of decline of population influenced over the number of agricultural holdings in Bulgaria.

At the beginning of the transitional period, the number of farms in Bulgaria is extremely large, with the largest number of farms having less than one hectare of land (Kopeva & Noev, 2001; Dirimanova, 2005). Due to land restructuring in Bulgaria by land ownership restoration, the total number of agricultural holdings decreases, which is mainly represented by the number of farms with size up to one hectare (Ivanova et al., 2000; Mergos et al., 2001). The number of agricultural holdings declined with 48% between 2007 and 2013 and this process is still undergoing (Doitchinova et al., 2017).

Other important factor, influencing agrarian sector is the intensity of the production system and some farmers' characteristics as farmers' training and educational level (D'Amico et al., 2013). The same authors stress that the structure of the farms has a significant effect on farm profitability in terms of GVA per holding and per employee (D'Amico et al., 2013).

In some countries as Romania the gross added value after 1990 has moving downwards despite the increase in the number and share of rural workers (Ciutacu et al., 2015).

So according to the literature review some of the most important factors, influencing GVA in agriculture are the investments and the employed persons in the sector. The factors having the highest impact on the number of agricultural holdings are connected mainly with land privatization, number of plots and farm size.

The aim of this research is to find some of the factors, influencing gross value added (GVA) in agriculture and the number of agricultural holdings in Bulgaria, using autoregressive distributed lag (ARDL) models.

Materials and Methods

The autoregressive distributed lag (ARDL) models were developed on the basis of information, published by the Ministry of Agriculture, Food and Forestry, Republic of Bulgaria, National Statistical Institute and Bulgarian National Bank. The time series were checked for unit root with Augmented Dickey-Fuller test (ADF) and Kwiatkowski–Phillips–Schmidt–Shin test (KPSS). The models were tested for serial autocorrelation, heteroskedasticity, normal distribution of the residuals, and for stability.

• ARDL model for the Gross Value Added in agriculture

The first developed model, which concerns the gross value added in agriculture, includes the following variables, represented as logarithms:

– Gross value added in agriculture in real terms (million BGN) – the nominal data was derived from the National Statistical Institute for the period 2000 – 2017. After that the data were deflated with the Consumer Price Index on the basis of 12.1995.

– Foreign direct investments in agriculture in real terms (thousand BGN) – the nominal data was derived from the

National Statistical Institute. Their values were represented in USD for the period of 2000-2006 and in EUR from 2007 to 2017. In order to find them in BGN, the values in USD were multiplied with the average annual currency rate of USD/BGN. The average annual currency rate was calculated by us, using data from the Bulgarian National Bank. The Bulgarian National Bank publishes information for the average currency rate for every month of the year. We summed these values on the yearly basis and then divided the sum by 12. The values, represented in EUR, were multiplied by 1.95583, which was the fixed currency rate for EUR/BGN. After that the data were deflated with the Consumer Price Index on the basis of 12.1995.

– Employed persons with higher education (in thousands) – the data for the period from 2003 to 2017 was taken from the National Statistical Institute.

In the model is included a dummy variable, which has value 1 for the period from 2008 to 2017, and value 0 for the period 2000 – 2007. The reason for including that dummy is because Bulgaria became a member of the EU in 2007. We figure out that the Bulgaria's membership in EU has an impact over the gross value added in agriculture. We found out under this research, that the impact of membership influenced significantly on the gross value added in agriculture one year after Bulgaria's accession to the EU. So the dummy has value 1 starting from 2008.

We suppose that the following model is applicable for the gross value added in agriculture:

$$GVAa = f(FDIa, EPh, Dummy), \tag{1}$$

where: *GVAa* – logarithmic value of the Gross Value Added in agriculture in real terms; *FDIa* – logarithmic value of the foreign direct investments in agriculture in real terms; *EPh* – logarithmic value of the employed persons with higher education; *Dummy* – it is the dummy, described above.

The exact ARDL model for the Gross Value Added in agriculture is represented as followed:

$$\begin{aligned} d(GVAa)_t &= \beta_0 + \beta_1 d(GVAa)_{t-2} + \\ &+ \beta_2 d(FDIa)_t + \beta_3 d(EPh)_{t-1} + \\ &+ \beta_4 dummy + \beta_5 GVAa_{t-1} + \\ &+ \beta_6 FDIa_{t-1} + \beta_7 EPh_{t-1} + \varepsilon_t \end{aligned} \tag{2}$$

where: d is the first difference; β_0 is the constant; from β_1 to β_3 are the short-run coefficients;

β_4 is the dummy coefficients; from β_5 to β_7 are the long-run coefficients; ε_t is the error term.

Equation (3) shows the long-run model, which is tested for co-integration (H_0) against the alternative of no co-integration (H_1). In order to check the long-run relation, Wald test is applied. H_0 of the test could be written as followed: ß5 = ß6 = ß7 = 0. The calculated F-statistic is collated with the lower and upper bounds of Pesaran et al. (2001) (unrestricted intercept and no trend) at 5% significance level.

$$GVAa_t = \alpha_1 FDIa_t + \alpha_2 EPh_t + e_t \tag{3}$$

The short-run version of the model for *GVAa* is represented in equation (4):

$$\begin{aligned} d(GVAa)_t &= \beta_0 + \beta_1 d(GVAa)_{t-2} + \\ &+ \beta_2 d(FDIa)_t + \beta_3 d(EPh)_{t-1} + \\ &+ \beta_4 dummy + \beta_5 ect\_gva_{t-1} + \varepsilon_t \end{aligned} , \tag{4}$$

where: *ect_gva* is the error correction term for the gross value added in agriculture.

• ARDL model for the number of agricultural holdings

The model includes the next variables:

– Logarithm of the number of agricultural holdings for the period of 2000 to 2016. The data for 2000, 2001, 2003, 2005, 2007, 2010, 2013 and 2016 were gathered from the Ministry of Agriculture, Food and Forestry, Republic of Bulgaria. For the other years we couldn't find information. So, a linear interpolation method was applied in order to fill the missing data (2002, 2004, 2006, 2008, 2009, 2011, 2012, 2014, and 2015).

– Logarithm of the average utilized agricultural area (in dca) – The data for 2000, 2001, 2003, 2005, 2007, 2010, 2013 and 2016 were gathered from the Ministry of Agriculture, Food and Forestry, Republic of Bulgaria. The missing data were filled with the help of a linear interpolation method (2002, 2004, 2006, 2008, 2009, 2011, 2012, 2014, and 2015).

– Logarithm of the number of population for the period from 2000 to 2017. The data were derived from the National Statistical Institute.

We figure out that the following model could be applied for the number of agricultural holdings in Bulgaria:

$$Na = f(AvU, Np) \tag{5}$$

where: *Na* is the logarithmic value of the number of agricultural holdings; *AvU* – logarithmic value of the average utilized agricultural area; *Np* – logarithmic value of the number of population in Bulgaria.

The developed ARDL model for the number of agricultural holdings is presented in equation (6):

$$Na_t = \beta_0 + \beta_1 Na_{t-1} + \sum_{i=0}^{1} \beta_2 AvU_t + \sum_{i=0}^{1} \beta_3 Np_t + \varepsilon_t \tag{6}$$

where: $ß_0$ is the constant; from $ß_1$ to $ß_3$ are coefficients of the model; ε_t is the white noise.

Bounds test is applied in order to check the co-integration between the variables from the long-run model (equation (7)):

$$Na_t = \alpha_1 AvU_t + \alpha_2 Np_t + e_t \tag{7}$$

The short-run version of the ARDL model is presented below:

$$d(Na)_t = \beta_0 + \beta_1 d(AvU)_t + \\ + \beta_2 d(Np)_t + \beta_3 ect\_na_{t-1} + \varepsilon_t \tag{8}$$

where: *d* is first difference of the variables; $ß_0$ is the constant; *ect_na* is the error correction term for the number of agricultural holdings in Bulgaria; from $ß_1$ to $ß_3$ are the coefficients of the model.

The short-run associations between the dependent and independent variables are checked with Wald test.

The error correction terms for both ARDL models represent the speed of adjustment in a long-run.

Results and Discussions

The results from the stationarity tests are presented in Table 1. According to ADF test, only the average utilized agricultural area is stationary at level. The other variables are stationary at first difference. According to the KPSS test, gross value added in agriculture and employed persons with higher education are stationary at level. The rest of the time series are stationary at first difference. Because some of the variables are *I(0)*, the other are *I(1)*, ARDL models are appropriate choice for that kind of a data (Pesaran et al., 2001).

• ARDL model for Gross Value Added in agriculture

The F-statistic of Wald test of the model with dependent variable D(GVAa) (equation 2) shows that the long-run coefficients are in equilibrium: the F-statistics of Wald test is 50.0031, which is higher than the upper bound of Pesaran et al. (2001).

Table 2 represents the estimates, goodness of fit and some of the diagnostic tests of the model for D(GVAa) (equation (2)).

The ARDL model for D(GVAa) is highly significant (F-statistic = 55.1570; probability = 0.0002). The adjusted R^2 was 0.9693. According to the results of test for serial cor-

Table 1. ADF and KPSS tests for stationarity at 5% significance level

Variable	ADF	KPSS
FDIa	Stationary at first difference	Stationary at first difference
GVAa	Stationary at first difference	Stationary at level
EPh	Stationary at first difference	Stationary at level
Np	Stationary at first difference	Stationary at first difference
Na	Stationary at first difference	Stationary at first difference
AvU	Stationary at level	Stationary at first difference

Source: Own calculations

Table 2. ARDL model with a dependent variable D(GVAa) (equation (2))

Variable	Coefficient	T-Statistic	Probability
d(GVAa(-2))	-0.199478	-3.6639	0.0145
d(FDAa)	0.309583	8.8960	0.0003
d(EPh(-1))	-0.943373	-7.9612	0.0005
Dummy	-0.234814	-4.5259	0.0062
Constant	-0.193428	-0.3712	0.7257
GVAa(-1)	-0.792355	-8.4901	0.0004
FDAa(-1)	0.068392	1.7838	0.1345
EPh(-1)	1.166601	9.64788	0.0002
R-squared/Adjusted R-squared	0.9872/ 0.9693		
F-statistic / Probability	55.1570/ 0.0002		
Serial Correlation LM Test (χ2/Probability):	5.3877/ 0.0676		
ARCH Heteroskedasticity Test (χ2/Probability):	3.1821/ 0.2037		
Jarque-Bera test (Coefficient / Probability):	0.6810 / 0.7114		

Source: Own calculations

relation and heteroskedasticity test we can accept that the model is homoscedastic and free from serial autocorrelation. The residuals are normally distributed (Jarque-Bera test) and the model is stable (Figure 1 and Figure 2). The dummy variable is highly significant, showing that there is a significant difference in the gross value added in agriculture before and after the EU accession of Bulgaria. The year 2007 is the first of Bulgaria's EU accession, but the first results can be traced out in 2008, or one-year lag appeared.

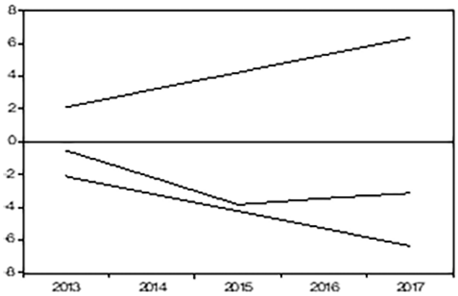

Fig. 1. CUSUM test of the ARDL model with a dependent variable D(GVAa) at 5% significance level (equation (2))
Source: Own calculations

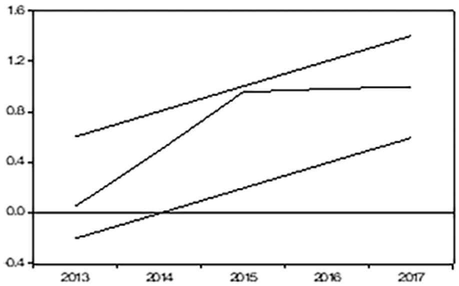

Fig. 2. CUSUMSQ test of the ARDL model with a dependent variable D(GVAa) at 5% significance level (equation (2))
Source: Own calculations

According to the long-run estimates from Table 3, employed persons with higher education influence significantly over the gross value added in agriculture. The coefficient in front of the employed persons with higher education is a positive number, meaning that with the increase of these persons, the gross value added in agriculture also increases and vice versa. So the human factor appears to be of a great importance for the gross value added in agriculture. The coefficient of the foreign direct investments in agriculture is a positive, but insignificant number.

The speed of adjustment in the short-run model is 79.24%, highly significant and a negative number.

Table 3. Long-run and short-run model for the Gross Value Added in agriculture

Variable	Coefficient	T-statistic	Probability
I. Long-run model for GVAa			
FDIa	0.086315	1.8288	0.1270
Eph	1.472322	6.7407	0.0011
II. Short-run model for D(GVAa)			
d(GVAa(-2))	-0.199478	-4.4097	0.0031
d(FDIa)	0.309583	19.4672	0.0000
d(EPh(-1))	-0.943373	-10.5677	0.0000
Dummy	-0.234814	-8.1710	0.0001
Constant	-0.193425	-13.1111	0.0000
ect_gva(-1)	-0.792355	-14.4918	0.0000

Source: Own calculations

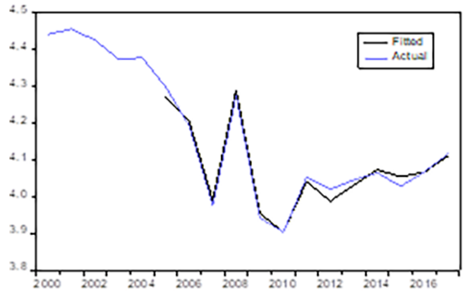

Fig. 3. Actual and fitted values of the ARDL model with a dependent variable D(GVAa) (equation (2))
Source: Own calculations

According to Figure 3, the model fits well to the actual values of Gross Value Added in agriculture.

• ARDL model for the number of agricultural holdings

According to the result of Bounds test of the model with the dependent variable N*a* (equation 6), the F-statistic is higher than the upper bound of Pesaran et al. (2001) (unrestricted intercept and no trend), showing that the long-run coefficients are co–integrated (F-statistic of the model is 5.76).

The model for Na is highly significant with a coefficient of determination 0.9984. Some of the diagnostic test of the model is presented in Table 4 and Figures 4 and 5. The model is tested for serial autocorrelation and heteroskedasticity, but problems are not observed.

Wald test indicates that the population number significantly influences the number of agricultural holdings in a

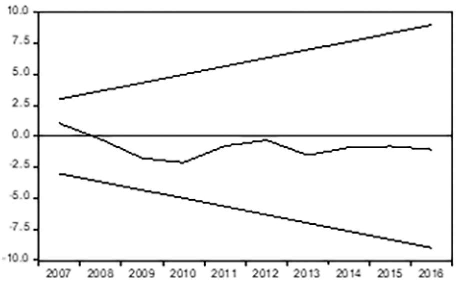

Fig. 4. CUSUM test of the ARDL model with a dependent variable Na at 5% significance level (equation (6))
Source: Own calculations

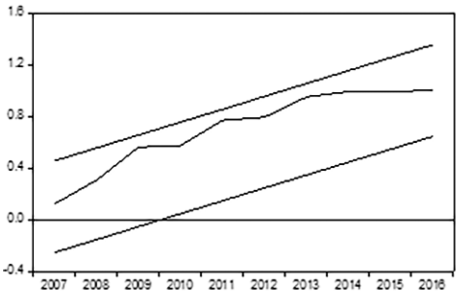

Fig. 5. CUSUMSQ test of the ARDL model with a dependent variable Na at 5% significance level (equation (6))
Source: Own calculations

Table 4. ARDL model with a dependent variable Na (equation (6))

Variable	Coefficient	T-Statistic	Probability
Na(-1)	0.522414	4.1107	0.0021
AvU	-0.296156	-2.3314	0.0419
AvU(-1)	0.157781	1.4180	0.1866
Np	1.055812	0.6590	0.5248
Np(-1)	2.600743	2.5479	0.0290
Constant	-51.16152	-2.7920	0.0191
R^2/ Adjusted R^2	0.9984/ 0.9977		
F-statistic / Probability	1285.547 / 0.0000		
Serial Correlation LM Test ($\chi 2$/Probability):	0.0082 / 0.9278		
ARCH Heteroskedasticity Test ($\chi 2$/Probability):	0.0883 / 0.7663		
Jarque-Bera test (Coefficient / Probability):	3.1379 / 0.2083		

Source: Own calculations

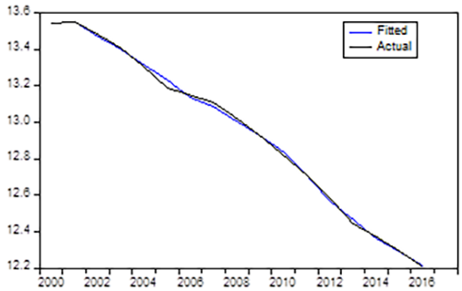

Fig. 6. Actual and fitted values of the ARDL model with a dependent variable Na (equation (6))
Source: Own calculations

Table 5. Long-run and short-run model for the number of agricultural holdings

Variable	Coefficient	T-statistic	Probability
I. Long-run model for Na			
AvU	-0.289739	-1.9105	0.0851
Np	7.656327	3.1676	0.0100
II. Short-run model for D(Na)			
Constant	-51.16152	-4.5607	0.0010
d(AvU)	-0.296156	-3.5649	0.0051
d(Np)	1.055812	1.1441	0.2792
ect_ na(-1)	-0.477586	-4.5550	0.0011

Source: Own calculations

short-run (χ^2 (probability) = 16.71 (0.0002)), but the influence of average utilized agricultural area over the number of agricultural holdings isn't significant in a short-run (χ^2 (probability) = 5.55 (0.0624)).

Long-run model for Na (Table 5) indicates that with the decrease of the number of population, the number of agricultural holdings also decreases (p = 0.01). It means that the processes of decline of population have a direct impact on the number of agricultural holdings. The coefficient in front of the average utilized agricultural area is negative, although insignificant. The error correction term (ect_na) is a negative and highly significant number; lower than 1, indicating the speed of adjustment (47.76%). Figure 6 shows that the model fits well to the number of agricultural holdings.

Conclusions

The main findings from the literature review can be summarized as follows:

- Some of the factors, influencing on GVA in agriculture are the investments and the employed person in the sector.
- The factors having the highest impact on the number of agricultural holdings are connected mainly with land privatization, number of plots and farm size.

The main conclusions from the ARDL models are:

- The ARDL model for the gross value added in agriculture was highly significant with the adjusted R^2 of 0.9693. The dummy variable was also highly significant, showing that there was a significant difference in the gross value added in agriculture before and after the EU accession of Bulgaria. The difference in the gross value added in agriculture appears with one-year lag after the accession (from 2008). According to the long-run model, the employed persons with higher education influence significantly over the gross value added in agriculture. The coefficient in front of the employed persons with higher education is a positive number, meaning that with the increase of persons with higher education, the gross value added also increases and vice versa. So the human factor appears to be of a great importance for the gross value added in agriculture. The speed of adjustment is 79.24%, highly significant and a negative number. In the long-run model the coefficient of the foreign direct investments in agriculture is a positive, but an insignificant number.
- The model for the number of agricultural holdings is highly significant with a coefficient of determination of 0.9984. The population number significantly influences the number of agricultural holdings in a long – run, as well as in a short-run and the processes of decline of population have a direct impact on the number of agricultural holdings. It means the smaller the population number, the smaller the number of agricultural holdings in Bulgaria. In the long-run model the coefficient in front of the average utilized agricultural area is negative and insignificant. The error correction term was a negative and a highly significant number, lower than 1, indicating the speed of adjustment (47.76%).

References

Bachev, H., Ivanov B., Toteva D. & Sokolova E. (2017). Agrarian sustainability in Bulgaria – economic, social and ecological aspects. *Bulgarian Journal of Agricultural Science*, *23(4),* 519-525.

Buchenrieder, G., Möllers, J., Happe, K., Davidova, S., Fredriksson, L., Bailey, A., Gorton, M., Kancs, D., Swinnen, J., Vranken, L., Hubbard, C., Ward, N., Juvančič, L., Milczarek, D. & Mishev, P. (2007). Conceptual framework for analysing structural change in agriculture and rural livelihoods. Discussion Paper, Leibniz Institute of Agricultural Development in Central and Eastern Europe, No. 113. https://www.econstor.eu/bitstream/10419/28462/1/556634519.pdf.

Bulgarian National Bank, www.bnb.bg.

Campos, M., Jaklič T. & Juvančič, L. (2010). Factors affecting farm productivity in Bulgaria, Hungary, Poland, Romania and Slovenia after the EU-accession and likely structural impacts. In: 118th EAAE seminar "Rural Development: Governance, Policy Design and Delivery", Ljubljana, Slovenia 25-27 August 2010, 939 -952.

Ciutacu, C., Chivu, L. & Andrei J. V. (2015). Similarities and dissimilarities between the EU agricultural and rural development model and Romanian agriculture. Challenges and perspectives. *Land Use Policy, 44,* 169-176. https://www.sciencedirect.com/science/article/pii/S0264837714001859

D'Amico, M., Coppola, A., Chinnici, G., Di Vita, G. & Pappalardo, G. (2013). Agricultural systems in the European Union: an analysis of regional differences. *New Medit, 12(4)*, 28-34.

Dirimanova, V. (2005). Land market with fragmented landownership rights in Bulgaria: An institutional approach. In 94th EAAE Seminar "From Households to Firms with Independent Legal Status: The Spectrum of Institutional Units in the Development of European Agriculture", Ashford, UK, 9-10 April 2005.

Dixit, A. K. & Pindyck, R. S. (1994). Investment under uncertainty. Princeton University Press.

Doitchinova, J., Harizanova, H. & Stoyanova, Z. (2017). Structural changes and agri-environmental assessment of agriculture in Bulgaria. Risk in the food economy – theory and practice, Institute of Agricultural and Food Economics National Research Institute, Poland, 231-243.

Giannakis, E. & Bruggeman, A. (2015). The highly variable economic performance of European agriculture. *Land Use Policy, 45,* 26-35.

Ivanova, N., Todorov & T. Zezza, A. (2000). The role of the agriculture sector in the transition to a market economy: Bulgarian case study. In: Perspectives on agriculture in transition: Analytical issues, modelling approaches, and case study results, Wissenschaftsverlag Vauk Kiel KG, Germany, 78-139.

Kopeva, D. & Noev, N. (2001). Aspects of land consolidation after the Bulgarian land reform. In: Proceedings of International Workshop the New Structure of the Rural Economy of Post-Communist Countries, October, 123-159.

Mergos, G., Stoforos, C., Mishev, P. & Ivanova, N. (2001). Analysing agricultural policy reforms under transition in Bulgaria. *Food Policy, 26(5),* 475-493.

Ministry of Agriculture, Food and Forestry, **Republic of Bulgaria.** www.mzh.government.bg.

National Statistical Institute, Republic of Bulgaria. www.nsi.bg.

Pardey, P. G., Kang, M. S. & Elliott, H. (1989). Structure of public support for national agricultural research systems: A political economy perspective. *Agricultural Economics, 3(4),* 261-278.

Pesaran, M. H., Shin, Y. & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16(3),* 289–326.

Sojková, Z. & Stehlíková, B. (2004). Comparative analysis of the economic role of agriculture in the EU countries. *Agric. Econ. – Czech, 50 (8),* 369-375.

Tarditi, S. (2000). Structural funds and rural development: suggestions from the Italian experience. World Bank Technical Paper № 504, Europe and Central Asia Environmentally and Socially Sustainable Development Series. The Challenge of Rural Development in the EU Accession Countries. Third World Bank / FAO EU Accession Workshop, Sofia, Bulgaria, June 17-20, 2000, 73-85.

Žídková, D., Řezbová, H. & Rosochatecká, E. (2011). Analysis of development of investments in the agricultural sector of the Czech Republic. *Agris on-line Papers in Economics and Informatics, III(1),* 33-43.

Received: December, 12, 2019; *Accepted:* January, 8, 2020; *Published:* February, 28, 2021