

SOCIAL AND CLIMATE CHANGES IN AGRICULTURE: CHALLENGES AS OPPORTUNITIES FOR ADAPTATION

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Abstract: The nature of social and climate change problems has expanded and negative externalities have increased everywhere, raising concerns about the trend of production. The high age of the farmers and the effects of flood damage, the wind damage and temperature damage are everywhere present in agricultural activities and may have additional effects to the trend of agricultural production. The literature supports the impact of several such factors as the age, the flood damage, the wind damage and temperature damage to the trend of production. The study’s objective is to test the potential impact between social and climate changing factors to the trend of agricultural production, illustrating with the case of farmers apple producer in north–eastern Albania (region of Dibra). The results of the statistical models used suggest that the age, the flood damage, the wind damage and temperature damage affects to the trend of production and also reveals interactions between them. Policymakers should focus, through incentives for farm adaptation with new technologies and must works on its modernization aiming increase of investments that provide sustainability and long–term–returns.

Keywords: The trend of production, age, flood damage, climate changes, agriculture, Albania.

Introduction

Over the years the problem of agricultural development everywhere has become more complicated. The nature of the problems has expanded and negative externalities have increased, and for more in factors with influence which previously have been basic advantages for many agricultural activities. The growing concerns reported in agricultural areas are particularly related to the social and climatic aspects of the environment. Thus, the migration of young people from agricultural regions and the implications from climate change on the other hand constitute a concern everywhere present and with implications for agricultural production. As in other countries even in Albania, similar evidences illustrate from the high–concentration areas of agricultural activity up to peri-urban areas near large cities. However, this problematic is particularly acute in regions resource–deprived and with general insufficiencies, where agricultural activity represents almost the main alternative for farmer families.

The removal of the new labor force has affected incomes and consumption of the farmers’, and may have implications for the future *agricultural production trend* and sustainable development. The high *age* of farmers in some regions has been previously a concern especially for the modernization and increase of farm efficiency, but this indicator has especially increased in size among agricultural activities characterized by low returns and seasonal. The increasing risks in the economic and social plan are already under the influence of climate change, which have increased overall costs and further complicated the functioning of the farm. The effects of *flood damage*, *wind*

damage and *temperature damage* are everywhere present in agricultural activities and may have additional effects to the trend of agricultural production. The *trend of production* can be considered as an important indicator about the future of agricultural farming and influential for sustainable development according to regions.

Farmers' apples producers in the region of Dibra of north–eastern Albania, which is the second most important region in the country for this agricultural crop, typically face a similar problem. The social implications and effects of climate change have contributed for the decline in agricultural production and have raised concern about its trend. In this context, the possible testing of factors of a social nature and some other factors related to the effects of climate change such as: *age*, *flood damage*, *wind damage* and *temperature damage* to the *trend of agricultural production* may be of interest for the prospect of sustainable development in the region. Moreover, the measurement of the effects of social change in this region presented above and the impacts of climate change to the trend of agricultural production represent a research subject of interest and not explored by other researchers.

The literature generally supports the impact of the above factors to the agricultural production. There is a relationship between the age of farmers and the output¹. In the context of an aging agricultural labor force, changes in the working–age households have a significant impact on agricultural output². The rural concentration of elders may have negative consequences for agricultural production³. The term 'flood damage' refers to all varieties of harm caused by flooding and it encompasses a wide range of harmful effects on humans, their health and their belongings, on public infrastructure, cultural heritage, ecological systems, industrial production and the competitive strength of the affected economy⁴. The damage to agricultural production that results from flooding during a specific flood event mainly depends on the time of occurrence relative to the growth stages and the share of crop types and grassland in the area flooded⁵. Calculated probabilities of wind damage were generally higher in the southern study area than in the northern one and were explained by differences in wind climate and with respect to tree species composition⁶. Climate change and temperature changes have complicated effects on agriculture, highly nonlinear and varying by season⁷. Changes in temperature and precipitation lead to reduction in yield and increases in crop water demands⁸.

Objectives and hypotheses

The objective of this paper is to test the potential impact between variables that are age, the flood damage, the wind damage and temperature damage in the second largest agricultural area well–known for apple production in north–east of Albania (region of Dibra) to the trend of agri–production.

The study hypotheses are:

- H1 — age affects to the trend of production;

¹ Loomis C.P. (1936). The study of the life cycle of families. *Rural Sociology* 1.

² Guo G., Wen Q., Zhu J. (2015): The Impact of Aging Agricultural Labor Population on Farmland Output: From the Perspective of Farmer Preferences. *Mathematical Problems in Engineering*. Volume 2015.

³ Woodsong C. (1994): Old farmers, invisible farmers: Age and agriculture in Jamaica. *Journal of Cross–Cultural Gerontology*. Volume 9, Issue 3. July.

⁴ Messner F., Penning–Rowsell E., Green C., Meyer V., Tunstall S., Van der Veen A. (2007): Evaluating flood damages: guidance and recommendations on principles and methods. *Integrated Flood Risk Analysis and Management Methodologies*.

⁵ Förster S., B. Kuhlmann B., Lindenschmidt E.-K., Bronstert A. (2008): Assessing flood risk for a rural detention area. *Natural Hazards and Earth System Sciences*, 8, 311–322.

⁶ Blennow K., Andersson M., Sallnäs O., Olofsson E. (2010): Climate change and the probability of wind damage in two Swedish forests. *Forest Ecology and Management*. Elsevier. Volume 259, Issue 4.

⁷ Mendelsohn R., Nordhaus D. W., Shaw D. (1994): The Impact of Global Warming on Agriculture: A Ricardian Analysis. *The American Economic Review*. Vol. 84, No. 4, September.

⁸ Adams M. R., Rosenzweig C., Peart M. R., Ritchie T. J., McCarl A. B., David Glycer J., Bruce Curry R., Jones W. J., Botte J. K., Hartell Allen L. (Jr.). (1990): Global climate change and US agriculture. *Nature Publishing Group*. Vol. 345.

- H2 — flood damage affects to the trend of production;
- H3 — wind damage affects to the trend of production;
- H4 — temperature damage affects to the trend of production.

The above variables are measured by perception of farmers’ producers of apples in an area of high priority for horticulture in region of Dibra and they are:

- age;
- flood damage;
- wind damage;
- temperature damage.

Measurement procedure

To achieve the objective of the study questionnaires were used in the study area (villages in the region of Dibra), by interviewing farmers’ (220) by random choice procedure. The above variables are measured by scales (1–5). Interviewed farmers’ have been responded to the respective questions according to the applied categorizations (from strongly disagree to strongly agree).

Based on data provided two approaches are used, the approach based on the linear model and the approach based on the logit model. The significance of the variables under review is presented in the following tables (table 1 and table 2).

Table 1. The significance of variables by linear approach

Option 1: Dependent variable: Trend of production

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	3.99635	0.243542	16.4093	<0.00001	***
Age	-0.0349625	0.0600478	-0.5822	0.56101	
Flood damage	-0.169977	0.0618469	-2.7484	0.00650	***
Wind damage	-0.128832	0.0636944	-2.0227	0.04435	**
Temp. damage	-0.148356	0.0653148	-2.2714	0.02411	**

Statistics based on the weighted data:

Sum squared resid	883.7918	S.E. of regression	2.027476
R-squared	0.280516	Adjusted R-squared	0.267131
F(4, 215)	20.95635	P-value(F)	1.33e-14
Log-likelihood	-465.1318	Akaike criterion	940.2636
Schwarz criterion	957.2318	Hannan-Quinn	947.1158

Statistics based on the original data:

Mean dependent var	2.518182	S.D. dependent var	0.846500
Sum squared resid	142.6661	S.E. of regression	0.814594

Source: Data processed by authors.

Table 2. The significance of variables by logit approach.

Option 2: Ordered Logit, using observations 1–220
Dependent variable: Trend of production
Standard errors based on Hessian

	<i>Coefficient</i>	<i>Std. Error</i>	<i>z</i>	<i>p-value</i>	
Age	-0.253461	0.141776	-1.7877	0.07382	*
Flood damage	-0.464044	0.169628	-2.7357	0.00623	***
Wind damage	-0.458325	0.224515	-2.0414	0.04121	**
Temp. damage	-0.155051	0.189456	-0.8184	0.41313	
cut1	-5.98867	0.897867	-6.6699	<0.00001	***
cut2	-4.21459	0.845117	-4.9870	<0.00001	***
cut3	-1.49598	0.805646	-1.8569	0.06333	*
Mean dependent var	2.518182	S.D. dependent var	0.846500		
Log-likelihood	-253.0078	Akaike criterion	520.0156		
Schwarz criterion	543.7710	Hannan-Quinn	529.6087		

Number of cases 'correctly predicted' = 116 (52.7%)

Likelihood ratio test: Chi-square (4) = 79.3129 [0.0000]

Source: Data processed by authors.

Conclusions and discussions

The study achieved the objective by providing an analytical overview of the potential impact of some variables of a social and climate nature to the trend of agricultural production in the region of Dibra in the north-eastern part of Albania. The paper represents an attempt to identify the increasing impact of socio-environmental implications on agricultural regions and the findings are in line with the way were hypothesized variables under review.

The age, according to the logit model (table 2) results an influential factor to the trend of agricultural production. With increasing age of farmers, chances increase that there will be a decline in the trend of agricultural production. The departure of the youngest peoples in such regions with general inadequacy and low income and the decline in the trend of agricultural production may have consequences in the fight against poverty and in this sense protective redistribution policies for the poorer could be more costly. If a farm does not have potential to stay at or adapt to new more sustainable level(s) it would be either liquidated⁹. Such a perspective would have three main consequences: an increase in poverty, a decline at the rate of resources of use, and the depopulation of villages. Policymakers should focus, through incentives for farm adaptation with new challenges and works on its modernization by increasing investments that provide long-term-returns.

Flood damage, results a very influential factor to the trend of production (table 1; table 2). With increasing flood damage the trend of production declines. Increase of rainfall intensity and irregular distribution has increased overall risks throughout the production cycle resulting in decrease of the trend of production. Moreover the study area and especially some of villages are characterized

⁹ Bachev H. (2005): Framework for Assessing Sustainability of Farms. Institute of Agricultural Economics, Sofia, Bulgaria.

by landslide problems. Removal of the youngest and degradation of apple trees has led to increase of landslides by causing problems in agricultural production systems and even resident homes. Policymakers should orient agri-production models according to the principles of multifunctional agriculture with focus on increase of productivity, protecting the environment and resources as well as creating rural landscapes. Investments in irrigation and drainage should be designed on a local basis (and not central), monitoring the new dynamics of local climate events and adapting them to new knowledge and technologies used by farmers. It can help but however in the long-term this problematic requires design of natural risk management strategies according to the characteristics of the regions. The system of risk management is to adapt/improve by taking advantage of the summarized new opportunities and overcoming/defending against evolving new challenges¹⁰.

Wind damage and *temperature damage*, results influential factors to the trend of production. Strong winds and temperature fluctuations during the production cycle can collapse yields, impair product quality and cause a decline in production and farmers' income, which further encourages their removal. At the level of policymakers required more by determining new inputs and varieties that are more stable during the flowering season (to avoid the damage of winds) and beyond during the production cycle (to avoid the damage of temperature fluctuations). The findings of the paper highlight the increasing importance of social and climate factors to the trend of production on apple farms. Moreover, except the impact of these factors is also evidenced an interaction of the above factors which results in a multiple effects to the trend of agricultural production.

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¹⁰ Bachev H. (2013): *Risk Management in the Agri-food Sector*. Econstor. Leibniz Information Centre for Economics. Provided in Cooperation with: University of Finance and Management, Warsaw.