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Evaluation of the Climate Change Impacts on Irrigated Wheat Lands Rent in Iran

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Abstract

Climate change refers to the long-term variability in the behavioral pattern of the average climate measures of an area in the absence of a change in the general climate of the region. Given the inevitability of the effects of climate change on the agricultural sector, the assessment of its effects can be a basis for compliance with the uncertain future conditions. The purpose of this research is to assess the effects of climate change on wheat crop in Iran. The needed statistics and information were collected using secondary data. To accomplish the research objectives, using the panel data and Ricardian approach, the final effects of climate change on wheat rent in major provinces of the country wheat production during 2000-2015 were investigated. In order to predict the effect of climatic variables on the rent in the future of climate scenarios (A1 , B1, and AB) was used. The results showed that the first and second degree coefficients of variables indicate the effects of U or reverse U on net agricultural income, which indicates that the average precipitation of spring season up to 91.5 mm leads to an increase in agricultural land rent and after this, the spot decreases with increasing precipitation. The results of the fall season were similar to those of spring season precipitation, i.e., rainfall increase up to 112.2 mm in this season, will increase the rents, but if rainfall is higher than this, the rent will decrease. The results of the final effect of climate change on agricultural land renting using scenarios of climate change in the future years showed that climate change has a significant negative impact on wheat yield rents and will lead to lower product rents in the future, So that the climate change will decrease the rent by 1.35,4.51 and 10.41 percentin 2025, 2100 and 2050, respectively.

Keywords: Climate change, Iran, Irrigated wheat, Panel data, Ricardian approach

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Expended Abstract

Introduction

There are assessing the impact of environmental change to internalize the externality. Climate change is the environmental change that needs to evaluate the impact on various sectors in the economy. Climate change refers to the long-term variability in the behavioral pattern of the average climate measures of an area in the absence of a change in the general climate of the region. Climate change occurs when changes in Earth's climate system result in new weather patterns remaining in place for an extended time. Agriculture is a climate-sensitive sector, and climate-smart agriculture is the way forward to increase agricultural productivity sustainably. Based on the reanalyzed index of global land-ocean temperature prepared by the National Aeronautics and Space Administration combined land and ocean skin temperature represents warming approximately to 1.35°C between 1880 and 2018. The climate change fact is intensive among the Middle East countries and especially Iran. According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, climate change (CC) will expand existing stresses on agricultural systems, particularly those in Asia for several reasons. Given the inevitability of the effects of climate change on the agricultural sector, the assessment of its effects can be a basis for compliance with the uncertain future conditions. Some of the research has investigated the potential impacts of climate change on agriculture crops across different geographical locations. Regarding the importance of wheat in Iran's food security, the purpose of this research is to assess the effects of climate change on wheat crops in Iran. In this way, partial goals are including:

Determination of irrigated land rent in Iran

Investigation the impact of climate variable on irrigated land rent in Iran

Determination of climate change impacts on irrigated wheat lands rent in Iran.

Materials and Method

Because of the potential for global warming, there are widespread concerns about the impact of changing climate upon the productivity of land in farming and other sectors. The needed statistics and information were collected using secondary data. The main wheat production province in Iran are West Azarbaijan, East Azarbaijan, Ardebil, Esfahan, Ilam, Razavi Khorasan, Khuzestan, Sistan and Balouchestan, Fars, Qazvin, Kordestan, Kerman, Kermanshah, Golestan, Lorestan, Markazi, and Hamedan Province. About 70% of total wheat production is related to irrigated wheat and 30% is related to rain-fed wheat.

In recent years, the land area of irrigated wheat in recent years is about 2.2 hectares in Iran. Also, The yield of irrigated wheat is about 3.5 ton per hectare in Iran.

To accomplish the research objectives, using the panel data and Ricardian approach, the final effects of climate change on wheat rent in major provinces of the country wheat production during 2000-2015 were investigated (relation 1 to 4).

$$Q_i = Q(K_i, E) \quad (1)$$

$$C_i = C(Q_i, W, E) \quad (2)$$

$$\pi = [P_i Q_i - C(Q_i, W, E) - PL_i L \quad (3)$$

$$V_L = \alpha E + \beta E^2 + \delta Z + \varepsilon_i \quad (4)$$

In Equation (1) to (4), where the Q is quantity of production, P is the market price of the crop, L is land, and Pl is the agricultural land value. In order to predict, the effect of climatic variables on the rent in the future of climate scenarios (A1, B1, and AB) was used. Climate change scenarios or socioeconomic scenarios are projections of future greenhouse gas emissions used by analysts to assess future vulnerability to climate change. Producing scenarios requires estimates of future population levels, economic activity, and the structure of governance, social values, and patterns of technological

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change.

The climate change scenarios for Iran have published by the Intergovernmental Panel on Climate Change (IPCC). Change in precipitation and Temperature will happen to 2100. Temperature and precipitation respectively increased and decreased. Based on Climate change scenarios in Iran between 2025 to 2100, change in temperature will happen one degree centigrade in 2025, 1.7-degree centigrade in 2050, 2.3 degrees centigrade in 2075, and 3 degrees centigrade in 2100. Also, precipitation will decrease by 0.9% in precipitation in 2025, 1.3% in 2050, 1.4% in 2075 and 2.5% in 2100.

Also, Iran will experience an increase of 3°C in mean temperatures and a 2.5% decline in precipitation in the next century. Also, Iran by total greenhouse gas emissions nearly 616,741 million tons of CO_2 is the first responsible country to climate change in the Middle East, and seventh in the world.

Results and Discussion

The results of the fixed effect by using Generalized Least Squares (GLS) show that the fixed effect is the best model for investigating climate change impacts on irrigated wheat land rent in Iran. F-test is applied to select between the pooled model and panel model. Also, the Hausman test is applied to select between the random effect model and the fixed-effect model. The quantity of F and Hausman test is respectively 2.48 and 37.2. The result indicates that the panel model is better than the pool model. Also, the fixed-effect model is better than the random effect model to evaluate the climate variable on agricultural land rent in Iran. The quantity of JB (5.8) shows that the model has normality. However, we applied GLS to resolve the heteroskedasticity in the fixed-effect model.

Log-log is the best form of this model. First, 72 proposed variables including temperature and precipitation in spring, fall, and interaction between variable, latitude, above mean sea level and quantity of inputs were estimated by stepwise regression. Then, based on the fixed-effect model, workforce, machinary, temperature, precipitation, precipitation* temperature, harvest precipitation, and harvest temperature are significant and R2 is equal to 92%.

When precipitation increases, first agricultural land rent increases. Also, when temperature increases, agricultural land rent decreases. Besides, by 1% increasing in precipitation, agricultural land rent increases 0.98%. Also, the machinary coefficient shows that by 1% increasing in machinary, agricultural land rent increases by 0.24%. The workforce indicates when percent labor increases, agricultural land rent increases by 0.13%.

The results of the final effect of climate change on agricultural land rent using scenarios of climate change in the future years showed that climate change has a significant negative impact on wheat land rents and will lead to lower product rents in the future, So, the climate change will decrease the rent by 2.07%, 2.2%, 2.34% and 3.41% in 2025, 2050, 2075, and 2100, respectively.

Conclusions

Based on results, the total effect of climate change on irrigated wheat land rent is negative. Regarding the decreasing irrigated wheat land rent, proposed cultivation resistant to reduced temperature and precipitation. Also, the negative impacts of climate change can decrease by the change in cropping calender of irrigated wheat. On the other hand, regarding various climate in Iran, regional research can help to decrease the negative effect of climate change. According to results, it could be mentioned that consideration of the effects of climate change on food security and farmers needed can decrease the negative effects of climate change.

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