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RESEARCH ARTICLE

The Effect of Fluctuations in Climate Parameters on Wheat Market

Hakimeh Hatef, Mahmoud Daneshvar kakhki*, Mohammad Reza Kohansal, Mohammad Bannayan, Naser Shahnoushi Froshani

[1]*Ferdowsi University of Mashhad, Agricultural Economic Department, Mashhad, Iran.*

[2]*Department of Agronomy, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran*

*Corresponding Author: **Mahmoud Daneshvar Kakhki** mk**akhki**

Abstract

The great dependency of agricultural sector on climate conditions and high attribution of this sector to the economy of developing countries shows the importance of agricultural sector and its impressions from climate change phenomenon. One of the important questions that occur in mind is the effect of fluctuations in climate parameters on market of agriculture sector products. Since production in agriculture sector is important because of food provision of society members, studies in this field are so important for policy making and planning aspects. This issue is more important in countries and regions in more vulnerability of climate changes. Therefore, dry and semi-dry climates of Iran and Khorasan Razavi province were mentioned to study the production and demand for strategic product, wheat, by consideration of climate changes condition. To reach this goal, first an index to study climate parameters fluctuations was designed and calculated. Then, wheat economic model was made by aim of reaching balanced price by making supply and demand sides. The demand and supply functions were estimated as panel data for 30 provinces of country in 2005-2015 in Stata software. Then, optimization model was made in GAMS software to reach product equilibrium in the studied region. Results of calculations displayed that permanent risks have a negative and significant effect on product and wheat balanced price in Khorasan Razavi province whose price was obtained 12863 Rial in 2015. It is suggested to policy makers and planners to use simulation of various parts of the model and the obtained results from scenario for prediction in order to select the adapted policies with climate changes or reduce negative effects of this phenomenon in regions such as studied region.

Keywords: *Price, Permanent risk, Recurrent risk, Partial equilibrium.*

Introduction

Climate is the mean whether condition of a specific place and period. Agriculture sector is one of the most important economic sectors being influenced by climate fluctuations. The effect of agriculture from climate fluctuations is not steady in various regions. It is expected the developing countries to be influenced by the negative effects of climate change [1].

Recent studies have shown that if an action isn't taken to cope with global warming, the global production of agricultural sectors will reduce to 15.9% in 2080, while developing countries will face with significant reduction in agricultural productions (19.7%) [2].

Which will be effective on their total economic conditions for participation of agriculture sector in national production.

Evidences of historical meteorological data and also predictions about Iran climates shows the climate change phenomenon such as other parts of the world in recent decades with continuous process in future [3]. Iran is considered as dry and semi-dry zoning in the world. According to studies, under the observation of United Nations Climate Change Convention and using the proposed scenarios in intergovernmental panel on climate change, Iran mean temperature will increase 1.5-4.5°C and mean raining will

reduce about 10% (nearly 25mm). Although, this matter is effective on state economic sectors, it discloses agriculture sector against fundamental constrains.

Vulnerability and climate changing are always with each other. In climate plan of the world meteorological organization, "determination of human communities' characteristics in various development levels that make them vulnerable or flexible against climate change" is significantly important. Since all areas of a country or a region aren't steadily imposed under the climate changes and fluctuations, and the imposed damages to various regions will be different, it is necessary to calculate amount of vulnerability in all areas.

On the other hand, one of the biggest challenges which human has faced with it in the present century is essential food supplement of society in climate changes condition. Global warming or global temperature rise, droughts, floods and wide climate changes, reduce horticulture and crop and livestock products, economic productivity, and consequently make fluctuations in food production [4].

Various researchers had studies climate change and its consequences that some of them are referred. Bannayan et al. [5] studied climate fluctuations in north east of Iran and their results showed that incremental temperature and humidity reduction were observed in that region.

Khiz and Zibaei [6] using a computing general equilibrium model concluded that food security reduces by drought and it will be increased by the severity of drought. Reilly et al. [7] estimated the economic welfare caused by climate changes in production and concluded that the lost economic welfare in developing countries is getting severed. Butt et al. [8] showed using biophysical models that malnutrition may be doubled for adaptation with climate changes.

Hallegatte [9] considered growth cost as a damage of climate changes using dynamic integrated climate economy (DICE) model which includes 5 parts of climate model, macro economy model, demographic model, pollution model, and effect model. John et al. [10] concluded in studying on climate change of Thailand rice production that the precise decision making model of farmers is so important to enable them cope with climate changes. Wang [11] concluded that using dynamic panel and fixed effects of climate changes had a significant effect on food security. Chijioke et al. [12] by analysis the climate changes effect on agricultural production and food access in Africa showed that global warming, rising river waters, and lack of raining have significant effects on food production and access.

Falco et al. [13] used simultaneous equation model, probit, least squares error, and FIML to adapt food security with climate change. Sassi and Cardaci [14] used random method and general equilibrium model to study raining pattern on grain market and food security in Sudan. Results emphasized on the relationship between climate change, poverty, and food security. Wang [15] in Jilin Province in China studied grain production in climate changes condition and their results showed that climate changes reduced food security.

As it was mentioned, many studies have been conducted according to the importance of climate change and agricultural, climatology or its economic consequences. This article tries to study the effect of climate changes on agricultural products from meteorological and economic parameters simultaneously. Therefore, this research studies on the effect of climate change on the most important product in the food basket of the most developing countries, wheat, and determines equilibrium price of this product in economic model.

Methodology

Studied Region

Iran is one of the wide countries of the world in 25° 3′ to 39° 47′ of northern latitude, and in 44° 5′ to 63° 18′ of eastern longitude and has 164819 km² area. Iran is the western Asian country and is located in central Asia. The mean height of Iran is about 1200 m altitude and is in dry and semi-dry zoning of the world climate. The mean raining is about 250 mm that is less than one third of the world (860mm) (Iran report UNFCC 2010[1]).

[1]United Nations Framework Convention on Climate Change

Khorasan Razavi province has 128420 km^2 area and has 7.8% of Iran total area. Generally, this province has dry and semi-dry climate, and the mean raining in this province was 207 mm in 1989-2015. Since global raining is 780mm, raining of this region is about one fourth of the global raining level.

Vulnerability of Iran and Khorasan Razavi province is totally observable for having dry and semi-dry climate [16]. It was indicated by checking Iran people nutrition pattern that 60% of people needed energy is provided by grains whose high percentage is wheat (Central bank budget review reports).

Wheat

Wheat is one of the most important energy provision resources of people daily needs. More than 58% of calorie and 52% of the consumed protein of Iran people are supplied by bread [17]. Central bank household budget survey report in 1992-2015 shows that 41% of Iran people food basket is made by bread. This statistics shows the potential importance of this product.

Materials and Methods

The used model in this research is made from various sectors. Each sector and how to calculate them are explained in this part.

Vulnerability Index of Climate Parameters Fluctuations

Meteorological data that was recorded in this region stations were obtained by aim of studying the climate parameters fluctuations in the studied region and their effect on production. As it is shown in Figure (1), vulnerability index of meteorological parameters fluctuations have 2 sections that each one has 2 sub-sections. In other words, the elements of this index consider two related threats of climate changes: 1- the resulted dangers by recurrent shocks (such as droughts, flood, and storm), and 2- resulted dangers by permanent shocks (such as temperature increase and raining reduction) [18].

Therefore, the negative shocks for raining and positive shocks for temperature are considered as a part of the most important resulted damages by climate factors fluctuations. Since the studied region neither doesn't have sea nor long-term inexperience of flood, these factors for recurrent shock were taken out from analysis. Therefore, storm and increasing aridity were considered as the factors of recurrent shocks regarding to the features of this region.

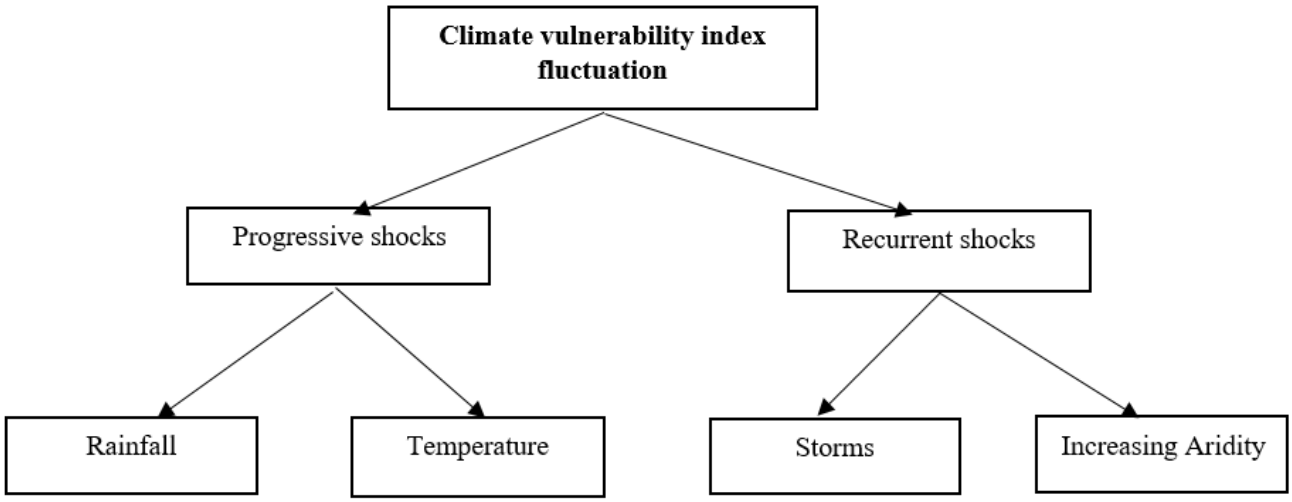

Fig. 1: Components of the vulnerability index Adapted from Guillaumont et al. With minor changes.

In order to reach the aim of this study and recurrent and permanent shocks entrance as a variable in production conditions, temperature fluctuation analysis, raining, storm, and increasing aridity must be analyzed. As lower raining level or higher dry lands of a region put that region in raining reduction or temperature increase in long-term, analysis their fluctuations is significantly important.

Aridity, as an alternative for drought increase danger, is considered as aridity index which can show the mean raining level in a state or amount of dry lands. In this regard, aridity index was used to calculate the intensity of increasing aridity in the

studied stations. This index was offered by United Nations environment program [19] [5] shows simultaneous changes in raining and evaporation potential, and is calculated using the following formula:

$$AI = \frac{P}{PET} \quad (1)$$

In which, P: Cumulative precipitation (mm) and PET: evaporation potential (mm) in the mentioned time scale. The numerical range of aridity index fluctuates between 0 and 1 that numerical values less than 0.05 shows very dry conditions and bigger than 0.75 values shows humid condition [5].

Evaporation potential was calculated using REF ET software and meteorological organization data for the studied stations. Of course, the proper method to determine evaporation potential in each region depends on climate conditions, needed data, and related costs to it. REF ET software needs the related data to solar total radiation, pure radiation, minimum mean temperature, maximum mean temperature, solarium, wind speed, and relative humidity in various methods. In this study, high used FAO Penman Monteith method was used, because this method has been introduced as the most precise method in both dry and humid climates [20].

Based on the global standard, storm is attributed to the winds with speed more than 30 knot (15 m/s) and horizontal vision less than 1 km. To calculate raining index, it is assumed that the mean temperature increase of the world will continue in all countries with the same path of recent decades and R_t is raining in year t, and IR is called index of raining.

$$IR = \sum \frac{|R_t - \hat{R}_t|}{\hat{R}_t} \quad (2)$$

In order to calculate IR, the recorded data in metrological station is moderated and calculated by ordinary least squares method.

The most popular method for meteorological time series analysis is usually checking the existence or non-existence of trend in them using statistical test. Since the existed trend in time series of meteorological variables are effective on analysis and evaluation of their effects on the related processes, it is essential to evaluate trend significance at first and then, if necessary, trend are removed. Various methods have been offered to analyze trend of time series which are divided into 2 parametric and non-parametric groups. However anticipation from non-parametric methods particularly Mann-Kendell, was more than others, because climate elements have non-linear behaviors and are not function of a specific statistical distribution [21].

Therefore, trend and instability in procedure was calculated using Mann-Kendell non-parametric test and results were not mentioned for summarization for each four elements of diagram (1) which were introduced as the elements of vulnerability index of climate factors fluctuations.

Weight was each element is determined after calculation of them. Generally, arithmetic mean weighting methods, geometric mean, geometric mean reversal, modified geometric mean, and analysis methods of the main elements in various studies were used to determine weights of the studied elements [18]. Following Guillaumont and Simonet [22] study, similar weights were selected for indexes in this research because of the difference in their various climate changes. That way, numerical values of permanent and recurrent risks was calculated for the studied region during 2005-2015 [23].

Economic Model

As it was explained, the aim of this study is including fluctuations in climate parameters in determination of wheat balanced price that is the main foodstuffs of Iran. To reach balance, the introduced partial equilibrium method by Huang and Li [24], and Witzke et al. [25] was made that includes production, consumption, and transaction, and two main part of product, supply and demand. Supply side simulates product condition about producer price, input prices, and shock.

Demand side includes consumption in rural and urban communities about income, consuming price, and demand for feed, seed, industry, waste, and transactions. Consumption for Urban and rural communities is considered as a function of income, product price, and price of other products and market factors.

Wheat Supply

The ratio of production than the supplied amount of a product is studied. There are many flexible and inflexible production functions. In flexible function form, there is no guarantee for advantages as uniformity, curvature, and positivity outside of the initial estimation that makes problem in using these types of function in balanced models to reach logical equilibrium [26]. Therefore, inflexible forms such as fixed succession or Cob Douglas have many applications in the related studies to determination of balanced conditions.

Decision about production is influenced by various factors such as product price, quantity, and input prices such as climate fluctuations (recurrent risks and permanent risks that were explained in the previous parts). Investment is in agriculture and agricultural policies such as supportive policies, institutional policies, marketing policies, etc. As Cobb Douglas function form is one of the most applied function in agriculture sector, relation (3) is as following:

$$Q_t = Q_0^{\beta A} . \prod_{jc=1}^{crop} (PC)^{\beta A} . \prod_{jc=1}^{n} (PI)^{\beta A} . \prod_{jc=1}^{m} (ZA)^{\beta A} \quad (3)$$

In which, Q_t is wheat production in time t, PC is wheat and other products price, PI is input price (such as workforce, land, fertilizer), ZA is shocks and regional, product or whole country policies. ßAIs price elasticity of the produced production inputs prices, one unit change in production shock.

Wheat demand

Wheat demand includes consumption of food, feed, seeds, industrial usage, and waste. Consumption is considered as a function of foods price, per capita income, and effective factors on market according to urban and rural consumers. Rural market hasn't so much developed in most developing countries of the world like Iran, and most farmers live in small lands and traditional cultivation conditions.

Their productions are their main resources of foodstuff and just a part of their products is sold and bought. Therefore, an index was defined for market development in demand equation for rural consumers [15]. This index includes cost share of rural family about food costs. Demand equations for rural and urban markets with price elasticity and various incomes include:

$$\text{Urban: } Q_t^{DU} = Q_0^{DU} . \prod_{jc=1}^{ncrop} (P_t^{DU})^{\beta Q_t^{DU}} . (IM_t^{U})^{\beta Q_t^{DU} \beta IMU} \quad (4)$$

$$\text{Rural: } Q_t^{DR} = Q_0^{DR} . \prod_{jc=1}^{ncrop} (P_t^{DR})^{\beta Q_t^{DR}} . (IM_t^{R})^{\beta IM} . (MKT_t^{R})^{\beta MKT^R} \quad (5)$$

In which, Q_t^D is consumption; Q_t^{DU} and Q_t^{DR} are consumption in urban and rural communities; P_t^{DU} and P_t^{DR} are consumer prices in urban and rural, IM_t^U and IM_t^R are annual income of urban and rural communities, andMKT_t^R is index of rural food market, $\beta Q_t^{DU}$and βQ_t^{DR} are price elasticity, and βIM_t^U and βIM_t^R are income elasticities in urban and rural areas.

In order to get wheat balanced price, the other elements of wheat demand include: $Feed_t$ is used wheat to feed for livestock, $Seed_t$ is used wheat for seeding, $Industry_t$ is used wheat for industry and $Waste_t$that were added to analysis. Wheat exchange with various regions of one country or with the studied region was considered for product supplement at the end. In this regard, the economic balanced wheat model was made that general supply of wheat must be equal to the product total demand in market clearing as the following equation shows it:

$$Qc_t^S + (import - export) = Qc_t^D + Feed_t + Seed_t + Industry_t + Weste_t + Stock_t \quad (6)$$

Solving this equation, wheat balanced price is obtained in each period in market clearing. In other words, reaching market clearing is a process to search for proper price groups by which wheat supplement will nearly equal to its demand. The objective function in mathematical planning model in GAMS software is minimizing the difference between product supply and demand functions with the following considered limitations:

l. land. First, it is essential to indicate the needed land for cultivation that was obtained in supply function (Q_w). Therefore, the following relation is used.

$$A_W = \frac{Q}{Y_W} \quad (7)$$

In which, Yw is wheat yield, Aw: wheat under cultivation land

$A^{S}_{Wheat} \leq b_{Land}$ (8)
b_{Land}: Accessible land

2. Water

$a_{WW}.A^{S}_{Wheat} \leq b_{Water}$ (9)

a_{ww}: Needed water to product wheat per hectare, b_{Water}: accessible water amount
3. Labor

$a_{LaW}.A^{S}_{Wheat} \leq b_{Labor}$ (10)

b_{Labor}: Accessible workforce

4. Capital
$a_{CaW}.A^{S}_{Wheat} \leq b_{Capital}$ (11)

a_{Caw}: Needed costs to produce wheat in per hectare, and$b_{Capital}$: accessible capital.

Variables

To achieve research objectives, research body is divided into 2 parts and the various mentioned variables are as following:

To study climate parameters fluctuations and their effects on production (permanent and recurrent risks): the meteorological parameters such as daily temperature data, raining, and wind force was obtained from province meteorological organization.

In economic sector: the land under cultivation, and wholesale price for wheat relationship with other products was considered such as barley price, potato prices, rice prices and wheat wholesale prices. Effective inputs on wheat production in the studied region whose prices are mentioned include land renting, seed, chemical fertilizer, animal fertilizer cost, labor, machineries, water, herbicide and insecticide cost, fungicide value of wheat, rice and barley and potato prices.

The executed plans by government to contrast with dessert phenomena, total natural area, watershed measures, the results obtained from the calculation in the previous section based on permanent and recurrent risk, the number of cooperative companies, the capital of cooperative companies, the purchase and sale of wheat, cost of research and development in agriculture and agricultural support services by the government for machinery, pesticides and fertilizers can be considered to include the effective plans or policies on product.

The considered variables in demand modeling include: per capita consumption of wheat (kg), urban population (one thousand people), retail and wholesale price of wheat, urban income, rural income, per capita consumption of rural areas(kg), rural population (one thousand people), total rural consumption (ton), and market size index. In order to fill the wheat supply side, the consumed wheat for feeds, seed, industry, waste, and also the amount of entered and exited wheat from Khorasan Razavi province were inserted in model.

Results and discussion

As it was explained, the objective of this research is to study the climate parameters fluctuations in wheat economic market. Therefore, first the fluctuations in parameters were divided to include the most important and effective climate parameters on production in agriculture sector.

Then, to make wheat economic model, supply and demand sides with the explained elements in model there weren't in long-term time series for the high distribution of variables, computations were considered by panel data for lack of efficient information for 30 provinces (the provinces named are in appendix)[2] in 2005-2015.

Information of this part was collected from various centers including statistics and reports from Iran's Statistics Center, Department of agriculture, Management and Planning, and Road and Transportation Organization in that period.

First, production function, urban demand, and rural demand for wheat in Khorasan Razavi province were estimated in STATA software, then the obtained elastic ties to achieve equilibrium were inserted in GAMS software. The used method to solve model is the maximum entropy that was done in Solver Conopt 3.

[2] It is to be noticed that Alborz province was separated in 2010 and there is not efficient data about this province.

Table 1: supply and demand coefficient

Supply				Demand		
Variable	Coeff	t		Urban demand		
PRice	-0.03	-0.94		Variable	Coef	t
PPotato	-0.06	-2.44		IMU	0.37	2.05
PBarley	-0.69	-2.95		PCW	-0.49	-3.8
PWW	0.74	3.09		PPotato	0.15	2.56
CWater	-0.01	-2.40		cons	9.13	7.19
Cseed	0.17	0.98				
Labor	-0.29	-2.56				
CChem	-0.08	-4.50		Rural demand		
ZChFer	0.35	5.32		Variable	Coef	t
ZMachin	0.45	5.86		IMR	0.23	4.41
Zdesert	0.20	5.99		PWW	-0.42	-3.24
TotalBS	0.02	1.81		MKT	0.14	2.62
ZTCap	0.12	3.45		cons	5.16	4.44
PerRrisk	-0.17	-1.94				
reRisk	-0.02	-0.23				
cons	0.63	0.31				

Diagnostic tests for panel data were conducted to select the panel model, fixed and random effects, and results showed the rejection of the panel model and accuracy of panel data. Moreover, results of pp Fisher and Im Pesaran, Shin were to study the unit root between panel data that was obtained from stationary of some studied series and presence of unit root in others.

The absence of unit root in the residuals of variables using model didn't have any problem that was based on Pedroni cointegrationtests.[3] The estimated coefficients for both supply and demand sides were provided in table (1) as panel data of 30 provinces of country that were obtained from Cobb Douglas model. It must to be pointed that the tables of results were only for statistically significant variables.

As it is observed in table (1), potato (P Potato) and barely (P Barley) prices in supply side are as the related products with wheat. The effect of wholesale price of them is negative and significant on wheat production, because it their price increases, the farmer reduces cultivation of wheat and replaces cultivation of these products to gain more benefit.

The obtained coefficient for rice price (Price) is negative, but it is not statistically significant maybe because of cultivation conditions for rice transplantations that many provinces of the country have a little rice production. Therefore, it seems that there is not enough motivation in farmers to change cultivation model toward rice. The effect of rice wholesale on production of this products is positive and significant confirming supply law and positive effect of price on production of this product.

It can be claimed about the effective inputs on wheat production that, the effects of water (CWater), workforce (Labor), and chemical fertilizers (CChem) price are negative and significant based on model results that show increase in price of agricultural inputs reduces amount of production .whose main reason is traditional production technics in the developing countries such as Iran, poverty among villagers, and economically low ability of farmers. The effect of seed price (Cseed) on wheat production is positive and significant.

Among plans, policies, or shocks that may be effective on supply and demand of wheat that were referred in variables introduction part, as is seen in table (1), there is positive and significant factors on wheat production between supportive services (like: ZChFer), in agriculture sectors by government, machineries (ZMachin)and chemical fertilizer (ZChFer) has positive and significant effect.

[3] Results of this part are omitted for more summarization, if readers like, results will be deducted.

Also desertification policy (Zdesert) with buying and selling of wheat (TotalBS) (as marketing policy), and the paid costs to research and development (ZTCap) in agriculture sector has positive and significant effect on wheat production.

Results of two last variables that were entered in analysis the climate parameters fluctuations (Per riskfor permanent risk and re Riskfor recurrent risk) by the considered index, show the negative effect of permanent and recurrent risks on wheat production in country.

Among these two variables, permanent risk has a negative and significant effect on production including temperature increase and raining reduction. In other words, more temperature increase and its higher fluctuations than the previous average of thisvariables will damage and reduce wheat production. However, recurrent risks, that include the made fluctuations in storm and increasing aridity on wheat production, are significant statistically in spite of the negative effects on production.

In demand side, as explained, demand for wheat is considered by separation for rural and urban settlers. The assumption in this section is that the effective price on urban demand is the retail price (PCW) and the effective price on rural demand is the wholesale price (PWW) of wheat.

This is because the retail price after the exchange of wheat comes from the production, the addition of transportation, and brokerage costs. However, as villagers live in production areas, their behavior is influenced by the wholesale price.

Urban per capita income (IMU), consumer prices, the retail price of wheat between provinces in the period, and the price of potatoes that has a direct relationship with wheat in consumption basket of families, were inserted among the introduced variables in the previous part that are statistically significant.

Meanwhile, the effect of income was positive and increase in urban settlers' income leads to more demand for product, the retail price of wheat has a negative effect on demand that confirmed demand law. Potato price has a positive effect on urban families demand for wheat, because increase in potato price reduces its demand and replacement of this product with wheat is more to supply nutritional needs of urban families.

In rural consumption function, per capita income of rural settlers (IMR), wholesale price of wheat, and development index of market size (MKT)among the introduced variables have a significant effect on wheat demand. Meanwhile, income and price has positive and negative effects on demand that confirms this law.
Table (2) shows number of groups and observations in the estimated supply and demand functions in STATA software. R^2 statistics and also the significance of the total regression test show good fittings.

Table 2: Goodness of fit

Model	Observations	Groups	Wald	Prob		R^2
supply	310	30	346.9	0.00		0.79
Urban demand	305	30	215.2	0.00		0.80
Rural demand	297	30	156.7	0.00		0.82

After the calculation of effective variables attractions on rural and urban demands, other elements of wheat demand in Khorasan Razavi province were filled during the statistics in the studied time period. The sent wheat from province is 576403 ton in average, the entered wheat to province from various province is 897489 ton, used wheat in industry was 606250 ton, feeds is 18585 ton, and used wheat for seeding is 103259 ton and the waste is 52534 ton in Khorasan Razavi province in 2015.

After the estimation and filling wheat supply and demand functions in Khorasan Razavi province to reach balanced price of product, the mathematical plan model was wrote in GAMS software in Khorasan Razavi province in 2015 whose goal was reaching equilibrium for wheat with accessible land, water, capital,

and workforce for product and region. The model was solved using maximum entropy, and 12863 Rial was obtained in 2015. Since the guaranteed price in 2015 was 1270 Rial by government, it shows a good ability of this model in simulation the dominant conditions on wheat economic market in region. It is suggested to the policy makers and planners to use simulations of various parts of model and the obtained results from scenarios for prediction to select the adaptable policies with climate changes or negative effects reduction of this phenomenon in regions such as studied region.

Conclusion

High dependency of agriculture sector on the climate conditions and high share of this sector in the economies of the developing countries shows the importance of agriculture sector and its effects about climate change phenomenon. One of the most important questions that occur to mind is the effect of climate change on agricultural sector and its important production.

Climate changes effect in short-term changes yield and production and consequently changes in supplement of agricultural products, but climate changes led variation income and decrease products and soil quality that will change demand side besides changing product supply side in long run. Since production in agriculture sector is effective on the important issue of food security, study the conditions and made changes is significantly important. This issues is more important in more vulnerable countries and region to climate changes conditions. Therefore, dry and semi-dry climates of Iran and Khorasan Razavi provinces were mentioned to study wheat production and demand in climate changes conditions.

The purpose of each economy is reaching balanced condition. Generally, studying equilibrium is popular by two general and balanced dimensions. Various economic sectors and dominated conditions on them are generally mentioned in studying various economic parts and their dominated conditions. General equilibrium models are not so much applied in climate change issues in spite of their high potentials in studying various subjects. Its most important reason is not adaptation between geographical and political boundaries with climate divisions. Therefore, application of partial equilibrium models is more popular in analysis of the related issues to climate change and fluctuations in climate change parameters. It is essential in studying partial equilibrium of economy to mention the conditions in both supply and demand sides.

To reach the objective of this survey, study the climate parameters changes on wheat economic market, first an index was designed to study climate parameters fluctuations including raining, temperature, storm, and aridity that consist of two permanent and recurrent risks.

Then, wheat economic model was made by making supply and demand sides with aim of reaching equilibrium price for product in this region, while other studies in this field in determination of equilibrium price and balance calculation in agricultural sector haven't considered any role for climate change, and the related studies about climate change neglected the effect of this parameter in the balanced conditions. This research considered the effect of climate parameters fluctuations in two permanent and recurrent risks for the first time and analyzes their formation on product production and supplement.

Results of calculations show that permanent risks have a negative and significant effect on wheat production, and the balanced price of wheat was 12863 Rial in Khorasan Razavi in 2015. Good ability of model is clear in checking the dominant conditions on wheat market.

Result of this study show that government tries to keep the price for wheat in low level than real condition and support consumers in determination of wheat guaranteed price. Thus, if market condition determines product price, government must pay the difference between the prices of bought wheat and the guaranteed price in pricing this product. If the effect of climate changes isn't included in determination of the guaranteed price in the next periods, the paid subsidence by government will increase according to the results of other studies that show wheat yield.

Although, the reason for determination of the guaranteed price of product by government in Centralized economics such as Iran doesn't makes it necessary to study products price according to some people ideas, Results of this article show that considering the climate parameters fluctuations has a significant effect on determination of wheat price.

Therefore, studying the effect of these factors in the partial equilibrium model seems necessary to determine product price and if government doesn't include then, this cost will be paid hidden in agriculture sector by producer or government and reduces producers' benefits. Or product will be losing which results in removal of product from cultivation model in the future periods.

According to the importance of wheat in families' baskets, Compromised of food security is possible, country dependency to import this product will increase, and self-sufficiency in wheat production will fail in wheat production. So it is suggested to study the share of climate parameters fluctuations or climate change for the present and future periods in determination of the studied product price in further research.

Moreover, it is suggested to policy makers and planners to use the obtained results from the prediction scenarios and simulations of various model parts to select adaptable policies with climate changes or reduction of negative effects of this phenomenon in the studied regions.

Since model includes the supply and demand completely, it is possibility of conditions simulation for various scenarios by climate change in future years based on the offered scenarios by Intergovernmental Panel on Climate Change (RCPs scenario) or changes in inflation, rising urbanization rates and the phenomenon of migration, changing patterns of consumption, the risk of emergence and economic conditions.

Government can select some plans to determine the wheat guaranteed price or various supportive, marketing, research, and etc. policies to analyze wheat market and select some plans to cope with the effects of climate changes with its adaptation to reduce the negative effects of this phenomena in agriculture sector.

Because important products such as wheat that supplies the main meal of Iran people is so important for planning to reach self-sufficiency, creation, and stabilization of food security. It is suggested to study on all agricultural products or consider planning and policy making in agriculture sector using comprehensive data banks. The similar system called CAPSIM[4] that was implemented in Europe and many developed countries.

[4]Common agricultural policy simulation model

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Appendix

The studied provinces in economic model formation were estimated as panel data that described as table (A).

Ardabil	Boushehr	Khorasan Shomali
Esfahan	Khozestan	Khorasan Jounobi
Ilam	Azarbayjan Sharghi	Khahar mahal
Zanjan	Azarbayjan Gharbi	Kohkiloye
Tehran	Khorasan Razavi	Sistan
Fars	Kermanshah	Mazandaran
Qazvin	Semnan	Markazi
Ghom	Golestan	Hormozgan
Kordestan	Gillan	Hamedan
Kerman	Lorestan	Yazd

