



# Analysis of the Effects of Agricultural Inputs Price Liberalization on the Production of Sunflower in Khoy Zone

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## Abstract

Sunflower is one of four main annual oil plants that cultivated in oil and nut varieties. This plant as an important and industrial food product and because of nutritional features and the potential for earning exchange has become a valuable product in foreign and inner markets and has a special position in agricultural sector. Khoy, by producing 40 percent of sunflower productions of country annually, is the greatest sunflower producer in Iran. The main purpose of this study is the analysis of the effects of inputs price liberalization on production of sunflower producers in this city. This study is according to a field research and cross-sectional data of 2009 have been used for it. Results show input price liberalization policy by increasing inputs prices and decreasing demand amounts of inputs, increases the production costs and decreases the production and totally it's harmful for sunflower producers. For preventing negative effects of liberalization on production, adopting necessary policies such as merging small farms and making big ones to profit by economies of scale and increasing production and productivity with the resulted incomes from liberalization and spending them in scientific researches to produce with low costs are suggested.

### Keywords:

Sunflower, Liberalization, Production factor, Production elasticity, Khoy

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## INTRODUCTION

Oil seeds as industrial plants are one of main and strategic products of agricultural sector that are cultivated for providing eatable oil. The importance and value of oil seeds are not only for their oil but also for valuable material that is consumed for nutrition after oil-pressing. Sunflower is one of four main annual oil plants that cultivated in oil and nut varieties. Nut varieties have special oil acids and less oil but oil varieties have 43-49 % oil that is full of D and E vitamins and has an important role in human health. Sunflower oil is important in clearing vessels and preventing brain and heart strokes. Also, it is used to make medicine, soap, colors and cosmetic materials. Because of desirable quality of oil and desirable reaction in unsuitable environment conditions, sunflower has a special position in agricultural sector and can be effective in economies of most countries (Mehrabi *et al.*, 2009).

Khoy is the greatest sunflower producer in Iran that produces 40% of sunflower production in country. Moderate weather, susceptible land, suitable market, having high price in comparison with other agricultural products, being precocious and possibility for second cultivation are the most important reasons of sunflower cultivation in this area. Nut varieties of Khoy are rare in color, taste and size and are competitive with other countries products. The products are exported to Persian Gulf countries and if export way becomes paved, thousands of tons of this production can be exported to other countries (Bagherzadeh, 2010).

As we know, agriculture is the economic heart of most countries and most likely source of significant economic growth (DFID, 2003). It has been observed as the major and certain path to economic growth and sustainability. In spite of the dominant role of the petroleum sector as the major foreign exchange earner, agriculture remains the mainstay of the economy (NEEDS, 2004) as the economic of most developing countries are built on agriculture. There is strong relationship between agricultural productivity growth and reduction of poverty. Sunflower in agricultural sector of Iran as an important and

industrial food product and because of nutritional features and the potential for earning exchange has become a valuable product in foreign and inner markets. Many governments intervene, directly in producing agricultural products through taxations and subsidization, so inputs price are not real. For increasing the ability of economy sector, it's necessary to use clear and competitive prices of inputs to have economic efficiency. Liberalization policy of agricultural sector as a way of development has been proposed to developing countries by World Bank. Liberalization simply means allowing market forces of demand and supply to determine what to provide, for whom to produce, and the method of production to be used in an economy. Liberalization involves deregulation and the removal or reduction of government's participation in the economy. Their justifying reasons for this policy are environment protection, decreasing government costs, increasing inputs productivity and stable development of agricultural sector. Since this policy has been enforced in our country since some years ago and now continues, there are some concerns about loss of this sector. The analysis of input price liberalization effects on production is too important because enforcing price liberalization policy by increasing inputs prices and decreasing their consumption affects production and production costs and if these effects are negative, they can make some problems that threat economic and political security of country.

Previous studies on input consumption in agricultural sector and subsidies effects show that subsidy elimination has been one of government's important economic policies in recent decades. In most countries there were such experiences that we imply some of them.

Gulati (1990) in a study on agricultural input price liberalization claimed according to high and increasing costs of agricultural input subsidies, eliminating these subsidies is necessary but it has some reactions on agricultural sector that needs to more study and analysis. Ready and Deshpande (1992) by analyzing the effects of fertilizer price liberalization in India showed that this policy as an agricultural development

tool has both positive and negative effects. Elyasian and Hosseini (1996) in a research on the analysis of effects of agricultural inputs subsidy elimination showed in case of wheat profitability after liberalization is twice as much as before liberalization. In another research Azizi (2005) studied the price liberalization effects of poison and fertilizer inputs on rice in Guilan. Results showed that fertilizer was using in second area –economic area- and price liberalization led to increase in price, decrease in fertilizer consumption and so decrease in production, but poison was using in third area, price increase led to consume in second area. Then by comparing the positive and negative effects of liberalization, continuing the policy was suggested for this input. In another study Karimzadegan (2006) presented eliminating fertilizer subsidy decreases its consumption for wheat and returning to optimal input consumption increases their production and profit. Ayinde et al., (2009) by studying the effects of fertilizer policy on production in Nigeria in two periods (before liberalization and after liberalization) showed despite fertilizer price increase, liberalization leads to production increase. In this study for having more production, controlling inputs prices and educating farmers are suggested. Badmus (2010) by doing the same research on corn production in Nigeria by using of SUR method on time series of 1970-1998 claimed liberalization is ineffective on fertilizer price and consumption but has positive effects on production. Mousavi et al., (2010) studied the welfare effects of eliminating fertilizer subsidy on corn production in Fars. Results showed liberalization despite price increase did not affect fertilizer demand and so it caused high production costs and low profit.

The main objectives of this study are the analysis of input price liberalization effects on sunflower production and its production costs. So according to our objectives, we try to derive production function, cost function, production elasticity of inputs and the comparative importance of inputs to show whether the farmers behave logical in applying inputs or not. Then by means of inputs demand functions and inputs

demand price elasticity, consumption and production changes are identified.

## MATERIALS AND METHODS

In developing countries including Iran, better use of agricultural inputs like land, fertilizer, poison, water and so on, for increasing the production and development of agricultural sector has special importance and there are several tools to achieve them. One of the most important tools for choosing suitable approaches in production and optimal allocation of sources is using production functions. In fact, production functions are one of analysis ways of quantitative relations between the amounts of inputs and production operation. These functions are mathematical relations that identify input conversion rate to output. So we have:

$$y = f(x_1, x_2, \dots, x_n) \quad (1)$$

Y is the amount of production and  $x_i$ s are production inputs.

Agricultural production function is:

$$y = f(x) = Ax_1^\alpha x_2^\beta, \quad \alpha, \beta > 0 \quad (2)$$

Total cost function is:

$$TC = w_1 x_1 + w_2 x_2 \quad (3)$$

Lagrange function is:

$$\min: w_1 x_1 + w_2 x_2 \quad \text{subject to } Ax_1^\alpha x_2^\beta \geq y \quad (4)$$

$$l = w_1 x_1 + w_2 x_2 + \lambda(y - Ax_1^\alpha x_2^\beta) \quad (5)$$

For minimizing agricultural sector costs, we make derivation toward each production input and put them equal to zero (Badmus, 2010).

$$\frac{\partial l}{\partial x_1} = w_1 - \lambda \alpha f(x)/x_1 = 0 \Rightarrow w_1 x_1 = \lambda \alpha f(x) \quad (6)$$

$$\frac{\partial l}{\partial x_2} = w_2 - \lambda \beta f(x)/x_2 = 0 \Rightarrow w_2 x_2 = \lambda \beta f(x) \quad (7)$$

$$w_1 x_1 + w_2 x_2 = \lambda(\alpha + \beta)f(x) \quad (8)$$

Then we give joint powers to the both sides of first condition equations, find the amount of  $\lambda$  and put in cost equation as follows:

$$w_1^\alpha x_1^\alpha = \lambda^\alpha \alpha^\alpha f(x)^\alpha, \quad w_2^\beta x_2^\beta = \lambda^\beta \beta^\beta f(x)^\beta \quad (9)$$

$$\Rightarrow (w_1^\alpha w_2^\beta) f(x)^{\alpha+\beta} = A \lambda^{\alpha+\beta} (\alpha^\alpha \beta^\beta) f(x)^{\alpha+\beta} \quad (10)$$

$$= \left( \frac{w_1^\alpha w_2^\beta f(x)}{A \alpha^\alpha \beta^\beta f(x)^{\alpha+\beta}} \right)^{\frac{1}{\alpha+\beta}} \quad (11)$$

$$c(y, w_1, w_2) = w_1 x_1 + w_2 x_2 = \lambda(\alpha + \beta) f(x) \quad (12)$$

$$\lambda(\alpha + \beta) f(x) = (\alpha + \beta) B A^{\frac{-1}{\alpha+\beta}} y^{\frac{1}{\alpha+\beta}} \left( w_1^{\frac{\alpha}{\alpha+\beta}} w_2^{\frac{\beta}{\alpha+\beta}} \right)$$

$$, B = \left( \alpha^{\frac{-\alpha}{\alpha+\beta}} \beta^{\frac{-\beta}{\alpha+\beta}} \right) \quad (13)$$

$$\ln C = \ln(\alpha + \beta) + \ln B - (1/(\alpha + \beta)) \ln A + (1/(\alpha + \beta)) \ln y + (\alpha/(\alpha + \beta)) \ln w_1 + (\beta/(\alpha + \beta)) \ln w_2 \quad (14)$$

Coefficients of each parameter in above equation are cost elasticities of inputs. Also we have this result as scale elasticity:

$$\frac{AC}{MC} = \frac{Costs}{y(\partial C/\partial y)} = \left( \frac{\partial \ln C}{\partial \ln y} \right)^{-1} = (\alpha + \beta) \quad (15)$$

Then we find demand functions of each input:

$$x_1(y, w_1, w_2) = \frac{\partial C}{\partial w_1} = \alpha B A^{\frac{-1}{\alpha+\beta}} y^{\frac{1}{\alpha+\beta}} w_1^{\frac{\alpha}{\alpha+\beta}-1} w_2^{\frac{\beta}{\alpha+\beta}} \quad (16)$$

$$x_2(y, w_1, w_2) = \frac{\partial C}{\partial w_2} = \beta B A^{\frac{-1}{\alpha+\beta}} y^{\frac{1}{\alpha+\beta}} w_1^{\frac{\alpha}{\alpha+\beta}} w_2^{\frac{\beta}{\alpha+\beta}-1} \quad (17)$$

This study is according to a field research and cross-section data of 2009 have been used for it. We spent 2 months for collecting data. At first we took the names of all sunflower producers of Khoy that were 5000 units then we classified the statistical universe of producers to 3 classes according to the size of cultivated land, (0-4] hectares, (4-8] hectares and (8, more) hectares, that 60% of lands were between (0.25-4) hectares, 30% of lands were between (4-8) hectares and less than 9% were more than 8 hectares. After classification, by using of classified random sampling, we could get optimal sample volume by:

$$n = \frac{Z_{\alpha}^2 \sigma^2}{d^2} \quad (18)$$

So for every class by random method we chose a volume of  $n_h = n.N_h/N$  that  $n$  is optimal amount of sample for statistical universe. Since

our method was random, for identifying optimal  $n$ , we should know the sum of all classes is equal to the optimal amount of sample of statistical universe. We know for collecting samples of  $n > 30$ , mean sampling distribution is normal. So:

$$\sum_{i=1}^h n_h = n \quad d = Z_{\frac{\alpha}{2}} \frac{\sigma_x}{\sqrt{n}} \quad (19)$$

$$\sqrt{n} = \frac{Z_{\frac{\alpha}{2}} \sigma}{d} \Rightarrow n = \left( \frac{Z_{\frac{\alpha}{2}} \sigma}{d} \right)^2 = \frac{Z_{\frac{\alpha}{2}}^2 \sigma^2}{d^2} \quad (20)$$

In above equations,  $d$  is the maximum amount of authorized error,  $\sigma_x^2$ , the variance of statistical universe and  $z$ , standard normal distribution by  $\alpha$  significance level. For calculating variance, we used,  $\sigma = (X_{max} - X_{min})/\varepsilon$ . The variance of statistic universe was 400, so  $\sigma_x = 20$ . Then we calculated the optimal amount of each class.

$$n = \frac{(1.96)^2 \cdot 400}{(4.65)^2} \approx 70 \quad (21)$$

After having total optimal number and optimal number of sample for each class, by using of random numbers table, we took the names of sample sunflower producers and finally found essential data for study.

## RESULTS AND DISCUSSIONS

Empirical studies and sampling methods in producing sunflower seeds show factors like seed, labor, fertilizer and watering times are the main factors of production function in this sector. Applied production function in this study is Cobb-Douglas. Cobb-Douglas function has better goodness of fit toward other agricultural production functions. So this function was used for estimating the relation between sunflower production and inputs. Sunflower production function that has been estimated by ordinary least squares method is presented as:

$$\ln y = -4.092 + 0.785 \ln s + 0.365 \ln l + 0.751 \ln w + 0.139 \ln f \quad (22)$$

t- statistics: (-4.25) (2.9) (1.58) (2.67) (1.85)

The numbers inside parentheses are t- ratios that show all variables of production function



Table 1: The results of estimation by Microfit 4.1

| Regressor     | coefficient | t-statistic |
|---------------|-------------|-------------|
| Constant      | -4.092      | -4.25       |
| Lns           | 0.785       | 2.9         |
| Lnl           | 0.365       | 1.58        |
| Lnw           | 0.751       | 2.67        |
| Lnf           | 0.139       | 1.85        |
| R-squared     |             | 0.75        |
| R-Bar-squared |             | 0.69        |
| F-statistic   |             | 12.256      |
| DW-statistic  |             | 1.8         |

have significance in 95% confidence level.  $R^2=75\%$  and  $\bar{R}^2=69\%$  that according to cross-section data are acceptable amounts. Also F-statistic related to analysis of variance is 12.256 that presents the significance of total regression in 95% confidence level. Also according to the results of White test, there is no problem of heteroscedasticity and not having correlation are admitted by (D.W) statistics. Following table presents the results of estimation by Microfit 4.1.

As we know estimated coefficients of equation are inputs production elasticities. According to coefficients, sensitivity of production toward watering times and seed in comparison with others are more and production has the least sensitivity toward fertilizer. All production elasticities are between zero and one that show inputs are used in second area-economic area-that is true about Cobb-Douglas functions. Production elasticity shows the sensitivity of production toward inputs demand. Here seed and water have more sensitivity toward their demand change and fertilizer has the least sensitivity.

In Cobb-Douglas production function, the sum of all production elasticities is the amount of scale elasticity. We have:

$$E = E_s + E_l + E_w + E_f \quad (23)$$

So scale elasticity is 2.04 that is more than one and shows increasing returns to scale. Increasing returns to scale happens in decreasing

part of long term average cost curve with economies of scale. On the other hand, in this amount, firm can decrease its average cost by increasing its production.

For studying price elasticities and cost elasticities, we need cost function. According to duality rule, we derive cost function as follows:

$$\ln C = 1.91 + 0.49 \ln y + 0.385 \ln w_l + 0.179 \ln w_2 + 0.368 \ln w_3 + 0.068 \ln w_4 \quad (24)$$

$w_i$ s are the price of each inputs. Now we can get demand equations.

$$x_1(y, w_1, w_2, w_3, w_4) = 1.31 \cdot 0.017^{-0.49} y^{0.49} w_1^{-0.615} w_2^{0.179} w_3^{0.368} w_4^{0.068} \quad (25)$$

$$x_2(y, w_1, w_2, w_3, w_4) = 0.61 \cdot 0.017^{-0.49} y^{0.49} w_1^{0.385} w_2^{-0.821} w_3^{0.368} w_4^{0.068} \quad (26)$$

$$x_3(y, w_1, w_2, w_3, w_4) = 1.25 \cdot 0.017^{-0.49} y^{0.49} w_1^{0.385} w_2^{0.179} w_3^{-0.632} w_4^{0.068} \quad (27)$$

$$x_4(y, w_1, w_2, w_3, w_4) = 2.23 \cdot 0.017^{-0.49} y^{0.49} w_1^{0.385} w_2^{0.179} w_3^{0.368} w_4^{-0.932} \quad (28)$$

If we write logarithmic form of demand equations, gained coefficients of inputs prices show inputs price elasticities. Following table presents price elasticity amounts of sunflower inputs.

Above table shows price elasticities are completely according to demand rule. All inputs price elasticities are negative. Seed has the least and fertilizer has the most amount of elasticity. 1% increase in seed price lead to 0.615% decrease in seed demand also if fertilizer price increases 1%, its demand will decrease 0.932%. Elasticity of fertilizer demand is about one and price changes have more effect on its demand. Seed demand because of low severity toward price changes takes less effect. Also this matter is true about other inputs.

Now, if price liberalization policy is enforced,

Table 2: price elasticity and intersecting elasticity of sunflower inputs

| Inputs     | Seed   | Labor  | Water  | Fertilizer |
|------------|--------|--------|--------|------------|
| Seed       | -0.615 | 0.179  | 0.368  | 0.068      |
| Labor      | 0.385  | -0.821 | 0.368  | 0.068      |
| Water      | 0.385  | 0.179  | -0.632 | 0.068      |
| Fertilizer | 0.385  | 0.179  | 0.368  | -0.932     |

the price of seed and fertilizer will increase. According to demand price elasticity of inputs, farmers demand for these inputs will decrease. On the other hand, with these amounts of production elasticities for inputs, by decreasing their demand, the amount of production will decrease. Of course by using of input substitution, we can take the production level at the same amount. So input price liberalization policy by increasing the price of inputs, increases the costs of production and decreases the production and totally it's harmful for sunflower producers.

## CONCLUSION AND RECOMMENDATION

Study results show that input price liberalization policy has negative effect on sunflower production. According to gained results, all inputs are used in second area of production –economic area- so liberalization policy by increasing inputs prices, according to demand rule, decrease the demand amounts of inputs and decrease in inputs consumption cause production decrease.

Gained price elasticity is about one for fertilizer that shows 1% increase in fertilizer price causes 1% decrease in input demand amount. Decrease in it's consumption lead to production decrease that is harmful for sunflower producers. According to demand inelasticity of seed, sunflower producers reaction toward price increase won't be too severe but it will have demand decrease of this input and finally according to seed production elasticity, the amount of production will decrease. In conclusion, the effect of inputs price liberalization policy on sunflower industry, is increase in production costs and decrease in sunflower production. So for enforcing policy, we need adopting exact and planned policies. According to gained results, following suggestions are presented:

Agricultural organizations should have true supervision on the amount, time and the way of input consumption and help farmers to increase their scientific informing to use inputs optimally and therefore increase their production and efficiency.

Government can compensate extra costs of farmers resulting from liberalization policy by giving cash subsidies. These subsidies could be

paid based on the amount of production or cultivated land. In this way farmers distribute the cash subsidy among all inputs and decrease severe use of one input.

For preventing negative effects of liberalization on production by merging small farms and making big ones, we can benefit of economies of scale and increase our profit. It's clear that increase in profit leads to increase in production and efficiency.

Also government should pay more attention to scientific and especially genetic researches and increase the research budget of R&D centers and universities to produce with low costs and improve total factor productivity.

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