International Journal of Agricultural Science and Research Volume 2, Number 2, Spring 2011(Serial #3)

A Model for the Wheat Market in Iran

L. Yazdanshenas[1]*; R. Moghadasi[1]; S. Yazdani[2]

1: Department of Agricultural Economics, Science and Research Branch, Islamic Azad University, Tehran, Iran.
2: Department of Agricultural Economics, Collage of Agricultural and Natural Resources, University of Tehran, Iran.

Received: June, 27, 2011 *Accepted: September, 28, 2011*

ABSTRACT

A model of the Iranian wheat market is specified and fitted to data from 1981-2008. Several diagnostic tests were employed in the analysis to determine the specification of the model. Despite the simplicity of the model and data problems, an examination of the econometric model leads to several conclusions with possible important policy implications for the wheat economy in Iran. The general results rejected adaptive expectation (AE) model in favor of partial adjustment (PA) to examine the supply response. The estimated short run price elasticity is not fairly low and is -0.2 because wheat is a strategic good that government has the responsibility of its supply, so with increasing its price, government follow some strategies to decrease the amount of wheat that had been supplied, on the other hand, price elasticity of supply is not low and is significant at five percent level that it denotes that the amount of supply affected largely from producer price in last period. The results obtained from production function is that all the factors have positive effect on production except fertilizer that have negative effect on wheat production and with decreasing the amount of fertilizer in wheat production, yield will increase. The demand function showed that wheat is a Giffen good and barley is an appropriate substantial good for wheat. Income elasticity of demand for wheat can obtain from this model and it is -0.77. It means that each 1 percent increase in consumer income contributes to the annual decrease in demand for wheat approximately 0.77 per cent. This indicated that wheat is an Inferior good in Iran either. The coefficient of trend variable and its significance and sign showed that consumer taste and preferences to wheat is going to increase year by year. The import demand function of wheat that estimated in this study showed that import doesn't influence from domestic price ratio and gross domestic product and the unique parameter that can decrease the amount of import is domestic production.

Keywords: Wheat; Market; Modeling; Iran.

* **Corresponding Author Email**: La.yazdanshenas@gmail.com

INTRODUCTION

Among the various economic sectors of a developing country, agricultural sector as the catering agent of the society is of remarkable importance (Akbari & Ranjkesh, 2003). Wheat has an outstanding cultivated area among the agricultural products and plays an important role in the people's nutrition. Thus estimating the market of this essential good is important from the view point of econometrics.

Nutrition is a key element to any strategy to reduce the global burden of disease. Wheat, the dominant food crop of Iran, is grown in all the major farming systems prevailing in the country, in most of which crops and livestock are closely related. Self-sufficiency in wheat has been one of the major goals of Iranian agricultural policies since the Revolution of 1979 (Piraie, 1994). As a result, the market analyzing of this product can help this sector of production. The objective of this paper is to formulate and estimate an econometric model for the supply, demand, import and product for wheat in Iran.

MATERIAL AND METHODS

The model consists of four basic components which explain supply, consumer, producer and import functions. The empirical model consists of four behavioral equations- a domestic supply equation, a production equation, a domestic demand for wheat and an import equation. The complete model described above consists of four endogenous variables, one lagged endogenous variables, and two lagged exogenous variable and ten exogenous variables. The empirical model is specified as follows:

$$S_t = a_{10} + a_{11}A_{t-1} + a_{12}PPW_{t-1} + a_{13}S_{t-1} + e_{1t} \quad (1)$$

$$Y_t = b_{10} + b_{11}A_t + b_{12}Fer_t + b_{13}Pes_t + b_{14}Seed_t + b_{15}Lab_t + e_{2t} \quad (2)$$

$$Q_t = c_{10} + c_{11}Pwr_t + c_{12}Pjo_t + c_{13}conI_t + c_{14}T + e_{3t} \quad (3)$$

$$M_t = d_{10} + d_{11}(\frac{P_m}{P_d})_t + d_{12}GDP_t + d_{13}Y_t + e_{4t} \quad (4)$$

Where

Endogenous variables

S_t: wheat supply in period t
Y_t: wheat production in period t
Q_t: wheat consumption in period t
M_t: wheat import in period t

Lagged endogenous variable

S_{t-1}: supply in period t-1

Exogenous variables

A_t: area under harvested in period t
Fer_t: fertilizer that used in wheat production in period t
Pes_t: pesticides that used in wheat production in period t
$Seed_t$: seeds that used in wheat production in period t
Lab_t: labor that used in wheat production in period t
Pwr_t: retail price of wheat in period t
Pjo_t: retail price of barley in period t[1]
$ConI_t$: consumer income in period t
T: Time trend (changes in consumer's taste and preference) in period t
$(P_m/P_d)_t$: the ratio of import price to domestic price

[1] The substitution between wheat and rice had been tested and was insignificant.

GDP_t: Iran GDP in period t

Lagged exogenous variables

A_{t-1}: area under harvested

PPW_{t-1}: wheat producer price in period t-1 [1]

All variables are entered in logarithmic form.

The supply equation in (1) is the Nerlovian (Nerlove, 1983) type of model where the quantity of wheat supplied is regarded as a function of lagged quantity (S_{t-1}), lagged price of wheat (PPW_{t-1}) and lagged of the area under harvested of wheat (A_{t-1}). Area under harvested and the producer price are assumed to be exogenous in the supply equation. Thus the supply equation has two lagged exogenous variable and one lagged endogenous variable. Equation 2 is the production equation for wheat. In this equation we use some available factor inputs that can affect this element. All this factor inputs are expected to have positive sign unless the use of these factors on wheat production has been happened in third sector of production. All these factor inputs assumed to be exogenous in the production function equation. Equation 3 is the consumption equation for wheat that is specified as a function of its retail price (Pwr), the price of substitute goods (barley) (Pjo) and per capita income (conI). In this equation, all the independent variables assumed to be exogenous too. The relation between the retail price of wheat and its consumption expected to be negative in the situation that wheat is a normal good and positive when it is a Giffen good. The sign of barley price expected to be positive and the relation between per capita income and consumption is positive if it is normal good and negative when it is Inferior good. The import demand equation in (4) is the Khan (1975) type of model where the quantity of wheat imported is regarded as a function of import domestic price ratio ((Pm/Pd)), gross domestic production (GDP) and production of wheat (Y). Gross domestic product and import domestic price ratio are assumed to be exogenous in the import demand equation and production of wheat (Y) is assumed to be endogenous. The sign of import domestic price ratio and the quantity of production are expected to be negative and the sign of gross domestic product is expected to be positive if it is normal good and negative when it is Inferior good.

RESULTS AND DISCUSSION

The data on the wheat statistics used in fitting the model are obtained from the ministry of agriculture of IRAN and various FAO sources. The time period selected for this study is from 1981 to 2008. If the classical assumption is satisfied, the parameters for these equations can be estimated by OLS method. The estimators provided by this technique will be unbiased and efficient. A simultaneous estimator is not required here because there is only one endogenous variable in supply and import demand equations.

Supply equation

The supply equation was nested in the more general partial adjustment-adaptive expectation (PAAE) model. To diagnose the appropriate specification, the procedure outlined by Doran (1988) that used likelihood based principles was used in this analysis. The general results rejected adaptive expectation (AE) model in favor of partial adjustment (PA) to examine the supply response. The preferred model for the supply equation that appears in table 1 meets two other diagnostic tests: linear specification and autocorrelation.

In this model all of the variables are statistically significant except intercept. The lagged area under harvested and the lagged producer price of wheat are significant at 5 per cent level and the lagged quantity of supply is significant at 1 per cent level and all of them had the expected positive sign. The estimated short run price elasticity is not fairly low and is 0/2 with negative sign (Shahnooshi, 2004) affirm that the price of wheat is insignificant in supply equation of this good, but the time period of their article is 1983-2002 that in this period, our results about price elasticity is like their results) because wheat is a strategic good that government has the responsibility of its

[1] We use wheat producer price with one lag because of using nerlove partial adjustment model.

supply, so with increasing its price, government follow some strategies to decrease the amount of wheat that had been supplied[1], on the other hand, price elasticity of supply is not low and is significant at five percent level that it denotes that the amount of supply affected largely from producer price in last period.

Table 1: Results of the supply function

Variable	Coefficient	Standard errors
Constant	0.855	1.0515
A(-1)	0.203**	0.0993
PPW(-1)	-0.237**	1.1007
S(-1)	0.798***	0.050
H=-0.255	$\overline{R}^2 = 0.95$ $R^2 = 0.96$	F=176.91

Note: figures in parenthesis denote standard errors. The price variable deflated by CPI (2004=100).

Zulfiqar and Chishti (2010) do such estimation in an article with title "Development of supply and demand functions of Pakistan's wheat crop". The estimated domestic wheat supply equation in that article (Sd=-8458.219 + 2.4879Â + 0.41528Pd + 2.4625FNTWT) reflects that the area under harvested (Â) along with the wholesale wheat price (Pd) and nutrient fertilizers (FNTWT) used determines the domestic production/supply of wheat in Pakistan.

Production equation

The results of production function analysis across of wheat are presented in table 2. The analysis clearly indicated that the estimated production function parameters were significantly different from each other.

Table 2: Results of the production function

Variable	Coefficient	Standard errors
Constant	-13.507***	4.378
A	1.914***	0.312
Fer	-1.084*	0.585
Pes	0.380*	0.194
Seed	2.284**	0.910
DW= 1.358	$\overline{R}^2 = 0.846$ $R^2 = 0.803$	F=19.371

Note: figures in parenthesis denote standard errors.

The results of production regression show that the coefficient of labour that used in wheat production was not significant so we omitted it from our estimation. Regarding to the culture of Iran agriculture and usual cultivation activity that all farmers have the same usage of labour per acre and it doesn't related to the kind of product, insignificancy of this coefficient is not unexpected. Hoseinzade and Salami (2004) in an article examine different kinds of production function for wheat in Iran and their results about labour were as same as our results. The regression for area under harvested was significant at one per cent, coefficient for fertilizer and pesticides were significant at ten per cent, and coefficient for seed was significant at five per cent. The preferred model for the production equation that appears in table 2 meets two other diagnostic tests: linear specification and autocorrelation either. The Durbin Watson statistics showed the probability of autocorrelation but with using LM test, this probability had been rejected.

The share of input variables to wheat production was estimated by using OLS technique. The value of F test in OLS estimation indicated that the model is significant at 1percent. The value of adjusted R^2 is 0.80 which reveals that the model has explained 80percent of total variation in wheat production due to the variation in area, pesticides, fertilizer and seeds. According to Gujarati

[1] Some strategies that government follow in this situation is:

- Substitute other cereal instead of wheat
- Increase the quality of wheat flour to decrease its wastage and supply

(1995), the coefficient of determination (adjusted R^2) is a summary measure that tells how well the sample regression line fits the data. The fit of the model is said to be better the closer is R^2 to 1. Therefore, in this model 80percent variation in wheat production has been defined by independent variables included in the model. The intercept is significant at 1percent level which implies the level of output when the value of all independent variables is zero. The coefficient of wheat area is positive and significant at 1percent level which implies that, other factors keeping constant, one per cent increase in area would result in 1.91percent increase in wheat production. Similarly, ceteris paribus, one per cent increase in fertilizer, would result into 1.08 percent, decrease in production and one per cent increase in pesticides, seeds use would results into 0.38 and 2.28 percent increase in production from the use of respective variables.

The fertilizer effect on production is significant at 10 percent level and has negative value which indicates the excess application and the variety which is responsive to higher dose of fertilizer; however the dose of pesticides can be increased. Similarly, the human or labor force has not any significant effect in production.

The demand equation

The consumption side of the model was specified with per capita consumption of wheat as a function of retail prices for wheat and barley and also consumer income. A trend variable is also included to capture changes in consumer's taste and preference.

Table 3: Results of the demand function

Variable	Coefficient	Standard errors
Constant	-2.602***	0.399
Pwr	0.106	0.113
Pjo	0.558***	0.154
ConI	-0.776***	0.196
T	0.019**	0.007
DW=2.27	$\overline{R}^2 = 0.68$ $R^2 = 0.57$	F=5.95

Note: figures in parenthesis denote standard errors. The price variable deflated by CPI (2004=100).

The results showed that own price elasticity for wheat is 0.106, however it's not significant but the sign of it showed that with increasing price of wheat, the quantity of demand will increase. This indicates that wheat is a Giffen good in IRAN. Tarmast (2000) do such a study and they estimated the demand function of some comestible in Iran with using two methods: ISUR & I3SLS. Their results show that with using ISUR method, bread is an Inferior good but with using I3SLS method, bread is an Inferior and also a Giffen good.

However the results of a study in Libya showed that Income and prices are important variables in determining the level of wheat consumption in that country, so wheat is not a Giffen or Inferior yield in Libya (Ramadan Elbeydi, 2005).

Cross elasticity with respect to the price of barley is o.55 this means that each 1 percent increase in the price of barley contributes to the annual increase in demand for barley by approximately 0.55 per cent. Mosavi and Sadrolashrafi (2007) wrote an article about globalization that works on supply, demand and imports of wheat in. They use rice for substitute product of wheat and they discussed that cross elasticity with respect to the price of rice is 1.044. Although they use the price of bread in the place of wheat and the coefficient of bread price was 0.134, so their results confirm our article results.

Income elasticity of demand for wheat can obtain from this model and it is -0.77. It means that each 1 percent increase in consumer income contributes to the annual decrease approximately 0.77 per cent in demand for wheat. This indicated that wheat is an Inferior good in Iran either. The

coefficient of trend variable and its significance and sign showed that consumer taste and preferences to wheat is going to increase year by year.

The wheat import equation

The formulation of the import equation assumed that imported and domestic wheat are substitutes. Thus the import demand function can be viewed as an excess demand schedule[1]. The results of the wheat import equation are presented in table 4.

Table 4: Results of the wheat import function

Variable	Coefficient	Standard errors
Constant	55.22***	19.31
Pm/Pd	-0.001	0.005
GDP	-1.64	1.69
Y	-2.16**	1.05
AR(1)	0.78***	0.14
DW= 1.83	$\overline{R}^2 = 0.73 \quad R^2 = 0.779$	F=17.67

Note: figures in parenthesis denote standard errors. The price variable deflated by CPI (2004=100).

The model explained 78 per cent of the variation in wheat imports. The import model showed that the import domestic price ratio and GDP have negative sign but they're not significant. The production coefficient also has negative sign but is significant. It shows that with improving the amount of domestic production, import quantity will reduce. The negative signs of the price ratios and GDP are related to wheat quiddity in human nutrition (wheat is a strategic good). Accordingly, it looks logistic that the amount of import doesn't have any relation with our country income and the price ratios.

Zubaidi Bahramshah (1991), discussed about rice import in his article. His results show that the coefficient of the domestic price was found to be negative and statistically significant at five percent level. The estimated price elasticity is high, indicating that domestic price has significant influence on the imports of rice. His results suggest that imports decrease with increases in domestic price. His results also suggest that the Malaysia government sets the level of imports according to the supply in the previous period.

CONCLUSION

The PAAE model was used to investigate the wheat supply response in Iran. The model was diagnosed for appropriate specification and the results of the diagnostic tests suggest that the PA model is the preferred specification to examine the supply response. Another model that was investigated in this study is production function equation that is a Cobb- Douglus kind of production model. The preferred model for the supply equation met two other diagnostic tests: log linear specification and autocorrelation. For demand specification we used a linear unique demand functional form. The last model that specified in this study was import demand function that we used Khan (1975) form of these models. The preferred model in each par met two other diagnostic tests: log linear specification and autocorrelation.

Despite the simplicity of the model and data problems, an examination of the econometric model leads to several conclusions with possible important policy implications for the wheat economy in Iran. The estimated short run price elasticity is not fairly low and is 0.2 with negative sign because wheat is a strategic good that government has the responsibility of its supply, so with increasing its price, government follow some strategies to decrease the amount of wheat that had been supplied, on the other hand, price elasticity of supply is not low and is significant at five percent level that it denotes that the amount of supply affected largely from producer price in last period.

[1] Production variable with one lag was insignificant, so it omitted from this model.

The results obtained from production function is that all the factors have positive effect on production except fertilizer that have negative effect on wheat production and with decreasing the amount of fertilizer in wheat production, yield will increase.

The demand function showed that barley is an appropriate substantial good for wheat. Income elasticity of demand for wheat can obtain from this model and it is -0.77. It means that each 1 percent increase in consumer income contributes to the annual decrease in demand for wheat approximately 0.77 per cent. This indicated that wheat is an Inferior good in Iran either. The coefficient of trend variable and its significance and sign showed that consumer taste and preferences to wheat is going to increase year by year.

The import demand function of wheat that estimated in this study showed that import doesn't influence from domestic price ratio and gross domestic product and the unique parameter that can decrease the amount of import is domestic production.

REFRENCES

1. Akbari, N., Ranjkesh, M. (2003). Analysis of the growth of total factors productivity of agricultural sector in IRAN (1966-96). *journal of agriculture economic and development*., 43& 44, 117-142. (In Persian)
2. Doran, H.E. (1988). Specification test for partial adjustment and adaptive expectation models. *Amer. J. Agric. Econs*., 70, 713-723.
3. Gujarati, DN., (1995). Basic Econometrics. New York: McGraw-Hill, Inc.
4. Hoseinzadeh, J., Salami, H. (2004). Choosing production function for estimating the economical value of water in agriculture, case study: Wheat production. *Agricultural economics and development Journal*., 48, 54-84. (In Persian)
5. Khan, M. S. (1975). Import and export demand in developing countries. *IMF Staff Papers*., 21, 678-93.
6. Mosavi, SN., Sadrolashrafi, M. (2007). Globalization works on supply, demand and imports of wheat in Iran. *Journal of agriculture economic*., 1, 117-142. (In Persian)
7. Nerlove, M. (1983). Expectations, Plans, and Realizations in Theory and Practice. *Econometrica.,* 51(5), 1251-1277.
8. Piraie, KH. (1994). *The effect of wheat price policies on government and society expenditure in Iran*. Ph.D dissertation in Trabiat Modares University, Tehran. (In Persian)
9. Ramadan Elbeydi, KH. (2005). *Dynamic econometric modeling and policy analysis of the Libyan wheat market*. PhD dissertation in the Senate of university putra Malaysia.
10. Shahnooshi, N. (2004). The study of effective factors on wheat supply in Khorasan province. *Agricultural economics and development Journal*., 47, 91-113. (In Persian)
11. Tarmast, Gh. (2000). Estimating the parameters of the most ideal demand system and investigating the demand for some comestible in Iran. *Joural of agricultural science.,* 10(3), 59-73. (In Persian)
12. Zulfiqar, M., Chishti, A. (2010). Development of supply and demand functions of pakistan's wheat crop. *The labore journal of economics*., 15(1), 91-102.
13. Zubaidi Bahramshah, A. (1991). A model for the rice and wheat economy in malaysia: An empirical assessment of alternative specifications. *Petanika*., 14(3), 383-391.