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Effective Influential Factors of Governmental Policy Implications in Production of Irrigated Wheat in Iran

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Abstract: The objective of study is to evaluate government policies towards wheat production, a staple food, in Iran. Policy Matrix Analysis (PAM) as a good instrument was used to achieve the objective of study. Time series data for 1980 to 2005 period extracted from national survey from statistical center of Iran and FAO site were used for the study. Changes trend for gained indices from Policy Analysis Matrix (NPC, NPCI, EPC and DRC) calculated in three exchange rate scenarios (absolute, relative purchasing power parity and calculated exchange rate by FAO) by using logarithmic function. The results revealed that comparative advantage of wheat production became better along the period of time and changes in exchange rate and shadow price of tradable inputs had the most effect on wheat comparative advantage in Iran. Revising of wheat support price, adopting more flexible foreign exchange rate policy and exerting new technology to yield per hectare incensement is recommended.

Key words: Comparative advantage · Wheat · Policy analysis matrix · Trend changes · Iran

INTRODUCTION

Many studies show that people from Middle East and the Near East gain almost 70 % of their calorie needs from wheat and wheat flour. Wheat bread is the most important daily food in Iran like many countries in the world and has the main role in energy and protein provides for these people [1].

In Iran, over 90 percent of used calorie gained from vegetarian food and 64 percent of it gained from cereals. In the meantime, high division of cereals consumption used for livestock feeding therefore the role of cereals has the indirect role in meat and animal protein and dairy brute [2, 3].

Consumption of wheat and its product have increased collinear with income increase from oil price. After end of 1970 decade, this increases because that wheat becomes the first food element in Iranian food consumption template. According to importance of wheat production role in food bundle management for Iranian households and job and income creation for many groups of producers, surveying the trend changes of effective factors of government policies on wheat production is too important [4].

Iranian government has a long history of subsidizing wheat as a staple food. on one hand, the government has pursued a policy of input subsidy by subsidizing new inputs such as fertilizer, pesticides and bred seed together with low interest rate on agricultural credit [4, 5]. On the other hand, the government has followed a program of general subsidy on bread to support consumers. The bread price subsidy which was limited to urban consumers at the beginning was extended to rural consumers at later stage. Besides that, the government has pursued a policy of purchasing wheat from farmers at guarantee price. The wheat support prices in many years have been a source of complaint from wheat producers. These two dimensional policies have raised question on government policy as for as wheat producers' incentives are concerned [4].

The main objective of the study is to determine the trend changes of comparative advantage of wheat and its determinant factors.

Krueger *et al.* [6] have studied the effects of government policies on agricultural sectors of 18 developing countries and have concluded that, with the exception of South Korea, the net effect of the policies has been negative in all other countries. Yao [7] showed

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the effects of government policies on diversification of products by using policy analysis matrix. He concluded that the government input subsidy and relative high prices have caused farmers to substitute other products for rice.

Fang and Beghin [8] have studied Chinese government protective policies and comparative advantage of major agricultural products by using PAM and have reached the conclusion that labor intensive had advantage over land intensive crops. Kubursi [9] has studied the effects of government policies on economic incentives for production of major agricultural products in Lebanon and has concluded that these policies have not contributed to improvement in resource allocation.

In other study, Shahabuddin and Dorosh [10] showed that the comparative advantage of major corps and government export policies in Bangladesh utilizing PAM. results showed that Bangladesh by using new technology and lower costs of production could gain comparative advantage in oil seeds and increase their export.

Najafi [4] have studied the wheat comparative advantage with using time series data from 1990 to 2001 period. The results suggested that among income factors change in yield per hectare and foreign exchange value had greatest effect on comparative advantage of wheat. Finally some recommendations are collected to improve the prevailing government policies.

MATERIALS AND METHODS

In the first step, policy analysis matrix was taken in to consideration and described as followings:

The policy analysis matrix: Government protective policies, mainly implemented through agricultural input subsidy, product prices or both. Various criteria are used to evaluate the effects of these policies on producers' behavior and incentives. The first group of these approaches is called "protection criteria" which determine the deviation of domestic from international prices by calculating the nominal and effective protection coefficients [4]. In addition, by using "comparative advantage" criteria, can measure the effects of government protection on economic efficiency of factors of production in domestic production. Notable among various comparative advantage criteria is supply side which illustrates the real condition. To achieve the objectives of the study the Policy Analysis Matrix (PAM) was used. The advantage of PAM is that it can cover the other criteria such as nominal and effective protection and comparative advantage. By using, PAM the difference between cost and revenue of products in terms of market and shadow (real) prices could be determined and make judgment on the efficiency of government protective policies possible [11, 12].

Table 1: Theoretical framework of policy analysis matrix

		Costs		
	Revenues	Tradable inputs	Domestic factors	Profit
Private prices	A	B	C	D
Social prices	E	F	G	H
Divergences	I	J	K	L

Source: Monke and pearson [11, 12]

The theoretical framework of PAM has been shown in Table 1.

The elements of matrix are defined as follows:

A&E = Total income of one hectare of product at market and shadow prices respectively.

B&F = Total cost of tradable inputs of one hectare of product at market and shadow prices respectively.

C&G = Total cost of non-tradable inputs of one hectare of product at market and shadow prices respectively.

D&H = Profit of one hectare of product at market and shadow prices respectively.

Market prices are affected by government protective policies while shadow or real prices are determined in the competitive market and without government interference. Tradable inputs are those inputs that could be traded in international market such as seed, fertilizer and pesticides [4, 11].

For this group of inputs border prices are considered as shadow prices. Non-tradable inputs are inputs such as land and labor that could not be traded in international market due to their immobility. For this group of inputs, their opportunity cost is considered as shadow prices.

The same definition is applied for products. Profit is calculated in terms of market and shadow prices. In this way, valuable information produced for evaluation of government protective polices in both input and product markets. On this basis, profit in terms of market price could be calculated as follows:

$$D = A - (B+C) \quad (1)$$

In the above equation, D>0 indicates that farmers produce above break even point and tends to expand production and D<0 indicates that under prevailing government policies, farmers are facing loss and it is expected to decrease production of the specified product [4, 11]. Profit in terms of shadow price calculated as follows:

$$H = E-(F+G) \quad (2)$$

Shadow priced profit is called net social profit (NSP) and shows the efficiency or inefficiency of resources used in production of products. H>0 indicates that under prevailing government policies the resources are allocated efficiently in production of specified product while H<0 indicates that misallocation of resources prevails. In other words, the resources could be used more efficiently in production of other crops if government would not intervene. Similarly, by calculating the difference between income and cost components in terms of market and shadow prices, the effects of government protective policies both in input and product market could be evaluated.

Based on relationships among various elements of the matrix, criteria for measuring the effects of protective government policies on producers' incentive could be introduced [4, 11,12].

Protection coefficients: Production coefficients describe the nature of government policies in both input and product markets [11-15]. This could be done by comparing domestic and international prices which indicate the degree of distortion caused by government intervention. Protection coefficients could be determined under two categories, namely, Nominal Protection Coefficients (NPC) and Effective Protection Coefficients (EPC). The first group (NPC) is used to measure the effects of government protection policies in input and product markets, separately. Effective Protection Coefficients (EPC) calculated to compare value added resulted from using tradable inputs under government protection and free trade. These coefficients measure the combined effects of government policies in both input and product markets [4, 15, 16].

Comparative advantage: As it was shown, comparative advantage of products could be determined by PAM. Governments could create nominal comparative advantage for a product through protective policies. Since shadow prices are constant in the short-run, this would result allocation of resources into production of crops with comparative disadvantage. Notable among various approaches for determining comparative advantage is a supply side criterion which is utilized in this study. This approaches include, Domestic Resource Cost (DRC).

Research implementation and data source: In this study, total cost of chemical fertilizers, pesticides and seed are considered as tradable and land, labor, water and manure are considered as non-tradable inputs. With respect to machinery cost, 64% was accounted as tradable and 36% as non-tradable. Time series data on costs, income, quantity of inputs and outputs was extracted from national survey related to 1980-2005 period. To calculate of shadow prices in inputs and product, the equivalent of border prices was utilized but for calculation of shadow price in foreign exchange, three scenarios were used. For this purpose, the data was collected from IMF and World Bank databases.

Shadow price of foreign exchange methods: The calculation of the foreign exchange rate has the most importance in policy analysis matrix and in conversion the internal price to international price. Therefore, in this research, nominal foreign exchange rate for calculating the shadow prices can not be used because foreign exchange rate in many countries controlled by government economical levers and results will have deflection.

There are some ways for calculating the shadow foreign exchange rate that used three ways for it.

1. Purchasing Power Parity Theory [13]
   In this way, foreign exchange rate is calculated in two ways: Absolute and relative

Shadow price of foreign exchange rate in absolute Purchasing Power Parity (scenario E1) is calculated by (P_{Ig}/P_{Dg}) formula and Shadow price of foreign exchange rate in relative Purchasing Power Parity (scenario E2) is calculated by $\left(\frac{P_I}{P_I^*}E_0\right)$

That, in this relation, we have:

P_{ig} = One ounce of gold price in inner market (Rials)
P_{dg} = One ounce of gold price in international market (dollars)
P_I = Price index for inner consumers
P^*_I = Price index for American consumers
E_0 = Foreign exchange rate in free market in base year (1997)

2. In some researches that are studied by FAO in Egypt and Kazakhstan, the foreign exchange rate calculated according to export and import volume and tariffs [5], according to below relation (scenario E3):

$$CF = \frac{(M + X)}{M * (1 + T_M) + X * (1 - T_X)} \quad (3)$$

Where; M denotes C.I.F (Cost, Insurance and Fright) country import volume; X denotes F.O.B (Free on Board) country export volume; TM denotes average import tariff rate and TX denote average export tariff rate.

And after calculating CF; shadow price will be calculated by below relation:

$$SER = \frac{OER}{CF} \quad (4)$$

Where, SER denote shadow foreign exchange rate; OER denote nominal foreign exchange.

In this study, surveying the trend changes in indices that gained from policy analysis matrix is calculated for the first time in and out of Iran for wheat product from 1980-2005. The data was collected from statistical center in Iran and statistical center at FAO site [2, 3].

In the first step, the effective factors should be detected. According to some research [1, 4, 8 , 14], that is done in the late years these factors are following:

C_i = Market cost of tradable inputs
C_e = Shadow price of tradable inputs
C_t = Shadow price of non-tradable inputs
Y = Product yield in hectare
e = Foreign exchange rate
P_b = Product shadow price in borderline

Time trend variable (T) is added to the other variables for estimating the indices trend in 1980 to 2005 and finally, these equations are considered for this study:

$$\begin{aligned} Ln(NPC) &= C_0 + C_1Ln(e) + C_2Ln(Y) + C_3Ln(P_b) \\ Ln(NPCI) &= C_4 + C_5Ln(e) + C_6Ln(C_i) + C_7Ln(C_e) \\ Ln(EPC) &= C_8 + C_9Ln(e) + C_{10}Ln(Y) + C_{11}Ln(P_b) + C_{12}Ln(C_e) + C_{13}Ln(C_i) \\ Ln(DRC) &= C_{14} + C_{15}Ln(e) + C_{16}Ln(Y) + C_{17}Ln(P_b) + C_{18}Ln(C_e) + C_{19}Ln(C_t) \end{aligned} \quad (5)$$

The reason for using this logarithmic mode is that these mode of equations, has appropriate results respect to other modes (linear and semi-logarithmic) and because, the main object of the most recent studies in comparative advantage subject is sensitivity analysis of comparative advantage indices respect to their influential effective factors.

These functions mode can show these object to us, therefore, this functions mode is preferred to the other modes. For preventing the auto correlation between residual terms, seemingly unrelated regression (SUR) method was used.

RESULTS AND DISCUSSION

The results for Nominal Protection Coefficient (NPC), Nominal Protection Coefficient of Input (NPCI), Effective Protection Coefficient (EPC) and Domestic Resource Cost (DRC) indices for wheat in Iran summarized in Table 2 that every one can comment these indices in different years according to above mentioned tables and explanation.

The results from logarithmic mode function on NPC, NPCI, EPC and DRC indices for this product in three scenarios of exchange rate summarized in Table 3. According to results, in each scenario of foreign exchange rate, foreign exchange rate variable has the most effect on NPC trend changes (-0.16, -0.14 and -0.11 in the order of E_1, E_2 and E_3 foreign exchange rate scenarios) and Yield

Table 2: Results on gained indices from policy analysis matrix for wheat in Iran in three scenarios foreign exchange rate (E_1, E_2 and E_3), 1980-2005

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
NPC_{E1}	0.68	0.68	0.69	0.78	0.79	0.83	0.69	0.68	0.69	0.71	0.71	0.73	0.78
$NPCI_{E1}$	1.09	1.17	1.15	1.15	1.14	1.17	1.18	1.15	1.16	1.14	1.13	1.09	1.08
EPC_{E1}	0.73	0.71.	0.72	0.72	0.75	0.71	0.63	0.66	0.76	0.79	0.80	0.84	0.93
DRC_{E1}	1.31	1.29	1.18	1.16	1.17	1.29	1.34	1.19	1.11	1.15	1.18	1.05	1.01
NPC_{E2}	0.70	0.70	0.72	0.72	0.74	0.79	0.71	0.72	0.71	0.72	0.72	0.75	0.79
$NPCI_{E2}$	1.08	1.14	1.08	1.16	1.14	1.13	1.15	1.17	1.15	1.15	1.14	1.08	1.08
EPC_{E2}	0.70	0.73	0.78	0.78	0.79	0.83	0.94	0.71	0.79	0.80	0.81	0.87	0.91
DRC_{E2}	1.04	1.05	1.01	1.11	1.09	1.03	1.29	1.18	1.16	1.17	1.19	1.04	1.01
NPC_{E3}	1.65	0.71	0.72	0.72	0.75	0.79	0.70	0.70	0.70	0.72	0.72	0.74	0.79
$NPCI_{E3}$	1.15	1.09	1.05	1.07	1.03	1.09	1.17	1.16	1.16	1.15	1.14	1.09	1.08
EPC_{E3}	0.79	0.63	0.66	0.76	0.79	0.80	0.79	0.69	0.78	0.80	0.81	0.86	0.92
DRC_{E3}	1.25	1.18	1.16	1.17	1.16	1.16	1.32	1.19	1.14	1.16	1.19	1.05	1.01

Table 2: Continued

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
NPC_{E1}	0.78	0.79	0.83	0.84	0.84	0.83	0.89	0.89	0.91	0.93	0.92	0.98	0.99
$NPCI_{E1}$	1.08	1.04	1.06	1.05	1.08	1.03	0.99	1.01	0.99	0.98	1.01	0.97	0.98
EPC_{E1}	0.96	0.95	0.86	0.92	0.94	0.93	0.99	1.00	1.00	0.99	1.01	1.00	1.01
DRC_{E1}	1.11	1.09	1.03	1.01	0.99	1.01	1.04	1.02	1.01	0.99	1.01	1.05	1.06
NPC_{E2}	078	0.81	0.84	0.83	0.83	0.87	0.87	0.89	0.90	0.96	0.91	0.97	0.94
$NPCI_{E2}$	1.09	1.06	1.07	1.00	1.09	1.05	0.95	1.03	0.97	0.97	1.03	0.99	0.99
$0EPC_{E2}$	0.97	0.96	0.95	0.93	0.99	0.96	0.99	1.01	1.04	0.98	1.05	1.01	1.03
DRC_{E2}	1.13	1.10	1.02	1.05	1.02	1.03	1.02	1.09	1.02	1.01	1.00	1.03	1.04
NPC_{E3}	0.78	0.80	0.84	0.84	0.84	0.85	0.88	0.89	0.91	0.95	0.92	0.98	0.99
$NPCI_{E3}$	1.09	1.05	1.07	1.03	1.09	1.04	0.97	1.02	0.98	0.98	1.02	0.98	0.96
EPC_{E3}	0.97	0.96	0.91	0.93	0.97	0.95	0.99	1.01	1.02	0.99	1.03	1.01	1.03
DRC_{E3}	1.12	1.10	1.03	1.03	1.01	1.02	1.03	1.06	1.02	1.00	1.01	1.04	1.02

Source of the table: Derived from data analysis

Table 3: Results on logarithmic function in three foreign exchange rate for wheat in Iran

Variables	C	Ln e	Ln Y	Ln P_b
Ln $(NPC)_{E1}$	0.15 (2.12)*	-0.16 (-2.94)**	0.11 (1.82)*	0.05 (1.91)*
Ln $(NPCI)_{E1}$	0.19 (0.94)	0.14 (1.93)*	-	-
Ln $(EPC)_{E1}$	0.39 (1.64)	-0.09 (-2.26)*	0.14 (2.34)*	0.11 (1.45)
Ln $(DRC)_{E1}$	0.39 (2.21)*	-0.04 (-1.92)*	-0.12 (-1.87)*	-0.15 (-1.54)
Ln $(NPC)_{E2}$	0.19 (3.06)**	-0.14 (-1.86)*	0.11 (1.93)*	0.02 (1.92)*
Ln $(NPCI)_{E2}$	0.16 (0.71)	0.11 (2.29)*	-	-
Ln $(EPC)_{E2}$	0.73 (2.45)*	-0.16 (-1.92)*	0.12 (1.87)*	0.13 (1.40)
Ln $(DRC)_{E2}$	0.42 (0.89)	-0.12 (-2.14)*	-0.06 (-1.96)*	-0.08 (-2.11)*
Ln $(NPC)_{E3}$	0.45 (2.96)**	-0.11 (-1.77)	0.02 (1.82)*	0.05 (1.84)*
Ln $(NPCI)_{E3}$	0.21 (1.47)	0.08 (2.94)**	-	-
Ln $(EPC)_{E3}$	0.44 (2.41)*	-0.12 (-1.90)*	0.09 (1.93)*	0.07 (1.10)
Ln $(DRC)_{E3}$	0.29 (1.66)	-0.13 (-1.94)*	-0.08 (-1.91)*	-0.05 (-2.19)*

Variables	C_e Ln	C_i Ln	C_t Ln	T	$\bar{R}^2$	D.W.
Ln $(NPC)_{E1}$	-	-	-	-0.12 (-2.48)*	0.81	1.86
Ln $(NPCI)_{E1}$	-0.16 (-1.89)*	0.15 (2.02)*	-	-0.19 (-2.12)*	0.78	2.02
Ln $(EPC)_{E1}$	-0.19 (-2.60)*	-0.05 (-3.18)**	-	-0.04 (-2.08)*	0.83	1.94
Ln $(DRC)_{E1}$	0.14 (3.01)**	-	0.09 (2.14)*	-0.03 (-3.22)**	0.91	2.05
Ln $(NPC)_{E2}$	-	-	-	-0.03 (-3.17)**	0.82	1.91
Ln $(NPCI)_{E2}$	-0.09 (-1.16)	0.13 (2.14)*	-	-0.13 (-2.64)*	0.75	1.93
Ln $(EPC)_{E2}$	-0.15 (-2.81)**	-0.11 (-3.01)**	-	-0.05 (-3.01)**	0.91	1.96
Ln $(DRC)_{E2}$	0.09 (1.83)*	-	0.11 (3.43)**	-0.09 (-2.31)*	0.92	2.02
Ln $(NPC)_{E3}$	-	-	-	-0.13 (-2.14)*	0.87	2.07
Ln $(NPCI)_{E3}$	-0.17 (-1.93)*	0.09 (2.21)*	-	-0.11 (-2.41)*	0.82	1.92
Ln $(EPC)_{E3}$	-0.11 (-2.35)*	-0.02 (-3.12)**	-	-0.12 (-2.72)*	0.91	1.89
Ln $(DRC)_{E3}$	0.06 (2.63)*	-	0.12 (2.35)*	-0.09 (-3.64)**	0.89	1.83

Asterisks indicate significance, *5% and **1%

in hectare variable, borderline product shadow price variable and trend variable (T) were significant. The negative sign of trend variable (T) showed that there was much urgings for taking tax on producing the wheat in that period of time.

In E_1 and E_3 foreign exchange rate scenarios, shadow cost of tradable inputs and in E_2 foreign exchange rate scenario, market cost of tradable inputs have the most effect on NPCI and trend variable (T) was significant and had negative sign in every foreign exchange rate scenarios that showed, there were urgings to grant some subsidy on effective inputs in production in that period of time.

Shadow cost of tradable inputs in E_1 foreign exchange rate scenario and foreign exchange rate variable in E_2 and E_3 foreign exchange rate scenarios have the most effect on EPC trend changes among the other effective factors.

In every three scenarios of foreign exchange rate, each variable, except borderline shadow price of product were significant that showed there were tax or favoritism on wheat producers in E_1 foreign exchange rate scenario and shadow price of foreign exchange rate variable in E_2 and E_3 scenarios had the most effect on DRC index.

Adjusted R_2 for equations are between 0.75 to 0.92 that showed their good fitness and the quantity

of D.W. showed that there are no autocorrelations in them [15, 16].

CONCLUSION

For advocacy of wheat production in Iran, with adopting the apposite foreign exchange rate and increase in wheat yield in hectare and continuing yield and produce increase program and using high yield specious in production and on time input allocating and input cost management and giving the important inputs like chemical fertilizer, pesticide and etc. in subsidy situation, the wheat producing will gain permanent comparative advantage and import quantity will decrease.

Finally, based on findings of the study following recommendations are made:

1. The revising of wheat support price in order to cover the complete cost of production.
2. With regard to change from negative to positive price policy, there in a lesser need for subsidizing inputs and gradual reduction of input subsidy because of environmental concern.
3. Since, yield per hectare has great effect on farmers' income, more investment on new technology through building up rural infrastructure, more research institutions and extension agencies.
4. Because the prevailing policy of overvaulting of foreign exchange had negative impact on comparative advantage of wheat production, use of more flexible foreign exchange rate policy is needed [15, 16].

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