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# Comparative Advantage, Self-sufficiency and Food Security in Iran: Case Study of Wheat Commodity

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## Abstract

Food security has a dynamic notion during the time and may be affected by various domestic and global factors. Nevertheless, Iranian policy makers consider food security as same as self-sufficiency in agricultural food products, particularly wheat production. However, self-sufficiency can contribute to food security only if it is in coincidences with comparative advantage and sustainable resource management. The present study aims to investigate the coincidences of self-sufficiency and comparative advantage and the real impact of self-sufficiency on net social benefit as a measure of food security; by developing a Policy Analysis Matrix (PAM) to analyze the trend of comparative advantage and self-sufficiency measures for the past decade. The data for wheat input-output quantities and their domestic prices during the period of study were obtained from production and cost system of agricultural products, and other relevant information collected from World Bank statistics and FAO database. The results showed that the self-sufficiency policy through price supports, inputs and credit subsidies and research and extension programs, has increased the physical productivity of wheat farms as well as increased the area under cultivation. However, the net social profit of wheat production was negative during the period of study, indicating a negative effect of self-sufficiency policy on the food security.

**Keywords:**  
*Food security, Comparative advantage, Net social benefit, Self-sufficiency*

## INTRODUCTION

The self-sufficiency strategy for agricultural commodities, especially in wheat as a staple food, attracted a heavy attention in Iran. Achieving food security for the country, in an old definition with emphasis on physical access to food that is internally produced, is the main goal of this policy. In this definition of food security, higher self-sufficiency coefficient or increasing domestic supply of food can contribute physical access, directly, and economic access, indirectly by decreasing food price (Palooch *et al.*, 2010). This conclusion for economic access is correct only if the domestic production enjoys a comparative advantage, so that the food internally produced has a lower price in comparison with importing; if not, self-sufficiency cannot affect food security in a positive manner. During last decades, the concept of food security modified widely in accordance with the new understanding of the nature of the food problem and the evolution of the global food system (Maxwell, 1996; Maxwell and Slater, 2003). For first time, at the 1974 World Food Conference the concept of food security has been revised and extended and entered the broader development policy debate. The World Food Summit in 1996 defined food security as a situation “when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 1996). At the World Summit of Food Security in 2009, the concept was extended and specified by adding that the four pillars of food security: availability, access, utilization, and stability (FAO, 2009). The new concept adopts a country perspective and distinguishes between the macro and micro dimension of food security. At the micro level, food security is subject to the household’s economic access to food and to basic household assets. A major factor of food access is household real income. In other words, poverty limits the economic access to food of sufficient quantity and quality. At the macro level, crucial factors of the food security system include macroeconomic stability, economic growth and income distribution (Ecker, 2012). In the new concept of food security, achieving real food security, does not mean just producing enough staple

foods inside the geographical borders of a country but needs a sophisticated economic management, considering comparative advantages and optimal allocation resources in order to obtain most social benefit by least social cost for the citizens of a country. Food production, in this framework, is a private good which private sector produces it on the basis of profit maximization incentive; while food security is a public good which must be provided by government (Maxwell, 1996). Considering food security as a public good means that government can intervene market in market failure condition, but the intervention is subject to provide more social benefit for society as whole. Otherwise, government intervention in food production in order to provide self-sufficiency without real positive effect on social efficiency results in government failure; that not only does not improve food security but also limits real economic access to food by exaggerating poverty.

The present study aims to find an answer to the question whether government interventions in wheat market in order to provide self-sufficiency via more domestic production of wheat in Iran really have increased social benefit and hence contributed to the food security during last decade. The strategy of self-sufficiency of wheat in Iran involves complex policies including price supports, inputs and credit subsidies, research and extension programs to enhance productivity of wheat farms and encourage farmers to produce more wheat in their crop pattern. For measuring the social benefits of the self-sufficiency strategy and examining the extent of its consistence with the comparative advantage measures, a Policy Analysis Matrix (PAM) developed.

Policy Analysis Matrix widely used for determining the comparative advantage measures and social benefit of various agricultural products (Gonzales *et al.*, 1993; Tobey and chomo 1994; Mesters and Wintner-Nelson, 1995; Shujie, 1997; Cai *et al.*, 2007; Sanderson and Ahmadi-Esfahani, 2009; Yan *et al.*, 2010). Furthermore, many studies have investigated, sporadically, the comparative advantage of wheat and calculated its social benefit in Iran. The results of Hajirahimi 1997, for dry and irrigated wheat in the Fars Province; Zare' 2002, for dry and irri-

Table 1: Policy Analysis Matrix

	Receipts	Costs		Profit
		Tradable inputs	Domestic inputs	
Market value	A	B	C	D
Social value	E	F	G	H
Deviation	I	J	K	L

gated wheat in the greater Khorasan Province; [Shahnoushi et al., 2005](#) for dry and irrigated wheat in three provinces of Khozestan, Khorasan and Fars; [Daneshvar Kakhaki et al., 2007](#) for dry and irrigated wheat in *Dashet-e-Mashhad* district; [Islami and Mahmoudin, 2008](#) for irrigated wheat in the Lorestan Province; [Hussein-zad et al., 2009](#) for irrigated wheat in the east Azerbaijan province and [Jolaie and Jiran 2009](#) for total wheat production are indicative that wheat production enjoyed comparative advantage in various farming years, generated positive social benefit. However, the results of [Ja'fari, 2001](#) for dry and irrigated wheat in the Hamedan province; [Shahnoushi et al., 2005](#) for dry and irrigated wheat in the two provinces of Golestan and East Azerbaijan, [Islami and Mahmoudi, 2008](#) for dry wheat in Lorestan province and [Hussein-zad et al., 2009](#) for dry wheat in the east Azerbaijan province, have reported lack of comparative advantage for the related farming years, generating negative social benefit. The above studies calculated social benefit and comparative advantage measures only for a farming year; which could not give a clear vision of the fact during the time. [Goodarzi and Sadrolasharfi 2007](#), applying policy analysis matrix, studied the comparative advantage of irrigated wheat in whole Iran in the years 1980 through 2005 and investigated the variations in the coefficients obtained from policy analysis matrix in three scenarios of foreign exchange rate. The results of their study in all the three scenarios of exchange rate and throughout all the term of study are indicative of lack of comparative advantage.

The present study goes a more step beyond all mentioned studies, by developing a comprehensive policy analysis for both dry and irrigated wheat in a decade duration, that provide the possibility of applying social benefit for analyzing

the effect of self-sufficiency strategy in Iran on food security position.

## MATERIALS AND METHODS

Policy Analysis Matrix (table 1) is an analytical approach, which addresses the impact of market deviations through comparing the difference between market and social profitability of products ([Monk and Pearson, 1989](#)). In this matrix, D is market profit calculated from equation 1, based on the prices exist for goods and services in domestic markets.

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

These prices are determined in the domestic market, and are affected by the government's policies and interventions, or by market inefficiency. They are in fact, the actual amounts paid or received by farmers.

Social profit (H) calculated from equation 2, on the basis of shadow prices that determined in a non-deviated condition, which cannot be affected by domestic policies subsidies and taxes, or the domestic market shortcomings like monopolies. Social value shows the opportunity cost for inputs or products.

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

The comparative advantage measures, DRC and SCB are calculated from the following relations:

$$DRC^1 = G / (E - F) \quad (3)$$

$$SCB^2 = (G + E) / E \quad (4)$$

Shadow prices for domestic inputs (labor, land, water and some part of machineries) usually, assumed to be as same as domestic prices ([Masters and Winter-Nelson, 1995](#)). Regarding tradable inputs like seed, pesticides, herbicides, chemical fertilizers, shadow prices can be obtained from global market prices. Owing to the fact that the majority of this inputs are either imported or domestically produced to replace the import; the CIF<sup>3</sup> prices was considered as the

<sup>1</sup> Domestic Resource Cost

<sup>2</sup> Social Cost Benefit

<sup>3</sup> Cost, Insurance and Freight

Table 2: Policy matrix analysis of dry wheat (unit of values 10 Rials)

Farming Year		Receipt (gross revenue)	Cost		Profit
			Domestic cost	Tradable cost	
1999-2000	Market price	87500	90793	14837	-18130
	Shadow price	77933	113048	18473	-53588
	Deviation	9567	-22255	-3637	35458
2000-2001	Market price	105000	75851	11519	17630
	Shadow price	79955	125633	19080	-64758
	Deviation	25045	-49782	-7560	82388
2001-2002	Market price	130000	61604	16286	52110
	Shadow price	89876	162434	42943	-115501
	Deviation	40124	-100830	-26657	167611
2002-2003	Market price	150000	68148	19512	62340
	Shadow price	98501	172086	49271	-122856
	Deviation	51499	-103938	-29759	185196
2003-2004	Market price	170000	86572	20968	62460
	Shadow price	114474	247828	60024	-193378
	Deviation	55526	-161256	-39056	255838
2004-2005	Market price	180000	105171	36399	38430
	Shadow price	116380	218496	75620	-177736
	Deviation	63620	-113325	-39221	216166
2005-2006	Market price	200000	128211	31679	40110
	Shadow price	134093	239211	59106	-164224
	Deviation	65907	-111000	-27427	204334
2006-2007	Market price	210000	132521	34749	42730
	Shadow price	176165	251307	65896	-141038
	Deviation	33835	-118786	-31147	183768
2007-2008	Market price	280000	295889	69411	-85300
	Shadow price	251268	341541	80000	-170273
	Deviation	28732	-42652	-10589	84973
2008-2009	Market price	305000	213112	43758	48130
	Shadow price	265350	301302	68338	-104290
	Deviation	39650	-88190	-24580	152420
2009-2010	Market price	330000	221378	54824	53798
	Shadow price	289874	324235	67927	-102288
	Deviation	40126	-102857	-13103	156086

Source: Agricultural Ministry data and research findings

final opportunity cost measure. The shadow price of the wheat commodity was also calculated on the basis of CIF price.

The shadow price of foreign exchange (USD) was obtained out from the method of absolute purchasing power parity, on the basis of domestic and global prices of gold as follow:

$$E = P_{ig} / P_{dg} \quad (5)$$

In which,  $P_{ig}$  and  $P_{dg}$ , are the price of one troy ounce of gold in I.R. Rial and US dollar, respectively, for different years of the study period.

Self-sufficiency coefficient (SSC) calculated

from below relation:

$$SSC = DP / (DP + IM - EX) \quad (6)$$

In which DP stands for domestic production, IM for import and EX for export.

The required data for wheat input-output quantities and their domestic prices during the period of study, were obtained through production and cost system of agricultural products, conducted by the Ministry of Agriculture. The data related to CIF prices of wheat and the inputs were collected through the non-published statistics of Iran Customs Office, and also taking benefits from the database of World Bank and FAO.



Table 3: Policy matrix analysis of irrigated wheat (unit of values 10 Rials)

Farming Year		Receipt (gross revenue)	Cost		Profit
			Domestic cost	Tradable cost	
1999-2000	Market price	87500	64204	9976	13320
	Shadow price	77933	112360	17458	-51884
	Deviation	9567	-48156	-7482	65204
2000-2001	Market price	105000	66790	10000	28210
	Shadow price	79955	126760	18980	-65785
	Deviation	25045	-59970	-8979	93995
2001-2002	Market price	130000	59385	18045	52570
	Shadow price	89876	133821	40663	-84608
	Deviation	40124	-74436	-22618	137178
2002-2003	Market price	150000	63380	22450	64170
	Shadow price	98501	108724	38510	-48734
	Deviation	51499	-45344	-16061	112904
2003-2004	Market price	170000	88074	23136	58790
	Shadow price	114474	168698	44316	-98540
	Deviation	55526	-80624	-21180	157330
2004-2005	Market price	180000	104467	21113	54420
	Shadow price	116380	278747	56336	-218703
	Deviation	63620	-174280	-35223	273123
2005-2006	Market price	200000	115870	27750	56380
	Shadow price	134093	234019	56047	-155973
	Deviation	65907	-118149	-28296	212353
2006-2007	Market price	210000	120279	31591	58130
	Shadow price	176165	245868	64578	-134281
	Deviation	33835	-125589	-32986	192411
2007-2008	Market price	280000	205784	42846	31370
	Shadow price	251268	320498	66731	-135961
	Deviation	28732	-114714	-23884	167331
2008-2009	Market price	305000	194817	45525	64658
	Shadow price	265350	296450	69524	-100624
	Deviation	39650	-101633	-23999	165282
2009-2010	Market price	330000	209179	74812	46009
	Shadow price	289874	305456	80751	-96333
	Deviation	40126	-96277	-5939	142342

Source: Agricultural Ministry data and research findings

## RESULTS AND DISCUSSION

The Policy Analysis Matrix result for dry and irrigated wheat presented in table 2 and 3. Concerning dry wheat, the results indicated that in all the farm years under study, the deviation of the cost of tradable and domestic inputs with market and shadow prices was negative. In other words, the social costs in both cases were more than the market costs. The profit with market prices was positive in most years, except for the farm years 1997-1998 and 1999-2000 in which the performance has drastically decreased as a result of severe draught. In other farming years, dry farm wheat farmers have been able to gain

net profit with market costs supported by governments input subsidies and output guaranteed price. Nonetheless, on the basis of the shadow costs and revenues, in the all years under study there has been negative social profit. In other words, during this period, dry wheat production has been more expensive than importing wheat from abroad for society as whole. The calculation of policy matrix for irrigated farm wheat (table 3).

The result of policy analysis matrix for irrigated wheat, indicated that in the all farming years, the deviation of the values with market and shadow prices was negative, as a result of

Table 4: Measures of comparative advantage and social profit

Farming Year	Dry wheat			Irrigated wheat		
	DRC	SCB	Social Profit (10 Rials/ton)	DRC	SCB	DRC
1999-2000	1.90	1.69	-53588	1.86	1.67	-51884
2000-2001	2.06	1.81	-64758	2.08	1.82	-65785
2001-2002	3.46	2.29	-11501	2.72	1.94	-84608
2002-2003	3.50	2.25	-122856	1.81	1.49	-48734
2003-2004	4.55	2.69	-193378	2.40	1.86	-98540
2004-2005	5.36	2.53	-177736	4.64	2.88	-218703
2005-2006	3.19	2.22	-164224	3.00	2.16	-155973
2006-2007	2.28	1.80	-141038	2.20	1.76	-134281
2007-2008	2.00	1.67	-170273	1.74	1.54	-135961
2008-2009	1.52	1.39	-104290	1.51	1.37	-100624
2009-2010	1.49	1.35	-102288	1.46	1.32	-96333

Source: Agricultural Ministry data and research findings

government policy interventions or non-integrated domestic markets with global markets. The profit with market prices was positive in all years for irrigated wheat, indicating that the market profitability of irrigated wheat has not been affected by draught. But, as same as dry wheat, with shadow values, the profit is negative in the all years, confirming that irrigated wheat production in Iran as well has been more expensive than importing wheat from abroad on the social point of view, although it was profitable for farmers by domestic markets prices as producers of this commodity, thanks to self-sufficiency-oriented policy interventions.

The comparative advantage measures (DRC and SCB) and social profit in hectare for dry and irrigated wheat are presented in table 4. As it can be seen, both for dry and irrigated wheat in all the period under study, the DRC and SCB are greater than one, indicating the lack of comparative advantage of domestic production in comparison with importing. Irrigated wheat, in general, has a better status. However, the calculated social profit in both dry and irrigated wheat showed that the self-sufficiency strategy did not help the food security position. Observing the measures of the comparative advantage for wheat, in general, indicate that the amplitude of fluctuation of the measures is high; and on the whole, no evidence of the improvement of trend of lack of comparative advantage is seen during the period under study. Even for dry farm wheat the opposite is seen, namely, it seems that the general trend has gone slightly inclined to-

ward increasing lack of comparative advantage. Considering the trend of climatic variations, relative decrease of precipitation and serious dependence of dry farm wheat on climatic conditions, this conclusion is justifiable.

The trend of performance in hectare and total production for dry and irrigated, self-sufficiency coefficient and total social profit for total wheat production are presented in table 5. In a short review, we can conclude that the governments' policies and interventions, via self-sufficiency policy, have been able to exert a tangible impact on improving performance or physical productivity of both dry and irrigated wheat; while these interventions had no positive impact on improving social benefit during the period.

The above results showed that the efforts made for strengthening productivity have been effective, and have caused increase of production in hectare. But, the governments' policies and interventions have not been able to exert a tangible impact on strengthening competitive power and improving total social profit in coordination with the self-sufficiency policy in wheat production. The results indicate that except for production in hectare or physical productivity of production, there are other economical factors which can affect the social profitability of producing a product, particularly inflation and exchange rate policy. The rate of exchange is one of the main macroeconomic variables which act as a bridge between the domestic economy and global economy, so it plays a great role in determining the competitive

Table 5: Performance, production, self-sufficiency coefficient and social profit (billion Rials)

Cropping Year	Dry wheat (ton)		Irrigated wheat (ton)		Total Production (ton)	Self-sufficiency coefficient	Total Social Profit
	Ton/ha	Total	Ton/ha	Total			
1999-2000	701	2060777	2787	6026979	8087756	0.551	-4231
2000-2001	873	3132631	3051	7069820	10202450	0.613	-6679
2001-2002	1068	4217773	3588	8232469	12450242	0.751	-11836
2002-2003	1180	4734882	3629	8704683	13439565	0.922	-10059
2003-2004	1187	4818176	3827	9750305	14568480	0.985	-18925
2004-2005	1004	4335305	3785	9972665	14307970	1	-29515
2005-2006	1084	4525975	3745	10127770	14662745	0.971	-23244
2006-2007	1196	5311572	3801	10575037	15886609	0.997	-21691
2007-2008	489	1456330	2855	6500315	7956648	0.61	-11317
2008-2009	1073	4512506	3672	8971949	13484455	0.72	-13734
2009-2010	1380	6161318	3447	8867471	15028789	0.94	-14844

Source: Agricultural ministry data and research findings

power and comparative advantage of production in various economic sections.

### CONCLUSION

The results of this study showed that the social benefit of dry and irrigated wheat during the last decade, in spite of increased physical productivity and self-sufficiency coefficient, has not improved. The social calculated profit was negative during all years of study period, indicating no contribution of self-sufficiency strategy to food security in economic access aspect. The problem, seemingly, is due to incompatibility in macroeconomic policies and self-sufficiency policy. It is worth mentioning that these results do not mean, by any means, that the production of wheat, as a staple food and important product, should be set aside in Iran. In producing wheat, in many cases especially in dry farm wheat, the farmers do not have practically a lot of choices for replacing other products in their farms. The results of this study only emphasize the fact that the production structure of wheat is not a fluent, efficient and acceptable one, which can compete with today's structure of producing agricultural products in the world. Moreover, this structural problem cannot be improved or modified with self-sufficiency policy without accompaniment of appropriate macroeconomic policies.

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