Applications of the Policy Analysis Matrix in Iranian Bottled Drinking Water Factory: The Case study, Sistan & Baluchestan Region, Iran

Alireza Karbasi[1*], Fatemeh Rastegaripour[2], Abolfazl Tavassoli[3] and Ebrahim Amiri[4]

[*1.] Department agricultural economics, Islamic Azad University, Zabol branch, Iran
[3.] Islamic Azad University, Mashhad branch, Iran. Young Researchers club. Iran
[3.] Islamic Azad University, Shirvan branch, Iran. Young Researchers club. Iran
[4]Department of Agriculture, Islamic Azad University, Lahijan Branch, Iran

Abstract: In this study the comparative advantage of bottled drinking water production in Sistan and Baluchestan province was investigated using DRC index and policy analysis matrix (PAM) in 2009. Data was collected from the site of External Trade Statistics Yearbook, FAO and annual foreign trade database. The Nominal protection coefficient showed that there was an indirect tax on producers in all sectors. The NSP index was positive in all regions. Result supports this idea that Sistan and Baluchestan has comparative advantage in bottled drinking water production. When yield increase and production cost decrease, bottled drinking water production is usefulness in Sistan and Baluchestan province.
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1. Introduction

Sistan & Balouchestan province lies on the south-east of the country and is one of the largest provinces of Iran. The mythical land of Sistan & Balouchestan consists of two regions: north & south. There are 10 cities in the province; Zahedan is the centre of province. The province lies on the south-east of Iran with two different structures. In the north Dasht- e- Sistan formed by Hirmand alluvium holds the largest fresh water lake of the world as well as Khaje Mountain. The 120-day winds are a distinguishing feature of this region. The southern part is mostly mountainous with a variety of climates due to the vicinity with Taftan Volcano & Oman Sea. Among the rivers Hirmand, Bampoor, Kajo, Sarbaz, and Kahir can be named as the most important. Industry is new to the province. Total cultivable lands in famine status are about 400000 Hectares equals 2% of province area. Due to famine, this amount reduces to 65% and totally includes 190000 Hectares. There land area of industrial towns here is more than 3920 hectares. Comparing with total country, 7% of lands and 11% of registered documents of industrial towns belong to this province. Some of the important factory under execution now is car parts, boats, ship scrape, water pipes, cement factories, Granite stone production and mineral water factory. The province extends from the lake Hamun in the north to the indigo plain of the Oman Sea in the south. Water for drinking, agriculture, and industry is supplied through two ways in the province: surface and subterranean. Surface sources are the 6 permanent rivers Sistan, Shirdel, Golmir in Sistan and Ladiz, Bampour,Sarbaz in Balouchestn. Water for agriculture in Sistan is supplied through river Hirmand and un the time of water shortage through half well reservoirs having capacity of about 660 million cubic m. but There are drought and water shortage in this province. Water shortage in arid and semiarid regions of the world has motivated the development of the innovative management measures. Therefore water management is necessary to solve this problem. Without improvement in water management, urban water demand will continue to increase, water supplies will diminish and the population pressure will decay infrastructures (Iran Statistic Center, 2010). Water in some region of sistan and Balouchestn province is not suitable for drinking; therefore establish bottled drinking water factory is necessary and important in this region.

Several methods have been developed to measuring comparative advantage of bottled drinking water factory. The Ricardian model of trade, which incorporates differences in technologies between countries, concludes that everyone benefits from trade, whereas the Heckscher-Ohlin model, which incorporates endowment differences, concludes that there will be winners and losers from trade. Change the basis for trade and you may change the outcomes from trade. In the real world, trade takes place because of a combination of all these different reasons. Each single model provides only a glimpse of some of the effects that might arise. Consequently, we should expect that a combination of the different

outcomes that are presented in different models is the true characterization of the real world. Unfortunately, because of this, understanding the complexities of the real world is still more of an art than a science. In economics, the law of comparative advantage refers to the ability of a party (an individual, a firm, or a country) to produce a particular good or service at a lower opportunity cost than another party. It is the ability to produce a product with the highest relative efficiency given all the other products that could be produced. It can be contrasted with absolute advantage which refers to the ability of a party to produce a particular good at a lower absolute cost than another. Comparative advantage explains how trade can create value for both parties even when one can produce all goods with fewer resources than the other. The net benefits of such an outcome are called gains from trade. It is the main concept of the pure theory of international trade (Pearson et al, 2003).

In this section After Bruno(1963), Gonzales and colleagues (1993), Master and Nelson (1995), shujie Yao (1997), Zhong and colleagues (2001), Shahabuddin and Dorosh (2002), Warr (2002), page (2002), Lagos and Mardones (2003), Huang et al (2003) and

fung(2004) investigated comparative advantage of agricultural and industrial products in different countries. In internal studies , Haji Rahimi (1999), Hadrbady(2001), Dehghani(2003), Mohammadi(2004), Karbassi et al (2005), Azizi and Yazdani, (2006), Mehdipour and Kazem Nejad(2006), Mehrabi Abadi(2007), Shahnvshy et al(2007), Kakhky Daneshvar et al (2007) and Zare(2008) to review policy and comparative advantage of crops in the Province.

In this study the ability of Sistan and Baluchestan in the production of bottle drinking water factory in 2009 years was investigated by using DRC index and policy analysis matrix (PAM) during 2009 year. This study assessed the overall goals and determines comparative advantage in producing drinking water and exchange rate sensitivity analysis and product price indices of comparative advantage.

2. Material and Methods

The policy analysis matrix is a product of two accounting identities, one defining for profitability as the difference between revenues and costs and the other measuring the effects of divergences (distorting policies and market failures) as the difference between observed parameters and parameters that would exist if the divergences were removed. By filling in the elements of the PAM for a management system, an analyst can measure both the extent of transfers occasioned by the set of policies acting on the system and the inherent economic efficiency of the system. Profits are defined as the difference between total (or per unit) sales revenues and costs of production (Monke and Pearson, 1989).

This definition generates the first identity of the accounting matrix. In the PAM, profitability is measured horizontally, across the columns of the matrix, as demonstrated in Table 2 Profits, shown in the right-hand column, are found by the subtraction of costs, given in the two middle columns, from revenues, indicated in the left-hand column. Each of the column entries is thus a component of the profits identity-revenues less costs equal profits. Each PAM contains two cost columns, one for tradable inputs and the other for domestic factors. This process of disaggregation of intermediate goods or services separates intermediate costs into four categories-tradable inputs, domestic factors, transfers and no tradable inputs (which themselves have to be further disaggregated so that ultimately all component costs are classified as tradable inputs, domestic factors, or transfers). Policy analysis matrix (PAM) represent in table 1. Private profits, D, equal A minus B minus C. Social profits, H, equal E minus F minus G. 'Output transfers, 1, equal A minus E. 1nput transfers, J, equal B minus F. Factor transfers, K, equal C minus G. Net transfers, equal D minus H; they also equal I minus J minus K. Domestic resource cost ratio (DRC): G/(E - F) Nominal protection coefficient(NPC) on tradable outputs (NPCO): A/E on tradable inputs (NPCI): B/F Effective protection coefficient(EPC): (A - B)/(E - F) Profitability coefficient (PC): (A - B - C)/(E - F - G) or D/H Subsidy ratio to producers (SRP): L/E or (D - H)/E. The data entered in the first row of Table 1 provide a measure of private profitability. The term private refers to observed revenues and costs reflecting actual market prices received or paid by manager in system. The private, or actual, market prices thus incorporate the underlying economic costs and valuations plus the effects of all policies and market failures. In Table 1, private profits, D, are the difference between revenues (A) and costs (B + C); and all four entries in the top row are measured in observed prices. The calculation begins with the construction of separate budgets for farming, marketing, and processing. The components of these budgets are usually entered in PAM as local currency per physical unit, although the analysis can also be carried out using a foreign currency per unit. The private profitability calculations show the competitiveness of the system, given current technologies, output values, input costs, and policy transfers. The cost of capital, defined as the pretax return that owners of capital require to maintain their investment in the system, is included in domestic costs (C); hence, profits (D) are excess profits-above-

normal returns to operators of the activity. The second row of the accounting matrix utilizes social prices, as indicated in Table 2. These valuations measure comparative advantage or efficiency in the system. Efficient outcomes are achieved when an economy's resources are used in activities that create the highest levels of output and income. Social profits H, are an efficiency measure because outputs, E, and inputs, F + G, are valued in prices that reflect scarcity values or social opportunity costs. Social profits, like the private analogue, are the difference between revenues and costs, all measured in social prices-H = (E - F - G). For outputs (E) and inputs (F) that are traded internationally, the appropriate social valuations are given by world prices-cif import prices for goods or services that are imported or fob export prices for exportable. World prices represent the government's choice to permit consumers and producers to import, export, or produce goods or services domestically; the social value of additional domestic output is thus the foreign exchange saved by reducing imports or earned by expanding exports (for each unit of production, the cif import or fob export price). Because of global output fluctuations or distorting policies abroad, the appropriate world prices might not be those that prevail during the base year chosen for the study. Instead, expected long-run values serve as social valuations for tradable outputs and inputs. The services provided by domestic factors of production-labor, capital, and land-do not have world prices because the markets for these services are considered to be domestic. The social valuation of each factor service is found by estimation of the net income forgone because the factor is not employed in its best alternative use. This approach requires the commodity systems under analysis to be excluded from social factor price determination. The practice of social valuation of domestic factors begins with a distinction between mobile and fixed factors of production. Mobile factors, usually capital and labor, are factors that can move from this section to other sectors of the economy, such as agricultural, services, and energy. For mobile factors, prices are determined by aggregate supply and demand forces. Because alternative uses for these factors are available throughout the economy, the social values of capital and labor are determined at a national level, not solely within the industry sector. Actual wage rates for labor and rates of return to capital investment are therefore affected by a host of policies, some of which may distort factor prices directly. The social opportunity cost of the land is not accurately approximated by the net profitability of a single best alternative industry; instead, it is measured by some weighted average of the social profits accruing from the set of industries. Because the correct weights and social profits associated with each crop in the set are generally not known, it is convenient in assessing industry activities to reinterpret crop profits as rents to land and other fixed factors (for example, management and the ability to bear risk) per hectare of land used. This reinterpretation includes private (and social) returns to land as parts of D (and H). Profitability per hectare is then interpreted as the ability of a industry activity to cover its long-run variable costs, in either private or social prices or as a return to fixed factors such as land, management skill, and water resources (Monke and Pearson, 1989, Pearson et al, 2003).

In this study the theory of equality of purchasing power (PPP) was used to calculate the relative and absolute shadow exchange rate. Using this method, shadow exchange rate is calculated by this formula (Central Bank of Iran, 2010).

$$PER = Er \times (WPI / CPI) \quad (1)$$

ER is the free exchange rate, WPI is the wholesale price index outside the country and CPI is the domestic consumer price index (Base year is 2004). Market exchange rate of the central Bank of Iran was obtained. Also, Using this method, shadow exchange rate is calculated by this formula (Central Bank of Iran, 2010).

$$E = P_{ig} \div P_{dg} \quad (2)$$

P_{ig} and P_{dg} which is respectively market price of a domestic (per Rials) and the global market (per dollar).

Transfers are shown in the third row of the PAM. If market failures are unimportant, these transfers measure mainly the effects of distorting policy. Efficient systems earn excess profits without any help from the government, and subsidizing policy (L > 0) increases the final level of private profits. Because subsidizing policy permits inefficient systems to survive, the consequent waste of resources needs to be justified in terms of no efficiency objectives. Comparisons of the extent of policy transfers between two or more systems with different outputs also require the formation of ratios (for reasons analogous to those offered in the discussions of private and social profits). The nominal protection coefficient (NPC) is a ratio that contrasts the observed (private) commodity price with a comparable world (social) price. This ratio indicates the impact of policy (and of any market failures not corrected by efficient policy) that causes a divergence between the two prices. The NPC on tradable outputs (NPCO), defined as A/E, indicates the degree of output transfer. Similarly, the NPC on tradable inputs (NPCI), defined as B/F, shows the degree of tradable input transfer. The effective protection coefficient (EPC), another indicator of

incentives, is the ratio of value added in private prices (A - B) to value added in world prices (E - F), or EPC = (A - B)/(E - F). This coefficient measures the degree of policy transfer from product market-output and tradable-input-policies. But, like the NPC, the EPC ignores the transfer effects of factor market policies. Hence, it is not a complete indicator of incentives. An extension of the EPC to include factor transfers is the profitability coefficient (PC), the ratio of private and social profits or PC = (A - B - C)/(E - F - G), or D/H. The PC measures the incentive effects of all policies and thus serves as a proxy for the net policy transfer, since L = (D - H). Its usefulness is restricted when private or social profits are negative, since the signs of both entries must be known to allow clear interpretation. A final incentive indicator is the subsidy ratio to producers (SRP), the net policy transfer as a proportion of total social revenues or SRP = L/E = (D - H)/E. The SRP shows the proportion of revenues in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies. The SRP permits comparisons of the extent to which all policy subsidizes agricultural systems. The SRP measure can also be disaggregated into component transfers to show separately the effects of output, input, and factor policies. This formula is presented in Table 2.

3. Results

In this study, financial processes, including costs and revenues is reviewed from water factory project in the province of Sistan & Baluchistan. Costs are including land, equipment, machinery, office equipment and other. Project income is including income from product sales a year. More clear after the shadow price of production and raw materials, possible indicators of comparative advantage comes from providing drinking water production. Table 3 and 4 showed the results of policy analysis matrix based on absolute and relative PPP mode shows. The results are in Table 5. According to the results of Table I <0, which means the market price is less than the shadow price of the product. An implicit tax on domestic producers has been imposed. J matrix in the two cases is less than zero, the domestic producers of inputs imported from the higher world prices to buy it. K matrix that represents the difference between the costs of domestic inputs required producing a single product to market and shadow price is greater than zero. L is income difference matrix calculated based on market and shadow prices shows the effect of government intervention in the profits of production is considered here in a state of relative ppp .L <0 obtained in this case, profit shadow gained market and profit producer with acts of government policy intervention can be affected.

DRC in table 5 is less than one. This means that there is comparative advantage in bottled drinking water production. The nominal protection coefficient (NPC) is a ratio that contrasts the observed (private) commodity price with a comparable world (social) price. This ratio indicates the impact of policy (and of any market failures not corrected by efficient policy) that causes a divergence between the two prices. The NPC on tradable outputs (NPCO), defined as A/E, indicates the degree of output transfer; Nominal protection coefficient of gain (NPC) in the form of PAM in both cases is less than unit, in other hand the market price is less than product shadow prices . An NPC on inputs of 0.27 shows that policies are reducing input costs; the average market prices for these inputs are only 27 percent of world prices.

Nominal protection coefficient of input (NIPC), indicating that how the support of external inputs (interchangeable) is using the appropriate relationship in the context of PAM in the two cases is less than one and this means that the cost of inputs can be traded at market prices less than its shadow price cost. The effective protection coefficient (EPC), another indicator of incentives, is the ratio of value added in private prices (A - B) to value added in world prices (E - F), or EPC = (A - B)/(E - F). This coefficient measures the degree of policy transfer from product market-output and tradable-input-policies. EPC is less than one in this project. Finally, net social profitability (NSP), which profits from production with the application of shadow prices and product production and internal and external inputs are calculated according to formulas that value in the PAM framework in both cases is positive. The results are in Table 6 having been changed.

NIPC index value based on PPP is reduced relative to the improved exchange rate means increasing the shadow price of inputs increased, while its shadow price is stable. As well as increased exchange rate index is less than NPC. Because it increases exchange rate and imports more expensive while the price of imported products are expensive product prices in the domestic market remains constant.

Table 1 - policy analysis matrix (PAM)

	Revenues	Costs		Profit
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Divergences	I	J	K	L

Source: Pearson et al: 2003

Table 2 - Introduction and comparative advantage index

index	Defined	Description
DRC	$DRC = \frac{G}{E-F}$	DRC<1: Production has a comparative advantage DRC>1: :Production has not a comparative advantage DRC=1: Head to head point
NPC	$NPC = \frac{A}{E}$	NPC<1: Indirect subsidies to producers will receive NPC>1 : Indirect taxes are imposed on producers NPC=1: the product does not support
NIPC	$NIPC = \frac{B}{F}$	NIPC<1: indirect subsidies for inputs to be paid trade NIPC>1: Manufacturers in the use of these inputs indirect tax paid to NIPC=1: Support any policy in this case does not apply inputs
EPC	$EPC = \frac{A-B}{E-F}$	EPC<1: Government intervention in production loss is EPC>1: government policy supports the production process EPC=1: Public policy the government does not apply to product
NSP	$NSP = (E-F-G)$	NSP>0: Comparative advantage in production is NSP<0: Comparative advantage in production is not NSP=0: Head to head point

Source: Pearson et al: 2003

Table 3 - policy analysis matrix (PAM) based on relative PPP

	Revenues	Costs	Profit	Revenues
		Tradable Inputs	Domestic Factors	
Private Prices	150000	8859	115721	25418
Social Prices	546063	9149	114234	422679
Divergences	-396063	-289	1486	-397260

Source: Computing Research

Table 4 - policy analysis matrix (PAM) based on absolute PPP

	Revenues	Costs	Profit	Revenues
		Tradable Inputs	Domestic Factors	
Private Prices	150000	8859	115721	25418
Social Prices	566357	9315	114433	442608
Divergences	-416357	-455	1287	-417189

Source: Computing Research

Table 5- Comparative advantage in two cases Relative and Absolute ppp

index	Relative ppp	Absolute ppp
I	-396063	-416357
J	-289	-455
K	1486	1287
L	-397260	-417189
D	25418	25418
H	422679	442608
DRC	0.21	0.20
NPC	0.27	0.26
NIPC	0.96	0.95
EPC	0.26	0.25
NSP	422679	442608
SRP	-0.72	-0.73

Source: Computing Research

Table 6- Effect of exchange rate changes on the comparative advantage indicators of drinking water

index	700	800	900	1000	1100	1200
DRC	0.31	0.27	0.24	0.21	0.19	0.18
NSP	0.39	0.34	0.30	0.27	0.25	0.23
NIPC	1.03	1.01	0.99	0.97	0.95	0.93
EPC	0.38	0.33	0.29	0.26	0.24	0.22
NSP	260196	314720	369245	423770	478294	532819

Source: Computing Research

4. Discussion

The interpretation of PAM results generally follows a set pattern. The analyst first explains private profitability (moving across the top row of the PAM) and then discusses social profitability (moving across the second row of the PAM). S/he next turns to the causes of the difference between private and social profits. This task requires the identification of divergences (moving separately down each revenue and cost column of the PAM). The logic is straightforward. Private valuations (of outputs and inputs) differ from social valuations because something gets in the way to make the observed market valuation (the private price) diverge from the efficient valuation or social opportunity cost (the social price). What might go wrong? The government might have decided to raise or lower the market price by introducing tax or subsidy policies, trade restrictions, or other policy interventions – collectively called distorting policies. Or the markets might be imperfect and fail to provide efficient valuations because of market failures (monopolies, externalities, or underdeveloped factor markets). Hence, if the observed market price differs from the desired efficient level, the divergence must be caused either by a distorting policy or by a market failure.

Calculated based on a policy analysis matrix, results showed that the production of drinking water in Sistan and Baluchestan is a social benefit. This means that after the national areas of comparative advantage, such as production, employment and value added in the drinking water production is economic justification.

Corresponding Author:
Dr. Alireza Karbasi
Associate Professor of agricultural economics department of Islamic Azad University of Zabol, Iran

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