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Statistical Study of Drink Markets: Case Study

Seyed Habib A. Rahmati*, Arash Haji Karimi, Reza Saffari, Zeeya Rashvand

***Abstract*—**An important official knowledge in each country is to have a comprehensive knowledge about markets of each group of products. Drink markets are one the most important markets of each country as a sub-group of nourishment markets. This paper is going to study these markets in Iran. To do so, first, two drink products are selected as pilot, including milk and concentrate. Then, for each product, two groups of information are estimated for the last five years, including 1) total consumption (demand) and 2) total production. Finally, the two groups of productions are compared statistically by means of two statistical tests called *t* test and Mann-Whitney test. The implemented Different related tables and figures are also illustrated to show the method more explicitly.

***Keywords*—**Market evaluation, Drink, Estimation, Mann-Whitney test

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I. Introduction

IN recent years, a tremendous interest has been devoted in the field of nutrition. Nutritional supplements have become a multibillion dollar industry worldwide. Nevertheless, many claims are unfunded due to the lack of research and studies. Of course some good researches have also been done. For instance, [1]-[2] showed that Mexican-origin women are one of the most obese populations in the U.S.

An important research issue is studying of corresponding industrial and official indices such as production and demand rate of nutritional products in a country. Knowing these indices comprehensively can open many new improvement fields for officials in each country. One of these fields is to know the behaviour of their society toward healthy and unhealthy nutritional products.

Among all nutritional markets, drink market are one the most important one because of many reasons such as our body's need to liquid or the habit of drinking in different situations. In an example [3], a research was done about the consumption of the energy drinks. They showed that although energy drinks are targeted to young adult consumers, they have been very popular among college students for a variety of situations in the United States.

Seyed Habib A. Rahmati is with Young Researchers Club, Qazvin Branch, Islamic Azad University, Qazvin, Iran. (phone: +989127826284; e-mail: sd_rahmaty @yahoo.com).

Arash Haji Karimi is with Islamic Azad University, Abhar Branch, Faculty of management, Qazvin, Iran. (phone: +989123812902; e-mail: Arashhajikarimi@yahoo.com).

Reza Saffari is with Qazvin Industrial State Company, Iran. (phone: +989122813463; e-mail: Saffari_r@yahoo.com).

Zeeya Rashvand is with Qazvin Industrial State Company, Iran. (phone: +989126819470; e-mail: Zeeya8@gmail.com).

Nevertheless, most of the studies in this field are related to healthy, medical or chemical aspects of drinks.

For example, [4]-[5] are just some examples that only studied mentioned aspect for energy drinks. In another series of researches [6]-[7]-[8], it was shown that residents of the Arab countries in the Persian Gulf region have become more sedentary and have dramatically changed their diet over the last two decades and consume more fat, meat, sugar, rice and wheat flour than before. Similar studies were also performed in china [9]-[10]. A study about impact of open-market on the diet of people was also done in china [11].

Now, this paper is going to study Iranian drink markets. To do so, milk, and concentrate are considered as two pilot products. It also should be mentioned for each of these pilot products, all sub groups of their products, produced in Iran or imported from foreign countries to Iran, are considered so that the all considered sub-groups of the two pilot products includes more than ten sub products. For example, in case of milk, all types of this product such as fruit milk, pasteurized milk, chocolate milk, and so on, are considered. Then, two indices, called 1) total production and 2) total consumption (demand) of the country are estimated in the last previous five years, for each of two groups of products. Finally, these indices are compared statistically. To do so, two common statistical tests called *t* test [12] and Mann-Whitney [13] test are used to compare the indices of the products.

Rest of the paper is organized as follows. Next section introduced the estimation method and statistical tests. Section 3 presents and analyses the estimated data and statistical tests. Section 4 concludes the paper.

II. Material and Methods

A. Estimation Method

Generally, to calculate the total production of a specific product in a country, the data of the related ministry is used. In Iran, the ministry of industries and mines has the task of gathering raw information about production circumstances of different industrial and production companies. In this study, all information of active companies, specifically small and medium sized enterprises (SMEs), are used to calculate the production of each product in the country. Of course, it should be mentioned that a ratio of nominal production capacity of companies is always used to estimate total production. In this study, this ratio is considered as 60%. It means, in a total view, it is assumed that 60 percent of nominal reported capacity is real production capacity.

To estimate the total demand of each product, two types of indices can be calculated, including 1) consumption rate and 2) total consumption. Meanwhile, consumption rate of

productions, which shows average consumption of each person in a year, is calculated according to the total consumption, which shows total consumption of the country per a year. To do so, first their total consumption is calculated. Then, by dividing total consumption by the total population size of the country, the consumption rate of the country for that production is estimated as (1).

$$\text{Consumption rate}=\frac{\text{consumption}}{\text{population size}} \quad (1)$$

$$\text{Consumption}=\text{import}+\text{production}-\text{export} \quad (2)$$

In (1), the consumption is calculated as (2). In this equation, consumption represents total consumption of each production per a year, total import and export present total value of import and export of each product in a year and is taken from the ministry of industries and mines of Iran. Population size is also taken from statistical center of Iran.

There are also some cases in which the consumption rate is estimated, but not by means of (1). For example, in some cases the existing information is not sufficient reliable to calculate total production because of production cutting of many companies in that industry or non-production due to some official laws. For example, in Iran, after policy of total subsidy omitting, many milk production companies ceased their subsidy milk production line. However, their reported capacity still includes that capacity. In these cases, we can use other method to estimate consumption. In this method, the approximate consumption rate is asked from experts and then total consumption is calculated as (3).

$$\text{Consumption}=\text{Consumption rate}\times\text{population size} \quad (3)$$

Tables I and II presents information for estimating total consumption by means of the first method. Table I is related to milk information and Table II is related to concentrate information. In these tables, consumption rate is also estimated. It should be mentioned, except the two first columns, the information of other columns are in kilogram.

TABLE I
ESTIMATING TOTAL CONSUMPTION OF THE PRODUCED MILK PER A YEAR OF IRAN

Year	Population size (a)	Production (b)	Import (c)	Export (d)	Consumption (E=b + c - d)	Consumption rate (F=E/a)
2005	69390405	1489004400	784126	3275378	1486513148	21.422
2006	70495782	1743188400	1704079	13280516	1731611962	24.563
2007	71532062	2048391600	3481784	21535518	2030337866	28.384
2008	72583586	2312959200	684141	30868122	2282775219	31.450
2009	73650566	2403151200	4018081	33500299	2373668982	32.229
2010	74733230	2403151200	876426	53521692	2350505934	31.452

TABLE II
ESTIMATING TOTAL CONSUMPTION OF THE PRODUCED CONCENTRATE PER A YEAR OF IRAN

Year	Population size (a)	Production (b)	Import (c)	Export (d)	Consumption (E=b + c - d)	Consumption rate (F=E/a)
2005	69390405	240336600	4251126	5652156	238935570	3.443
2006	70495782	242826600	4126487	2158981	244794106	3.472
2007	71532062	249246600	5859303	3263213	251842690	3.521
2008	72583586	256506600	6168126	3828828	258845898	3.566
2009	73650566	257106600	10376004	2458338	265024266	3.598
2010	74733230	257106600	12698896	1946508	267858988	3.584

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B. Statistical tests

As mentioned, in this study, two statistical tests are used to evaluate and compare the two considered groups of products together. These tests are called *t* test and Mann-Whitney test. *T* test is a parametric test, while as Mann-Whitney is a non-parametric test.

1. t test

This test is a simple two sample *t* test that is used for testing means of two normally distributed populations with unknown standard deviations.

2. *Mann-Whitney*

This test is a non-parametric hypothesis test that is used to determine whether two populations have the same population median (η) or not. Therefore, the null hypothesis tests the two population medians are equal ($H_0 : \eta_1 = \eta_2$). Like any other hypothesis test, the alternative hypothesis can be left-tailed ($\eta_1 < \eta_2$), right-tailed ($\eta_1 > \eta_2$), or two-tailed ($\eta_1 \neq \eta_2$) in this test. Since this test is non-parametric, it does not require the data to come from normally distributed populations. In comparison with implemented *t* test, this test uses the ranks of the sample data, instead of their specific values, to detect statistical significance.

It is also worth to be mentioned that in both of these tests, the alternative hypothesis is a two-tailed test.

III. Results

Fig. 1 to 3 summarizes obtain results of the Table I and II for total production and total demand (consumption) respectively.

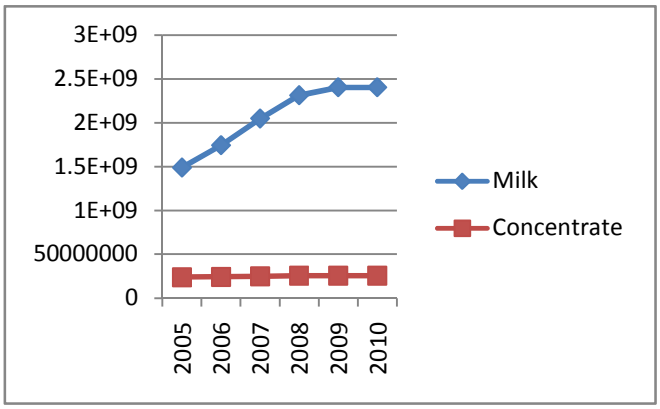


Fig. 1 total production of the two products in the last five years

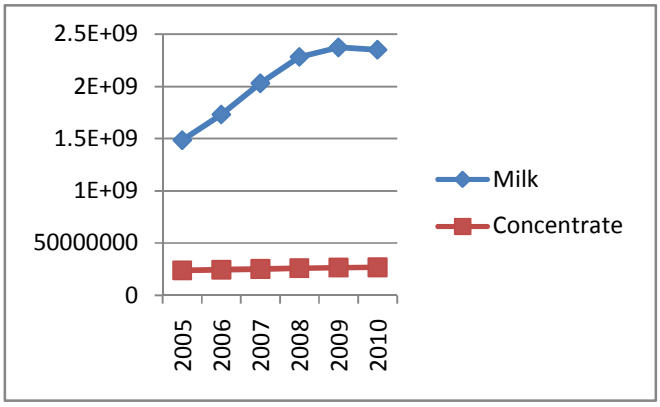


Fig. 2 total consumption of the two products in the last five years

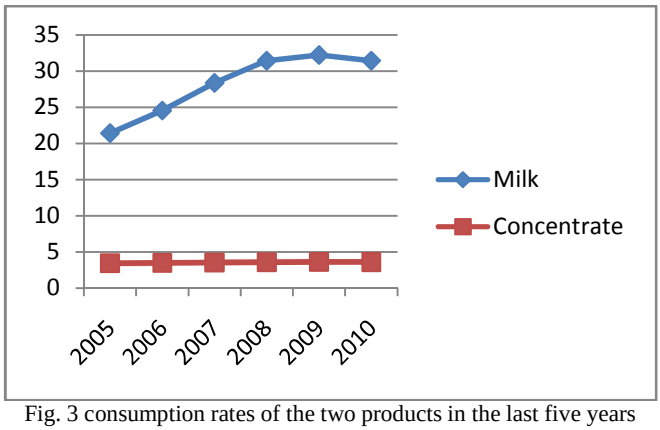


Fig. 3 consumption rates of the two products in the last five years

By a total view in these figures, significant difference of the outputs of milk with concentrate is clear on all the indices, including 1) total production of the two products in Fig. 1, 2) total production of the products in Fig. 2, and 3) consumption rates of the products in Fig. 3. Nevertheless, these results still need to be proved through statistical tests.

Now, the two indices are compared statistically. The outputs of these tests, which are performed in Matlab software, are presented in Table III and IV. Conformity of these test with previous numerical and graphical results can systematically proves the existence of the significant different among the indices of the products. Before presenting statistical test, it is worth to be mentioned that using both of the parametric and non-parametric statistical test can boost the validation of the outputs. Specifically, in case the outputs of these two tests are consistent. As it is seen in both parametric and non-parametric tests, milk indices have significant differences with concentrate. A reason for this is that high consumption of milk is a strategic plan in Iran like any other country, because this product has high impact on the health of people and decrease of the many diseases. On the other hand, concentrate is usually as a fun product. Therefore, the obtained results are expectable. Fig.4 also illustrates the mentioned significant difference graphically.

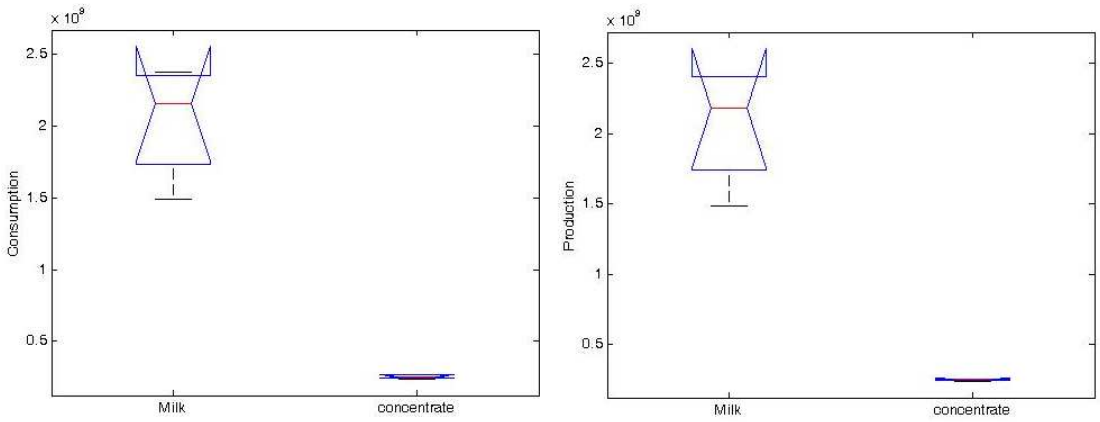


Fig. 4 Box plot of the indices for the two products

TABLE III
STATISTICAL COMPARISON OF THE TWO PRODUCTS VIA *T* TEST

	t test	
	P-value	Result
Total Production	**0.00**	Null hypothesis isn't not rejected
Consumption	**0.00**	Null hypothesis isn't not rejected

TABLE IV
STATISTICAL COMPARISON OF THE TWO PRODUCTS VIA MANN-WHITNEY TEST

	Mann-Whitney test	
	P-value	Result
Total Production	**0.005**	Null hypothesis isn't not rejected
Consumption	**0.005**	Null hypothesis isn't not rejected

IV. CONCLUSION AND FUTURE WORK

In this paper, the markets of the two drink products of Iran were studied. To do so, in the beginning, two indices called total production and total consumption were calculated and estimated and then the products were studied statistically.

These outputs presented and summarized following results:

- Estimate and present the total consumption and production of the milk and concentrate products systematically and clearly
- Show milk as a strategic product for the health of the people has a statistically higher significant consumption rate rather than concentrate as a non-strategic product in Iran
- Present a comprehensive summarized market information of the two products that can be used in other studies such as feasibility studies for establishing the related industrial companies

Future work of this paper can perform similar process for other drink markets and present comprehensive market knowledge about different drink products in any country. It can be also performed for other nutritional products.

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