Research concerning the Correlation between Demand and Offer in the Romanian Milk Market

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Abstract

The paper analysed the evolution of Romania's milk production and consumption in the period 2000-2008 in order to identify the correlation between milk offer and demand. Fixed basis index, average, standard deviation, variation and correlation coefficients have been used for processing data. The specific indicators taken into account are: number of milk producing animals, milk yield and production, production per inhabitant, consumption per capita and milk offer-demand ratio. Milk production increased by 9.4 % from 51,630 thou hl in the year 2000 to 59,006 thou hl in 2008, because of the higher milk yield by 24 % but the lower number of milk producing animals by 8 %. As a result, milk production per capita decreased by 4.15 %. Milk consumption increased by 31.9 % from 193 liters/capita in 2000 to 254.7 liters in 2008, being covered both by domestic production and import as well. Milk yield and milk production are positively and strongly correlated (r=0.927) and milk production and consumption per capita as well (r=8.897). But between milk production per capita and consumption/capita is a weak relation. Milk consumption has been entirely covered by production between 2000-2002 and since 2003 it has been also covered by imports.

Key words: correlation, demand, market, milk, offer, Romania

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1. Introduction

Milk in one of the most important products commercialized in food market as discussed by Georgescu Gh and all [1].

In the Romanian market, milk is mainly assured by dairy cows, but also by buffalo cows, ewes and goats as presented by Ministry of Agriculture, Forests and Rural Development [2] and national Institute for Statistics [3], Popescu Agatha [4] and Popa Ecaterina and all [5]. Milk and dairy products demand is relatively stable representing a current commodity for human consumption as discussed by Grodea Mariana [6].

Romania is situated among the main milk producers in the EU, but milk consumption per capita has increased both due to a higher production but also because of milk imports as presented by Popescu Mihaela [7].

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In this context, the aim of the paper is to analyse the evolution of milk production and consumption in order to identify the correlation between milk demand and offer in the Romania market during the period 2000-2008 based on the data provided by Ministry of Agriculture, Forests and Rural Development, National Institute of Statistics and Eurostat 2010 [2,3,8].

2. Materials and methods

The main indicators characterizing milk offer and demand are: number of animals producing milk, average milk yield, total milk production, number of inhabitants, production per inhabitant, consumption per capita and milk offer/demand ratio.

In order to calculate these indicators, the data have been collected from the National Institute for Statistics, Ministry of Agriculture, Forests and Rural Development and FAO Stat, 2010.

The reference period for this study is 2000-2008.

The following statistical methods have been used:

Fixed basis Index (FBI), 2000=100, reflecting the evolution of milk offer and demand during the reference period, based on the formula:

$$FBI = \frac{x_n}{x_0}.100$$

Where x_n=offer or demand in the years 2000-2008 and x_0= offer or demand in the year 2000.

Average Milk offer or Demand, calculated according to the formula:

$$\overline{X} = \frac{x_1 + x_2 + ...x_n}{n}$$

Standard Deviation (S) of Average Milk Offer or Demand, calculated according to the formula:

$$S = \sqrt{\frac{\sum_{i=1}^{n}(x_i - x)^2}{n-1}}$$

Variability Coefficient (V%), determined by the formula:

$$V\% = \frac{S}{\overline{X}}.100$$

Correlation Coefficient between milk production and consumption, based on the formula:

$$r_{xy} = \frac{n\sum xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}},$$

Milk Offer/Demand Ratio (D/O), calculated dividing demand by offer.

3. Results and discussion

Milk Producing animals are represented mainly by dairy cows, but also by buffalo cows and ewes. During the period 2000-2008, the number of cows and buffalo cows has registered a various evolution from a year to another, but a decreasing trend has characterized this period of time.

In the year 2008, there were 1,639 thousand dairy cows,buffalo cows and heifers compared to 1,775 thousand in the year 2000. This means a decrease by 7.67 %. At the mean time, the number of ewes and ewe lambs has continuously increased from 5,870 thousand heads in the year 2000 to 7,597 thousand heads in 2008, so that in the last year of the analysed period, the value of this indicator was by 29.42 % higher than in the first year of study. (Table 1).

Table 1. Number of animals producing milk (thou heads)

Year	Cows buffalo cows and heifers	Ewes and ewe lambs	Year	Cows buffalo cows and heifers	Ewes and ewe lambs
2000	1,775	5,870	2005	1,812	6,453
2001	1,741	5,823	2006	1,810	6,526
2002	1,759	5,795	2007	1,732	7,207
2003	1,757	5,879	2008	1,639	7,597
2004	1,755	6,192	2008/2000%	92.33	129.42

This trend is justified by cow culling based on milk performance and more attention paid to ewes as an additional important milk source in Romania where pastures and meadows have an important weight in the agricultural land.

Average Cow Milk yield has increased by 24.20 %, from 2,867 kg/cow in the year 2000 to 3,562 kg in the year 2008, which is a positive aspect but milk yield has still a very low level compared to the EU average milk yield (Table 2). This is due to the fact that cows are raised is small households in a traditional rearing system, keeping 98 % of total dairy farms.

Table 2. Average cow milk yield (kg/cow/year)

Year	Milk Yield	Year	Milk Yield
2000	2,867	2005	3,510
2001	3,014	2006	3,570
2002	3,133	2007	3,464
2003	3,198	2008	3,562
2004	3,342	2008/2000 %	124,20

Milk Production, as a dependent factor on the number of milk producing animals and average milk yield, has increased from 51,630 thou hl in 2000 to 59,006 thou hl in the year 2008, meaning 9.4 % more milk as shown in Table 3. But, the highest milk production was registered in the year 2006 – 64,607 thou hl (Table 3).

Table 3. Total Milk Production (thou hl)

Year	Total Milk Production	Of which cow and buffalo milk	Year	Total Milk Production	Of which cow and buffalo milk
2000	51,630	48,518	2005	60,614	55,334
2001	53,169	50,036	2006	64,607	58,307
2002	55,146	51,800	2007	61,048	54,875
2003	57,736	54,199	2008	59,006	53,089
2004	59,818	55,444	2008/2000 %	114.20	109.4

Milk offer is mainly based on milk production but during the last years, Romania has imported milk and milk products from other European Countries

because of the uncorresponding ratio between milk offer and demand and the enlargement of the EU market.

Milk Production per inhabitant is considered to be a living standard indicator. Its value registered a decreasing trend from 224.3 liters/capita in the year 2000 to 215 liters/capita in the year 2008, a very low level compared to other EU countries (Table 4).

Milk Consumption reflects milk demand and its evolution during the period 2000-2008. It increased by 31.9 % from 193 liters/capita in 2000 to 254.7 liters/capita in 2008. The difference between milk consumption per capita and milk product per capita is covered by milk imports, starting from the year 2003 till present.

Table 4. Milk Production per Inhabitant and Milk Dairy Products Consumption per inhabitant (liters/capita)

Year	Milk Production per capita	Milk Consumption per capita	Year	Milk Production per capita	Milk Consumption per capita
2000	224.3	193.0	2005	216.2	239.2
2001	224.0	197.4	2006	215.8	246.6
2002	217.9	215.0	2007	215.3	252.8
2003	217.3	225.0	2008	215.0	254.7
2004	216.7	238.9	2008/2000 %	95.8	131.9

The average value, standard deviation and variation coefficient for all the indicators presented above are given in Table 5.

Table 5. Statistical Parameters: Average, Standard Deviation and variation Coefficient

	$\overline{X \pm S}$	V %
No of cows and buffalo cows	1,754 ± 51.05	2.91
No of ewes and ewe lambs	6,371 ± 650.95	10.21
Average Cow Milk	3,296 ± 255.15	7.74
Total Milk Production	58,086 ± 4125.48	7.10
Milk Production/capita	218.05 ± 3.57	1.63
Milk Consumption/capita	229.17 ± 20.52	8.95

During the whole analysed period 2000-2008, the average number of cows and buffalo cows was 1,754 thousand heads, while the average number of ewes and ewe lambs was 6,371 thousand heads.

In the same period, the average milk yield per cow was 3,296 kg/year, while total milk production was 58,086 thousand hl.

As a result, average milk production per capita was 218.05 liters.

Average milk consumption registered 229.17 liters/capita, by 11.12 liters more than milk production because of milk imports. Therefore, milk imports/capita represented 4.85 % of milk consumption/capita in the whole analysed period of time.

Correlation Coefficients have been calculated for the following combination of indicators: Average Milk Production x Total Milk Production, Total Milk Production x Milk Consumption/capita, Milk Production/inhabitant x Consumption/inhabitant, Total Milk Production x Milk Production/ inhabitant (Table 6).

Between average milk yield and total milk production it is a very strong positive correlation, rxy=0.927 reflecting that the increase of average milk will determine an important increase of total milk production.

This aspect is very important for milk producers, as farmers have to pay a high attention to average milk yield and take all measures to improve feeding, reproduction breeding, cow selection and rearing system.

Table 6. Correlation Coefficients, rxy

Average Milk Production x Total Milk Production	r=0.927
Total Milk Production x Milk Consumption/inhabitant	r=0.897
Milk Production/inhabitant x Consumption/inhabitant	r=-0,00298
Total Milk Production x Milk production/inhabitant	r=+0,027

The correlation between total milk production and milk consumption per inhabitant is also high, strong and a positive one, rxy=0.897, reflecting how important is a high milk production for assuring a high milk consumption per inhabitant.

This aspect is important for milk producers to join their efforts for getting higher milk productions, but also for assuring milk quality standards (fat %, protein %, acidity, number of somatic cells and lack of pathogenic germs).

The correlation between milk production/ inhabitant and consumption/inhabitant is a very weak and a negative one, rxy=-0.00298, reflecting that an increase of milk production/inhabitant is not enough to increase consumption per capita, because milk demand has to take into consideration both milk production import.

The correlation between milk production and milk production per inhabitant is a low and a positive one, rxy=0.027 reflecting that an increase of milk production assures just a small increase of milk

production/inhabitant because of the variation of population from a year to another (Table 6).

Milk offer/demand ratio per capita. This ratio shows the degree of coverage of milk demand by milk offer as shown in Table 7.

Table 7. Coverage Degree of Milk Consumption by Milk Production (%)

Year	%	Year	%	Year	%
2000	116.21	2003	96.57	2006	87.51
2001	113.47	2004	90.70	2007	85.16
2002	101.34	2005	90.38	2008	84.41

In the years 2000, 2001 and 2002, milk consumption per capita has been entirely covered. Starting from the year 2003, milk production was not enough to cover milk consumption and Romania was obliged to make milk imports. For this reason, coverage degree of milk consumption by production was 96.57 % in the year 2003, reflecting that 3.43 % was coming from imported milk. In the year 2008, the coverage degree of milk consumption by production was 84.41 %, meaning that the difference of 15.59 % had to be assured by imports.

This situation is determined by the low milk performance per animal compared to other EU countries, the decreased member of milk producing animals, mainly cows, the existing problems regarding feeding, reproduction, breeding and rearing systems in small farms.

4. Conclusions

In the period 2000-2008, milk production has increased by 9.4 % from 51,630 thou hl in the year 2000 to 59,006 thou hl in 2008, because of the increasing cow milk yield by 24 % but negatively influenced by the decreased number of milk producing animals.

As a consequence, milk production per capita registered a decrease by 4.15 % from 224.3 liters in the year 2000 to 215 liters in 2008.

Despite that, milk consumption has increased by 31.9 % from 193 liters/capita in 2000 to 254.7 liters in 2008, reflecting that the lack a production was covered by imported milk.

The correlation coefficient between average milk production and total milk production is a positive and a very high one (r=0.927) and the correlation coefficient between milk production and milk consumption per capita as well (r=0.897). Between milk production and milk production per inhabitant is a low but positive correlation (r=0.027) but between production per capita and consumption per capita the correlation coefficient was a negative one (r=-0.00298).

As a result, the coverage degree of milk consumption by production was higher than 100 % in the period 2000-2002, but starting from the year 2003 it has registered lower and lower values accounting for 84.41 % in the year 2008. It is obvious that since 2003, Romania has imported more and more milk to cover milk demand.

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