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Market Analyses of Milk: The Case of UB City

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Abstract: Milk is of the traditional food in Mongolia with hundreds years of custom. Current domestic liquid milk production has not met with the consumption of Ulaanbaatar (UB-capital city) and other big cities in Mongolia. The total milk production of farmers in surrounding area of UB is 10-12 million liters; however 100 million liters of milk is required for the consumption of inhabitants of UB. According to existing studies and official statistics, average consumption of milk and dairy products urban person is 2 times less than rural person, and only 20 percent of procured milk is processed. The objective of this study is to analyze market equilibrium of liquid milk market of UB. Market theory, including demand and supply analyses, was applied using regression analyses to estimate functional forms and other required statistical – econometrical indicators. The functions and elasticity(s)of demand and supply for liquid milk show clearly that the share of dried milk higher in the market. More advanced development of intensified dairy farms and supports of their activities are essential in order to meet the demands.

Keywords: Market analyses, milk market of UB city, statistical- econometrical indicators, intensified dairy farm

INTRODUCTION

In Mongolia, UB city is not only the largest and capital city with continuously growing populations due to its own development. Market capacity of the milk and milk products in Mongolia is 403 million liters of milk annually. 27 percent of this domestic demand is supplied by ourselves and other remained by import. 92 percent of the imported dried milk is delivered from the Russian Federation, South Korea, New Zealand; including liquid milk of 100 percent is supplied completely from the Russian Federation. In last year in Mongolia entered through the state boundary over 100 tons of acid milk, 330 tons of curd from sour milk, cheese, 100 percent of butter, 3500 tons of dry milk. It shows that the most part of dry milk used by the largest manufacturers overweighed in the import[1].

Milk and dairy products are one of the traditional foods of the Mongolians and it is the first necessity for physiology needs. Therefore, milk is included in the nutrition strategy list of four foods for population by a new Food Law of Mongolia [2]. In Mongolia with sharply continental climate, where is dominated the pasture animal husbandry it is less time to prepare the milk /about 4 months/.In warm season, it is formed excess milk. In addition, it is delicate product with high risk to blink in transportation. In cold season, it is deficiency in the milk. Because of delayed treatment of excess milk accumulated in warm season, $^{1}/_{3}$of milk is “lost - pour out”. Depending from this in cold season the need in milk is compensated by imported milk. /There are over 18.0 million liters of milk are imported annually/ [3]. The Mongolian people do not use the milk directly in their food, but they add milk to tea, make yogurt and curd, additionally use the clotted cream in their food; also high contents of oil in the everyday products as melted butter, milk butter, mare's milk, drink made by thinning, acid drink, high contents of colostrum's as cheese, dried curds and dried milk products as habit to accustomed from ancient period in their life [4].Now it is restoring manufacture branch for milk and milk products but it is impossible to supply the needs of population in milk especially for population in settlement areas, therefore it is compensated by the import goods to reserve the foodstuffs. Annually use 87.6kg of milk in urban areas but cattle-breeders 220.8 kg of milk [5]. From the government in 1999 year it was approved “White Revolution” [6]national program with a purpose to improve milk and dairy product supply for the population.

Level of the small enterprise’s technology, especially products packaging were improved; at the same time it was increased capacity to produce sterilized milk, yogurt, whipping cream, hard and soft cheese, delicious ice-cream and brand products [4]. Even though consumers know that most of companies in UB using milk powder for their packed milk advertising it as fresh liquid milk, they still consume these fake products. Probably, consuming of powdered milk that

compensating fresh mill is rather cheaper than wasting time and money for investing on establishment of dairy farms [7]. It is necessary to meet demands of dairy products, lacked in urban areas with resources excessive in rural areas, eliminate seasonal fluctuations of dairy plants, increase amounts and kinds of dairy products, support to establishments of plants for manufacturing dried milk and other preserved foodstuffs, and increase numbers of intensified dairy farms in peri-urban areas [8].

Mongolia in 2014 year has totally 51.1million livestock, from what there are 2.9 million of horse, 3.4million of cattle, 0.3 million of camel, 23.2million of sheep, 22million of goat [1]. There are 42.8% of total livestock are dams. These are about 530.0 million liter of milk resource where 79.2 percent is cow milk(Figure 1).

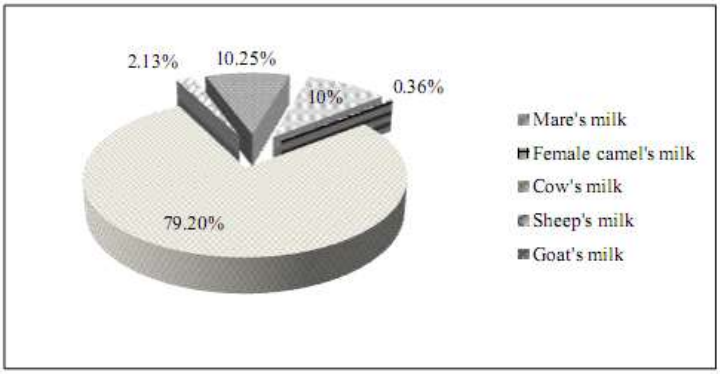

Fig.1:Milk resource in the country /by kinds of livestock/
Source; Statistical Year book of Mongolia (2014)

The government program "Supporting intensified animal husbandry" [9], national programs "Milk" [10]and "Food Guarantee"[11] were directed to make investment for citizens and entities that produce milk and milk products, also to provide real financial assistance [12].

Figure 2 shows the milk production since implementation program for "Supporting intensified animal husbandry" [13].

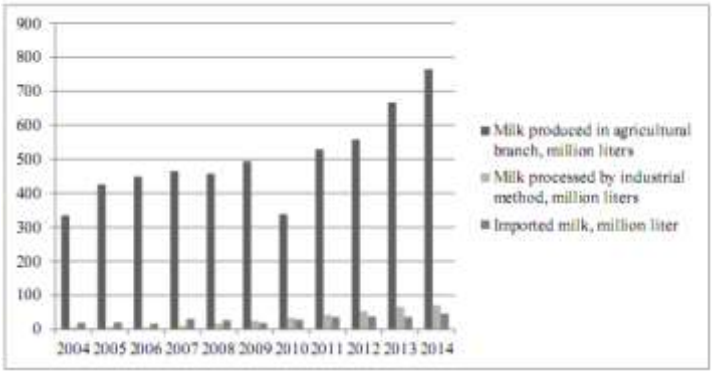

Fig. 2: Milk production, million liters
Source; Statistical Year book of Mongolia (2004-2014)

DESCRIPTION

UB is the capital city of Mongolia and only city of million population in the country on the one hand, and an zone called Ulaanbaatar the capital (briefly the capital), which has 4,704.4 square km area and 9 districts, 3 of which are distinct cities according to new managerial divisions in 1992.As of 2014, there were 1.3 million populations in the capital [14]. UB city is situated in eastern central body of Mongolia, surrounded with soums ofTuvaimag(Figure 3).

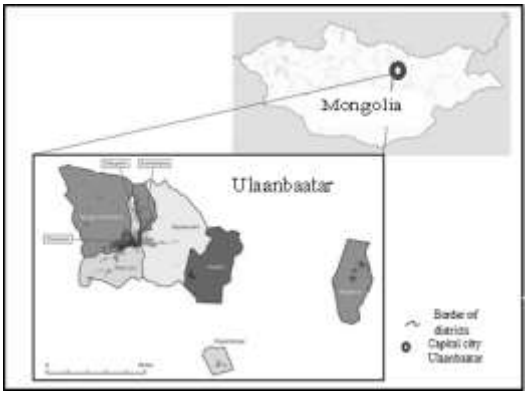

Fig. 3: Map of UB city
Source: google.mn

METHODOLOGY

Based on thedata StatisticalYear book of Mongolia (2004-2014), liquid milk market equilibrium of UB citywere determined on the basis demand and supply theory [15].

Use MS-Excel [16] equilibrium of liquid milk market was calculated relying on total consumption of liquid milk (mln L), supply (mln L), consumers' price (MNT per liter), annual household income (thousand MNT) of UB city and producers' price(MNT per liter).

RESULTS AND DISCUSSION

Liquid milk demand (1) and supply function (3)s (Based data analysis reports (table 1, table 2)) are:

$$Q_D = 50.9879 - 0.0236 \cdot P_D + 0.0325 \cdot R; \quad r^2 = 0.95; \tag{1}$$

From demand function (1), increase of consumers' price one liter milk by 1 MNT resulted in decrease of consumption by 0.0236 million liter, increase annual family income by 1000 MNT leads to increase of milk consumption by 0.0325 million liter. Fisher value F=78.12 expresses confidence probability of the equation is 0.95.

If R of the equation (1) is replaced with household income of 2014: $R_{2014} = 1519.8$demand functionis

$$Q_D = 100.4437 - 0.0236 \cdot P_D; \tag{2}$$

Table1: Data analysis report

Regression Statistics				
Multiple R	0.9753416			
R Square	0.9512912			
Adjusted R Square	0.939114			
Standard Error	2.0887962			
Observations	11			
ANOVA				
	Df	*SS*	*MS*	*F*
Regression	2	681.6918448	340.84592	78.120674
Residual	8	34.90455519	4.3630694	
Total	10	716.5964		
	Coefficients	*Standard Error*	*t Stat*	
Intercept	50.987928	1.993247585	25.580329	
P_D	-0.0236204	0.025957966	-0.909948	
R	0.032549	0.02205866	1.9184313	

Table 2: Data analysis report

Regression Statistics				
Multiple R	0.9501861			
R Square	0.9028536			
Adjusted R Square	0.8920595			
Standard Error	4.3210219			
Observations	11			
ANOVA				
	Df	*SS*	*MS*	*F*
Regression	1	1561.729615	1561.7296	83.643636
Residual	9	168.0410754	18.671231	
Total	10	1729.770691		
	Coefficients	*Standard Error*	*t Stat*	
Intercept	-17.505185	4.472074378	-3.9143322	
Ps	0.0544823	0.00595716	9.1456895	

$$Q_S = -17.5052 + 0.0549 \cdot P_S; \quad r^2 = 0.90; \tag{3}$$

From supply function, increase of producers' price one liter milk by 1 MNT resulted in increase of production by 0.055 million liter. Fisher value F=83.64 expresses confidence probability of the equation is 0.95.
Equilibrium state (figure 4):

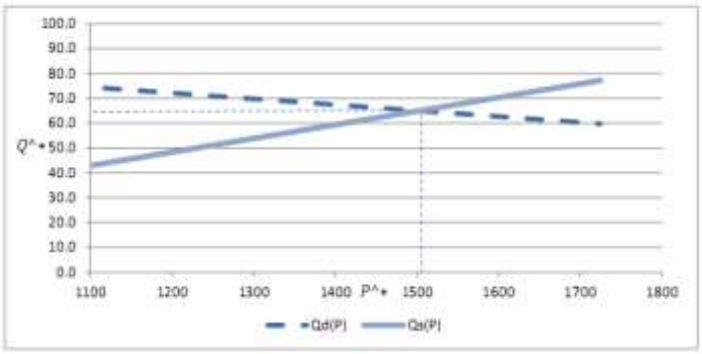

Fig. 4: Equilibrium liquid milk market of UB city

$$100.4437 - 0.0236 \cdot P_D = -17.5052 + 0.0549 \cdot P_S; \tag{4}$$

Equilibrium price:$0.0785 \cdot P^* = 117.9489$; $P^* = 1502.534$ MNT per liter
Equilibrium quantity is $Q^* = 100.4437 - 0.0236 \cdot P^* = 64.9533$ million liters

Elasticity(s): $$E_{Q_d} = b_{Q_d} \cdot \frac{\bar{P}}{\bar{Q}_d} = -0.2828 \approx -0.3; \tag{5}$$

$$E_{Q_S} = b_{Q_S} \cdot \frac{\bar{P}}{\bar{Q}_S} = 1.82; \tag{6}$$

(5), (6) elasticity(s) including producers' price increase 1% demand will decrease 0.3%, producers' price increase 1% supply will increase 1.82%.

Table 3: Statistical and econometrical significance levels

parameters	Demand function	Supply function
$F_{actual} > F_{theoritical}$	78.12>5.12	83.64>5.32
$t_b > t_{0.95}$	-0.2024<2.2622	-3.97<2.2622
$t_a > t_{0.95}$	0.8977<2.306	9.69>2.2622
correlation coefficient	R=0.99	R=0.94
R square	$R^2 = 0.98$	$R^2 = 0.88$

Liquid milk demand and supply functions were confident (table 3), use them calculated forecast of interval error [17].

For demand function$Q_D = 100.4437 - 0.0236 \cdot P_D$:

a. Milk consumers' price is similar to 2014and if it was$P_{Dk} = P_{D2014} = 1375$ MNTper liter;

$$m_{\tilde{Q}_{D2014}} = S_{\tilde{Q}_{D2014}} \cdot \sqrt{1 + \frac{1}{n} + \frac{(P_{2014} - \bar{P}_D)^2}{\sum(P_D - \bar{P}_D)^2}} = 2.3372; \quad (7)$$

Forecast error, million liters:

$$\varepsilon = t_{0.95} \cdot m_{\tilde{Q}_{D2014}} = 2.3372 \cdot 2.2010 = 5.1442\ ; \quad (8)$$

$$\tilde{Q}_D - \varepsilon = 67.9657 - 5.1442 \le Q_D^* \le \tilde{Q}_D + \varepsilon = 67.9657 + 5.1442 \quad (9)$$

When consumer's price is similar to 2014,liquid milk demand is between the below interval: $62.8214 \le Q_D^* \le 73.1099$ million liters.

b. Considering it is greater by 25% than 2014or $P_{D2014} = 1718.75$ MNT per liter, if the error is estimated, it is clear that:

$$m_{\tilde{Q}_{D2014}} = S_{\tilde{Q}_{D2013}} \cdot \sqrt{1 + \frac{1}{n} + \frac{(P_{2014} - \bar{P}_D)^2}{\sum(P_D - \bar{P}_D)^2}} = 2.6666 \quad (10)$$

Forecast error, million liters:

$$\varepsilon = t_{0.95} \cdot m_{\tilde{Q}_{D2014}} = 2.2010 \cdot 2.6666 = 5.8692; \quad (11)$$

$$\tilde{Q}_D - \varepsilon = 59.8416 - 5.8692 \le Q_D^* \le \tilde{Q}_D + \varepsilon = 59.8416 + 5.8692; \quad (12)$$

When consumers' price is greater by25% than 2014 or $P_{D2014} = 1718.75$ MNT per liter,liquid milk demand is between the below interval: $53.9769 \le Q_D^* \le 65.7154$million liters.

For supply function$Q_S = -17.5052 + 0.0549 \cdot P_S$:

a.Milk producers' price is similar to 2014and if it was $P_{Sk} = P_{S2014} = 1013$ MNT per liter;

$$m_{\tilde{Q}_{S2014}} = S_{\tilde{Q}_{S2014}} \cdot \sqrt{1 + \frac{1}{n} + \frac{(P_{2014} - \bar{P}_S)^2}{\sum(P_S - \bar{P}_S)^2}} = 6.0287\ ; \quad (13)$$

Forecast error, million liters:

$$\varepsilon = t_{0.95} \cdot m_{\tilde{Q}_{S2014}} = 6.0287 \cdot 2.2010 = 13.263; \quad (14)$$

$$\tilde{Q}_S - \varepsilon = 37.6854 - 13.2692 \le Q_S^* \le \tilde{Q}_S + \varepsilon = 37.6854 + 13.2692; \quad (15)$$

When consumers' price is similar to 2014,liquid milk supply is between the below interval:
$24.4223 \le Q_S^* \le 50.9485$million liter.

b. Considering it is greater by 25% than 2014or $P_{Sk} = P_{S2014} = 1266.25$MNT per liter, if the error is estimated, it is clear that:

$$m_{\tilde{Q}_{S2014}} = S_{\tilde{Q}_{S2014}} \cdot \sqrt{1 + \frac{1}{n} + \frac{(P_{2014} - \bar{P}_S)^2}{\sum(P_S - \bar{P}_S)^2}} = 5.2572; \quad (16)$$

Forecast error, million liters:

$$\varepsilon = t_{0.95} \cdot m_{\tilde{Q}_{S2013}} = 5.2572 \cdot 2.2010 = 11.5711\ ; \quad (17)$$

$$\tilde{Q}_S - \varepsilon = 51.4831 - 11.5711 \leq Q_S^* \leq \tilde{Q}_S + \varepsilon = 51.4831 + 11.5711; \quad (18)$$

When producers' price is greater by25% than 2014 or $P_{Sk} = 1266.52$ MNT per liter,liquid milk supply is between the below interval: $39.912 \leq Q_S^* \leq 63.0542$million liters.

CONCLUSION

The functions (2), (3) and elasticity(s)(5), (6) of demand and supply for liquid milk show clearly that the share of dried milk higher in the market.Therefore, support of domestic liquid milk producers should desirable to increase domestic liquid milk supply. More advanced development of intensified dairy farms and supports of their activities are essential in order to meet the demands.

Consumption of liquid milk is similar to that in 2014, probability of equation of consumers' price to purchase milk (9) and consumption is greater by 25% than those in 2014, probability of equation of consumers' price 1 liter liquid milk (11) and supply is similar to that in 2014, while probability of equation of producers' price of 1 liter milk (15) and supply is greater by 25% than those in 2014, probability of equation of producers' price 1 liter liquid milk (18) is 0.95.

Calculated function and parameter report (Table 4) shows demand and supply function regression coefficient (-0.2042<2.2622), (-3.97<2.2622) and **a** coefficient of supply function 0.8977<2.2622) are not confident, while supply function regression coefficient (9.6940>2.2622) is confident. Functions correlation coefficients closer to +1 indicates correlation density is good, while determination coefficient (R^2) closer to +1 reveals proper selection of linear function.

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