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Small Farmer Milk Production Efficiency in the Chui Province Rural Area, Kyrgyz Republic

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A B S T R A C T

Creating a strong economy and providing a high standard of living is a priority for the Kyrgyz Republic. This is unachievable without the agricultural sector, which employed 32.4% of the working-age population and was 14% of the gross domestic product (GDP) in 2017. In the Chui province, small farmers produce 90% of the milk, and the production has increased over the past ten years. Milk and dairy products are traditionally important, but the volume of their consumption depends on household income levels. Farm development is necessary for sustaining the Kyrgyz rural area, but the raw milk industry is limited to small-scale production, the milk yield per cow is reducing, breeding numbers are low, epizootic diseases are present, and contracts with processors are lacking, resulting in low milk quality. This study analyzed the efficiency of small milk farmers in the Kyrgyz Republic rural area to provide sector development recommendations. Stochastic frontier analysis was used to analyze survey data from 136 farmers. The results indicated that the milk production industry provided most farmers with mine income, the financial conditions depended on the farming efficiency, and stochastic frontier analysis determined the most efficient farming method.

Keywords: Determinants of inefficiency, Milk farmers, Rural area. Stochastic frontier analysis, Technical inefficiency

Introduction

Agricultural production is the first condition for the food supply of human life. This characterizes the vital role of agriculture in countries (Batyr, 2016). The emergence of the food problem leads to the high relevance of the development of agriculture and related industries, as well as the development of agricultural relations and agricultural policy (Batyr, 2016). Agriculture is one of the key sectors of the Kyrgyz economy, as it is pleased with other developing countries (Source: National Statistic Committee of the Kyrgyz Republic).

The Kyrgyz Republic got independence from the Soviet Union when it collapsed in 1991. From that moment, it started to build a market economy. The change in the economic system has led to the destruction of the former

planning and economic system of operation (Abdurasulov, 2010). The state industrial policy of territorial- industrial complexes, collective and state farms formed during the Soviet industrialization in the early 90-ies of the last century has lost its consistency and efficiency as a method of regulation and economic development (Abdurasulov, 2010). Over the past 27 years, the Kyrgyz Republic has been trying to form a market economy. However, the country's economy, including the agricultural sector, remains underdeveloped. There are many problems in agriculture, including the sectoral structure of agriculture, which continues to remain at the level of small farms, which are under the low-profit position (Abdurasulov Y., 2010).

The dairy sector plays an important role in the country's economy. One-third of the produced livestock production is accounted for raw milk production, while in the structure of gross output of agricultural production, the production of raw milk is 15 percent (Fig. 1). Milk production in the Kyrgyz Republic during the last 5 years shows a positive trend, which is also associated with an increase in the number of cows. According to official data in 2015, raw milk was produced in the amount of 29,628.4 million soms, which is almost 8 million soms more compared to 2011. The marketability of milk also increases - according to data for 2015, 71.8% of all milk produced was sold to the market, which is 5 percent more compared to 2011.

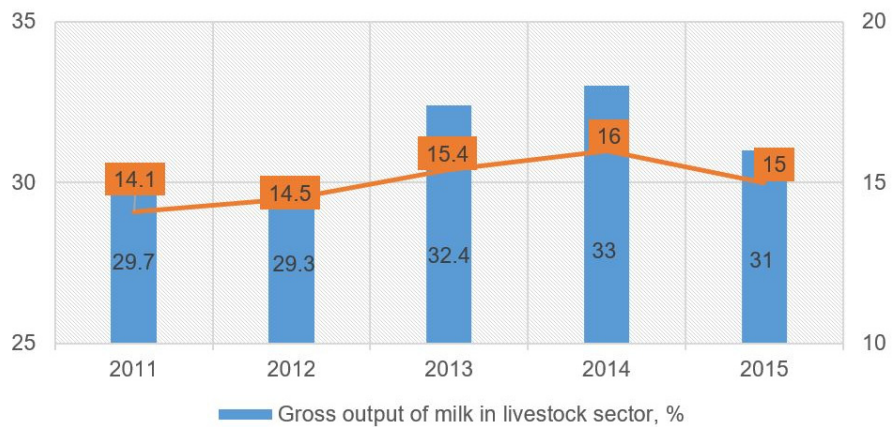

Fig. 1. The gross milk output (%).

Source: National Statistic Committee of the Kyrgyz Republic (NSCKR), P.: 2011 − 2018, Agriculture of the Kyrgyz Republic, Bishkek, Kyrgyz Republic.

Now, Chui province's rural population is 728,085 people or 82.03% of total population. According to the official statistic data, the agriculture sector employed 105,9 thousand people. In the GDP structure, the share of agriculture is about 14%. In the total volume of gross output of agriculture, the share of crop production accounted for 49.5%, livestock - 48.1%, forestry and fishery - 0.2% and agricultural services −2.2% (Source : Database of the National Statistic Committee of the Kyrgyz Republic, 1992-2018).

There are 47,767 farmers in Chui province (Source : Database of the National Statistic Committee of the Kyrgyz Republic, 1992-2018). It is about 76% of all participants in agricultural sector. The average estimated need for milk for industrial processing in accordance with the design capacities of industrial the enterprises are 1,670 tons. The

export potential of the dairy industry is high, but due to the complex epizootic situation, exports are limited to supplies only in Republic of Kazakhstan (Source: Ministry of Agriculture, Food Industry and Reclamation of the Kyrgyz Republic, 2018).

The share of animal husbandry in the agricultural sector is about 47.6%. Dairy farming is about 14.1% of total agricultural production. Chui province is characterized with the high level of dairy farming in the country and it has second place on the milk production volume among 7 provinces. In the structure of land fund by type of farmland, the share of posture is 8,5 thousand km2 or 85% of total province' area (Source: Database of the National Statistic Committee of the Kyrgyz Republic, 1992-2018). At the same time, according to survey results, 80.1% of respondents answered, that the pasture area is enough for them. According to the quality of Chui province's pasture, the standard necessity of pasture square per cow is equal to 2.5 – 3 ha. As a result, survey data confirmed farmers' real satisfaction with pasture.

In 2015, there are 131,556 cows in Chui province. Share of cow belongs by farm's types: State Farms – 75 (0.05%), collective farms – 2,988 (2.3%), Farming – 75,093 (57.1%) and Part time of farm – 53,400 (40.6%), (Fig. 2). Efficiency of farmers related to "Part time of farm" and "Farming" are an objective of this research.

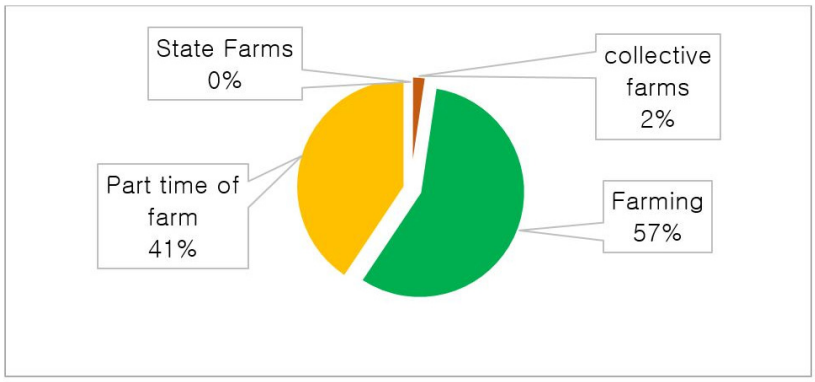

Fig. 2. The share of cows by owner in the Chui Province (2015).

Source: Database of the National Statistic Committee of the Kyrgyz Republic (DBNSCKR), P.: 1992 – 2018, web-address: http://stat.kg/ru/statistics/selskoe-hozyajstvo/.

As we can see from the above diagram, "Part time of farms" and "Farming" are owner of a large number of cows (98%). Therefore, the improving and increasing of milk production efficiency in the rural area is important issue from a view of rural development. Through the survey data, we will try to determine what kind of factors has affected to farming efficiency. Now, small-scale farming still uses outdated, inefficient and expensive milk production technology, based on the tethered content of cows and milking in portable buckets. This is one of the factors limiting the growth of milk production, improvement of quality and increase of milk productivity of animals in the province. They do not get access to new technologies, new agriculture equipment, because of several reasons, including luck of soft funding, poor farmer's capacity building, coordination and guiding of farming from Government side and luck of effective state policy, etc.

Today, the deterioration of agricultural equipment is 80% (Source: Database of the National Statistic Committee of the Kyrgyz Republic, 1992-2018). In general, milk production is seasonal for small farms. Winter is an unfavorable period for milk production, and there is an increase for milk in summer. The lack of planned livestock breeding, the lack of feed and feed additives in the winter months, the lack of strategy for the preparation of winter feed are additional factors that create a situation of shortage of milk during the winter months. In spite of low level of profitability of farming milk production, as mentioned above last 5 years the number of cows and volume of milk yield are stable increasing (Source: Database of the National Statistic Committee of the Kyrgyz Republic, 1992-2018). It ensures that the farmers are interested in developing of milk producing and it is a main family income source. In order to support local producers, Government tries to find new foreign markets for all exporters. In 2016 the Kyrgyz Republic became as a member of Eurasian Economic Union with 180.0 million populations.

The issues of export of livestock products, including raw milk and dairy products reflected in the "Plan of the Government of the Kyrgyz Republic for the development of exports of the Kyrgyz Republic for 2015－2017", the Law "On State Regulation of Foreign Trade Activity in the Kyrgyz Republic". (Source : Russian farmers official, 2017). In connection with the accession to the EEU in 2014, the Kyrgyz Republic undertakes acting within the framework of the Regulations on the Uniform Procedure for Joint Inspections of Facilities and of Goods' (Products) Sampling Subject to Veterinary Control (Supervision). This Regulation establishes general principles for ensuring the safety of animals and products of animal origin that imported into the customs territory of the Customs Union from the territories of third countries. In 2015, a Resolution adopted on the Action Plan for the Application of Technical Regulations of the Customs Union in the Kyrgyz Republic, to harmonize national legislation in the field of technical regulation with the legislation of the Customs Union (Source : National Statistic Committee of the Kyrgyz Republic).

In 2013, Ministry of Agriculture, Food Industry and Reclamation (MAFIR) developed two programs of state policy for agriculture sector: "The program of transition to sustainable development of the Kyrgyz Republic for 2013－2017" and "The national strategy of sustainable development of the Kyrgyz Republic for 2013－2017". (Source : National Statistic Committee of the Kyrgyz Republic). In these documents, the government outlined the plan and direction of the policy for 5 years. In 2014, the Kyrgyz Republic adopted the "Strategy for the development of agriculture until 2020" (Source : National Statistic Committee of the Kyrgyz Republic). The program's goals are to satisfy the needs of the population, to ensure the safety of agricultural products, to increase productivity and quality, to carry out effective management of agriculture. Thus, because of the implementation of the plan, the quality of products will increase, production will increase, the competitiveness of agricultural export products will increase, and the income of agricultural producers will increase (Source: Ministry of Agriculture, Kyrgyz Republic, 2014). Within the framework of the program "Strategic objectives and targets up to 2020" the directions and numerical values of the targets of dairy farming are defined (Table 1).

Table 1. The targets and targets to 2020

Indicators (year-end)		Base value	Target values (in brackets-in% to 2010)	
		2010	2014	2020
Production volume	Average annual yield from 1 cow (kg)	2,036	2,380 (116.9%)	3,260 (160.1%)
	The average annual wool clip from one sheep (kg)	2.6	3.1 (119.2%)	3.5 (134.6%)
Number of cows (thousand)	Livestock	1,298.8	1,344.0 (103.5%)	1,425.0 (109.7%)
	Number of sheep and goats (thousand)	5,037.7	5,620.2 (111.6%)	6,500.0 (129.0%)
	Number of farms (thousand)	378.4	387.8 (102.5%)	407.0 (107.6%)

Note: According to the statistics of the USSR in 1985 the productivity of 1 cow was 3,500 kg per year
Source: ministry of agriculture, 2014. strategy for the development of agriculture until 2020. food industry and reclamation of the kyrgyz republic.

The main objective of this study is to examine the efficiency of small milk producers in rural area of the Kyrgyz Republic. Even though the milk production is very important in the Kyrgyz Republic, no study has not examined this topic.

Materials and Methods

Material

The target population for this research includes the farms, which has cattle breeding and milk production. In this study, the farmer's deal was analyzed, as effectiveness. The sample of the population of this study stood at 136 farmers, which has been as respondents of research survey. Proportion of sample farms to population is 47767:136. A random sampling procedure was used for selecting the participants in this study from 3 villages in Chui province ("Jany-Jer", "20-Hutor" and "Dacha-Su"), where concentrated a lot of families, which produce milk.

A questionnaire designed with an emphasis of barriers definition in order to get maximum profit. It includes itself points about age and education, daily volume of milk yield and income, farmer's input and output. Totally, a quaternary consists of 36 questions. After the finalizing and all necessary modifications, the survey administered directly to the chosen sample for the study. Two hundred copies of quaternary were prepared and 136 copies of them successfully completed during the February 2018.

A summary of values of the variables, which used in this research showed in Table 2. The mean of output of milk per cow is 51,6 liter/day. Average number of cows per farmer is equal to 5,59. Among the total number of survey participants, 76.5% farmers have 2 – 5 cows. It means all of them has average income per day – 5.57 – 13.9 USD, without the counting of inputs. According World Bank's survey, conducted in Chui province in 2016, amount of input for one cow per day is equal to 1.3 USD. Average cost of farmer's input is 2.6 – 6.5 USD. In this case, we can assume

that monthly income of most farmers is equal to 136.5 USD, while average salary in the country is 223 USD. Compared with average indicators across all the country, we can ensure that farmers have very low amount of income. The main point in this condition, there was a question in survey as "in case of the milk, producing is not acceptable for farmer, if farmer is ready to change his business?", and 68 farmers (50% of respondents) answered that their business is not acceptable for them, but all of them confirmed, that they are not going to change their business. Such a result is related with the low level of employment in rural area. Even they want to change their business, it is almost impossible to find other income sources. In addition, 23.5% of surveyed farmers has more than 6 cows, and they daily income is more than 14 USD. Land cultivation is equal to 1 if a milk producer also produces other crops.

The main variables we selected is coming from general efficiency studies except cow weight. Given the importance of cow weight on milk production, we included cow weight as an input variable.

Table 2. A statistical summary of milk farmer variables in the Chui province

Variable	Mean	Standard deviation	Minimum value	Maximum value
Output (liter/day)	51.60	23,54	35	130
Labor (hour/day)*	8.38	1.90	8	24
Number of cow (head)	4.59	2.09	2	10
Cow weight (kg)	384.55	40.90	350	500
Increasing in live weight, per year (kg)	24.15	10.85	0	40
Farmer's age (years old)	47.52	9.19	26	51
Education (years)	3.47	0.84	1	4
Credit	0.83	0.36	0	1
Association	0.89	0.30	0	1
Land cultivation	0.41	0.49	0	1

Note: 8 hour equals to 1 labor

Method

We estimate stochastic frontier production functions to cross-sectional data, for milk producers as mentioned above from three villages of Chui province, which were chosen randomly. The stochastic frontier model is used in a large literature of studies of production, cost, revenue, profit and other models of goal attainment. attainment (Azad et al., 2019). The model as it appears in research was developed by following the original model, which was constructed by Aigner, Lovell, and Schmidt (Aigner et al., 1977). The formulation that serves as the foundation for other variations is their model:

$$y = \beta' x + v - u,$$

where y is the observed outcome (goal attainment), $\beta' x$ is the deterministic part of the frontier and v is the stochastic part, $\beta' x + v$ is the optimal, frontier goal (e.g., maximal production output or minimum cost) pursued by

the individual. The two parts together constitute the "stochastic frontier" (Azad et al., 2019).

Stochastic frontier models allow to analyze technical inefficiency in the framework of production functions. Production units (firms, regions, countries, size, climate, infrastructure etc.) are assumed to produce according to a traditional method, and reach the frontier when they produce the maximum possible output for a given set of inputs. Inefficiencies can be due to structural problems or market imperfections and other factors which cause countries to produce below their maximum attainable output (Mastromarco, 2008). Mastromarco describes that the frontier can shifts, indicating technical progress. Moreover, production it possible, those units moves along the frontier by changing quantity of inputs. Finally, there can be some combinations of these three effects. The stochastic frontier method allows a decomposing growth into changes in input use, changes in technology and changes in efficiency, thus extending the widely used growth accounting method (Mastromarco, 2008).

The stochastic frontier model (1) for farmers within the Chui province:

$$Ln\,Y_i = \beta_0 + \beta_1(Labour) + \beta_2(Cattlenumber) + \beta_3(cowweight) + V_i - U_I \tag{1}$$

where the subscript i indicates the ith farmer in the sample (i=1, 2, 3 ⋯ 136). In represents the natural logarithm (i.e. logarithm to base e); Y represents the output of milk (liter/farm); Labor number represents number of human attended in the farm (hours/day); Cattle number represents number of cow used in the farming operations (head/farm); Cow weight represents a live weight of cow (kg); Vis are permissible to be independent and identically distributed random errors having N(0, σ_v^2) - distribution; and the $U_i s$ are non-negative random variables, which called technical inefficiency effects. They are permissible to be independently distributed such that Ui is defined by the milk volume (at zero) of the normal distribution with mean μ_i (2), and variance, σ^2, where μ_i is defined by:

$$\mu i = a_0 + a_1 A^{\beta} + a_2 E^{\gamma} + a_3 C^{w} + a_4 S^{h} + a_5 W^{c} + a_6 L^{j} + a_7 V^{n} \tag{2}$$

where Y-gross output of milk, USD; A − age; E − education; C − credit; W − Cow weight after one year; L − Land cultivation; V − volume of credit; S - Association. α, β, γ, w, c, j, h and n − regression coefficients showing the degree of influence of each factor on the effective index; a_0 is the free coefficient.

The technical efficiency of production (3) of the ith farmer in the appropriate data set, given the levels of his inputs:

$$TE_i = \exp(-U_i) \tag{3}$$

The prediction of the technical efficiencies is based on its conditional expectation, given the observable value (Battese and Coelli, 1988). A parcel's distance from the efficiency frontier depends on farmer and cow characteristics, including number of tenures.

The mean of the stochastic frontier output (4) for the given input values for the ith farmer, can be estimated by:

$$E(Y_i * | X_i) = \exp(X_i\beta) \exp[1/2(1-\gamma)\sigma_s^2] \quad (4)$$

Result and Discussion

In the framework of this study for Stochastic frontier used three parameters, labor, number of cow and weight of cow (Table 3). According to the survey results regarding this parameter, it is important to note that five farmers of 136 answered attract additional labor from outside or among family members. However, 10 farmers (7.3%) of 136 answered they keep more than 10 cows, 15,4% 6 − 9 cows. For example, the average monthly salary of employed labor across the country is equal to 223 USD, while farmer, who is keeping 3 cows has total income for 225 USD. It means, that for farmer not effectively to employ labor. In additional, in the framework of the survey it was found out that 58% of farmers has land cultivation. We can assume that big farmers who have more than 10 cows can employ additional labor because of extended farm. Unfortunately, this research does not cover square of farmers' land cultivation area in order to estimate in frontier part of stochastic model. By the way, land cultivation variable influence estimated in inefficiency model.

Table 3. Stochastic frontier analysis milk production parameter results

Variable	Parameter	Coefficient	Std. err.
Stochastic frontier			
Constant	β_0	2.215***	0.159
Labor	β_1	0.013***	0.006
Cow number	β_2	0.201***	0.008
Cow weight	β_3	0.003***	0.000
Inefficiency model			
Constant	δ_0	3.944***	1.829
Age	δ_1	-1.048***	0.035
Education	δ_2	-0.824***	0.377
Land cultivation	δ_3	-1.357**	0.756
Credit	δ_4	-1.557***	0.774
Association	δ_5	1.547*	1.012
Cow weight in 1 year	δ_6	-0.051***	0.028
Ln (Likelihood)		78.912	

Note: *, **, and *** represent significance levels at 10%, 5%, and 1%, respectively.

As we can see from the table above, all input variables of the Frontier model, including labor, cow number and cow weight has positive coefficients. The coefficient of labor is statistically significant, which means additional labor has positive effect on output for bigger farms. At the same time, the most important thing, that must be took in mind is proportional relationship between additional labor and number of cows. For example, farmer can employ

additional labor to increase output, and without increasing cow number, he will be forced with inefficiency. In such kind case, he can achieve maximum production from having few number cows but has an output in small production frontier.

The coefficient of cow is equal to 0.124 and more significant in compare with other frontier variables. It means that farmers can get mere output as they increase the number of the cows which is raised by themselves. It can be explained by milk output and physical conditions. In other words, it is related to farming ability of farmer. The advantages of small farms are that they produce environmentally friendly products, providing a relatively low cost due to labor efficiency. It means only family members are attended in farming.

Cow weight variable's coefficient is positive, it equal to 0.002, and significant at the 5% significance level. From this indicator we can conclude that cows with more weight has more volume of milk output and respectively farmer with cow of more weight has positive terms for the achievement of the more volume of milk production. The productivity of the cow influences by quite diverse factors. Among them, as main of them we can consider the weight of a cow. More cow's weight means more ability to produce milk for which reason is greater nutrient intake too. Unfortunately, this research does not cover feed issues of farmers due to limited time during the survey procedure.

Regarding the cow weight, it is important to note, that in 2016, by the Russia Ural state agricultural University was conducted study on the topic of the influence of live weight of cows on their milk productivity (Galatova, 2016). The aim of the research was to study the influence of live weight of cows in the agricultural firm on their milk productivity. To do this, the task was consisted of the solving the assess of the cow's milk productivity of the 1 and 3 lactation depending on the live weight (Galatova, 2016).

As showed in the (Table 4), with the increase of live weight of heifers their productivity increases. Thus, 5203 ± 323.15 kg of milk were obtained from cows with a live weight of 423 kg, which is less than from cows with a higher live weight by 745 and 931 kg. It should be noted, that the difference between the second and third groups with a live weight of 436 and 482 kg was small and amounted to 186 kg or 3.03%, whereas between the first and second groups it was 14.31%. According to the coefficient of milk production, it can be judged on the constitutional orientation of cows in the direction of a particular productivity. In our case, all the first-heifers were dairy areas of productivity (Galatova, 2016). However, cows with a live weight of more than 450 kg in this ratio were almost the same with animals of the first group (400 − 430 kg), that is, we can say that increasing the live weight of heifers over

Table 4. First-calf cow milk production

Indicator	Live weight, kg		
	400 − 430	431 − 450	Более 450
Number of cow, hd	11	7	12
Milk yield for lactation, kg	5203 ± 323.15	5948 ± 299.43	6134 ± 274.87
MJ,%	3,80 ± 0.09	4,02 ± 0.06	3,98 ± 0.04
Live weight on average, kg	423 ± 7.71	436 ± 4.12	482 ± 12.32
Amount of milk fat, kg	197.7 ± 18.13	239,1 ± 13.98	244,1 ± 15.37
Coefficient of milk yield, kg	1230 ± 96.23	1364 ± 102.52	1273 ± 87.84

450 kg does not increase the efficiency of milk production. At the same time, heifers with a live weight of 431 − 450 kg are most effective, since they produce 1364 kg of milk for every 100 kg of live weight. They outperform their peers from other living mass on 134 − 91 kg or 10.9% − 7.1% (Galatova, 2016).

In the inefficiency part, among the estimated six variables, five of them are negative. One variable related to farmers' association to any unions is significant at the 10% level. Here, positive sign indicates a negative sign contribution to inefficiency while negative sign of a coefficient indicates positive contribution to efficiency since the dependent variables are inefficiency scores.

The estimated coefficient for age of farmers is negative at the -0.139. It indicates that the older farmers are more technical efficient than younger farmers. It can be explained by the more experienced advantages of older formers in compare with the younger farmers. The coefficient of education is negative too. It equal to -0.824, which indicates that farmers with more years of education are more technically efficient than few years. It also indicates, that farmers' education is closely related to cattle breeding. It implies that farmers with more years of education is important due to the necessity of knowledge on farming. Agribusiness involves the creation of an industrial production. Industrial production is grown only with the help of special knowledge. That is, to be an effective farmer, it needs to either be a specialist or hire a specialist. In addition, this is a prerequisite, because otherwise farmer can lose everything because of improper production, lack of or illiterate use of available resources, lack of new technology of growing cows, lack of monitoring of their development, diseases.

Land cultivation variable has negative coefficient, -1.357 and sing at 5% level. From this result, we can conclude that farmers with land cultivation are more efficient than farmers without land cultivation. In this regard, it is important to note, that stables cattle (for example in winter) requires a significant amount of money, including the most important food. At the same time, the role of own feed production increases significantly in the efficiency of farming. This conclusion may come from our assumption: a farmer with land cultivation, which produces own cattle feed feeds keeps more cows than a farmer without land cultivation. Thus, the quality and quantity of feeding cows will affect the weight of the cow and even their number. As a result, availability of land cultivation reflects in the output of milk.

The coefficient of credit is negative. It means the farmers who has loan are more efficient in compare with others. From this result, we can indicate that the borrowing funds farmers use for buying additional cow to produce milk and it positively effects to efficiency.

The variable related to the farmer's membership in associations or any public unions has positive coefficient, 1.547 and significant at 10%. According to the survey results, they are membership in some associations related to finance, loans, politic unions, etc. In this case, the positive coefficient may be explained by the luck of specified associations in milk production or cattle breeding. Also, we may also conjecture that additional time spending for implementing actions related to association can negatively influence on farming. During the survey 86 of 136 farmers responded that they want to be membership to specified associations.

The "cow weight in a one year" variable's coefficient is negative, - 0.051, which means that farmers whose cows

gets weight are more efficient in compare to farmers whose cows doesn't get weight. It is because the average productivity of cows increases every year to the fifth -seventh calving, and then decreases. Thus, we can assume that farmer whose cow gets weight is on the step of milk volume increasing. As a rule, the life expectancy of cows is about 20 years, rarely up to 35 years. The animal's growth continues up to 5 years, some late-maturing breeds up to 6 − 7 years. The dairy productivity of the cow significantly influenced by its age. In most cases, milk yield increases from the first lactation to 6 − 7 (Fig. 3), and then gradually decreases. However, some animals show record productivity in the seventh and even eighth lactation. Here its need to note, it has long time been economically proven that the breeding of highly productive cows provides a high level of income. Each farm must firstly be interested in high productivity of cows to increase income. The productivity of cattle is 75% determined by environmental factors. This is the result of the agriculture sector specialists' study. Therefore, animal genetics is not critical, while good care and maintenance are most important for high yields.

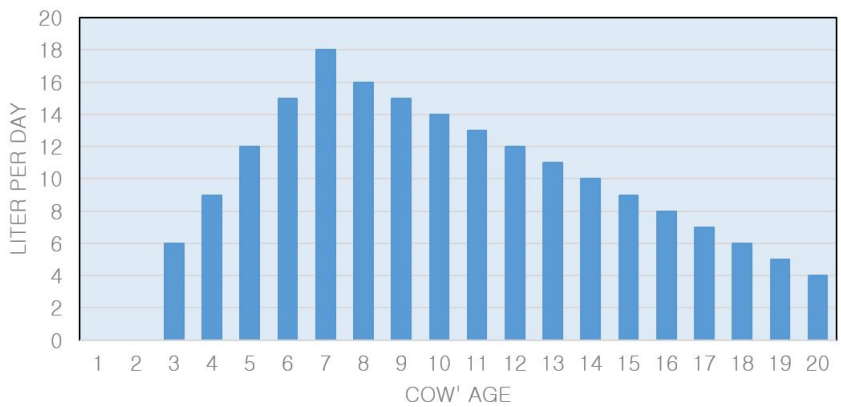

Fig. 3. Average cow productivity.
Source: ministry of agriculture, food industry and reclamation of the kyrgyz republic, (2014).

As we can see from figure above, the average productivity of cows increases every year until seventh year, and then decreases. Therefore, a farmer needs to take into account the age of the animals and their size. After all, the major usually get more milk than small ones. Cows calving in spring and summer months usually have less milk yield than cows calving in autumn and winter. In addition, those what calved in 12 − 14 months after the previous calving, give more milk for lactation than cows with a shortened interval between bodies. It follows from the above that this parameter is closely related to the level of education of the farmer.

The technical efficiencies of milk farmers are less than one. The predicted technical efficiencies for the farmers range from 0.675 to 0.991. The mean technical efficiency estimated to be 0.927 with the standard deviation of 0.069. A frequency distribution of the predicted technical efficiencies within the ranges of 0.05 is given in the (Fig. 4). From the Figure, we can say that the distribution of technical efficisencies if closely grouped near 1.00.

The average efficiency level of the farmers is only 92% implying that milk production can be improved, and output would be increased on average by 8%. It can be increased by increasing number of cows, weight of cow, which firstly

depends on the good carrying of cow. At the same time labor must be considered according to the increasing of farm size. The efficiency in production of farmers visible to improve by training farmers in cow breeding, milk producing and storing, marketing, financial issues as well as other farm skills in order to increase they experience.

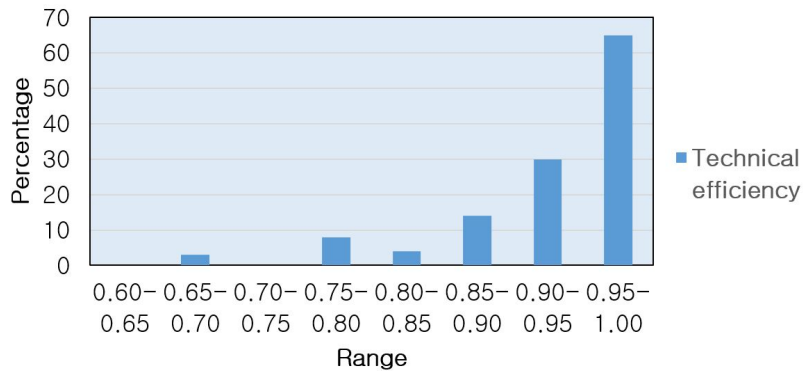

Fig. 4. The milk farmer technical efficiencies distribution in the Chui province.
Own estimation by STATA Program 13, data source: database of the national statistic committee of the kyrgyz republic

Conclusion

The research has calculations of production parameters in order to determine stochastic frontier production functions for milk producer-farmers of the Chui province. The stochastic frontier estimates are important contribution for small farmers to determine optimal level of cow breeding.

Rural farming, especially milk production is a main business for rural population, they income and employment closely related to livestock farming. About 98% of cattle are owned by small peasant (farmer) farms operating without a legal entity, the size of the herd of which ranges from 3 to 5 heads. The level of sanitation and hygiene on many farms is low. All operations, such as milking cows, fodder and haymaking, are performed manually. Farmers are not aware of the importance of hygiene and clean milk production. Irrational breeding of cattle, lack of strategy of preparation of winter forages and shortage of feed additives serve are additional factors of reduction of milk yield. There are no specialized training programs, information and advisory services for farmers to inform about best practices in dairy production.

According to the estimates in the framework of this research, we found out those such kind parameters, as age, education and credit are important for increasing efficiency of farmer. The age variable indicates negative coefficient, which means its importance in efficiency farming due to farmer's experience and skills, which gained after many years. Education has main role for farmers' efficiency. In order to maximize efficiency of milk production farmers need pay attention for them capacity building. Research results also indicates that farmers need contribution from Government side in the provision of high-yield cows, stable and higher price for milk and capacity building of farmers. One more support that is important for efficiency, which can be provided from Government side are soft loans or subsidies for farmers' size extension. The main problems on the way to

improving the efficiency of dairy production are the increasing of farmers' capacity, coordination and support dairy sector through 1) the creation of procurement centers for the storage and transportation of milk without the participation of intermediaries, 2) the creation of the centers of insemination of cows with dairy-oriented breeds, and 3) the introduction of a system of concessional lending to milk producers for the purchase of cows and agricultural machinery.

The state policy in the field of dairy cattle breeding should provide for the farmers' use the modern production technologies, improvement of breeding work, the use of promising high-yielding breeds of cow, and modern veterinary measures.

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