Risk Analysis in Turkey Milk Production

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Abstract

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The present study has been done in order to determine the risks inherent in the milk production in Turkey. For that objective, factors such as the milk yield, the gross revenues realised, and the price levels as reflected to the producer's benefits, have been taken into account. Upon the calculation of the measures for variables, fluctuations were found in the milk yield, prices, and gross revenues. Based on the hypothesis that the information possessed by the producer on the economic and technological developments is scarce and restrained, the variable coefficient has been calculated as 10.81% for yield, 23.26% for prices, and 30.01% for gross revenues, respectively. With the hypothesis that the producers are aware of and informed on the economic and technological developments, these ratios, that is to say, the fortuitous variable coefficients would be, respectively, 2.07%, 15.96%, and 16.07%. According to the conclusions reached, an environment in which the producers can take rational decisions concerning the milk production can be said not to exist. For this reason, the government intervention through efficient measures for the dairy production will be necessary. Furthermore, the producers should be given informational support through the published studies in the agricultural extension.

Keywords: dairy production; risk; uncertainty; Turkey; agricultural extension

One of the economic sectors that needs to be rapidly developed in Turkey in the process of the European Union membership is the animal production sector. It is very important for this sector to acquire a strong structure with a competitive edge inside the European Union. For this reason, we should aim at entering into a rapid and sustainable development process in the animal production sector. Inside the animal production sector in Turkey, the dairy production presents many structural problems reaching from the production to marketing. Due to structural problems such as the difficulties encountered in finding the necessary raw materials, inadequacies at the level of the policies implemented, lack of organisation among producers, insufficiency of the veterinary and other health services provided, the levels desired both for the production and the consumption can not be attained. Yearly milk production per cow is 5880 kg in the EU (25), 8647 kg in the USA, and 1709 kg in Turkey (FAO 2004). The value in Turkey is still further reduced to around 1000 kg in the Southeast and Northeast Anatolian Regions (SIS 2004a). Yearly milk consumption per person is 241.1 kg in the EU, 258.4 kg in the USA, and 148.6 kg in Turkey (FAO 2004). As for the various risks inherent in the Turkish dairy production sector, due to their causing uncertainties in the yield, prices and revenues, they exercise a negative influence in the decisions by the producer

regarding the future milk production. This results in considerable fluctuations in the dairy animal production and creates impediments to attaining the desired levels of production, yield, and consumption as compared to the developed countries. The encouragement towards animal production by means of agricultural publications, bringing producers to a position from which they can plan the future production, and as a way of realising these points, increasing incitement measures are deemed as necessary.

It is observed that in some studies conducted in this field, the producers' behaviour under the conditions of risk has been put under examination. In a study realised by Talpaz *et al*. (1986), the activity choices under the conditions of risk and indecision have been dealt with. The objective of this study has been to put about a traditional planning model by taking into account the producers' behaviour relating to uncertainties at the level of revenues as expected in time, and to draw an insight into the effects on the producers' production plans resulting from this adopted behaviour (Talpaz *et al*. 1986).

Pannell (1990) departs from the point of the important place held by the definition of the risk in the decisions on keeping use of non-native fodder in the vegetation input at check. Accordingly, he establishes that, even in such cases where producers wish to maximise their profits, the risks presented by non-native fodder checks would influence the decisions (Pannell 1990).

Economics has a well-organised story of decision making under risk and uncertainty. It adopts a two-way classification which can be summarised as follows:

1. Static decision making under risk
2. Static decision making under uncertainty
3. Dynamic decision making under risk
4. Dynamic decision making under uncertainty

The two distinctions used in economics are (a) risk versus uncertainty, (b) statics versus dynamics. These give us the four classifications of the table above (Hey 2002).

Cohen (1985) describes the three strategies the decision-makers use to cope with uncertainty. We shall call these engineering, discounting, and inference (Cohen 1985; Cook 1998).

Engineering controls likely outcomes by investing in structures which limit the range of possibilities.

Discounting accommodates uncertainty by preparing for a range of likely outcomes.

Inference reduces uncertainty by defining the likely outcomes under current conditions.

These options clearly do not apply equally to different farming activities. Engineering is too expensive for extensive activities such as grain production, but can be successful, for example by using irrigation, for high-value crops. Inference is attempted, for example, by making a reasoned guess about the likely yield, given readily available information about prior yield, soil type, or rotation. However, in the absence of good information the accuracy is often low. The remaining strategy open to farmers is discounting. If the outcomes can be neither controlled nor predicted, the best option is to hedge, and prepare for a range of possibilities.

Discounting is, by definition, sub-optimal because it is imprecise. A range of possible outcomes is anticipated, but only one can occur. An imprecise decision effectively trades off optimality against risk. This strategy can be paraphrased by the statement: "I never apply exactly the right thing, but I'm never far off". According to Anderson *et al*. (1977), the value of information is in the degree to which it improves optimality, that is, the degree to which it is possible to remove redundant expectations. If the cost of uncertainty is the difference between the actual action and the best action, the value of information is the degree to which it enables a decision maker to improve (Cook 1998).

Farmers and ranchers make decisions in a risky environment everyday. The consequences of their decisions are generally not known when the decisions are made. Furthermore, the outcome may be better or worse than expected. The variability of prices and of yield are the greatest sources of risk in agriculture. Technology changes, legal and social concerns, and the human factor itself also contribute to the risk environment for agricultural producers. The two situtions that most concern the agricultural producers are: (1) is there a high probability of adverse consequences, and (2) would those adverse consequences significantly disrupt the business (Kaan 2005).

The risk can be defined as imperfect knowledge where the probabilities of the possible outcomes are known, and the uncertainty exists when these probabilities are not known. A more common usage of these terms would state the uncertainty as imperfect knowledge and the risk as uncertain consequences (Hardaker *et al*. 1997).

Since it is impossible to foresee future developments clearly in the agricultural sector, the resulting environment of uncertainty in which the production and investment decisions are made constitutes important problems in the economy of this sector.

MATERIAL AND METHODS

Material

The present study covers a 23 year-period between 1982 and 2004. The data constituting the main material has been obtained from FAO and State Institute for Statistics Sources (FAO 2004; SIS 2004a, b; SIS 1982–1998; CBRT 2004; SPO 2004). The following measures have been used in the method.

Methods

Measures for variables. For the product examined, "standard deviations" of the series of productivity, price and gross revenues have been taken as absolute variable measures for these series, and as for the relative variable criteria, variable coefficients calculated by means of the standard deviations and the averages for the series have been used.

$$VC = \frac{S}{\bar{X}} \times 100$$

where:

VC – variable coefficient
S – standard deviation of any batch (yield, price, and gross revenues)
$\bar{X}$ – arithmetical mean of the batch (yield, price, and gross revenues)

Measures for fortuitous variables. Although it is not possible to estimate the fortuitous variable composant value of a particular incident in a given year, it is possible to advance estimations on the distribution parameters belonging to this fortuitous composant. Since fortuitous composants are observed as a certain number of fluctuations around the systematic composant in the given time series, in order to make an estimation on the fortuitous composant, it is necessary to determine the systematic composant first. In this context, for the aim of determining in an empirical manner the systematic composants of the time series, certain alternative approaches exist.

One of these techniques is the method based on the deviations from trends. In this method, by exposing the systematic composant with a proper trend line, the fluctuations around this trend are admitted as representing the fortuitous composant. This is the method that has been employed in the present study. Under the hypothesis that the differences between the values belonging to the real series and the trend values will provide the fortuitous composant, the trend equations relating to the series have been estimated exponentially. The models created within this scope are tested through various mathematical forms (exponential, quadratic, linear); and the exponential model has been used with the highest determination coefficient (R^2) expressing the ratio of change in the dependant variable explained by independent variables and inconsideration of the size of error expressions, parameter size, and signs. On the basis of the series for the remaining values, "fortuitous variable measures" has been calculated. The fortuitous variable measures used in the present study is composed of the statistics on the regression standard deviation and the statistics named as fortuitous variable coefficient. The standard deviation of the regression is obtained through the variables of the fluctuations around the trend and is used as an absolute variable measures.

$$S_{yi} = \sqrt{\frac{\sum_{i=1}^{n}\left(Y - \bar{Y}\right)^2}{n-k-1}}$$

where:

S_{yi} – standard deviation of yield, price or gross income of product i from the regression slope [yield (kg/head), price ($/kg), gross revenue ($/head)]
Y – yield (kg/head), price ($/kg) and gross revenue ($/head) of the product
$\bar{Y}$ – regression predictions regarding the yield (kg per head), price ($/kg) and gross revenue ($/head) of the product in the units of Y
n – number of observations
k – latitude level

The formula for the fortuitous variable coefficient is presented below:

$$FVC = \frac{S_{yi}}{\bar{Y}} \times 100$$

where:

FVC – fortuitous variable coefficient

S_{yi} – standard deviation of yield, price or gross revenue of product i from the regression slope [yield (kg/head), price ($/kg), gross revenue ($/head)]

$\bar{Y}$ – arithmetical mean of product yield, price or gross revenue

Since the fortuitous variable coefficient is stated in percentages, it is used in the comparison of distributions stated in different units.

Coefficient of correlation and the test statistics. Correlation coefficient has been calculated for the purpose of finding whether or not there is any relation between the price and yield series. The correlation coefficient calculated needs to be checked to determine whether or not the calculated correlation coefficient is a coincidental or real relationship. Hypotheses established for the check are determined as

$H_0: r = 0$
$H_1: r \neq 0$

and the test statistics is calculated according to the following formula (Hovardaoglu 1994)

$$t = r\sqrt{\frac{(n-2)}{1-r^2}}$$

where:

t – test statistics
r – correlation coefficient
n – number of observations

RESULT AND DISCUSSION

The variable and fortuitous variable measures calculated for the yield, price, and gross revenue series relating to cow's milk production in Turkey have been presented in Table 1.

The standard deviation and variable coefficients are based on the assumption that the producer qualifies all fluctuations in the yield, price, and gross revenue as unpredictable or fortuitous.

For the milk yield, the variable coefficient has been calculated as 10.81%. This coefficient states that the producer will face a variable rate of 10.81% in the milk yield. In such a case, it is known in advance in which direction the variance will take place. With a certain number of unpredictable risks acquiring a permament character, projective calculations will appear affected.

As for the fortuitous variable coefficient in the milk yield, it has been calculated under the assumption that the producer is informed on the productivity trends, and qualifies as unpredictable or fortuitous only the fluctuations around these trends. On this basis, the fortuitous variable coefficient in the milk productivity has been calculated as 2.07%. The fact that the fortuitous variable coefficient is lower as compared to the variable coefficient indicates that the producer is informed on subject matters in the technical and economical fields. The producer is not wholly ignorant of the developments.

When the subject matter is backed by this calculation, the following explanations lay down the causes.

Turkish milk production is dispersed along lines showing important enterprise structure differences. A dispersion reaching from the street vendors to the traditional dairies and to the enterprises equipped with modern technologies can be observed. As the numbers of the enterprises equipped with modern technologies increased over the years, and along with commercial campaigns and advertisements focused on consumers, the necessity for the producers to attach importance to the quality of

Table 1. The variable and fortuitous variable measures calculated for yield, price and gross revenue series

Series	Standard deviation	Standard deviation of regression	Average for the period 1982–2004	Variable coefficient	Fortuitous variable coefficient
Yield (kg/head)	159.86	30.65	1478.8	10.81	2.07
Price ($/kg)	0.0644	0.0442	0.277	23.26	15.96
Gross revenue ($/head)	124.51	66.65	414.83	30.01	16.07
The trend equations that represent the series in the best manner					
Yield	$Y = 1222.33 \times (1.01553)^t$				
Price	$Y = 0.214951 \times (1.01906)^t$				
Gross revenue	$Y = 262.742 \times (1.03488)^t$				

milk has become more topical. When the producers produce quality milk in profitable conditions, they are able to market the milk from their farm to the modern dairy establishments without having to pass through intermediaries. This could well be the underlying cause of the rather low risk intensity found in the context of the present study. The producer seeks ways of reaching higher levels of profitability and quality for his produced milk, by following the technical and economical developments. It is observed in this context that the producers are able to take more efficient decisions in their plans on the milk productivity.

The variable coefficient calculated for the milk prices (23.26%) has been found to be higher than the fortuitous variable coefficient (15.96%). This situation indicates that the unpredictable fortuitous fluctuations will be high. At the same time, it is a well known fact that the risk in the milk production stems largely from the price fluctuations. And according to the conclusions reached, it is not possible to state that supportive policies implemented in Turkey in favour of milk remove the fluctuation risks inherent in the product.

In recent years, two alternative supportive policy lines have been under attention in Turkey. These policies are the incentive premium for milk and price objective/actual price difference payments. The practice of the incentive premium for milk has been started in 1987 and in this context, fixed rates of payment are made to producers on the basis of each kilogram of milk by means of price incitement measures. Whereas for price objective/actual price difference payments, the difference occurring between the target prices and the market prices is paid to the producer by the State. The effects of the implementation of both these policies for Turkey's milk production have remained within a limited scope. For example, in the second half of 1990's, the increases in the incentive premium were recorded at levels lower than those in the milk prices (Yavuz *et al*. 2004).

In a research examining the effect of Turkey's governmental support policies on the producers' revenues, when real prices as reflected to the producer are taken into account, the increases recorded on the basis of the product in the real agricultural production value for the examined period are found to be stemming from the increases that take place in the production quantities rather than the prices as reflected to the producer (Kizilaslan & Gurler 1998).

In consequence, it is observed that the producers are not adequately informed on the fluctuations in the milk prices, and on this account, the resulting environment of uncertainty influences producers' decisions negatively, so they are unable to take rational decisions. In other words, even accepting the hypothesis that the producers are adequately informed on the developments in the economical and technological factors (Fortuitous Variable Coefficient = 15.96%), it is seen that the fluctuations in the milk prices are rather high.

By increasing the variety of the products that are produced, a contribution to reducing the risk related to low prices can be made (Kip 1974). Besides the product variety, importance should be attached to producing alternative products that bear lower risks (Patrick 1985). In the dairy production, the producer does not produce only raw milk, but by putting this raw material into use in forms such as curd, cheese, butter, and yoghurt, offers these to the market under different prices. But the prices of agricultural products are generally formed in markets where the conditions of free market reign and the production remains largely uncontrolled. This structure of the agricultural product market causes fluctuations in agricultural prices.

The variable coefficient calculated for the gross revenues (30.01%) is higher than the fortuitous variable coefficient (16.07%). This indicates that, even in such cases where, as for the price and the productivity series, the producer is not adequately informed on the developments taking place in the technological and economic factors, the revenue risks will remain quite high. But a considerable proportion of risk exists even in the cases where they are informed (16.07%). It can be said that the gross revenue risk inherent in the milk production stems mainly from the price fluctuations.

The variations in the milk production depending on the season and even the month influence the gross income. The price is influenced by such factors as storage, transportation, processing installation conditions, input, marketing, while in some regions production surges take place, as a result of which the producers face the obligation to sell their products at the immediately available prices. The debt situation of the producers to such actors as commission agents and traders or difficulties encountered in storage and preservation, are additional factors forcing producers to sell their milk below its value price (UTCA 2002), and therefore causing revenue fluctuations.

As for the yield, the gross revenue risk, that arises as a consequence of the interactions between, the productivity and the price fluctuations, is more important than the direct risks in the productivity and prices. The producer's wish is to assure that these revenues obtained as an outcome of the year-around activities suffice to meet his household needs and to bring a positive contribution to the next cycle of production. For this reason, it can be affirmed that extreme deviations from the expectations will not only put the producer in a very difficult situation but will also hinder this producer from taking efficient decisions for the production (Dilmen 1984).

Furthermore, the correlations between the price and the yield series inside the variations in gross revenues are also important. A negative correlation between the price and the yield series is a factor that will have a reducing effect in the variations that arise in the gross revenues over the years. When this correlation is in a positive direction, the gross revenue variations show a tendency to increase in relation to the volume of the correlation coefficient (Kip 1975).

In the present study, a positive correlation has been reached between the milk yield and the price series. Correlation coefficient is 0.533. In examining whether or not the correlation found is important or not, as the bidirectional test critical value is $t_{01.21} = 2.83$. $t_{hesap} > t_{tablo}$ ($t_{2.89} > t_{2.83}$) at the 0.01 significant level, H_0:$r = 0$ is rejected. As a result, it has been understood that the correlation coefficient found is important and not coincidental. For this reason, the variations in the gross revenues show a tendency to increase.

The producers who are unable to make an estimation on the market price of the product they produce, and consequently on their own levels, display a tendency to attain, inside their enterprises, a structure that will be affected at the lowest possible levels by the price fluctuation, by clinging to the aim of minimising the risks stemming from this environment of uncertainty. For that end, they retreat to an introverted approach, try to adopt a production level that is mainly focused on their own consumption, avoid new investments even when these involve productivity increases, reduce the capital factor in the production processes to the lowest possible levels, adopt labour intensive production technologies, and refrain from enlarging the production scales of their enterprises. The resulting negative effect is the blockage of the economical development. The productivity decreases and the total production volumes are pulled down. The reductions in the production for the market lower the contribution made by the agricultural sector to the country economy. The choice of a labour intensive production processes decreases the productivity of both the total production and the labour itself. As a consequence, while agricultural enterprises adopt a structure in which they will be least affected by the effects of uncertainties in general and the price risks in particular, they lose the development dynamics and the country agriculture fails to develop (Dinler 1988).

CONCLUSIONS

The adoption of the necessary measures should be assured in order to permit the milk producers to take their decisions in a rational manner and to minimise the risk factors.

Policies on the dairy products may be re-arranged by taking into perspective the practices in the countries that have accomplished their treatments of the subject matter. Internal consumption and foreign trade should be taken into account. The estimated figures at the global level, as well on the capacity that is present, should be timely communicated to the producers by the relevant institutions. Modern dairy products installations of regional scale should, for the benefit of their own product demand, conduct informative work oriented towards the producers in the matters of the milk productivity, quality, stocks, demand, and prices. The milk producers should attach importance to getting together in the framework of associations and cooperatives, and through these should be able to market their products in the status of an economical force to be contended. The practice of insuring the animals should be extended. Furthermore, efforts should be made to ensure a continuous flow of information towards the producers by means of agricultural extension and educative work.

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