PRODUCTION RELATIONSHIPS IN THE MINAS GERAIS DAIRY INDUSTRY - 1995[1]

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ABSTRACT

Product supply and factor demand are examined for the dairy industry in Minas Gerais for the year 1995, through a translog profit function. The complementary character of milk and meat production in the activity is evidenced. The milk supply is elastic, while the meat supply does not respond to variations in its price. The inputs, capital, labor, and food, are complementary to each other. Increase in the product's price intensifies the input use, while increase in the input prices reduces the milk and meat production, that is, the relationships between the products and production factors is not regressive. The dairy activity is, therefore, sensitive to the policies that affect output and input prices.

Key words: translog profit model, production relationships, dairy industry

1 Introduction

As well as other Brazilian agricultural segments, the dairy industry has gone through several changes over the last few years. The commercial liberalization and the decrease in the government's intervention in the

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activity brought larger competitiveness to the sector, requiring more technical and economic knowledge regarding the activity of the producers, in order to continue in the market.

It has been observed that the Brazilian milk producer needs to improve his market knowledge, improving productivity and product quality. Increases in scale have become fundamental due to the small return per liter of milk. Thus, the producer should identify deficiencies in its productive system and look for alternatives to overcome them.

Researches that can provide information about the relationship between factors and products in the productive process for the economic agents - producers, organs of technical attendance, policy agents, among others - became important to the development of the activity. However, the studies that provide a technical-scientific base on optimum resources allocation, in order to reach larger efficiency in the productive process, are scarce. Therefore, it is necessary to suppress that deficiency, producing works that focus on the productive structure and resources use of the dairy activity.

The rural manager objective is to maximize profits. This maximum happens with decreasing marginal returns of each resource, given the technology level, in the point where the marginal product value is equaled to the resource price, under the competitive market assumption, both in the input purchase and in the output sale (Gomes, 1976). In that way, the relationships between price levels and factors amounts and resulting products in the productive process knowledge is of highest importance for the producer.

According to Oliveira *et al.* (1985), the use of modern inputs implies the possibility of a productivity increase both in the land and labor employed in agriculture. In Brazil, differentiated policies decisions along time and between inputs can have caused the excessive use, in social terms, of some inputs instead of others, which increased costs and reduced returns. The knowledge of the modern input market structure for the agriculture is necessary to the success of the promotion policies of the use of the input.

In the international scenery, the commercial opening brought to the producers the imports competition. In this context, Argentina has presented lower costs production and has gotten to increase its exports for the great Brazilian market, due to import tariffs reduction, facilitated by MERCOSUR's ascension activities.

The end of the government price control of milk, in the beginning of the decade, exposed the producer to the market structures, competition and the consumer's demands.

Reis (1993), when trying to verify the government intervention effect on the productive structure of the milk market, concluded that the government's intervention in that activity was not capable of reaching the objectives of production and productivity incentive, producer income stabilization and productive infrastructure improvement. The price control policies, according to this author, was responsible for the dairy activity capital loss in Minas Gerais and the internal market competitiveness was guaranteed by the product imports taxation, in the 1977-84 period.

Along the years the Brazilian milk price has been decreasing, while production has been increasing. The productivity increase and the decrease of production costs allow this contradiction. Even so, the Brazilian productivity indexes are still low and the existence of duality can be verified among the production systems, which vary from the most to the least efficient, and these last ones tend to become less and less viable (SEBRAE/FAEMG, 1996).

Minas Gerais's milk production is the largest in Brazil, corresponding approximately to 30% of the national production (MINAS GERAIS, 1995), and the south of Minas and Zone of the Forest, traditional areas in milk production, have been presenting a small growth in relation to the areas of the Triangle and High Paranaíba, Brazilian "cerrado" areas (SEBRAE/FAEMG, 1996). In spite of Minas Gerais's dairy industry importance in the national context, such activity is mixed with the bovine meat production, as Reis (1993) evidenced. He affirmed that milk and meat are produced in fixed proportions, not verifying dairy production a specialized activity.

Before this scenario, it is necessary to know the milk production and market characteristics, in order to contribute for this activity to continue playing an important role in the national economy.

The existing relationships among the main production factors employed in the dairy industry in the State of Minas Gerais for the year of 1995 is studied in this paper. It intends to determine the substitution or the complementary relationship among the production factors, as well as to evaluate the impacts of the prices variations of milk and meat products, and of the input in the milk production. In that way, it will try to characterize the product's supply and the factor's demand structure in the activity.

In the next chapter, the theoretical instrumental used in the study is introduced, based on the translog profit function. To proceed, the results obtained in econometric estimates are discussed and finally, the main conclusions are presented.

2 Methodology

The Production and Cost Theories allow the empirical study of the productive process, being admitted the duality existence among the production, cost and profit functions, so that the study of the productive process through the profit or the cost function is enabled. Hertel (1984), as well as Varian (1994), discussed the duality focus in full details.

A production function is a technical relationship that associates the product maximum amount obtained to each factors endowment. Therefore it synthesizes, for a determined time period, the existing technological stock of knowledge for a given product (Curi, 1997).

A production function, for any agricultural product, should try to relate the production with the factors, such as land, labor and capital. Thus, the function can be represented by:

$$Y = f(T, L, K) \qquad (1)$$

where: Y = agricultural production; T = land; L = labor; and K = capital.

In the economic analysis, the profit concept becomes important in the duality context. A profit function relates the production value with the involved costs, for a given product level. In that way, the profit is obtained through the difference between revenue and costs. That function can be represented in the following way:

$$\Pi = P_Y . Y - C \qquad (2)$$

where: Π = profit; P_Y = product price; and C = cost.

For the duality theory, information on production technology, expressed by the production function, can be obtained from the cost and profit functions. Therefore, more than a form of representing the production technology can be obtained. Through duality, product supply and factor demand equations can be obtained by the partial differentiation of an indirect function-objective, which will be the profit function or the cost function.

Starting from the indirect profit function differentiation, regarding the factor and product prices, it is possible to obtain the factor's demand and products, supply equations that optimize the long-term profit levels of the firm. That differentiation consists of the Hotelling's theorem application.

The factor's demand and product's supply equations parameters become important to calculate the partial elasticity of substitution, direct and crossed price elasticity of demand and supply.

Functions estimates of flexible functional forms have been used to express elaborated technologies, starting from the algorithms use in the multiple equations estimate. In this way, it is possible to outline Cobb-Douglas and CES (Constant Elasticity of Substitution) models deficiencies.

Starting from the flexible functional forms it is possible to apply Hotelling and Shephard's theorems to obtain product supply and factor demand equations and use them to find the partial elasticities of substitution.

The transcendental logarithmic functional form (translog), presented by Christensen *et al.* (1973), mentioned by Hertel (1984), is a very used flexible functional form, being a second order approach to Taylor series.

An output supply and input demand set of equations can be obtained using the translog profit function. This function allows the obtaining of substitution elasticities among factors, products and between both.

The translog profit function can be specified as:

$$\ln \pi = \alpha_0 + \sum_i \alpha_i \ln P_i + 1/2 \sum_i \sum_j \beta_{ij} \ln P_i \ln P_j , \qquad (3)$$

where Pi and Pj correspond to the product's and factor's prices.

The profit function has the properties of being continuous and differentiable in the products and factors prices, having symmetry; being linearly homogeneous in terms of prices, and being convex in the latter. The first difference of the profit function in relation to a given factor price provides the optimum demand function of this factor. In the same way, the first difference of the profit function in relation to the product price provides the optimum supply function of this product. The input demand and output supply functions are continuous and homogeneous of zero degree in prices.

For the translog profit function to be in agreement with the properties above, it is necessary to impose restrictions to its parameter values, in order to satisfy homogeneity and symmetry conditions. The translog profit function must, yet, satisfy monotonicity and convexity conditions that should be verified, for these characteristics are not previously imposed to the model.

The symmetry and homogeneity conditions can be expressed as:

$$\beta_{ij} = \beta_{ji}, \quad i \neq j;$$
$$\sum_i \alpha_i = 1; \qquad (4)$$
$$\sum_j \beta_{ij} = \sum_i \beta_{ji} = 0.$$

The monotonicity condition, to be tested after the estimate, will be satisfied if the profit shares are positive for the product and negative for the production factors. The convexity condition, also to be tested, will be satisfied when the Hessian matrix, formed by partial elasticities of substitution, is positive semi-definite.

The share profit equations can be obtained, for each product or factor (Yi), by differentiating the translog profit function with respect to product and input prices logarithms and applying the Hotelling theorem:

$$S_i = \frac{Y_i P_i}{\pi} = \alpha_i + \sum_j \beta_{ij} \ln P_j \qquad (5)$$

The partial equation system obtained constitutes a singular matrix and, therefore, cannot be inverted. To solve this problem, the homogeneity restriction is applied again in order to eliminate one of the equations, which will have its parameters obtained through a difference, observing the homogeneity and symmetry conditions imposed to the model. In that way, each profit share equation will have an eliminated parameter B_{ij}, corresponding to the one whose term j corresponds to the discarded equation, as well as all prices will be divided by the product or factor price belonging to the eliminated equation.

From the model estimate, we can obtain partial elasticities of substitution, direct (Z_{ii}) and cross (Z_{ij}) price elasticities of product supply, and direct (η_{ii}) and cross (η_{ij}) price elasticity of factor's demand, through the following expressions:

$$
\begin{aligned}
Z_{ii} &= S_i + \frac{\beta_{ii}}{S_i} - 1, \\
Z_{ij} &= S_j + \frac{\beta_{ij}}{S_i}, \\
\eta_{ii} &= S_i + \frac{\beta_{ii}}{S_i} - 1, \\
\eta_{ij} &= S_j + \frac{\beta_{ij}}{S_i}.
\end{aligned}
\tag{6}
$$

It is important to indicate that such elasticities are not symmetric, that is, $Z_{ij} \neq Z_{ji}$ e $\eta_{ij} \neq \eta_{ji}$, being symmetrical the product of the referred elasticities by the respective profit shares participation. We must point out that Allen's estimate of the partial elasticities of substitution is not applied to the profit function. Therefore, its application in Reis (1992) is inadequate.

In this study, the profit shares equation system for the production factors and products involved in the dairy industry will be estimated. The dairy industry can be considered as a multi-product activity that uses the same input for milk and meat production (animal sells), as specified by Reis (1992). The meat production should be considered as the aggregate sales of animals to the slaughterhouse and breeding activities.

The translog profit model should include the milk production total profit, the prices of the several input and of milk and meat. The input should be aggregated in order to represent capital, labor and feed shares. In this way, the Minas Gerais dairy translog profit function will be that in agreement with the representation (3), being indexes i and j for products milk (L) and meat (C), and factors capital (K), labor (M) and feed (A).

The capital, labor and feed input studied in this work corresponds to about 71.17% of the total operational cost of the Minas Gerais's dairy industry for the year of 1995 (SEBRAE/FAEMG, 1996). Milk and meat correspond to the dairy industry products, considering that this activity has a mixed character, as evidenced by Reis (1992, 1993).

The profit share with the milk (meat) product is given by the relationship between the milk sale (animal sale) revenue and the total profit of the dairy activity. A profit share with a given factor is the relationship between the service flow of that factor and the dairy activity's total profit.

The milk price is obtained by dividing the milk revenue by the total production. With regard to the meat price, it is obtained by dividing the animal sale revenue by the total number of animals sold. The factor price is obtained by dividing factor expenses by the amount used in the dairy productive process.

The capital factor (K) was measured as the value of installations, machines and equipment used in the dairy production. The capital services flow corresponds to capital depreciation in the year in study. Factor labor (M) aggregates the workers hired for the dairy activity (administrator, milker, assistant and eventual workers) and the family labor used in the activity. The labor services flow corresponds to the total expenses with this factor in the agricultural year in question. The factor corresponding to the item feed (A) aggregates the livestock feeding supplied in form of rations, flour, salts and minerals. The feed service flow corresponds to the explicit expenses with this input during the agricultural year in study.

The profit share equations will be estimated in order to obtain the translog profit function parameters. Since the sum of the profit shares equals one, it is necessary to suppress one equation to avoid singularity in variance-covariance matrix. In this work the system of equations will be estimated with the exclusion of the feed (A) profit share equation. The coefficients of this share will be obtained through difference. Therefore, the output supply and input demand equations system to be estimated, in terms of profit shares, can be expressed as:

$$
\begin{aligned}
S_L &= \alpha_L + \beta_{LL}\ln(P_L/P_A) + \beta_{LC}\ln(P_C/P_A) + \beta_{LK}\ln(P_K/P_A) + \beta_{LM}\ln(P_M/P_A),\\
S_C &= \alpha_C + \beta_{CL}\ln(P_L/P_A) + \beta_{CC}\ln(P_C/P_A) + \beta_{CK}\ln(P_K/P_A) + \beta_{CM}\ln(P_M/P_A),\\
S_K &= \alpha_K + \beta_{KL}\ln(P_L/P_A) + \beta_{KC}\ln(P_C/P_A) + \beta_{KK}\ln(P_K/P_A) + \beta_{KM}\ln(P_M/P_A),\\
S_M &= \alpha_M + \beta_{ML}\ln(P_L/P_A) + \beta_{MC}\ln(P_C/P_A) + \beta_{MK}\ln(P_K/P_A) + \beta_{MM}\ln(P_M/P_A),
\end{aligned} \quad (7)
$$

where S_i = product or factor profit share, Pi = product or factor price, and i = milk (L), meat (C), capital (K), labor (M), and feed (A).

The homogeneity restriction is imposed to the model by the profit share equation normalized for the variable feed price (A). Starting from this normalization, we notice that estimated parameters β_{ij} incorporate price relationship P_i/P_A. As the partial elasticities of substitution are obtained from the estimated parameters, these elasticities express the variation in the supplied product or demanded input amount from price relationship variation P_i/P_A. Still, the elasticities obtained from translog profit functions are destined to the study of a group of activities (multi-products) that use input in common (multi-factors), just capturing the relationships among those economic variable. In that way, the comparison of those elasticities of substitution with the price demand or supply elasticity obtained through changes in the input demand or output supply amounts due to variations in prices does not proceed.

The monotonicity and convexity conditions are tested through the analysis of the behavior of the profit shares and the through the result of the Hessian matrix. According to Fulginiti and Perrin (1990), who studied Argentina's agriculture through a translog profit model, the convexity will be violated if the direct price elasticity has opposite signs to the ones anticipated by the theory.

According to Reis (1992), the translog profit function cannot totally satisfy monotonicity and convexity conditions. As discussed by Hertel (1984), obtaining estimates that violate the economic theory is common, due to data qualities and aggregation problems, as well as to the own vulnerability of the profit maximization hypotheses maintenance.

In that way, the monotonicity and convexity conditions can be evaluated locally.

As the model to be estimated is an equation system, its error terms can be correlated, therefore, Zellner's Method (SUR - Seemingly Unrelated Regression) will be used to estimate the system (Greene, 1990).

The regression parameters significance will be tested by statistics " t " of Student. The monotonicity and convexity conditions will be checked.

The data used in this study are part of the Projeto Sistema Agroindustrial do Leite (Milk Agribusiness System Project), coordinated by SEBRAE - MG, in partnership with FAEMG - Agriculture Federation of the State of Minas Gerais, with the support of OCEMG - Cooperatives Organization of the State of Minas Gerais. The data were collected under the coordination of STG-Advisory in Agricultural Economy, located in Viçosa - MG, through direct interviews with milk producers, distributed in all Minas Gerais sub-regions, referring to the agricultural year of 1994/95. A number of 133 observations were used, covering all production levels (small, medium and large).

It is worth emphasize that time series data are more recommended for translog profit function application. This work possesses the limitation of disposing just cross-section data which correspond to just a year of observation. Even so, as discussed by Lopez (1984), since a systematic price variation exists among the observation units to allow an estimate demand and supply response, and that the relative price variability in the study year corresponds reasonably well to the previous years, the elasticities interpretation is not affected, considering, for such reasons, as of long-term. The input and output price variations observed in the available data can be considered as in agreement with such subjects and they are due to transport costs, scale and processing differences among milk industry buyers, prices differences obtained by cooperatives and different input suppliers, so much among areas as among properties.

3 Results and Discussion

The parameters estimates results of profit shares equations are presented in Table 1. Park, Glejser and White Heterocedasticity Tests for the analysis were accomplished, in agreement with Gujarati (1995), not being detected any evidence of this problem in the model. The value of coefficient R^2 was not presented, because it does not reflect coherent results when the Generalized Least Squares method is used, specifically, Zellner's method, as discussed by Tomek (1973) and Reis (1992).

The equations presented in Table 1 satisfy the symmetry and homogeneity restrictions, once they have been imposed to the model. A total of 20 parameters were estimated: 14 obtained directly from the estimate and 6 calculated by the homogeneity restriction. Of the estimated parameters, three were significant at a 10% probability, one at 5% and five at 1%. The equation coefficient values of feed share were obtained by the homogeneity restriction.

The monotonicity condition was satisfied for all products and input, by the positive value of the estimated profit shares for the milk and meat products, and by the negative value obtained for the estimated profit shares of capital, labor and feed factors (Table 2). The convexity condition for milk was satisfied by the positive value obtained by the direct price elasticity of milk supply, and for all inputs, by the negative value of the direct price elasticity of demand for capital , labor and feed factors. For meat, its direct elasticity price presents negative sign; even so, its value is not statistically different from zero, what does not violate the convexity condition (Table 3).

The coefficients presented in the Table 1 are very important to calculate the partial elasticities of substitution, that can provide a description of the products supply and factors demand structure for the dairy activity. Table 3 presents the results of those estimates.

Table 1. Coefficients estimates for the profit share equations of the Dairy Translog Profit Model, 1995

Dependent Variables [a]	Intercept	Independent Variables[a]				
		P_L	P_C	P_K	P_M	P_A [b]
S_L	3.4870**	-0.6777	-0.2306**	0.3914*	0.3842	0.1327
	(5.5787) [c]	(-1.1654)	(-2.9139)	(2.0097)	(1.5127)	
S_C	-0.9186**		0.2117**	-0.0741+	0.0039	0.0890
	(-4.0014)		(6.0671)	(-1.9217)	(0.0943)	
S_K	-0.5290+			-0.3748**	-0.0087	0.0662
	(-1.8886)			(-4.2224)	(-0.1008)	
S_M	-0.2493				-0.2539+	-0.1255
	(-0.7867)		(symmetric)		(-1.9445)	
S_A	-0.7901					-0.1624

Source: Research results.

[a] S_L = milk share; S_C = meat share; S_K = capital share; S_M = labor share; S_A = feed share; P_L = milk price logarithm (log) ; P_C = meat price log; P_K = capital price log; P_M = labor price log; P_A = feed price log.
[b] Calculated using homogeneity restriction.
"t" statistic in parentheses.** 1% of significance; * 5% of significance; + 10% of significance.

Table 2. Profit shares estimates, dairy translog profit model, 1995

Description	Estimated Share (S_i)
Product	
Milk	2.5958
Meat	0.4716
Production Factors	
Capital	-0.5911
Labor	-0.8850
Feed	-0.5912

Source: Research results.

Coefficients sum in each equation is approximately equal to zero, showing that the homogeneity restriction was satisfied.

Table 3 shows that increases in milk price induce the producer to increase its produced amount, in a more than proportional way to the price increase, what characterizes milk as an elastic supply product (elasticity of 1.33). Production systems with greater technique standard, with larger modern input use, are more elastic as to its supply. In that way, the area in study seems to present a considerable degree of utilization of modern production techniques. Actually, the Minas Gerais milk production has a great heterogeneity in producers and productive techniques, from small traditional farmers to great modern managers. As pointed by Gomes (1999), in spite of the largest number of small producers in the Minas Gerais dairy activity, their relative participation in the total state production has decreased, and great producers, who use more modern techniques, are more and more responsible for the State's milk production. In this way, the high value of price elasticity of milk supply reveals that modern farmers are more responsible for the production.

The cross price elasticity of milk supply, in relation to the meat price, reveals that those products are complementary, because the increase in the meat price (measured by the price of the animals) induces the producer to intensify the milk production.

The direct price elasticity of meat supply did not present a coefficient that was statistically different from zero. This result suggests that the meat supply, for the milk producer, is not sensitive to animals sale price variations. The value estimated cross price elasticity of meat supply, in relation to price of milk, again evidences that this activity is complementary to milk production, in which the high elasticity value (2.11), compared to the value of the crossed price elasticity of milk supply in relation to the meat price (0.38), shows that the producer is more sensitive to the variation in milk price than the animal sale price. Therefore, we can suppose that, although the activity is mixed, milk is the main product for the producer's sensibility to its price. In that way, the producer worries, in first place, about the milk production, and the meat production is a consequence of the first, being a way of diversifying the producer's income.

Table 3. Dairy Translog Profit model direct and cross price-elasticity, 1995

Quantity	Price					
	Milk (L)	Meat (C)	Capital (K)	Labor (M)	Feed (A)	Line Σ
Milk (L)	1.3347**	0.3828**	-0.4403**	-0.7370**	-0.5401	0.0001
	(5.9579)	(12.5571)	(-5.8694)	(-7.5332)		
Meat (C)	2.1068**	-0.0795	-0.7482**	-0.8767**	-0.4025	-0.0001
	(12.5571)	(-1.0746)	(-9.1562)	(-9.9317)		
Capital (K)	1.9336**	0.5969**	-0.9570**	-0.8703**	-0.7032	0.0001
	(-5.8694)	(-9.1562)	(6.3726)	(5.9713)		
Labor (M)	2.1617**	0.4672**	-0.5813**	-1.5981**	-0.4493	0.0001
	(-7.5332)	(-9.9317)	(5.9713)	(10.8324)		
Feed (A)	2.3713	0.3211	-0.7031	-0.6727	-1.3165	0.0001

Source: Research dates.

"t" statistic in parentheses: $t = \varepsilon_{ii}(\varepsilon_{ij})/SE\varepsilon_{ii(}\varepsilon_{ij)}$, where $SE\varepsilon_{ii(}\varepsilon_{ij)} = SE\beta_{ii(}\beta_{ij)}/S_i$.

** 1%significance; * 5% significance; + 10% significance.

The results for the cross price elasticity of milk supply, in relation to the input prices, reveal that milk producers are sensitive to prices variations of this input, because they reduce the production when capital, labor and feed factor's prices increase. In the same way, the results of the cross price elasticity of meat supply, in relation to input prices, leads us to believe that the meat production is sensitive to the variations of the inputs prices, occurring reduction in the sale of animals when capital, labor and feed prices increase. Those results corroborate the statement that milk and meat products are produced in a complementary way. It is worth to highlight that the milk and meat production are more sensitive to the labor price variation in relation to other inputs, for the higher value of cross elasticity of demand of the products in relation to this factor price. Every result for the cross price elasticity of product supply in relation to the factors' price was non-regressive. According to Hertel (1984), the regressivity happens when the sign of those elasticities is positive, indicating that an increase in factor price causes the increase in the product production that uses such factor.

Through the production factors demand, it is possible to note that factor labor seems to be the most limiting one for the Minas Gerais dairy industry, for it price elasticity of direct demand (-1.60), followed by the factor feed (-1.32) and, last, for the capital factor (-0.96). Those values indicate that the milk producers from Minas Gerais presents high response to input prices variations, what makes us believe that this activity is relatively modernized in the area in study, since larger flexibility in the productive process tends to be associated to the use of more modern technologies. As previously discussed about the direct price elasticity of milk supply, such result is due to the great participation of technical producers in the Minas Gerais milk production. A similar result was obtained by Fulginiti and Perrin (1990), who studied the structure of Argentina's agricultural production through the relationship among capital, labor and other inputs prices in the production of the main agricultural goods of that country. In that way, policies that affect inputs prices, such as salary and credit restrictions, can cause strong impacts on the Minas Gerais's dairy industry.

The negative signs obtained by the cross price elasticity of factor's demand facilitate to conclude that the input capital, labor and feed possess complementary characters, so that an input price increase takes to the reduction in the use of other inputs in the activity, for both products. Once again, it evidences the complementary character of milk and meat production, since inputs present a complementary relationship for both products. Thus, capital, labor and feed are all necessary to the productive process, so that the limitation of one of those resources should limit the use of the others, not seeming to be possible the substitution of a factor by any of the others. These results differ from those found by Reis (1992), where input feed and capital would be substitutes in the productive process, while labor and capital, as well as labor and feed would be used in fixed proportions.

Analyzing the cross price elasticity of factor demand in relation to the prices of the products, it is noticed that increases in product prices stimulate larger production input use. The input demand is more sensitive to milk price variations than to meat price variations, since the values of cross elasticity of factors demand, in relation to the product price, are always larger for the milk product. Then, we can reaffirm the prevalence of the product milk on the meat in the producer's management and decision concerning the productive process. The high value of feed demand cross price elasticity in relation to milk price, of 2.37, what suggests that the livestock feed technology is very sensitive to the milk price variation, as observed by Reis (1993). In that way, the producer tends to improve the cattle feed technology when milk price increases. In the last years, we have observed the constant milk price reduction, what makes us suppose that the producer has been reducing the use of complementary feed, reducing the livestock management technology.

We can deduce that the Minas Gerais's milk producer is more specialized in the milk production, and the sale of animals is a mere complement, since the elasticity price of meat supply is statistically equal to zero, the crossed elasticities of meat supply in relation to the inputs prices have the same signs that the milk supply elasticities and, in the same way, the cross elasticities of factors demand in relation to the meat product price have the same signs and smaller magnitude than such elasticities in relation to the milk price. In that way, when the bovine sales price increases the milk producer does not sell animals of its herd. When the inputs prices increase, the producer decreases the milk and meat supply, not discarding animals to decrease inputs costs, and finally, when milk price increases, the producer increases the inputs use in larger degree than he does when the meat price increases. Therefore, the Minas Gerais's milk producer has become specialized, so that the dairy industry mixed activity character seems to be decreasing in the present decade.

4 Conclusions

This study examines the product's supply and factor's demand structure for the Minas Gerais's dairy industry, in the year of 1995, through a partial equation profit system estimate of milk and meat as well as for capital, labor and feed factors, using a Translog profit function.

It is verified that the product milk presents elastic supply and that milk and meat are complementary products in the Minas Gerais dairy activity. The product meat, measured by the sale of animals, does not present response to its price variation. Producers are sensitive to inputs, capital, labor and feed price variations, reducing the use of these factors when their prices increase.

The factor labor comes as the more restrictive to the productive process in analysis, followed by the factor feed and, last, for the capital factor. It is verified, also, that the capital, labor and feed input possess complementary character to each other in the milk production, so that increases in the price of one factor will cause reduction in the use of the others. The use of those inputs is intensified when the price milk and meat increase.

The mixed activity character, in which difficulties with the product milk leads to the intensification in animals sales, seems to be losing strength, since the producer is becoming more specialized. That recent transformation can be attributed to fast changes that this activity has been going through in the present decade, due to the most competitive atmosphere formed with the commercial opening and milk price liberation in the Brazilian economy.

We conclude that policies related to the prices of products and factors have important quantitative effects on these markets. In that way, policies that affect the prices paid or received, that is to say, policies that act on imports tariffs, exports rates, exchange rate, products and wages taxes, can imply important changes in the agricultural products and input markets, particularly in the dairy production.

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