CHAPTER 5: CONCLUSIONS AND IMPLICATIONS

5.1 SUMMARY

Despite the relative importance of the South African dairy sector in the country' agriculture, very little analysis has been done and published on the structure of dairy production and on the response of dairy farmers to price and other policy changes. This is partly due to the industry's apparent reluctance to make data available to academic institutions that have the capacity, resources and interest in performing the required analyses. This situation seems to be changing and it is a positive movement for the industry and academia.

Supply response studies take many forms and the complexity of agricultural supply response as opposed to studies on consumer demand only contributes to the diversity in methods of analysis. A predominant method of supply response analysis that is employed in many empirical studies pertaining to milk production, is econometric estimation of the parameters of the production process through the use of Duality theory, whereby cost or profit functions (rather than production functions) are fitted to data from farm or regional cost surveys (time-series, cross-sectional or panel data). This approach has many computational and estimation advantages over normative or programming methods and over direct econometric estimation of production functions.

For this study, the profit function approach was chosen. Two of the most frequently used functional specifications of profit functions, the Normalised Quadratic and the Translog forms, were applied to the data. In addition, both single equation estimation techniques (OLS) and system estimation techniques (ISUR and FIML) were employed. Those structural properties that were not imposed during estimation were tested afterwards. Due to the small sample size and some missing price observations in the data, as well as the substantial demand on degrees of freedom required by the functional specifications, aggregation of inputs and outputs were necessary. The maintained hypothesis was that farmers are profit maximising agents operating in unregulated markets. Each

farm was treated as a multi-input multi-output production unit. The outputs were fluid milk and an aggregate of traded livestock. Variable inputs comprised of two aggregates: aggregated purchased feed and aggregated self-produced feed. The quasi-fixed variables that were considered are livestock capital, total farm labour and a proxy for management efficiency.

Out of all the estimation results for the initial specifications, those from the ISUR application to the translog system of profit and profit share equations yielded the most plausible and consistent results. Symmetry was imposed in both the Normalised Quadratic and Translog systems. The former system imposed homogeneity, while the results from the latter lead to the rejection of homogeneity. In both systems, convexity of profit with respect to all prices was rejected. Monotonicity was rejected in the case of only a small number of farms and two farms were excluded from the analysis due to negative restricted profits. An important note, however, pertains to the substantial number of statistically insignificant coefficients, of which many displayed unexpected signs and magnitudes. This is an indication that substantial improvement should be possible in terms of specifying the profit system.

Consequently, alternative specifications were tested. As a first step, the translog system was normalised by the price index of traded livestock, similar to the Normalised Quadratic. The specifications of both the Normalised Quadratic and Normalised Translog in which livestock and labour quasi-fixed variables were dropped produced the best results. The results of both specifications conformed to theoretical requirements for well-behaved profit functions. Uncompensated- and compensated price elasticities of supply and demand were calculated. These elasticities should be interpreted as an example of the type of answers analyses and data similar to that of this study could yield.

In milk production purchased and self-produced feed inputs were gross complements and net substitutes, according to both the Normalised Quadratic and Normalised Translog supply system specifications. The normalised translog system indicated substantial expansion effects in input

demand, while both systems indicated contraction effects for milk supply as a result of milk price changes. Milk production was more intensive in purchased feed use than in self-produced feed use. Finally, input demand was much more price elastic in the short- and long-run than output supply.

The parameters of the quasi-fixed variables showed significant influences on all the profit share equations, except in the self-produced feed's profit share response to livestock capital input, and for all quasi-fixed variables in the livestock trade profit share. Increased management and higher labour expenditures, as they were defined in this study, led to a decrease in milk's share of profit, contrary to the expectation that higher management efficiency would result in more profitable milk production and livestock trade activities. From the modified systems' results, improved management would reduce milk supply and input demand in the Normalised Translog case. However, the Normalised Quadratic results indicated that improved management increases milk supply and the demand for purchased feed inputs, whilst reducing the demand for self-produced feed inputs.

These inconclusive results indicate that substantial improvement in specification and estimation could be achieved if the data set was expanded in terms of size and detail on prices and quantities of inputs and trading activities.

5.2 CONCLUSIONS AND RECOMMENDATIONS

This study was intended to be a platform upon which future dairy supply response studies can build. From the outset, the data dictated what can be done, assumed and reported.

In a time in South Africa were public agricultural research expenditure decreases annually, it is important that research issues are jointly identified and defined by the industry and the researchers - thereby limiting the need for resource expensive and duplicative surveys and experiments. For sound and useful analysis and prediction purposes, it is imperative that the industry and research institutions nurture a partnership in which information sharing and confidentiality are paramount.

Only when this prevails can researchers access the required detailed information on prices, input use strategies, farming goals, physical quantities of input use, timing of production activities, risk coping strategies and expectation formation that would negate the need for elaborate and unrealistic assumptions that are currently incorporated in analyses.

The quality of results is partly ascribed to the quality of the data that it is based on. In the dairy sector, substantially more detail is required for useful analyses and where this detailed data exists, it is important that analysts gain access to it – for the benefit of the industry as a world market competitor. In the absence of data, the industry and researchers should collaborate on developing surveys, managing the information and dissemination of results to the industry.

Possible improvements in existing available data are:

- Larger samples

- Time-series data or panel data (balanced or unbalanced)

- Unit cost of inputs, valued at market prices or opportunity cost; unit prices of all traded animals; unit prices of animal products (milk, butter, fat, etc.)

- Farm level records of climatic conditions (rainfall, temperatures)

- Farm level specification of technologies used (e.g. feedlot, grazing, combination, automated milking methods, manual methods, etc.)

- Type and quantity of labour actually utilised in production as opposed to employed labour.

- Uniform quality ratings of resources (grazing land, herd quality, labour quality, etc.).

- Stock patterns within and between seasons, and

- Detail on the allocation of variables (i.e. feed, labour, etc) to different farm enterprises.

International literature on the economics of dairy production, -processing and supply response provides many ideas for short or more intensive studies pertaining to the South African dairy sector. At the risk of sounding redundant, the problem of data access remains the most inhibiting factor. As

much as this study tried to show the potential use of existing data, it is also a call for increased co-operation between the industry and the academic profession in serving the needs of the dairy sector.

The results from this study suggest that dairy producers in South Africa are rational profit maximisers who use resources efficiently to the point where the marginal returns are zero. They allocate bought and self-produced feed components as substitutes in the short-run but treat them as complements in the long-run. The intensity of purchased feed use is higher than that of self-produced feed use. This has implications for the animal feed sector in terms of confirming dairy farmers' preferences for scientifically formulated feed components. It also suggests increased pressure on the international competition for already limited natural animal protein sources (fish meal, bone meal, etc.). Analysis of this apparent preference should be checked against time series data, also of other economic variables such as exchange rates, natural animal protein prices, maize prices and investment in animal feed research. In addition, disaggregated modelling of the self-produced and purchased components is necessary to evaluate the substitution status between components within and between the two broad classifications.

Milk supply shows an inclination to contract over time. Hence, this study's results suggest that increased milk prices will not stimulate expansion of the industry. Again, this should be checked against time series data and international patterns of herd size expansion, productivity increases and decreasing producer concentration. Very useful information can be obtained if similar analysis is conducted for different production regions (given the high geographic diversity) and different groups of producers (based on technology preferences or size of operations) to establish what effects input and output price changes might have on short and long term production dynamics.

Supply analysis, as it was performed here, provides testable hypotheses about producer behaviour, and a basis from which supply and demand elasticities for dairy products can be computed for policy simulation and analysis, thus enabling the dairy sector to be proactive in its response to international and local economic stimuli.